Electrical World

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and Its Practical Applications

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July 7 to December 29, 1923

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INDEX TO VOLUME LXXXII

July—December, 1923

GENERAL INDEX

Entries from the Digest of Current Electrical Literature are indicated by D (Digest)

Pages by Weeks

July 7	1 to 58
July 14	59 to 110
July 21	111 to 162
July 28	163 to 212
August 4	213 to 266
August 11	267 to 316
August 18	317 to 366
August 25	367 to 416
September 1	417 to 468
September 8	469 to 518
September 15	519 to 570
September 22	571 to 638
September 29	639 to 688
October 6	689 to 742
October 13	743 to 792
October 20	793 to 844
October 27	845 to 894
November 3	895 to 948
November 10	949 to 998
November 17	999 to 1048
November 24	1049 to 1098
December 1	1099 to 1152
December 8	1153 to 1202
December 15	1203 to 1252
December 22	1253 to 1302
December 29	1303 to 1352

A

B

*Indicates illustrated articles

*Indicates illustrated articles

D

H

*Indicates illustrated articles

I

J

K

L

*Indicates illustrated articles

*Indicates illustrated articles

*Indicates illustrated articles

R

*Indicates illustrated articles

*Indicates illustrated articles

T

*Indicates illustrated articles

U

*Indicates illustrated articles

AUTHOR INDEX

A

B

C

D

E

F

G

H

J

K

L

M

*Indicates illustrated articles

*Indicates illustrated articles

PERSONAL INDEX

A

B

C

D

E

F

G

H

I

J

K

L

*Indicates illustrated articles

M

N

O

P

R

S

T

U

V

W

Y

Z

*Indicates illustrated articles

Electrical World

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Superpower Opportunities

and

Need of Action

PRESIDENT HARDING in the address on natural resources which he made in Spokane last Monday did well to "emphasize that many of the most valued resources of the West are of such a character and their development must be on such a scale that they can only be made available under concentrated management and by the use of capital in large units." He might have added that the same conditions apply to the East and that skill and experience are also essential.

What we lack now, however, is not so much public appreciation of this fact as a determination to work out our own salvation. Much publicity has been given to superpower systems since 220,000-volt transmission became a reality, because hydro-electric energy can now be transmitted over longer distances and used directly as such or employed to augment electrical energy derived from steam stations or interconnected with other hydro-electric or combination systems into a larger power zone. However, publicity and an aroused public sentiment, helpful as they are, will not start development.

The industry must heed the movements for state and national development which have arisen frequently of late and checkmate their further spread by actual installations and work. While the President spoke of the West, there are several large projects proposed east of the Mississippi, but the will and determination to start work on these have not reached proportions which impel action.

The electrical industry owes its prosperity and growth to its continuous program of development. First came the arc and incandescent lamp, then the electrification of the street railways, followed by intensive application of industrial motors. Improvements in the efficiency of incandescent lamps gave new impetus to the lighting industry, and the steam turbine made possible the erection of superpower stations and the more economical production of electricity from coal. Water-power development, transmission of electricity and wide interconnection of contiguous systems brought electric service within the reach of more and more people, and the numerous household and labor-saving appliances added immensely to the popularity of the service.

Now there must be sought another great outlet for electricity, and this is available through the electrification of the steam railroads and by the wider application of electricity in manufactures and mines. The need is great also for a more nearly universal electrification of the smaller cities and the rural communities so that these may prosper in the same degree with larger cities.

Such a constructive program is devoid of risks and offers economic opportunities to other industries as well, at the same time enlarging and stabilizing our own and making it in reality one of the great basic industries of the nation.

Josiah Pickard Jollyman

An electrical engineer of ability who has done much in the development of the high-voltage interconnected transmission system of the West.

THE West is recognized for its leadership in high-voltage transmission and its extensive interconnected transmission system, and much credit is due the central-station electrical engineer for the part he has played in these accomplishments. Josiah P. Jollyman, hydro-electric and transmission engineer of the Pacific Gas & Electric Company, has had much to do with the design of the substations and transmission lines of this great utility's system, which embraces within the territory it serves half the State of California. His keen mind and balanced engineering judgment and his intimate knowledge of transmission and hydraulic problems, gained from years of experience in the field, have made him a recognized authority on these subjects and an outstanding figure in the electrical engineering profession of the Pacific Coast.

Mr. Jollyman was born at Santa Barbara, Cal., in 1879 and was graduated from Stanford University with a degree of A.B. in 1903. He was with the California Gas & Electric Corporation from 1903 to 1909 in construction and operation of hydro-electric plants and transmission lines. From 1909 to 1911 he was employed by the Great Western Power Company of California, first as superintendent of the Big Bend station and later as electrical engineer. During this period the Great Western Power Company established the first 110,000-volt transmission in the West, and he worked out the details of operation.

Since 1911 Mr. Jollyman has been with the Pacific Gas & Electric Company as engineer of electrical construction and during the past two years as hydro-electric and transmission engineer. In this period the company has established its South Yuba and Pit River developments and its 110,000-volt and 220,000-volt transmission systems. He had much to do with the design of the Drum, Halsey and Wise power houses, the Cordelia and Newark substations and the electrical features of the transmission lines of this project. The co-ordination of the several transmission networks now constituting the system of the Pacific Gas & Electric Company was carried out under him. He participated in the work of the California committee on inductive co-ordination, which made the first extensive investigation of this subject.

Mr. Jollyman has been a frequent contributor to the technical press and has taken an active part in the affairs of electrical associations and societies. He is a past-chairman of the San Francisco Section of the A. I. E. E.

Editorial Comment

Electrical World, July 7, 1923

Volume 82

Number 1

Another Electrical Pioneer and Executive Gone

JOHN A. BRITTON,* the "dean" of the electrical industry on the Pacific Coast, has been summoned by his Creator. His death was unexpected, for he had just been made first vice-president of the National Electric Light Association as an earnest of the greater honor to follow in 1924. Those who heard him speak at that convention the last publicly spoken words of his life can attest to the uncommon grace of his bearing and of his utterance. Although old in years, still in heart and mind Mr. Britton was strong and resolute, and his speech before the Public Relations Section caused a very real, a very deep and a very spontaneous beating of hearts. His confidence in the West and its people was unbounded, and he had the happy faculty of inspiring others with his enthusiasm.

In his relations with employees and others Mr. Britton was considerate, even to a fault, and his attitude was more like that of a father than of a superior. His vision and ideals were high and poetic, and he perceived the hand of God in things in the earth. Few men have served the industry longer or more faithfully, and fewer have earned so great a reputation outside of it. But such nature, such admiration, such repute can be acquired only by the steady, silent, persuasive appeal of character, intellect and service extending over long years. To him the Pacific Gas & Electric Company stands as a monument.

An Outstanding Achievement in Station Design

TWO things stand out in the design of the new Weymouth station of the Edison Electric Illuminating Company of Boston, described in this issue. The first is a predicted thermal efficiency of more than 25 per cent, which means the production of a kilowatt-hour of electrical energy for 13,500 B.t.u., as compared with about 17,000 B.t.u., the best present practice. This is a tremendous improvement in steam-station economy and will have a very important bearing on the territorial limits of hydro-electric developments because of the economic considerations involved. In addition, this gain in economy will be reflected in national economic and social advantages difficult to measure or predict. Among these might be listed the conservation of national fuel resources, the more abundant and universal use of power because of decreased costs of production, and a quicker realization of a national power supply through increasing the economic limits of long-distance transmission.

The other outstanding element in the station design is the possibility of introducing into older and less economical stations the equipment necessary to bring their operating performance to a comparable stage of efficiency. The high-pressure boiler, turbine unit and reheating scheme can very readily be adapted to existing installations in most cases, and at a minimum of expense, as it is largely self-contained and can be placed on top, so to speak, of the existing plants.

The designers of the station are to be congratulated upon their initiative in devising an installation whose success will react so favorably on the whole industry and which yet, if it fails, will jeopardize in no way the efficient and reliable operation of the standardized portion of the plant. They have played safe and yet will be able to realize fully the possibilities of the high-pressure plant should experience prove its value.

Concerning the details of the design of the standardized portion of the station designers may differ, but a predicted performance of 15,000 B.t.u. per kilowatt-hour for this portion of the plant indicates its high caliber. Whether an air heater would result in higher economies than the use of economizers, whether pulverized-fuel equipment would have proved more successful than stokers, whether some other pressure than 375 lb. would have resulted in more efficient operation, are debatable questions, but a decision must be made one way or another and the proof of engineering judgment must usually be found in future experience. The excellence of the chosen design indicates that those responsible considered every possibility and alternative in the light of general and special considerations.

In the electrical layout of the station departures from existing practices are contemplated and at the same time the best existing practice has been incorporated. Segregation, an absolutely reliable excitation and auxiliary power supply, flexibility and operating contingencies of many kinds have been anticipated and provided for.

A study of the detail shows that the designers were daring and yet subordinated everything to their ideal of producing an economical plant which would provide reliable and continuous service to the people of the Boston metropolitan district. It is very encouraging to find this forward-looking type of engineering in the central-station industry. The actual performance of the station will be a matter of great interest.

To See Ourselves as Others See Us

PUBLIC relations have been the subject of many a discussion at conventions and other gatherings of electric utility men during the past few years, but little effort has been made to find out how the general public views the utilities. Public service commissioners have been invited, but they at best give principally a reflected opinion. We have been prone to discuss our problems among ourselves and then go home with a feeling of pride and satisfaction that all is well with our public relations. In contrast with the usual procedure, several outsiders were invited to attend the

convention of the Northwest Electric Light and Power Association held in Seattle last week and expressed themselves frankly on the problems of the electrical utilities as they are viewed by those not associated with the industry. Those who arranged the program are to be commended upon the character of the talks that were given. The men who made them did not mince words, and it is certain that their hearers were deeply impressed with the menace of public ownership which is threatening the utilities of this country. Public opinion is the most vital element of the central-station business, and more meetings of this character should be held at conventions.

Working Together for Improved Lighting

FROM the viewpoint of artificial lighting the dark ages have just passed and the suddenness of the appearance of the age of adequate artificial light, full as it is of tremendous possibilities, has found us unprepared and blinded. The modern electric filament lamp gives us a flexibility in size, control and color which, if understood and appreciated, provides potentialities in distribution and quality of light almost infinitely beyond those of the ages of candles and other flames. But the wonders of artificial light as an expressive medium as well as a utilitarian and an economic factor will not be adequately realized until lighting is freed from the narrow channels of pure engineering. Practically all fields of lighting demand for their exploitation the development of a composite individual in whom are peculiarly combined a knowledge of optics, engineering, economics and psychophysiology as well as an artistic feeling for light, shade and color.

Elsewhere in this issue M. M. Samuels touches upon some of the details involving the fixture designer, the engineer, the architect and the electrical contractor. In the design of a new building the architect usually has the responsibility of co-ordinating or harmonizing many elements, of which lighting is a very important one. He has a picture in his mind's eye of the completed interior. Usually he recognizes that he is no more a lighting expert than he is an expert heating engineer. He depends upon expert help and performs the function of harmonizer and often that of compromiser. He needs assistance in lighting matters and usually asks for it. But can he gain respect for the illuminating engineer, and can he attain any adequate knowledge of the wonders of artificial lighting, if artificial lighting is presented merely as a matter of outlets and fixtures, if it is considered from a viewpoint similar to that from which an element like heating is considered, if it is not shown that it must be planned for its total effect upon the appearance of an interior and with due consideration for the most important sense—vision?

In many new installations the electrical contractor merely carries out orders, but he can be helpful—indeed, very helpful—in rehabilitating the lighting of old buildings where a supervising architect is not available. The electrical contractor should develop a deeper and broader knowledge of the potentiality of artificial light.

The fixture designer, too, must do his part. He must break the ties of the age of candles, however charming the associations may be. He must design fixtures for modern lamps. He must introduce good lighting principles and design fixtures that have lighting aims instead of merely sockets for lamps attached to a beautiful form borrowed from ages past. Let him preserve all the artistic merit of those centuries when men were craftsmen and when, notwithstanding various crudities of life, mankind loved beauty. The brightness of modern electric lamps is many times greater than that of flames, and therefore modern lamps should not be too generally exposed. But this need not compel the adoption of the other extreme solely. Much of the illumination intensity on a given space may come from large areas, but usually some directness and a moderate degree of brilliancy is desired. We can have the charm of chandeliers and even of frosted lamps in large rooms if they are well out of the normal range of vision, but we can also have a large portion of the light come from concealed sources, reflected from ceilings or transmitted through dense glass or other media.

Nature's lighting in its most cheerful aspects includes the dominant directed light from the sun and the diffused light from the sky reflected from the surroundings. We can improve on natural lighting, but not by departing too much toward its unpleasant moods. Furthermore, the fixture designer should realize that different rooms and different activities require different methods of lighting. He should design fixtures which have lighting aims as well as artistic ends. He should design in terms of the present possibilities of light and of present requirements of lighting. Well may he keep an eye directed toward the past ages for artistic inspiration, but if he is to do his part in this age of adequate light, he must keep the other eye on the present.

If the fixture designer and the engineer will view modern lighting in its proper breadth and depth, surely architects will gladly accept the great aid of modern artificial light in making interiors safe, convenient, comfortable and even delightful places in which to live and work.

Simplification Arguments Causing Introspection

IS THE simplification excitement leading anywhere? This is a question not infrequently heard these days, and to satisfy doubters and inquirers it ought to be said that it is. In other words, there are real benefits to be realized by purchaser, by manufacturer and by distributor by a sincere simplification program put into practice.

Doubtless Washington, where the movement originally started, is in a peculiarly advantageous position to see the results of the campaign; and judging from reports from Washington there is substantial progress. The fact of the matter seems to be that the discussion has led large numbers of manufacturers to examine into their own practices and as a result has led many of them to abandon costly specialty work and devote themselves to mass or quantity production of the things they are most able to make. The result is lower manufacturing cost, reduced distribution expense, and finally a smaller price and better service to the ultimate purchaser.

If this program is a good one for the manufacturers in general, it is a good one for the electrical industry. Already there are signs that the electrical industry is actually taking part in the program. Every one interested should encourage so constructive and beneficial a plan.

High Continuous Voltage for Insulation Tests

THE development of the hot-cathode tube, through its rectifying properties, has made available at greatly reduced complication and expense continuous voltages of almost any desired value. This has already afforded opportunities for several important researches in the field of insulation and has drawn attention to some of the advantages of continuous over alternating voltage for commercial testing of insulation. The disadvantages of alternating voltage in high-capacity equipment, such as cables, and in the heating caused by dielectric losses are well known. The use of continuous voltage appears to avoid both these difficulties, and particularly to reduce the requisite volt-ampere rating of the testing equipment.

But the continuous voltage carries with it some troubles of its own. The most conspicuous of these is the phenomenon of dielectric absorption, or the slow soaking in of charge on the continued application of voltage. This is a most obscure phenomenon, and its magnitude varies over a wide range as affected by the composition of the dielectric and by temperature and moisture content. It is probably present in all types of insulation and is especially conspicuous in compound materials such as are used in commercial insulation. It is thus at present not possible either to predict or completely to control the degree of absorption present in manufactured insulation. Therefore all measurements of current resulting from the application of continuous voltage, as, for example, in an attempt to measure the insulation resistance, depend on the time of application and conditions of the material, which it is impossible to control or ascertain, and so are of little or no value. Information as to the value of continuous voltage for break-down tests is given in the paper presented by Hayden and Eddy before the annual convention of the A. I. E. E., in which they try to establish a fixed relation between the alternating-current and direct-current breakdown voltages. But here also this relation is found to vary with the material, with the rate of application of the voltage and with other influences. These variations are undoubtedly due in large measure to dielectric absorption and to rapid changes in conductivity and internal heating inherent in the steady application of continuous potential.

The far more promising field of usefulness for these high voltages at present is that of research into the nature of the dielectric phenomena which are so hard to pin down, such as absorption, phase angle, conductivity and dielectric breakdown. Investigation in all these fields may now be greatly extended by this means.

Transatlantic Radio Methods Gain in Accuracy

GRATIFYING progress in the physical control of overseas radio transmission was emphasized last week at the A. I. E. E. convention in papers by Alexanderson, Arnold and associated authors. It can now be stated on high authority that a pair of transatlantic radio-telegraph stations can be designed to operate within a very narrow range of wave bands at an efficiency satisfying extremely severe technical and commercial requirements. Guesswork has yielded to engineering development and the end is not yet. The technique of transoceanic radio telephony shows similar advances along the line of increased reliability and economy of operation.

Engineering strategy of a high order is at work in the research laboratories and field stations of the communication expert. The conquest of the ether by the aid of the ubiquitous vacuum tube, by the improved design of antennas, skillful elimination of carrier and side-band waves and the general betterment of auxiliary circuit apparatus is proceeding steadily. Associated new refinements in frequency measurement described by Horton and others point the way to a closer control of the ether traffic and increased service in a firmament fast being "grubstaked by electrical prospectors," to quote T. C. Martin. The outlook for further progress via the route of quantitative measurements of the strength of signal and noise waves is most alluring, as is that for a more scientific development of "loudspeaker" design, outlined at the Swampscott gathering by Nyman, Kennelly, Kellogg and other participants in the discussions.

THE ELECTRICAL WORLD is a consolidation of the ELECTRICAL WORLD, the *Electrical Engineer* and the *American Electrician*, which was effected on Jan. 1, 1906.

The ELECTRICAL WORLD traces its history to the year 1874, at which time *The Operator*, devoted entirely to telegraphy, began its career. In 1883 *The Operator*, which was a monthly, became *The Operator and Electrical World*, and on April 28 of that year the paper was divided and the ELECTRICAL WORLD began its separate career.

In 1888 *The Electrician*, which had been founded in 1882, was named the *Electrical Engineer*, which remained a monthly until 1890, when its first weekly issue appeared.

In 1894 the ELECTRICAL WORLD adopted its present quarto style. In 1896 the *Electric Railway Gazette* was absorbed, but this part of the paper was later combined with what is now the *Electric Railway Journal*. Early in 1899 the ELECTRICAL WORLD and the *Electrical Engineer*, which had then become the two leading weeklies in the electrical field, were purchased by James H. McGraw and consolidated under the name ELECTRICAL WORLD AND ENGINEER, and the McGraw Publishing Company was organized to assume ownership and management of this and other papers. The paper bore the name ELECTRICAL WORLD AND ENGINEER until 1906, when the *American Electrician*, a monthly founded in 1896 and owned by the McGraw Publishing Company, was absorbed. The paper has since been known as the ELECTRICAL WORLD.

Each of the editors of the various journals named has contributed to the traditions and standing of the publication in the profession and industry. C. O. Mailloux was in reality the first technical editor of the ELECTRICAL WORLD. Others who directed its editorial policy for a longer or shorter time were Franklin I. Pope, Dr. Louis Bell, Dr. Carl Hering, C. J. H. Woodbury, Joseph Wetzler, J. E. Woodbridge, Ralph W. Pope, N. S. Keith, H. W. Frye, G. H. Stockbridge, C. T. Rittenhouse, C. T. Child, C. P. Poole, T. C. Martin, W. D. Weaver, Frank F. Fowle, Dr. A. S. McAllister, F. M. Feiker and D. H. Braymer—the last five having served as editors of the paper with its present form and title.

The present staff of the ELECTRICAL WORLD consists of:

New York: W. H. Onken, Jr., and H. V. Bozell, co-editors; L. W. W. Morrow, associate editor; Allen M. Perry, engineering editor; Earl E. Whitehorne, commercial editor; R. M. Davis, statistical editor; T. P. Kindig, R. L. Shepherd, H. M. Cunnington, assistant editors.

Chicago: J. C. Martin, Western editor; H. C. Anderson, assistant editor.

San Francisco: W. C. Heston, Pacific Coast editor.

Boston: H. S. Knowlton, New England editor.

Joint Problem for Architect and Engineer

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CO-OPERATION is a game that architects and illuminating engineers are learning to play and one which has been found mutually beneficial in that it gives to their joint client — the builder—a structure which is both artistic and utilitarian. Where co-operation has been lacking it has too often happened that effective lighting has been sacrificed to harmonious artistic appearance or vice versa. Neither side is wholly at fault—each must respect the other's knowledge and shape its plan accordingly.

In the article by M. M. Samuels is told how one engineer is co-operating with architects. The author submits the accompanying pictures as examples: Top, right—Diffused lighting along bank tellers' windows. Bottom—Excellent interior illumination for a restaurant. In oval—Well-balanced church lighting, St. Mark's-in-the-Bouwerie, New York.

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Architect and Electrical Engineer

Importance of Their Co-operation—Responsibility for Faults in Illumination Falls on the Engineer—His Occasional Shortcomings—Things that Must Be Considered in Making Plans

By M. M. SAMUELS
The J. G. White Engineering Corporation

THE serious fault of many lighting installations in otherwise well-designed buildings is that the fixtures are not designed to aid proper illumination and at the same time fit the architectural treatment of the rooms in which they are installed. Usually the question of illumination is neglected. To obtain the best results close co-operation between the electrical engineer and the architect is essential. The electrical engineer must assume the responsibility for sufficient illumination and the design of electrical features that will fit in with the architectural treatment and avoid inharmonious effects. To the architect belongs the responsibility for fitting the fixtures to their surroundings, at the same time allowing the electrical engineer opportunity to insure a safe installation.

There is a tendency to lay shortcomings in illumination at the door of the architect, the building owner or the electrical contractor. In some isolated cases here and there one or the other of these may actually be responsible, but the writer can testify to the fact that in all his dealings with architects he has found them ever ready to co-operate and gratefully to accept all reasonable suggestions. The specifications and figures used by architects are in all cases obtained by them either directly or indirectly from electrical engineers, and they use the best specifications available. The building owner has to depend on the architect, and the electrical contractor has to bid in accordance with specifications. Since most electrical contracts are given on a lump sum basis, the electrical contractor is naturally forced to furnish the cheapest material and labor which will pass inspection. It is, therefore, necessary for the electrical engineer to accept the responsibility for shortcomings in the art of illumination, to study them and to find means for their elimination. In accepting this responsibility the electrical engineer must also accept the responsibility of maintaining close co-operation with the architect. First of all, he must realize that it is not sufficient for him to know that the Underwriters allow only 12 outlets per branch circuit or how to figure watts per square foot or foot-candles. To be an illuminating engineer he must know something about light and shadows, about colors and their influence on the human eye and upon human moods and emotions, and he must at least know the difference between beauty and extreme ugliness.

The engineer must consult the users of electric light, office workers, factory workers, householders and others interested and must be trained to take criticisms and suggestions at their true value, as experience has shown that those who have been used to individual lights will at first be very much dissatisfied with general illumination, but will gradually accustom themselves to it and will then sing songs of praise in its favor. If judiciously applied, the criticisms of stenographers, draftsmen, bank cashiers and housewives can be of great value in discovering the actual shortcomings of the art. Furthermore, the engineer must at all times keep in touch with the fixture industry, as well as with the supply industry, to be able to apply all new improvements.

Failures of the Engineer

Often one sees a beautiful bronze fixture on a marble background, carefully designed by a skillful architect and installed at great expense, with a piece of unsightly rusty BX cable across the marble background carrying the circuit to the bronze fixture. Such negligence cannot be laid at the door of the architect, even though he could effectively protest against it. In expensive office buildings, even in some of the best banks, the lighting is sadly neglected. This is surely not due to any economical tendency on the part of the owners, because the expenditure on interior equipment often approaches waste. In fact, there are very few office buildings equipped with satisfactory lighting, and one very seldom encounters an office worker who is really satisfied with the illumination as it exists. He complains either of insufficient illumination, of improper distribution of illumination or of excessive glare. In apartment houses a similar condition prevails. It is seldom that the necessary outlets are found in the proper places when moving into a new apartment, even one of the most expensive type. This results in the necessity of swinging lampcords across the room, laying them on the floors or running them along the baseboard or picture molding. The cheapest kind of fixtures made of solder or tin are often found in the best apartments, though upon first glance they appear to be in accord with the architect's sketch. This, perhaps, is one of the reasons why the architect is sometimes blamed.

In some churches, well known for the beauty of their architecture and the wealth of the congregations, an almost intolerable condition of lighting is often encountered. Beautiful bronze chandeliers are provided by the architect, only to be equipped by the electrical contractor with glass globes of the most objectionable kind, neither utilitarian nor decorative, and allowing a painful glare without sufficient illumination for reading purposes, in spite of the fact that the wattage is much higher than would be required for reasonably good illumination.

Some Faults of Lighting Installations

The following is a brief summary of some of the most important faults to be found in lighting installations, together with some suggestions for their elimination:

First to be considered is the method of preparing a lighting drawing. One good lighting drawing is more important than many pages of specifications. For elaborate work the lighting should not be indicated on the architect's plans, but should be taken care of by

separate drawings. The symbols used are of very little importance; any symbol will do as long as it is explained in a note on the drawing. The obsolete symbols, accepted years ago by the contractors' association, are still to be found even in the newest edition of electrical, mechanical and architectural handbooks, though they are hardly ever used by illuminating engineers. They only result in making the amateur believe that he is an illumination expert when he masters the key to these symbols. The best method is to indicate each outlet by a circle, giving an identification letter for the type of fixture inside the circle and the circuit number on the outside of the circle.

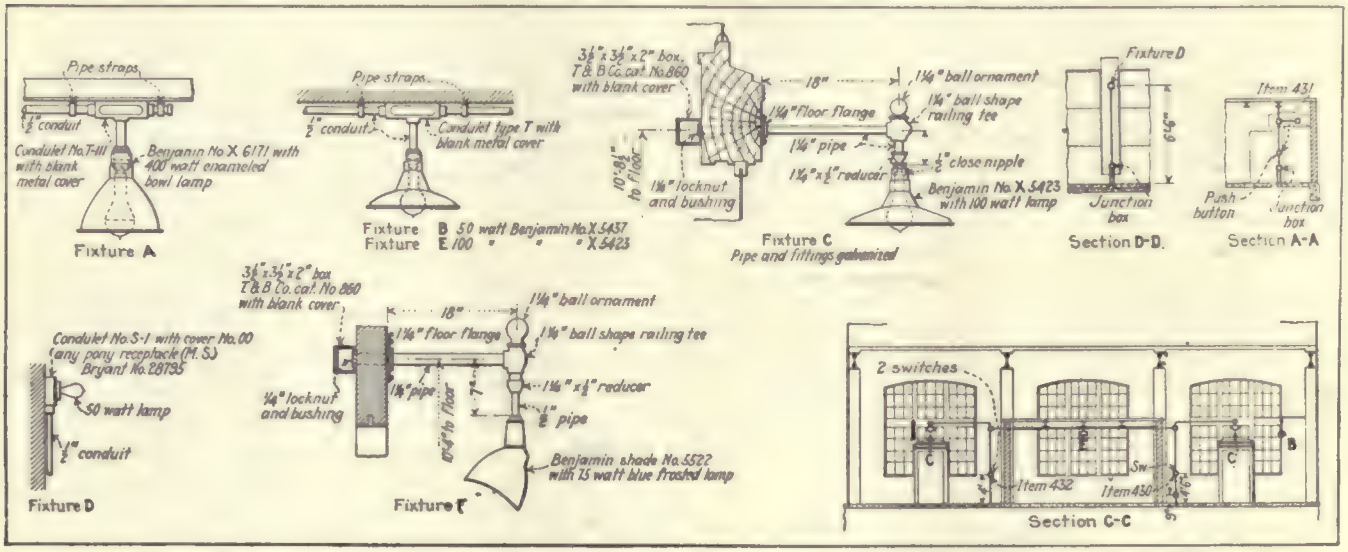
NATURE OF PLANS IMPORTANT

It is important to lay out the circuits properly and indicate the circuit number at each outlet, in order that the necessity of going back to the cabinet to try out a number of circuits before being able to identify a blown fuse may be avoided. All conduits should likewise be shown on the drawing, giving the conduit size and the circuits which it carries—i.e., "¾—15, 17," which would mean a ¾-in. conduit carrying circuits Nos. 15 and 17. Wherever conduit or "BX" is to be installed near elaborate fixtures the conduit entrances should be shown in detail, to prevent a contractor from installing it in the easiest and cheapest way. Cabinets should all be of the safety type, and standard specifications should be made available giving metal gage, thickness and other characteristics of slate, sizes of copper bars, trims, handles, locks and finish. It might be advisable to have separate sets of specifications available for first-class, second-class and third-class construction. Architects would gladly avail themselves of such specifications, and the better manufacturers would likewise welcome them because it would make it possible for them to quote on a known basis and eliminate the possibility of unscrupulous competition. Standard specifications should likewise be available for wire, tape and similar items.

The fixture problem is perhaps the most difficult to handle, because it is the least tangible. The modern idea of a fixture is that it shall be seen and not heard, and preferably not even seen, because a beautifully designed fixture sometimes gives the impression of being out of place when the lights are turned off. Here, too, it should be possible to have standard sets of specifications for offices, apartments, stores, factories, etc., each specification likewise subdivided into first-class, second-class and third-class construction. Such specifications should leave the architect a free hand for treatment and still be sufficiently clear to allow all bidders to quote on an equal basis.

The various specifications can cover the material of which the fixtures are made, the kind and quality of glassware, the types of sockets, the sizes of pipes and the material for the pipes. It should also be possible to develop a specification covering glare and distribution of illumination.

It must be admitted that it will be difficult and take a great deal of time to establish fixture standards ready for use. A beginning must be made, and even if a considerable length of time must elapse before an upper limit can be established, if it ever is, it is more important and within the range of possibility to establish a lower limit for the quality of fixtures. This should be a minimum line of demarcation that no architect would be willing to cross.



SEPARATE DRAWINGS FOR ILLUSTRATING PLANS PREVENT LEAVING THE EXECUTION OF WORK TO THE WHIMS OF THE CONTRACTOR

The location of main outlets must be determined by the types of fixtures used. It must be borne in mind that the incandescent lamp is steadily being improved in efficiency and quality, and a good lighting installation must make it possible for fixture improvements to follow upon radical improvements in lamp units. For auxiliary outlets, such as fan outlets, base receptacles, etc., there should likewise be a standard specification, subdivided into first-class, second-class and third-class construction, particularly for office buildings and apartments, and specifying for each case types and number of outlets.

Dr. Hutchinson's Chart

In "Directions for Use of Chart Enabling Calculation of Line Regulation," by Cary T. Hutchinson, printed on page 1467 of the ELECTRICAL WORLD for June 23, the equation near the bottom of the middle column should read:

$$\mu^2 = [1 + (x/r)^2]\rho^2$$

Under "Data: 7" the following equation should read $L = 66$.

Features of 1,200-Lb. Weymouth Station*

Boston Edison's New Plant Will Include Ultra High-Pressure Equipment—Normal Pressure Equipment Dominates Initial Installation—Design Combines Economy and Flexibility of Operation

By I. E. MOULTROP† and JOSEPH POPE‡

EXTRAORDINARY advances in the application of higher steam pressures combined with provision for flexibility and economy in operation throughout the plant characterize the design of the new Weymouth station of the Edison Electric Illuminating Company of Boston, now under construction to meet increasing demands for service which can no longer be adequately handled by existing generating facilities. The station is expected to have an ultimate capacity of 300,000 kw.

The selected site on the Fore River in Weymouth contains about 63 acres. It is on deep water, readily accessible by large oceangoing coal carriers, and has all other advantages necessary to give entire freedom in the design of a large modern station. The turbine room is to be adjacent to the waterfront so that the condensing-water tunnels will be direct and short.

The initial main generating equipment will consist of two turbines, each driving a main 30,000-kw. generator, and a 2,000-kw. auxiliary generator directly connected to the shaft of the main generator. These units will be supplied with steam at a nominal pressure of 375 lb. and a total temperature of 700 deg. F. There will also be one 2,500-kw. high-pressure turbo-generator taking steam up to 1,200 lb. pressure and exhausting into the 375-lb. system. All station auxiliaries are to be driven by alternating-current motors.

The boiler installation will include three boilers each containing 19,743 sq.ft. of heating surface, with additional superheater and economizer surface designed for 375 lb. working pressure. There will also be one boiler, of approximately the same heating surface, which will be designed to operate at a maximum of 1,200 lb. It will likewise be provided with a superheater, an economizer and a steam reheater to restore the temperature of the exhaust steam from the high-pressure turbine to 700 deg. before it passes into the 375-lb. system. All boilers will be fired with underfeed stokers.

The coal-handling equipment will consist of two electric unloading towers, a traveling bridge spanning the storage pile and a system of belt conveyors for transporting the coal to or from the main storage or directly from the unloading towers to the station bunkers. A Bradford breaker will be used for crushing the coal on its way to the station.

Energy will be generated at 14,000 volts, three-phase, 60 cycles. It will be distributed from the station through underground circuits partly at generator voltage and partly at 25,000 volts through an adjacent outdoor transformer substation. Future transmission by overhead lines at 115,000 volts will also be provided for.

The important bearing which the operating steam pressure and temperature have upon the possible maximum fuel economy of a station naturally called for an extended study of these features. It was apparent that this study, to be complete, would have to cover the following considerations:

1. The improvement in economy of heat utilization made theoretically possible by increased steam pressure.
2. The extent to which available equipment could be expected to take advantage of the theoretical possibilities.
3. The probable effect of increased pressure upon reliability of operation and its flexibility in meeting anticipated load conditions with high over-all economy.
4. Freedom in taking advantage of future changes in the art.
5. The economic balance of carrying charges and operating costs over a long period.

The development of one part of the study to determine the effect of the higher pressures upon improved economy is illustrated by the curves in Fig. 1.

SELECTION OF STEAM CONDITIONS

If steam turbines could be constructed which would be equally efficient in transforming the available heat energy into useful work under all initial steam-pressure conditions, Curve 4 (Fig. 1) would indicate that the over-all thermal efficiency would increase with the pressure throughout the entire range considered. The most important factors which act to decrease the turbine efficiency at higher steam pressure are the increased gland and interstage leakage losses and, more particularly, the increased steam friction occasioned by the entrained water after the dew point has been reached. This lowered efficiency is particularly marked where the maximum permissible total temperature causes the higher pressures to be accompanied by diminished superheat, thus advancing the dew point to an earlier stage. The recognized method of meeting this difficulty and thus permitting the superior possibilities of higher steam pressures to be realized is to interrupt the expansion of the steam at some intermediate pressure and restore its temperature by reheating before the expansion is continued. This may be accomplished either by employing two independent turbines, one exhausting to the other through the reheater, or by returning the reheated steam to the lower stages of the same machine from which it was extracted. The design of the Weymouth station makes provision for employing the first of these two methods, using a maximum pressure of 1,200 lb.

In order that the reheater may be required to add superheat only to the steam, it is necessary that the exhaust from the high-pressure turbine be dry. The amount of energy that may be extracted from a given weight of steam between an initial condition of about 1,000 lb. at 700 deg. and the dry saturated condition is only a fraction of that which can be utilized by its

*From a paper presented at the convention of the A. I. E. E., Swampscott, Mass., June 25-29.
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further expansion to vacuum after reheating. This condition permits the use of large standard-design turbine units for the second expansion stage of the cycle. Thermodynamically it makes little difference in the cycle efficiency at what pressure the steam is reheated, or, indeed, if it is reheated at all. In practical operation there is a certain pressure at reheat which gives the best combined efficiency of the two turbines working in series, but the efficiency at this pressure does not appear to be a great deal higher than at other pressures rather widely different from it.

Of greater importance are the mechanical problems connected with rehandling the steam, and the higher the pressure, within limits, the easier these become. For the particular situation under discussion it was desirable to have the lower-pressure portion of the plant able to function as a complete and highly economical station, so that the same considerations which control the selection of an initial pressure for the single-expansion cycle were allowed to govern the choice of a reheat pressure in this case. Although it appears from Curve 5 of Fig. 1 that about 600 lb. is the most efficient pressure for a single expansion unit, cost influences make a somewhat lower pressure more economical to use. For the Weymouth station the pressure selected is 375 lb.

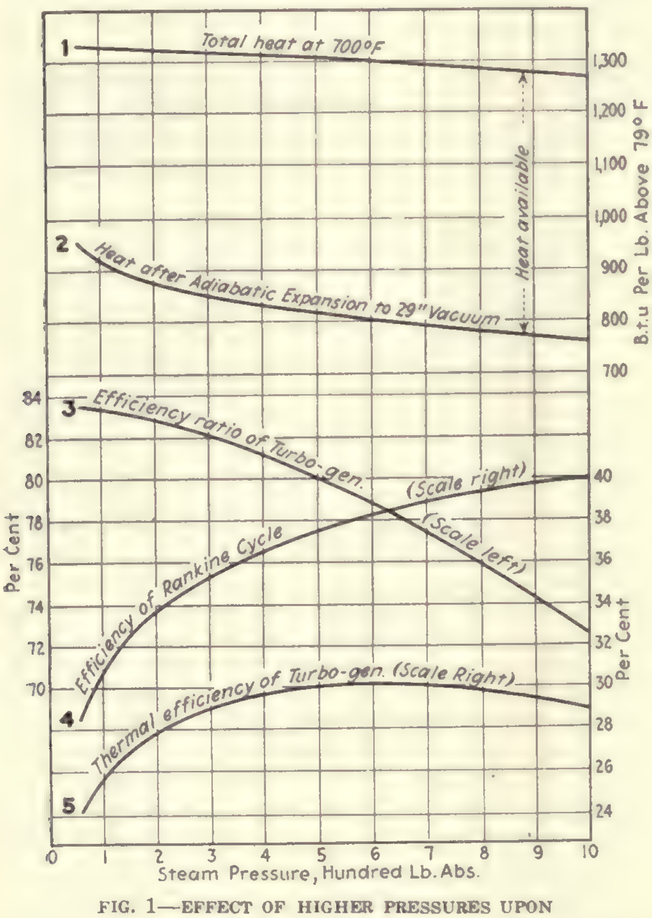


FIG. 1—EFFECT OF HIGHER PRESSURES UPON PLANT EFFICIENCY

(All of these curves have absolute steam pressure as their abscissas)

Curve 1—Total heat in 1 lb. of steam at a uniform temperature of 700 deg. F., above 79 deg. F., which is the temperature corresponding to 1-in. absolute pressure. It will be noted that the total heat shows a decrease with increasing pressure.

Curve 2—The heat remaining in the steam after perfect adiabatic expansion from the stated initial conditions to a pressure of 1 in. absolute. The vertical distance between this curve and curve No. 1 accordingly represents the B.t.u. per pound of steam theoretically available for doing work.

Curve 3—Best efficiency at present to be expected of turbo-generators in converting the available heat, as shown by Curve 3 into useful electrical energy. In determining this curve the unit is credited with all heat recovered in the condensate by bleeding at two stages.

Curve 4—Available heat as a percentage of the total initial heat shown by curve No. 1, representing the efficiency of the Rankine cycle at varying pressure. Its upward convex curvature indicates how the rate of increase in theoretical efficiency diminishes with increasing pressure.

Curve 5—The percentage of the total initial heat in the steam which would be actually converted into electrical energy or returned to the boiler in the condensate (product of Curves 3 and 4). It will be noted that this curve takes the shape of a dome, with its highest point corresponding to a steam pressure of about 600 lb. absolute.

HIGH-PRESSURE INSTALLATION

The high-pressure boilers will normally deliver steam at approximately 1,000 lb. pressure and 700 deg. total temperature, corresponding to about 153 deg. of superheat. The entire steam output of each boiler, which under the usual operating conditions will be about 110,000 lb. per hour, will pass through a simple three-stage turbo-generator, where it will be expanded down to a pressure of 375 lb. The steam will then be reheated to 700 deg. in a reheater installed in the same boiler setting and finally be discharged into the 350-lb. header serving the main turbines. It may be noted from the quantity of steam passing through each of the high-pressure turbines that three such boiler-turbine units will be required to supply one of the main 32,000-kw. turbines at the higher loads. Operating under the conditions outlined, each of the high-pressure turbines will generate about 2,000 kw. Thus a total of 6,000 kw. will be generated in reducing the pressure of the steam required by one of the main units.

The high-pressure boilers will have tubes 2 in. outside diameter and 15 ft. long. The tubes will be arranged in two banks with sufficient space between for the superheater and reheater. The drum will be a hollow-steel forging of 48 in. outside diameter with walls 4 in. thick. In order to maintain suitable drum strength, the tubes and nipples, which commonly enter the drum in lines parallel with its axis, are turned in pairs through an angle of 90 deg. so that the two enter the drum on a common circumference.

The generator of the pressure-reducing units rated at 3,000 kva. is to be of the induction type, if a suitable design can be worked out. This would avoid the necessity of separate excitation and careful synchronizing when being placed in service.

The ratio of high-pressure equipment and normal-pressure equipment to be installed in the future will depend upon the results obtained from this initial installation and upon the experiences of others who are working along similar lines or who are employing other methods for the utilization of high-pressure steam and the reheat cycle.

BOILER PLANT AND FEED-WATER HEATING

The normal-pressure boilers, which are to deliver steam at 375 lb. and a final temperature of 700 deg., will be of the cross-drum design, forty-eight tubes wide and seventeen tubes high, with the superheaters between the tube banks. The exit gases will be further cooled by straight steel-tube economizers which, with the induced-draft fans, will be placed above the boilers. The furnace arrangement provides for firing from the low end of the boilers. The stokers are to be of the underfeed type, with clinker grinders, there being sixteen retorts per boiler. The boilers will be set with the bottom of the uptake headers 25 ft. above the firing floor. They will be arranged in parallel rows with the uptake ends facing a common center aisle from which all firing operations will be controlled. The stokers,

which will thus be in the side aisles, will be supplied with coal from overhead longitudinal bunkers. This will assure well-lighted, clean and cool working quarters for boiler-room operators and locates the stokers where abundant side light and ventilation are obtainable.

Except for the necessary modification in details, the boiler designed for operation at 1,200 lb. pressure and previously described will be installed in accordance with the same general plan employed for the lower-pressure boilers. The stoker and furnace installation will be practically the same, and no attempt is to be made to isolate this installation.

Make-up water is to be provided by evaporators, and the entire supply will be deaërated.

Economizers with a heating surface equivalent to about 55 per cent of the boiler surface were chosen. This selection was preceded by a study of the following influential factors:

1. The temperature at which the feed water should leave the bleeder heaters and enter the economizers.

2. The most advantageous division of the total heating surface between the boiler and the economizer.

The capacity of the feed water to absorb heat is theoretically limited by the range between two fixed temperatures—that of the condensate and that of the saturated steam in the boiler. The practicable range of heating is, of course, somewhat narrower. The heat consumption of the main turbine, when credited with all heat returned to the system, is unquestionably the lowest when all of the heating is done by extracted

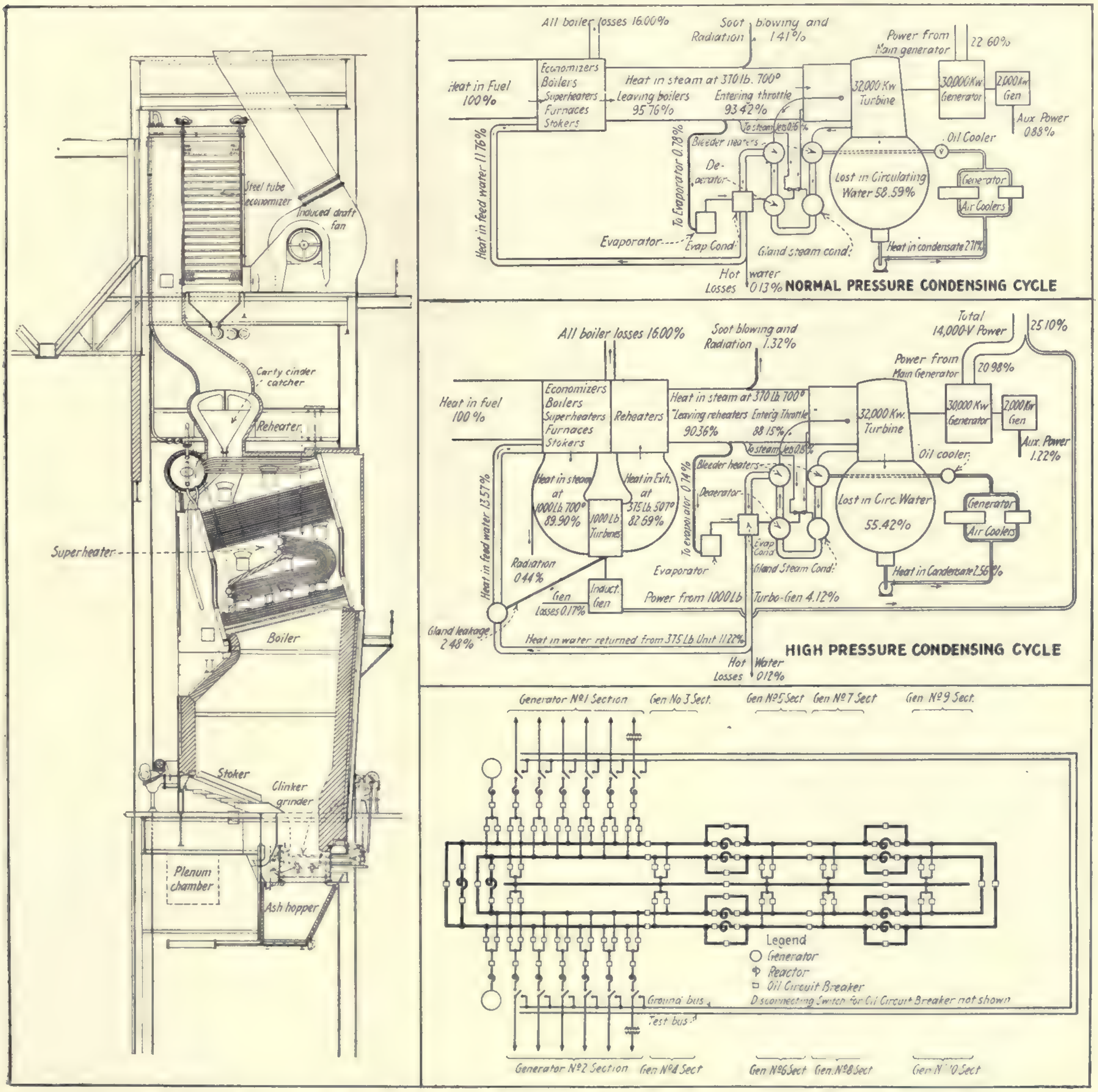


FIG. 2—CROSS-SECTION OF WEYMOUTH 1,200-LB. BOILER, GRAPHIC REPRESENTATION OF HEAT BALANCE, AND BUS, SWITCH AND REACTOR LAYOUT

The upper right-hand diagram shows an analysis of the performance which could theoretically be realized in the operation of the normal-pressure (375-lb.) portion of a station of the design described. The diagram below shows a similar analysis for such a station operating exclusively on the reheat cycle, with the entire steam supply generated at 1,000 lb. Both diagrams are based upon ideal operating conditions, i.e., a constant station load that would permit the main units to operate at best efficiency and at 100 per cent load factor. The efficiency of each piece of equipment is that guaranteed by the manufacturer.

steam. On the other hand, the efficiency of the boiler plant is highest when all of the heating is done in the economizer. The best over-all plant efficiency must therefore lie in some compromise between these opposing considerations. The calculations made for the Weymouth station indicated that the most advantageous temperature to change the method of heating was between 210 deg. and 220 deg. F. Practically considered, this is a most desirable temperature also, for it avoids the use of superheated steam in the extraction heaters, diminishes the possibility of external corrosion of economizers and permits adequate deaëration of the feed water.

Decision to fire the boilers with stokers was reached only after a very careful study of the relative merits of using pulverized coal. The conditions surrounding this problem for the Weymouth station were such that the probable savings in fuel through the use of powdered coal represented a relatively low percentage of the total fuel cost. This estimated saving was further reduced by the additional carrying charges to a margin which was too narrow to clearly call for the use of the powdered-coal system. It was accordingly decided to adhere to the present practice of the Edison company and employ stokers, at least for the initial boiler installation.

All of the normally operating station auxiliaries are to be electrically driven, using alternating-current motors throughout. Motors of 25 hp. and less will, in general, be served at 550 volts, and those of greater capacity at 2,300 volts. Any necessary speed regulation is to be obtained by the use of brush-shifting and slip-ring motors.

Power for all auxiliaries upon which the continuity of operation of the main units depends will be supplied from auxiliary generators driven by the main turbines through direct connection to the shafts of the main generators. These auxiliary alternators will have a rating of 2,500 kva. and will generate at 2,300 volts, three-phase. They will be mechanically in phase with the main generators, so that although they will normally operate independently, they may be connected to the main bus through suitable transformers when desired. In starting up a main unit all of the auxiliaries will be started from the main bus, but after the unit is in operation the important auxiliaries will be transferred to the auxiliary bus of that unit and thus be supplied from the auxiliary generator independently of the main circuits. The less important auxiliaries will be regularly operated from a 2,300-volt bus fed through transformers from the main bus. A separate steam-driven auxiliary turbo-generator will be provided to permit starting the station from cold in emergency.

Each generator will be excited by a 175-kw. motor-generator set, consisting of a 2,300-volt induction motor and a 250-volt direct-current generator. This set will be operated from the directly connected auxiliary generator. A spare motor-generator exciter and also a spare steam-driven exciter are to be installed for emergency excitation and for battery charging. A storage battery will float on the exciter bus. The 2,300-volt auxiliary generators will have directly connected exciters, but in an emergency may be excited from the 250-volt buses.

All incoming and outgoing circuits enter or leave through the cable room in the basement. In the layout of this room the following have been the guiding principles:

Proper segregation of the cables in the ducts.

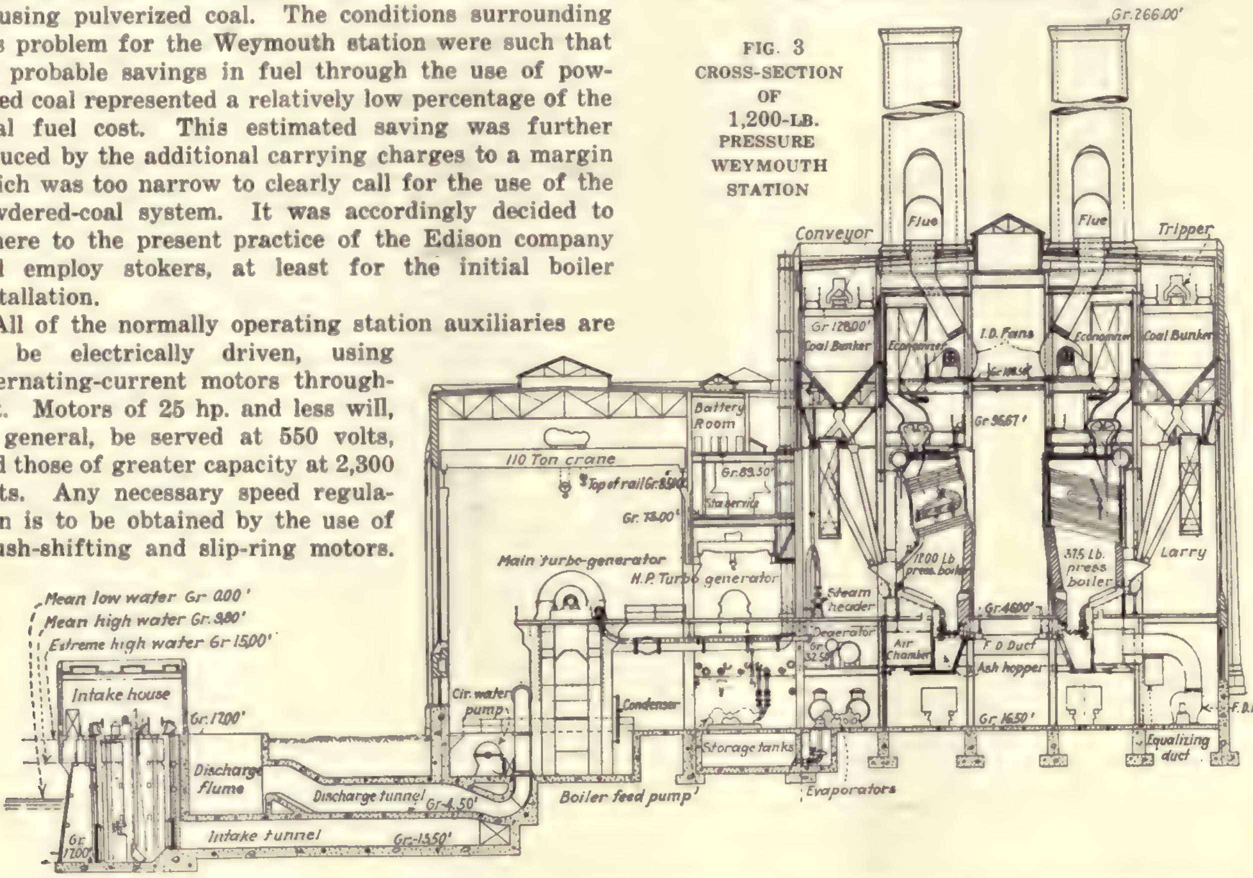


FIG. 3
CROSS-SECTION OF 1,200-LB. PRESSURE WEYMOUTH STATION

Facility for taking any feeder circuit into any outgoing duct line without the need of further crossovers in outside manholes.

Means for testing any cable at any time at suitable high voltage and for complete protection of men working on cables through potential indicating and grounding devices.

Suitable space and handling facilities for cables.

The switch-house structure is subdivided by suitable longitudinal and cross-partition walls so that each bus section is in a room by itself. Conduit is run in floors and kept out of electrical structures wherever possible. Metallic reinforcement of concrete electrical structures has also been avoided as far as practicable, and where reinforcing is essential it is either discontinuous or solidly grounded, so that a high-resistance ground passing insufficient current to open the circuit will not cause heating of the reinforcement and disintegration of the concrete.

A double-ring bus is planned in conjunction with a single transfer bus. The two ring buses will be

sectionalized with current-limiting reactors between sections. Each section will be fed by two generators. It will be possible by use of the transfer bus to interconnect any two of the sections, thus permitting complete flexibility of operation. For the initial development only one bus section will be necessary, which will be operated simply as a double bus.

The connection of all generator and feeder circuits to the bus is to be through two oil circuit breakers in series so that there may be double assurance of ability to open the circuit under any emergency condition. This object may also be attained by the use of group buses if the capacity of the individual circuits is insufficient to warrant the expense of the extra breakers that would otherwise be required. The oil circuit breakers for use on feeders and for bus sectionalizing are guaranteed to rupture 34,500 amp. at 15,000 volts. Those on generators and on large-capacity transformer circuits which may connect with other power systems are guaranteed to rupture 58,000 amp. at this same potential.

The generators and their cable connections to the buses will be protected by balanced relays arranged to disconnect automatically any unit from the bus in the event of a ground or short circuit on the machine side of the circuit breaker. The generator leads are to be single-conductor cables carried on insulators from the machines to the switch house through closed corridors. No cables carrying a higher potential than 2,300 volts will be carried in ducts within the station.

On account of the relatively low capacity of the generators which are to be driven by the 1,200-lb. pressure turbines, the expense of providing the necessary switching equipment and building space for their direct connection to the main bus is not warranted. It is planned, therefore, to connect each group of three of these units to a separate bus through low-capacity oil circuit breakers. The group bus will in turn be connected to the main bus in about the same manner as a feeder.

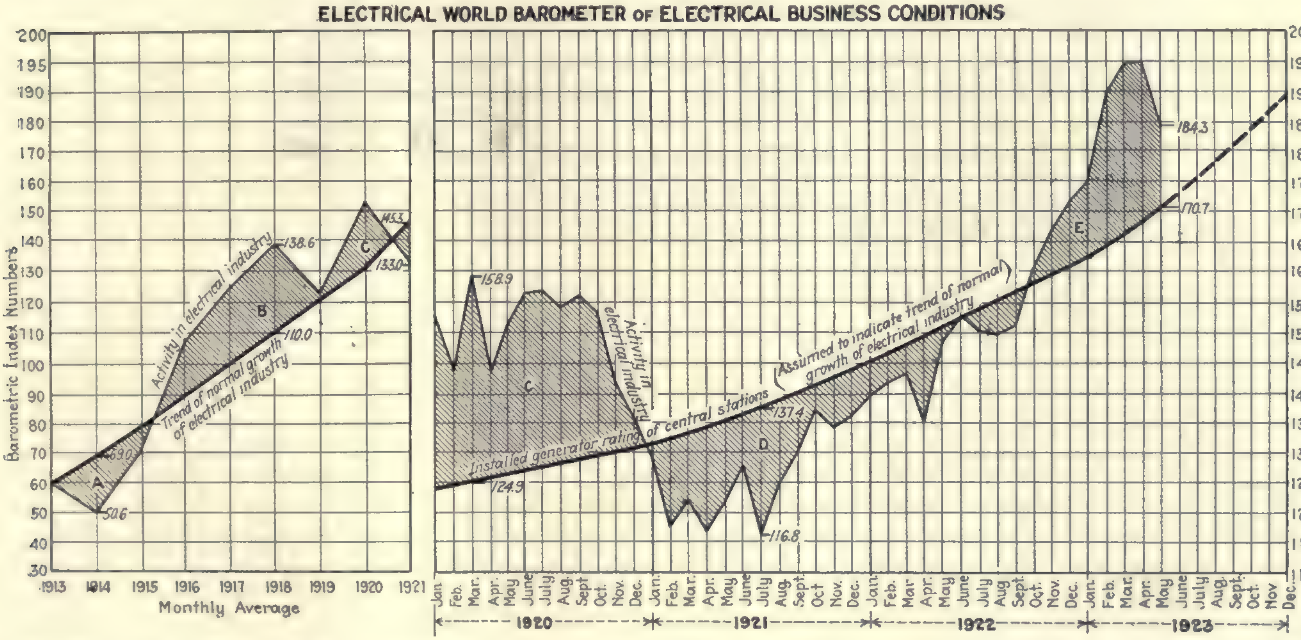
From the accompanying diagrams it will be observed that the normal-pressure, straight-condensing plant will transform 22.6 per cent of the heat in fuel into electrical energy, which is equivalent to 15,100 B.t.u. per kilowatt-hour net generated, or approximately 1.05 lb. coal of a heat value of 14,400 B.t.u. per pound, while the corresponding figures for the high-pressure reheat plant are 25.1 per cent, 13,600 B.t.u. per kilowatt-hour and approximately 0.945 lb. coal.

The above calculated results represent only the ultimate possibilities under ideal load conditions. It is, of course, impossible to predict what the results of actual operation will be, as this will be influenced considerably by the extent to which a constant base load can be allocated to the Weymouth station and the extent to which it is found advisable to employ the high-pressure equipment in making future extensions to the plant.

Decreased Activity During May

INDEX figures upon which the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" is based indicate that activity within a few other primary industries decreased during April and May. The continued decline in volume of construction has begun to show a reaction—probably temporary—in the barometer of business conditions in the electrical industry. The *Engineering News-Record* construction volume index shows that between March and June there was a drop of almost 80 points in the index scale as compared with 1913 construction. Construction is now about 20 per cent under that of June, 1922. Contracts filed during the last two weeks in June, however, indicated that this decrease in volume of new construction had been halted, and that the volume of construction would be maintained about as of the middle of June.

ELECTRICAL WORLD BAROMETER OF ELECTRICAL BUSINESS CONDITIONS



The basic data upon which the "ELECTRICAL WORLD Barometer" is based indicate a decrease of 10.7 points on the barometer scale as compared with April activities. During this interval the industry has grown 2.7 points, leaving a net decrease in activity of 13.4 points on the barometer scale as compared with April. The electrical industry as a whole was operating in May at 13.6 points or per cent above what would have been the point of seasonal demand if growth in the industry had been normal. In April it was operating at 27.0 points or per cent above the point of normal demand.

Swampscott Convention of A. I. E. E. Has Record Attendance

Real Contributions to the Art and Science of Electrical Engineering Interspersed with Numerous Trips of Technical and Historic Interest —Phenomena Occurring in Dielectrics Receive Particular Attention

AN ATTENDANCE of more than 1,600 sets a new mark for conventions of the American Institute of Electrical Engineers. This was the registration at the thirty-ninth annual convention, which met last week at the New Ocean House, Swampscott, Mass., and it gives an indication of the value placed on the convention by the Institute members and their friends. As usual, the week was a full one and pleasure was combined with business. The afternoon trips to points of historic and engineering interest were highly successful, and the entertainment program left nothing to be desired.

That it was not all pleasure, however, is indicated by the fact that in the four mornings from Tuesday to Friday six technical sessions were held, besides one on Wednesday evening, while on Monday, before the formal opening, there was a discussion of sectional and regional problems, as reported in the news columns of the ELECTRICAL WORLD last week.

Most of the papers presented represented real contributions to the art and science of electrical engineering. Among the outstanding points in the technical sessions might be mentioned:

Description and discussion of the new Weymouth station of the Edison Electric Illuminating Company of Boston, with its high-pressure unit.

Discussion of the cooling of electric machines.

Steinmetz's interpretative discussion of his own scientific investigations of cable changes and discharges to show the practical application of the results obtained.

Account of laboratory facilities at hand, as disclosed by Peek, to study phenomena accompanying lightning discharge, these facilities having afforded a new tool for explaining hitherto mysterious phenomena in the extra-high voltage field.

Descriptions of Housekeeper's method of sealing base metals through glass, of a 12,000-volt direct-current generator and of a pellet-type oxide-film lightning arrester for moderate voltage circuits.

Reports on the increased accuracy and efficiency of transatlantic radio communication through the use of multiple-tuned antennas eliminated carrier and side-band waves and increased flexibility of circuit control; the improved methods of measuring signal and noise strength at receiving stations and progress in the measurement of frequency; the proposed test code for "loud speakers," and the value of artificial-line research to the electrical industry and to engineering education through the predetermination of transmission phenomena and the stimulation of students' interest.

A general account of the meetings, the papers presented and the discussion thereon is given in the following pages.

DIELECTRIC PHENOMENA

Soaking in of Charges Visualized by Dr. Steinmetz—Voltage Distribution Depends Upon Specific Capacities and Resistivities— Short Method of Calculating Cable Capacities

THE first session of the convention was opened by an address by President F. B. Jewett, whose line of thought was indicated in last week's issue. His theme was "Engineering Associations —Their Problems, Past, Present and Future." Following the delivery of this address three excellent papers more or less related to cables were submitted. One, by Dr. C. P. Steinmetz, gave a basis for visualizing what takes place in a dielectric when it is charged or discharged. The second, by J. L. R. Hayden and W. N. Eddy, brought out the wide range of ratios between direct and alternating voltage breakdown values. D. M. Simons presented a graphical method of calculating current-carrying capacity of cables.

Soaking in of Charges

Many mysterious phenomena occur in insulations which have prevented their utilization without allowing extremely large safety factors. Hence it is proper, declared Dr. Steinmetz, that considerable study be devoted to reaching a satisfactory explanation of these

phenomena if this important constituent of every electrical circuit is to be used most effectively. One of these phenomena is the soaking of charges into dielectrics.

Dr. Steinmetz declared that this is a true electric circuit transient, slower than electrical technicians are ordinarily accustomed to and caused by a gradual readjustment of charges within the dielectric due to combinations of capacitance and resistance which exist in all dielectrics. At the moment of voltage application the voltage distributes between the components of the dielectric in proportion to their specific capacities. Gradually, however, this voltage distribution changes to a distribution proportional to the resistivities of the component dielectrics and electrostatic charges built up at the boundaries between the component dielectrics. Owing to the high resistivity of most dielectrics, this readjustment is very slow and accounts for the long transients of minutes, hours and sometimes days.

As a result of this redistribution of stresses a dielectric may break down promptly or after a considerable application of voltage, depending on whether it is alternating or unidirectional and depending on how the distribution of stresses during this readjustment compares with the respective dielectric strengths of the components. Because of these reasons there can be no definite relation between breakdowns resulting from either alternating-current and direct-current.

Dielectric Strength Ratio

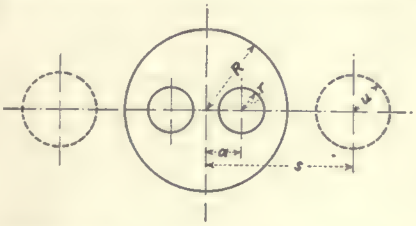
According to extensive tests reported by J. L. R. Hayden and W. N. Eddy, excess direct voltage is less likely to damage insulation permanently than alternating voltage. However, the ratios of the dielectric strengths measured with both voltages may extend over a considerable range. Sometimes this dielectric strength ratio may be very much greater than unity and sometimes less. Ratios less than unity were given by oils, petrolatum, powdered glass, etc., whereas ratios greater than unity were found with paper, cloth, solid glass, mica, etc. The ratio was found to vary considerably for laminated insulations and in general increase with decreasing temperature and thickness and increasing rapidity of voltage application.

Calculation of Cable Current-Carrying Capacities

A graphical method of calculating the safe current-carrying capacity of cable embodying the use of a "geometric factor" was explained by Donald M. Simons. With it results were determined for two, three and four-conductor cables and an empirical formula was developed. Compared with experimental results which have been obtained, the results with this method are very satisfactory, the author contended. Various applications of the formula to practical cases were illustrated.

Transients and Cable Capacity

The difference in transients in gaseous, liquid and solid dielectrics, the effect of previously charging a dielectric on its dielectric strength ratio and the possibility of calculating cable capacity by simple mathematics constituted the chief subjects of discussion following the presentation of papers by Messrs. Steinmetz, Hayden, Eddy and Simons. Dr. Slepian questioned whether the phenomena of soaking in of charges could be explained as Dr. Steinmetz did by attributing it to non-homogeneity,



taking as an illustration a vacuum dielectric. With this, he pointed out, space charges are developed which make the dielectric gradient non-uniform. The transient which occurs with application of voltage is more rapid than in a solid dielectric because of the freedom of movement of the electrons.

Mr. Simon referred to some experiments in which it was found that charging a dielectric in different directions prior to the measurement of the dielectric strength ratio has considerable effect on the results which are obtained. Using a steep wave front and previously charging one dielectric, the alternating voltage breakdown strength was more than cut in two, he explained.

H. B. Dwight presented an accurate mathematical method of calculating capacities of cables using the direct process of calculating capacitance and "geometric factors" of multi-conductor cables. The results, he declared, have agreed with those obtained by standard hyperbolic cosine formulas to six significant figures. The terms involve only the dimensions of the cables and can be calculated with a slide rule. The only disadvantage is that the formula contains a large number of terms.

Capacitance of Two-Conductor Cable

$$= \frac{1}{2 \log_h F_c}$$

$$2 \log_h F_c = \log_h \frac{(s-a-u)(s-a-r)(s+a-u)(s+a+r)}{r\,u\,(2a+r)(2s-u)}$$

$$+ \sum_{n=1}^{n=\infty} \frac{L_n}{n}\left[1-\left(\frac{r}{s-a-u}\right)^n-\left(\frac{-r}{s+a-u}\right)^n+\left(\frac{-r}{2a+r}\right)^n\right]$$

$$- \sum_{n=1}^{n=\infty} \frac{M_n}{n}\left[1-\left(\frac{u}{s-a-r}\right)^n-\left(\frac{u}{s+a+r}\right)^n+\left(\frac{u}{2s-u}\right)^n\right]$$

$$u = \frac{R^2 r}{a^2-r^2} \qquad s = \frac{R^2 a}{a^2-r^2}$$

$$A_n = \left(\frac{r}{s-a}\right)^n - \left(\frac{-r}{2a}\right)^n + \left(\frac{-r}{s+a}\right)^n$$

$$F_n = -\left(\frac{u}{s-a}\right)^n + \left(\frac{u}{2s}\right)^n - \left(\frac{u}{s+a}\right)^n$$

$$B_n = -\left(\frac{r}{s-a}\right)^n \sum_{k=1}^{k=\infty} \frac{(n+k-1)!}{(n-1)!\,k!}\left(\frac{u}{s-a}\right)^k F_k$$

$$-\left(\frac{-r}{2a}\right)^n \sum_{k=1}^{k=\infty} \frac{(n+k-1)!}{(n-1)!\,k!}\left(\frac{-r}{2a}\right)^k A_k$$

$$-\left(\frac{-r}{s+a}\right)^n \sum_{k=1}^{k=\infty} \frac{(n+k-1)!}{(n-1)!\,k!}\left(\frac{u}{s+a}\right)^k F_k$$

$$G_n = -\left(\frac{u}{s-a}\right)^n \sum_{k=1}^{k=\infty} \frac{(n+k-1)!}{(n-1)!\,k!}\left(\frac{r}{s-a}\right)^k A_k$$

$$-\left(\frac{u}{2s}\right)^n \sum_{k=1}^{k=\infty} \frac{(n+k-1)!}{(n-1)!\,k!}\left(\frac{u}{2s}\right)^k F_k$$

$$-\left(\frac{u}{s+a}\right)^n \sum_{k=1}^{k=\infty} \frac{(n+k-1)!}{(n-1)!\,k!}\left(\frac{-r}{s+a}\right)^k A_k$$

For C_n and H_n use the same formulas as for B_n and G_n except change A to B and F to G. For D_n and I_n change B to C and G to H, etc.

$$L_n = A_n + B_n + C_n + \cdots$$

$$M_n = F_n + G_n + H_n + \cdots$$

WEYMOUTH STATION AND GENERATOR COOLING

Air Preheaters Versus Economizers—Desirable Size of Tubes—Importance of Reliability—Possibility of Incorporating Weymouth Design in Old Stations

IN THE Wednesday morning session, presided over by R. F. Schuchardt, the new Weymouth station of the Boston Edison Company was the topic of major interest. In addition, two notable papers on generator cooling were presented. In presenting the paper on the Weymouth station (see page 9 of this issue) I. E. Moultrop stated that a great opportunity now existed to utilize new principles and equipment in power-station design, and that it is becoming increasingly important to increase the efficiency of energy production in fuel-burning plants.

The two things that stand out in the design of the Weymouth station, I. E. Moultrop said, are the use of higher steam pressures and the decision not to use pulverized fuel in spite of its recent widespread adoption. A study of the stoker-fired plant in comparison with the pulverized-fuel plant showed no advantages in the latter. It had, instead, some disadvantages because of the newness of the type.

The use of high steam pressures was based on careful study to the effect that 375 lb. and 725 deg. temperature were the upper limits in pressure and temperature for use with standardized equipment and for economical operation. A study of various reheating schemes showed a promise of highest

efficiency for the installation of a 1,000-lb. boiler rather than a 550-lb. boiler, and in addition a unit cost comparable to that of the standardized plant. Load conditions prohibited operation of the station as a base-load plant, and this had a decided bearing on the decision. If the new station succeeds in reaching 15,000 B.t.u. per kilowatt-hour, it will be very encouraging because it will permit steam stations in the Boston district to compete successfully with St. Lawrence hydro-electric power for many years to come.

S. Z. Ferranti of England, in a written discussion, considered the design correct in its essentials. He commented on the fact that an economizer was used instead of an air heater and suggested that a further gain in economy could have been secured if a flue-gas heater had been used to increase the temperature of the feed water. He also stated that his experience had proved that the reheating boiler should be located very near the turbine to avoid long pipe runs.

Dr. D. S. Jacobus, in a written discussion, stated that the use of high-pressure steam was not new but that installations of large size were not available. In his opinion it might be economical to use 600 lb. pressure and not 1,200 lb. pressure with reheating to secure better operating economy in large stations. He also favored the use of an air heater, and said that it might be advantageous to eliminate the economizer entirely. In discussing the boiler design he stated that a more efficient boiler might have been designed with the use of 1-in. tubes and with only the two lower layers exposed to the flame, but that careful consideration showed that better and more economical operating conditions could be obtained with the existing design, which uses 2-in. tubes and six rows exposed to the furnace. Trouble with maintenance of refractories, maintenance costs and convenience in cleaning were governing considerations in favor of the present design.

Peter Junkersfeld stated that reliability in operation and minimum over-all productive costs were primary elements for designers to consider. He asserted that too much standardization in station design was fallacious as each plant had local conditions of a special character. The cost of fuel and the load factor are governing considerations in design, and the latter is a variable depending on local conditions. He desired to know why the specific pressures and temperatures were decided upon and the value of the efficiencies assumed in working out the predicted performance.

Professor Davis of Harvard said the paper proved conclusively the inadequacy of existing steam tables at the higher pressures, but that research work was now in progress and that data were available up through 550 lb. pressure.

L. L. Elden said that the station was to be used in connection with the company's complete scheme for supplying power to the Boston metropolitan district. It will be connected to a 110,000-volt ring high-tension line the other end of which will tap a future station to the north of the city. These stations with interconnections with the existing L Street station will serve the territory for many years. Provision is also made for tapping any hydro-electric source to the ring as developments occur in the territory exterior to the ring.

H. P. Liversidge emphasized the importance of reliable and economical stations for central-station service. He said that, although the new station involved radical departures in practice, yet it was safe, in that all contingencies have been anticipated in case the high-pressure installation proves unsuccessful.

The Weymouth type of installation recommended itself to G. L. Knight, Brooklyn Edison Company, because it could, if successful, be placed in some of the older existing stations to increase their operating efficiency and economy.

H. W. Eales stated that the Cahokia station, which used pulverized fuel, was designed for ready change to any other system of fuel burning should the art advance. He stated that discussion of pulverized-fuel installations was profitless until real data on the large stations were made available. A saturated core reactor connecting the auxiliary main bus was adopted for Cahokia and should be considered by other designers. He inquired if a double-current generator might not be used on the main-unit shaft to supply both excitation and auxiliary power.

Cooling Apparatus

A valuable experimental paper was presented by G. E. Luke on the cooling of generators. A complete abstract of this paper will appear in a later issue of the ELECTRICAL WORLD. The fundamental principle of the designer is to keep the machine operating continuously at the maximum permissible temperature and to have this temperature uniform throughout the machine.

C. W. Rice presented a research on "Free and Forced Convection in Liquids and Gases," in which he supported the Langmuir film theory, assembled extant information on the subject and extended the degree of theoretical knowledge concerning it.

V. M. Montsinger discussed the paper by C. W. Rice and stated that he had made experiments recently which supported conclusively the film theory of Dr. Langmuir. He said that the area of the heated surface and the temperature ranges used were very important in dealing with convection.

C. J. Fechheimer emphasized the difficulty of the heating problem, but asserted that the progress made in attacking its elements augured well for its future solution.

LIGHTNING SPARKOVER LAWS UNIFORM

Discharges Follow Same Laws as at Lower Voltage—Some Low-Voltage Conductors Become Insulators at High Potential—Insulation Deterioration Caused by Ionization Losses

DIELECTRIC ionization in one phase or another constituted the main theme of the four papers presented at the sixth technical session Friday morning. The paper by F. W. Peek, Jr., drew forth particularly thorough discussion. President-elect H. J. Ryan commended all the authors most highly for what he called the explicit way in which each stated the conditions under which observations were made. This, he declared, is particularly important because the breakdown of dielectrics involves a very complicated combination of several factors. Work of the sort represented by these papers, he said, will help explain some of the rather mysterious results now obtained in practice.

Peculiar Phenomena with Very High Lightning Voltages

Some remarkable phenomena take place when lightning voltages with a very steep wave front of the order of millions of volts per second are allowed to discharge, declared F. W. Peek, Jr., who has been studying these phenomena in the Pittsfield laboratory with a 2,000,000-volt lightning generator. For instance, much higher lightning voltages are usually required to jump a given distance than voltages at normal operating frequency; conductors at normal-frequency voltages are often good insulators for lightning voltages; water may be punctured like oil; the wet and dry sparkover voltages of insulators are equal; the lightning discharge has a decidedly explosive effect, etc.

The lightning sparkover of various gaps follows the same laws at these extremely high voltages as at the lower voltages. It usually takes a higher lightning voltage to "jump" a given gap than a low-frequency voltage.

The lightning sparkover of insulators is not greatly affected by rain or weather conditions. On a shielded string of insulators the spark may be made to clear in both fair and rainy weather. The lightning sparkover voltage is not reduced by the shield.

Certain materials that are conductors of moderate resistance at normal-

frequency voltages may be good insulators for lightning voltages. Tests in this direction indicate how useless a high-resistance lightning arrester is.

In measuring lightning voltages resistance must not be used in series with the sphere gap. Resistances so placed give the sphere gap all of the time-lag characteristics of the needle gap, and the sparkover voltage varies with the wave front.

An investigation of the change in characteristics of lightning waves as they travel along a transmission line shows a decrease in voltage and flattening of the wave front due to corona and other losses. The waves tend to double up or increase on striking an open line or an inductance. Under certain conditions the voltage on the far side of an inductance may be increased to three or four times the voltage that reaches the inductance. In general, inductance to be safe should be shunted by resistance.

Unusual interest was shown in the phenomena accompanying discharge of lightning voltages by the quite general participation in the discussion of Mr. Peek's paper. Dr. F. B. Jewett cited an interesting instance in which the conductor in a rubber-covered wire completely disappeared after a lightning stroke without damaging the rubber insulation to an appreciable extent.

H. Goodwin, Jr., R. H. Marvin and D. D. Clarke pointed out that Peek's investigation seemed to indicate that the resistance of wooden cross-arms may be of considerable insulating value against lightning discharges.

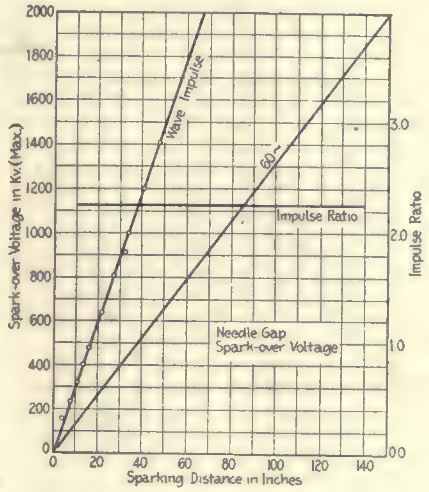
The time lag of sphere gaps is largely dependent on the time required to charge the spheres, declared J. F. Peters. He also pointed out that high-resistance arresters are ineffective, not because of a larger impulse ratio, but because of their inability to draw off large currents. Resistance, while detrimental in some respects in connection with arresters, may be beneficial in series with gaps to prevent their overshooting, he contended. The reflection characteristic of reactors is very valuable in connection with lightning arresters.

Dr. J. Slepian questioned whether the sphere gap can be considered as having no time lag when waves reaching a maximum in 10^{-8} seconds are involved. According to tests which the speaker reported, there is a lag in sphere gaps under these conditions of about 10^{-6} second. When gaps are in series with reactance such as exists in the leads the voltage may rise to double normal value, owing to resonance, if some damping resistance is not inserted. When the rate of rise of voltage is very large in comparison with the natural period of oscillation of the gap, the voltage measured by the gap may be far from correct.

H. J. Ryan pointed out that as the gap increases the impulse ratio diminishes.

D. D. Clarke referred to Peek's investigation as a new tool by which more definite information can be obtained regarding what happens on a transmission during lightning storms. He supplemented other speakers in suggesting that the resistance of wood cross-arms (wet or dry) may extinguish power arcs that may follow flashovers caused by lightning.

When the time for a voltage surge to reach maximum value is four and one-half micro-seconds the error with sphere-gap measurement may be 5 per cent, G. E. Howes announced, whereas if the time is only three-quarters of a micro-second, the error may be 24 per cent.



COMPARISON OF LIGHTNING AND 60-CYCLE SPARKOVER DISTANCES

The possibility of studying means of protecting buildings against lightning through the medium of the lightning generator was suggested by H. S. Warren.

Attention was called by K. B. McEachron to the enormous pressures which are produced by electric sparks. He said that 600 atmospheres are produced by even small sparks.

In closing the discussion on his paper, Mr. Peek urged caution in the use of series resistance with lightning arresters. While he did not contend that sphere gaps have no time lag, he expressed the belief that they are sufficiently accurate for measurements. He offered the explanation that the high pressures exerted within wood when it is subjected to a high-voltage discharge may be due to distillation of the wood. Studies are being made of lightning protection for buildings, he announced.

Gaseous Ionization in Built-Up Insulation

Gaseous ionization losses in built-up insulation begin about 4,000 volts (corresponding to an average potential gradient of about 16,000 volts per centimeter), declared Prof. J. B. Whitehead in his paper. Above this value the losses increase more rapidly than as the square of the voltage. For the most tightly wrapped mica-folium bars the exponent may be as low as 2.15. For bars high in mica, dried and expanded under temperature, it reaches 4.4. The values for the whole series of bars in the undried state lie between 2.15 and 2.6, with an average value about 2.3. In well-wrapped mica-folium insulation from 10 per cent to 40 per cent of the total dielectric losses are due to internal ionization. Ionization losses, while not of sufficient amount to increase materially the temperature of the coil, do, however, cause progressive deterioration of the insulation. The total dielectric losses in mica-folium and paper insulation increase with decreasing mica content. Reducing the mica folium by 75 per cent and substituting shellacked paper approximately doubles the loss. Omission of the final 25 per cent of mica increases the original loss ten times.

The internal air spaces which permit ionization are increased to some extent by the bowing of the mica on bending, but more particularly by loose wrapping and expansion of the insulation under temperature. Bars wrapped under temperature and pressure show the lowest ionization loss, but the run of the bars in each group of three is not uniform, occasional samples showing high ionization loss.

Danger of failure of mica insulation from corona is very small, declared C. J. Fechheimer, up to 15,000 volts. Where ionization holds over from crest to crest the voltage per inch required to break down the air gap may be reduced greatly, H. J. Ryan asserted. It may be as low as 1 kv. per inch.

D. M. Simons spoke very highly of the reliability of the quadrant electrometer in measuring small losses, saying that he had used one ten years without accident.

In the past the thickness and character of built-up insulations has been determined largely by allowable temperature and dielectric strength, but the possible effect of ionization should make this more of a factor for consideration than it has been, R. B. Williamson said. Even where dielectric strength and temperature do not demand mica insulation it may be desirable to use it to prevent ionization, especially in the higher-voltage rotating equipment.

G. E. Howes emphasized the need of minimizing air gaps in built-up insulation, citing some data which he had obtained. For example, an air gap 0.026 cm. thick will break down at 50 kv. per centimeter, whereas one 0.004 cm. thick will require 120 kv. per centimeter.

Photographic Methods of Studying High-Voltage Discharges

Some of the results of two methods of drawing out the alternating-current corona discharge along a time axis were presented in a paper by Karl B. McEachron.

The first method consists in photo-

graphing with the usual camera the discharge from a needle point revolved by the alternator which is the source of supply for the high-voltage transformer. The needle is revolved inside a porcelain tube whose outside surface is made conducting and grounded. The second method makes use of a special camera using mirrors revolved synchronously by the alternator itself. This camera is equipped with a shutter so arranged that photographs of sparks may be taken using one sweep of one of the mirrors. When drawn out along the time axis certain characteristics of corona discharges may be seen, even when the discharge is extremely weak, for the exposure may be continued for any length of time with a reoccurring phenomenon. The most interesting observations made as a result of the tests were the peculiar shape of positive and negative corona discharge and electric sparks.

The Axially Controlled Magnetron

When straight filaments of large diameter are used in vacuum tubes it is found that the magnetic field of the heating current exercises a restraining effect on the escape of electrons, equivalent to the action of the grid in the pliotron or the impressed magnetic field in the magnetron, Dr. A. W. Hull declared, in a paper describing a new type of magnetron. This new valve principle may be utilized to control the output of the tube for practical purposes, such as changing high-voltage direct current into alternating current. It leads to a very simple and efficient type of tube. The type of magnetron is operable only with large diameter filaments, and hence is adapted only to high power applications. For these applications, however, it appears to be the simplest and most efficient tube that has yet been studied. A system containing six single-phase units (twelve tubes) would give an output of 60,000 kw. of fairly good wave form, with an efficiency of 96 per cent. The power capacity of these tubes is ample for conversion purposes, and their efficiency, so far as can be predicted at present, compared favorably with that of other types of conversion apparatus. Many problems remain to be solved before high-voltage operation of these tubes is practicable, but there is no known obstacle or limitation in sight.

ARTIFICIAL LINES HELP STUDY OF TRANSMISSION

Method of Incorporating Distributed Constants for Determination of Short-Circuit Conditions—Engineering Research in Colleges Should Develop Into Valuable Service in Future

GREETINGS and felicitations from the British, French and Italian electrical societies were extended to the Institute membership on Thursday morning. Elihu Thomson and A. E. Kennelly represented the British organization, M. Le Blanc the French and J. W. Lieb and G. Faccioli the Italian. President Jewett responded for the Institute and thanked the delegates and the societies for their good wishes for its success.

The program for the session consisted of seven papers on transmission and allied topics. F. S. Dellenbaugh, Jr., described the artificial transmission line built at the Massachusetts Institute of Technology and gave the design formulas upon which the line was based. A three-phase, 400-mile line and the equivalent of a 1,000-mile, 110,000-volt, single-phase line have been made available and practical data have been obtained from the structures.

The line is built up of unit coils of wire, tinfoil and condenser paper so as to give the effect of distributed constants as in the construction of the early Pupin line. The line has limitations in regard to skin effect, leakage and dielectric hysteresis, and it also is a periodic structure so that cut-off occurs at the higher frequencies. It was used by V. Bush to study transients and the results were embodied in the paper by Mr. Bush. Experimental transients obtained from the line and from actual installations checked the theoretical transient curves very closely, although the actual wave fronts were rounded slightly.

A modified type of combined T and Pi artificial lines was presented in a paper read by Dr. A. E. Kennelly for the authors, H. Nukiyama and K. Okabe. The paper dealt with steady-state conditions and gave the design calculations for determining the line. The line furnished an opportunity to secure greater flexibility over wide frequency ranges.

The solution of network alternating-current problems was the subject of a paper by O. R. Schurig which dealt with the possibilities and limitations of using miniature systems to obtain solutions of the problems encountered. The miniature system has an accuracy of the order of about 10 per cent in determining current divisions under normal and abnormal conditions, voltage and current phase relations at any point and the limits of stability in machine operation. The author advocated the use of the miniature system for large alternating-current networks involving problems whose mathematical solution is particularly difficult. The structure and its design elements were detailed and examples of its applications cited.

A simplified method for solving short-circuit problems was the subject of a paper by R. E. Doherty. The author neglected resistance and capacity and developed a method for determining short-circuit current magnitudes based on the theorem that with zero R and C the magnetic leakages of a circuit were constant. Under this hypothesis the current only can change when abnormal conditions occur and its magnitude can be determined. The theorem was applied to several typical cases.

Proximity Effect and Floating Neutral

In furnaces, heaters and high-frequency induction applications occasions may arise where it is necessary to determine the proximity effect in wires and their tubes, and H. B. Dwight discussed the mathematics of the subject in his paper. The method of solution is based upon determining the current at any point and balancing it with the current effect of the return conductor. Applications of the formula were outlined and treated fully.

The floating neutral in an n-phase alternating-current star system was the subject of a paper by L. A. Doggett, and by a simple formula the author showed how the neutral could be determined for any unbalanced circuit.

In opening the discussion President Jewett called attention to the similarity in problems and methods of attaching them now existing in the communication and high-tension fields of electrical engineering. Aram Boyajian discussed the paper by Mr. Bush and stated that the discrepancy between the theoretical and actual wave fronts found in the paper could be explained by the fact that the theoretical curve was inexact in that several factors had been neglected in its determination. If skin effect, for example, had been incorporated in the formula, a rounded wave front would have resulted.

Lines having distributed loads or network connections were not susceptible to artificial-line solutions, J. F. Peters asserted. Any accurate solution of a transmission-line problem must also consider the inertia and reaction effects of rotating machinery connected to the circuit. He also said that surges were not accurately represented in artificial lines because the inductance was lumped and real distributed constants could not be devised.

It has been thought that the steeper the wave front the more disastrous the effect of a surge, but Dr. J. Slepian declared this held true only up to a definite value of wave-front magnitude as stated in the paper by Mr. Bush. He also said that wave-front steepness was a relative term and should contain an element of time. He preferred to refer to a time element based on the natural period of oscillation of the circuit or apparatus considered. He also thought that double voltage might not occur on short open-circuit lines because the reflection would be modified by other conditions. Moreover, on short circuit, although double voltage due to reflection would occur, the actual voltage to ground might be much less because of the polarity of the superimposed wave.

O. R. Schurig discussed the percentage errors occurring in instrumental measurement of transients and pointed out that for errors not exceeding 5 per cent about the same percentage of error is obtained with either series or shunt-connected instruments. In a written discussion of R. E. Doherty's paper, Prof. W. V. Lyon, Massachusetts Institute of Technology, pointed out that resistance plays a larger part in determining the first rush of current in short circuits than is generally realized.

Engineering Research Inspires Students

Prof. D. C. Jackson, Cambridge, showed how the development of artificial transmission lines at the laboratories of the Massachusetts Institute of Technology had stimulated the interest of students in this class of problems. He pointed out that engineering research by graduate students, instructing staffs and seniors has an influence upon undergraduates that will develop into valuable service in future years.

H. W. Buck said that the real test of engineering progress is whether simplification is attained and contended that modern network and transmission equipment costs are too high.

H. L. Melvin, Spokane, Wash., predicted that engineer-executive attitudes toward research will change as younger men trained in research enter the profession and advance into its front lines. Other speakers emphasized the value of miniature lines in cable transmission studies and urged use of alternating-current calculating tables in system studies.

Closing, Prof. Dellenbaugh touched upon the value of artificial lines in graduate instruction. The evils of such lines are less than those of a "lumpy" type of line in actual service, from the investigator's standpoint. At Cambridge a 1,000-mile artificial line, single-phase, built in 8-mile sections, occupies only the space of a 4-ft. cube and cost but 60 cents per mile. A 450-mile three-phase artificial line built in 20-mile sections occupies 25 per cent more space.

Mr. Schurig stated that at present measuring methods employing vacuum tubes are more suited to laboratory than to field conditions.

OXIDE-FILM ARRESTERS AND QUALITY OF LAMPS

Methods of Sealing Base Metals Into Glass, Standardization of Measurements, and High-Voltage Direct-Current Generators Were Also Given Consideration

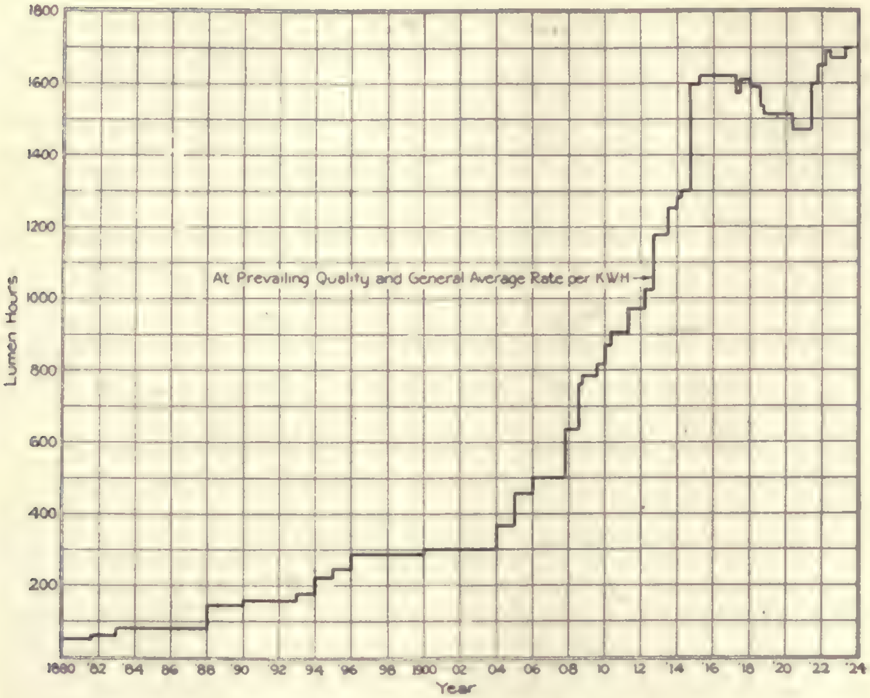
A VARIETY of subjects occupied the attention of the convention at the fifth session Friday morning. Principal interest centered in the quality of incandescent lamps, the standardization of measuring instruments and the pellet type of oxide-film lightning arrester, though W. G. Housekeeper's description of methods of sealing base metals through glass excited much favorable comment.

Quality of Incandescent Lamps

In a paper which gave a great deal of historical data John W. Howell and Henry Schroeder showed the development of the electric incandescent lamp from the standpoint of its quality and the amount of light or illumination which can be purchased now for one cent as compared with earlier days. For example, the 40-watt vacuum lamp is now more than eight times as efficient as the 40-watt lamp of 1907, when tungsten lamps were first introduced. Likewise, if the present 40-watt lamp were made for the same mean efficiency as the lamp of 1880, it should have a life of more than one hundred and fifty thousand years. The general reduction in cost of lighting consists, of course, of two factors—improvement in the lamps and reduction of rates for electrical energy. It is estimated that in 1880 about 50 lumen-hours of light were obtained for one cent, covering the cost of energy and lamp renewals—this from the 40-watt tungsten lamp. At the present average rate of 4½ cents per kilowatt-hour 1,700 lumen-hours can be had for one cent from the 40-watt size. If there had been no rate reduction, 432 lumen-hours would now be had because of lamp improvements; if there had been no lamp improvements, 190 lumen-hours would now be

PAST-PRESIDENTS IN EVIDENCE AT SWAMPSCOTT CONVENTION

Out of twenty-four living past-presidents, sixteen were in attendance at the convention. These sixteen, together with President Jewett and President-elect Ryan, made eighteen Institute presidents together, the largest number, it is said, that ever gathered at one convention. The photograph shows seventeen of the eighteen, together with Secretary Hutchinson. Top row, left to right, they are: Calvert Townley, E. W. Rice, D. C. Jackson, C. F. Scott, P. M. Lincoln, W. McClellan, Carl Hering, J. W. Lieb, and F. L. Hutchinson. Bottom row, left to right, they are: A. W. Berresford, R. D. Mershon, H. J. Ryan, T. Comerford Martin, Charles P. Steinmetz, Elihu Thomson, F. B. Jewett, A. E. Kennelly, and C A. Adams. H. W. Buck was also present.



IMPROVEMENT IN LAMPS SINCE 1880

had because of rate reductions. If the basis of measurement of present-day values is shifted to the gas-filled lamp of the 1,000-watt size, 3,820 lumen-hours can be had for a cent on the 4½-cent rate. The use the public has made of these improvements is to use more light. If the same amount of light—for which about $500,000,000 was spent in 1922—were produced by the 1880 method rather than the present-day method, the cost would have been increased $3,500,000,000, requiring about fifty million extra tons of coal.

John W. Lieb, in discussing this paper, pointed out that the improvement mentioned was not alone a scientific development but also that it had been introduced commercially to widespread advantage, and yet all this had been done without any shock to the rising young industry due to abrupt loss of load as a result of great increases of efficiency. The industry had smoothed over these turbulent changes. He warned against a too narrow interpretation of the word "quality." It should not refer alone to efficiency and life, but should also include the elements of ruggedness, applicability to both alternating and direct current, uniformity of behavior, etc.

Clayton H. Sharp questioned the 500-hour testing basis used by the author and pointed out that, though this method is in vogue with the lamp manufacturers, it is not generally accepted by other testing agencies.

Sealing Base Metals in Glass

William G. Housekeeper in his paper described the process and development which has led to the ability to seal base metals through glass. The fundamental principle is to use thin strips of the base metal with edges tapered off to a fine-angle edge. This work has made possible dependable seals in the large-size lamps and other electrical apparatus where a conductor into a glass inclosure is necessary. Various illustrations were given of seals which had been made in this way.

Discussion by several indicated the great importance of the development, Prof. C. F. Scott pointed out that what Mr. Housekeeper really had done was to take the commonplace and by means of studies produce desired results—he had not sought the solution in new fields, but rather in well-known ones.

Answering a query as to whether metals other than copper could be sealed in, on account of the occluded gases, Mr. Housekeeper said that any metal, such as nickel, if heated in a vacuum at about 800 deg. C. for fifteen or twenty minutes, could be sealed in at any time within several weeks without the appearance of gas bubbles.

Instrument Standardization

H. B. Brooks, speaking for the subcommittee on instrument standardization, presented arguments for national standard specifications for instruments, from the standpoint of purchaser, manufacturer and every one concerned. The paper also reviewed the situation in other countries and presented a proposed set of specifications for discussion, modification and adoption.

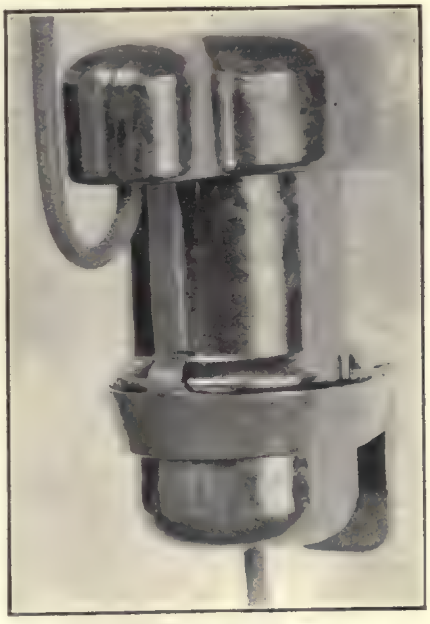
W. B. Kouwenhoven, A. E. Kennelly and C. N. Greene discussed the paper, calling attention only to minor points, except that Professor Kennelly pointed out that specifications made for American use should consider the requirements of international use and therefore use uniform terminology and units. The necessity of the work proposed by Mr. Brooks was unanimously approved by persons attending the session.

Pellet-Type Oxide-Film Arrester

N. A. Lougee described the new pellet type of oxide-film arrester. Fundamentally, an oxide film has been applied to a large number of pellets, or pill-like pieces, of lead peroxide and a large number of these pellets have been placed between two electrodes—the assembled unit forming a practicable, inexpensive arrester for use on low-voltage circuits (primarily 2,300 volts to 13,200 volts). The advantage of the unit lies in its application to general industrial and distribution transformers and apparatus. In action each pellet is a small individual oxide-film arrester, acting in series to allow surge current to discharge but not to allow any dynamic or normal frequency to flow. The oxide coating actually behaves more as a porous spacer than as a solid insulation.

The electrical characteristics of this pellet-type arrester are very similar to the "OF" type, according to oscillograms.

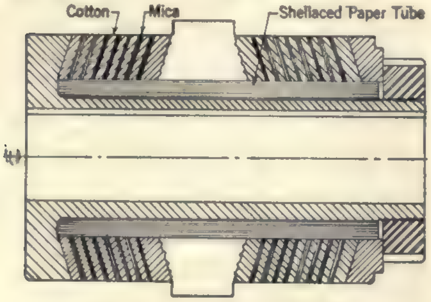
Dr. C. P. Steinmetz, in discussion, pointed out that this arrester fills a gap in the lightning-arrester line. He traced the development of the multigap arrester, the aluminum cell and the oxide film each to do its work, and then showed how the present pellet type comes in, largely on account of the economical element—the regular oxide film is too expensive for small distribution circuit equipment. E. R. Stauffacher asked if a number of the pellet-type arresters could be used to replace an oxide film at substations and other rather larger installations, and Mr. Lougee indicated his belief that they could. A. L. Atherton said that both the large manufacturers were treating lightning arresters from the same standpoint, namely as necessary protection to their primary electrical equipment. The protective equipment is in the nature of necessary accessories.



OXIDE FILM ARRESTER FOR 2,300-VOLT SERVICE

A 12,000-Volt Direct-Current Generator

S. R. Bergman described the principles underlying the successful design and manufacture of a high-voltage direct-current generator. He attributed the success of the design to its being



12,000-VOLT COMMUTATOR

based on or built around commutation. A distributed field winding as well as a distributed armature winding made possible successful commutation, even though the voltage between bars is high. The principal mechanical problem was to build the commutator. A special construction, as shown in the accompanying illustration, made this possible. The principal use of such a machine is to provide the plate voltage of large vacuum tubes.

Duplication of Generating-Station Equipment

In the absence of William F. Sims, his paper on this subject was presented by title. In it he listed various apparatus which should be duplicated in order to insure continuity of service—such as buses, excitation supply, synchroscopes, some auxiliaries, etc. R. L. Young, in discussion, pointed out from the standpoint of the user the desirability and value of continuity of service. He stated that in some cities it was possible, on account of the high reliability of service, to depend on absolute continuity if supply were had from two power houses, but that in other places, where less attention was paid to this, such users as the telephone company had to install gas engines or other emergency auxiliary supply.

Frequency Measurement in Electrical Communication

J. W. Horton, N. H. Ricker and W. A. Marrison considered the need for increased accuracy in measuring any frequency between one and several million cycles per second and described a tuning-fork apparatus with vacuum-tube equipment for this class of work which has given excellent results. Data were given upon the effect of temperature, potential of power supply and circuit constants upon frequency, determined either by comparisons with a constant frequency or by ascertaining the absolute value of the frequency. The ratio of the rate of the fork to that of a carefully modulated clock has been found to be constant within six parts in one million over considerable periods of time. For measuring the frequency of any alternating current used in electrical communication in terms of the known frequency there has been developed an arrangement of harmonic producers and a special modulator-rectifier circuit for combining known harmonics of the base and comparing other frequencies with them.

Following the presentation of this paper, Mr. Horton stated that an agreement as close as 25 cycles in one million had been observed between the transmitted standard frequency of the United States Bureau of Standards and that of the apparatus described by the authors.

Telephone Equipment for Long Cable Circuits

The use of lead-covered cables in place of bare wires for long-distance telephone lines has been an important development of recent years, and a paper by Charles S. Demarest gave a comprehensive résumé of the latest practice in repeater assembly, test-board and signaling equipment, emphasizing the importance of compactness, standardization of dimensions, uniformity in assembly and mounting of units, together with the need of careful correlation of electrical and mechanical requirements.

More Research Needed in Electrical "Loud Speakers"

Much interest was shown in a paper by A. Nyman on electrical loud speakers which reviewed the mechanical and electrical essentials of this device and briefly described present forms and methods of developing and testing. The telephonic receiver, moving coil, inclosed armature and relay types were shown. The use of a condenser transmitter pick-up, with vacuum-tube amplification and resultant current measurements by milliammeter, with provision for voltage check, were described. The art of "loud-speaker" design is extremely new, but eventually it is expected that a horn or a vibrating structure can be designed with the same facility as an electric motor, since a loud speaker is in reality a motor,

TRANSOCEANIC COMMUNICATION

Sound Foundations Laid for Technical and Financial Expansion—Signal Strength, Noise Obstruction and Advances in Loud Speakers Discussed

THE substitution of engineering analysis for reliance upon empirical methods in radio telephony and telegraphy featured the third technical session, which was held on Wednesday morning under Chairman Blackwell, after an introduction by President Jewett. Marked progress in transatlantic communication by radio and in measurements of signal strength and volume of noise obstruction were emphasized, together with gratifying advances in the unification of telephone-cable repeater apparatus. Important studies of "loud-speaker" design and the need of further research in this field were also brought out and discussed at this session.

Guesswork Abandoned

The expansion of the transoceanic communication system of the Radio Corporation of America from a few isolated plants to a unified group of electrical installations, all controlled for communication purposes from a central traffic office in New York, was described in a paper by E. F. W. Alexanderson, A. E. Reoch and C. H. Taylor. The authors also summarized the technical conditions covering the design of the "radio central" station on Long Island and those to be met in operating efficiently a modern radio communication system. Multiple reception of telegraph waves from all European transmitting stations is now achieved with a single antenna.

The extraordinarily high resistance of the quartz sand in the Long Island soil has been overcome by a buried network of 150 miles of wire. The working voltage of antenna has been increased from 60,000 to 150,000 by careful design, although above 135,000 volts corona losses are close to the line of insulation reserve. Provision for melting sleet from antenna wires has been made. By using a wave antenna remarkable success has been attained in suppressing atmospheric disturbances and in securing directive reception.

Transatlantic Radio Telephony

A new method of transatlantic radio telephony using a single side band with eliminated carrier formed the subject of a paper by H. D. Arnold and Lloyd Espenschied. With this method the narrowest possible band of wave lengths in the ether is used; all the energy radiated has maximum effectiveness in message transmission, and the stability of transmission is improved. An important element of the high-power transmitter is a water-cooled-tube installation by which the power of the transmitted currents is amplified to the order of 100 kw. or over.

The direct-current power for these tubes is supplied from a 60-cycle source through water-cooled rectifier tubes. A highly selective and stable type of receiving circuit has also been developed. Curves included with the paper present the most accurate and complete data of the kind yet obtained for transatlantic radio.

though with a less tangible load than that of most motors. Considerable acoustic research, mechanical analysis of vibrating structures and investigations of the effects of vibrating parts in an electromagnetic structure must be done in this field.

E. W. Kellogg, Schenectady, N. Y., in discussing the Nyman paper, submitted a proposed test code to facilitate interlaboratory comparisons of loud speakers. This recommended that the oscillator be equipped with a filter to eliminate overtones and that a tone trap be provided in the amplifier for the same purpose; that the test room be not less than 15 ft. square and 10 ft. high, with three walls heavily damped and the fourth hard; that the transmitter be mounted 6 ft. from the loud speaker, the latter being at the middle of the hard wall and 6 ft. from the floor, and that results be expressed in dynes per square centimeter sound pressure per volt-ampere supplied to the instrument.

Dr. A. E. Kennelly said that while the paper offered a valuable means of rapid analysis, the motional impedance circle would appear to yield more scientific results. These studies are complex, but each year now produces the development of a dozen former years. W. H. Martin pointed out that a loud speaker should produce none other than the imposed frequency. In his opinion the important problem is how properly to transform the mechanical motion of the loud-speaker diaphragm into sound. In testing the effect of harmonics in the applied current is bad unless more careful provision is made for their removal than appears in the paper.

Closing, Mr. Nyman said that acoustic tests would probably always be needed in acceptance trials of loud speakers. He favored standardized tests, but felt that the details proposed by Mr. Kellogg should be modified somewhat. A sine wave test is excellent, but the tester cannot get along without a tone filter. It might be more desirable to mount the loud speaker according to anticipated service conditions than in a rigid position as specified. Both directional loudness and energy loudness measurements are needed.

TECHNICAL COMMITTEE REPORTS

Protective Devices, Industrial Power Applications, Transmission and Distribution Practices and Power Station Improvements Receive Major Consideration

TWELVE technical committees made their annual report regarding progress during the past year at the session on Wednesday evening and submitted suggestions for future work. These reports were on protective devices, electrophysics, marine practices, industrial and domestic power, instruments and measurements, transmission and distribution, lighting and illumination, power stations, electric machinery, telegraphy and telephony, education, and electrochemistry and electrometallurgy.

Protective Devices

Particular attention in the report of the protective devices committee, of which H. R. Woodrow is chairman, was directed to oil circuit breakers, switches and fuses, reactors, lightning arresters, grounding systems and relays. Establishment of relations with the British oil-switch research committee and other foreign committees of a like nature has been undertaken, and B. G. Jamieson is now in Europe for this purpose.

According to the answers to the questionnaire sent out by the sub-committee on reactors, nearly all failures of these instruments have been confined to installations which have been made for several years. The latest designs are much better mechanically and electrically. Manufacturers are prepared to build reactors for any voltage in use today, it was announced. Tests show that a resistor shunting the reactor reduces the overvoltages which arise from the inductive kick. Operating companies, it was pointed out, are beginning to realize the importance of installing reactors having a greater thermal capacity than formerly.

Progress toward the preparation of a specification for lightning arresters was announced by the sub-committee on this subject.

The investigation of the sub-committee on grounding has developed that there is still a wide divergence of opinion as to the proper manner in which to ground a given transmission system, that systems of different characteristics require different treatment, and that special problems arise from time to time in connection with the operation of the grounded and ungrounded systems. Data are being collected which will permit an analysis of simultaneous cable failures and protection of high-voltage cable.

The chief activity of the sub-committee on relays has been the preparation of the "Relay Handbook," which will describe all schemes of proved merit.

Marine

There has been evidence during the past year, the marine committee (S. A. Pierce, Jr., chairman) stated, that ship owners and operators are beginning to realize not only the saving in fuel but the saving in maintenance, the increased speed and precision which can be obtained by the use of electrical auxiliaries. Considerable work has been done in standardizing fixtures and appliances and in modifying existing rules on power apparatus. No attempt will be made at present to take up standardization of electrical propulsion apparatus, it being now in a formative state.

Industrial and Domestic Power

Interest in industrial and domestic power is chiefly based on ideas of general economy rather than on purely engineering considerations, the committee on this subject (H. D. James chairman), asserted. The great problem which leaders of industry are facing is increased production per person in order that more goods may be produced with fewer hours of productive labor per workman. Output has been very greatly increased during the last twenty-five years by the substitution of the electric drive for the steam-engine drive. By far the largest factors contributing to the success of the electric drive have been the improvement in control apparatus and the development of new and improved methods of mechanical drive. Power-factor correction is attracting considerable attention, being undertaken through the more careful application of motors rated at close to the normal load. The application of the synchronous motor has been materially widened by the use of the magnetic clutch and by the new synchronous motor, which can develop a starting torque equal to its pull-out torque. Improved forms of automatic starting devices are being placed on the market for induction motors in increasing numbers, and the tendency seems to be toward push-button control. Voltage control as a method of controlling direct-current motors is rapidly coming to the front, as is likewise sectional drive for paper machines. The electric drive has practically superseded the small steam turbine for the operation of power-house auxiliaries.

Recently an adjustable-frequency system of control has been used for woodworking machinery, and a source of low-frequency power has been used to permit the low speeds necessary in threading paper into paper calenders. The development of the electric-steam generator has made possible the complete electrification of mills utilizing process steam, although its use cannot be justified in all cases.

Instruments, Measurements and Electrophysics

This year it was decided to go ahead with the actual work of preparing what is hoped will develop into an American standard for electrical measuring instruments, the committee on instruments and measurements (G. A. Sawin, chairman) reported. During the past year there have been developments in alternating-current demand meters, very small synchronous motors, volt-ampere meters, small switchboard instruments and other appliances. Numerous European developments were reported by the committee.

The electrophysics committee reported, through its chairman, F. W. Peek, Jr., that the greatest interest in electrophysics appears to be concentrated in researches on the constitution of matter and the structure of the atom.

Transmission and Distribution

Cable research, construction problems, cable-testing and inductive co-ordination constituted the major subjects discussed in the report of the transmission and distribution committee (E. B. Meyer chairman). It was reported that an investigation into the maximum permissible temperature for impregnated paper insulation which is being conducted by the Massachusetts Institute of Technology is progressing favorably. The present indications are that manufacturers will ultimately be able to offer customers high-voltage cables with just as low a dielectric power factor as any heretofore furnished and at the same time with a materially higher dielectric strength.

An arrangement has been made with the Harvard Engineering School to make an investigation into the subject of ionization loss and ionization in high-voltage cables. Two of the larger operating companies with stations on both sides of their respective cities are seriously considering plans for high-voltage tie lines between their generating stations. Changes in joint construction which will materially reduce the length of the joint are necessary for higher voltages, the committee asserted.

Commenting on transmission distribution construction, the committee pointed out that with the increasing scarcity of certain timbers heretofore widely utilized for poles, there is evident a further increase in the employment of steel structures and more attention to improved methods of timber preservation. Insulator manufacturers have continued to improve materials, processes and designs with most satisfactory results. Warning against too rigid a form of attachment of conductors to insulators, the committee pointed out that too rigid a clamp may result in breakage of the conductors and even in serious depreciation of the insulator heads. For some extra-long spans bronze cables are being experimented with and new types of weatherproof insulation have quite recently appeared. There is a continued tendency toward standardization of minor details in line hardware. During the past year several new types of line switches have appeared on the market, and many satisfactory types are now available. New and improved devices for series street lighting are coming on the market. While higher-voltage distribution continues to increase, 2,300-volt and 4,000-volt systems remain the general standard. The rural-line problem continues to be one in which economic considerations are paramount. Some of the causes of trouble on underground cables have been studied and definite remedies have been found.

Probably the outstanding result of the year in inductive co-ordination was the publication of the third report of the engineering sub-committee of the joint general committee of the Bell Telephone System and the National Electric Light Association, the committee declared.

Lighting and Illumination

Many new lighting installations are being made and old ones are being revamped with a tendency toward higher standards of illumination, reported the committee on lighting and illumination, of which G. H. Stickney is chairman. Considerable experimentation to develop so-called gaseous-conductor illuminants has been reported. School lighting, store lighting and theater and art-gallery lighting are continuing active. Surveys of industrial lighting practice have been reported. For a number of years horticulturists have evinced interest in the application of artificial light to the control of plant growth.

Telegraphy and Telephony

Machine switching, submarine-cable telegraphy, long-distance radio telegraphy and telephony and printing telegraphy had special consideration from the committee on telegraphy and telephony, under the chairmanship of O. B. Blackwell. It was pointed out that the year has been marked by a considerable increase in the number of machine-switching telephone central offices. Several of the Western Union Telegraph Company's transatlantic cables are now being operated directly between New York and London. On Jan. 14, 1923, a group of about sixty people gathered in London and listened for two hours to speeches transmitted by radio from America. Since atmospheric disturbances constitute one of the principal limitations to long-distance radio, a great deal of effort has been directed toward finding methods of reducing their effect. The interest in radio-telephone broadcasting has steadily developed. In addition to increasing the number of its multiplex printing-telegraph circuits, the Western Union Telegraph Company has put into service a number of "forked-series" circuits of this class.

Education

Significant movements have been inaugurated both in the colleges and in outside circles looking toward better co-ordination between preparatory training and professional education on one hand and between professional education and industrial demand on the other, the educational committee, of which W. E. Wickenden is chairman, reported. The deans of fourteen engineering colleges in the Middle West have agreed upon a four-year engineering curriculum composed chiefly of fundamental and humanistic subjects with a fifth year mostly or wholly technical. The first four years lead to a bachelor's degree and the fifth year to an advance degree in engineering.

Power Stations

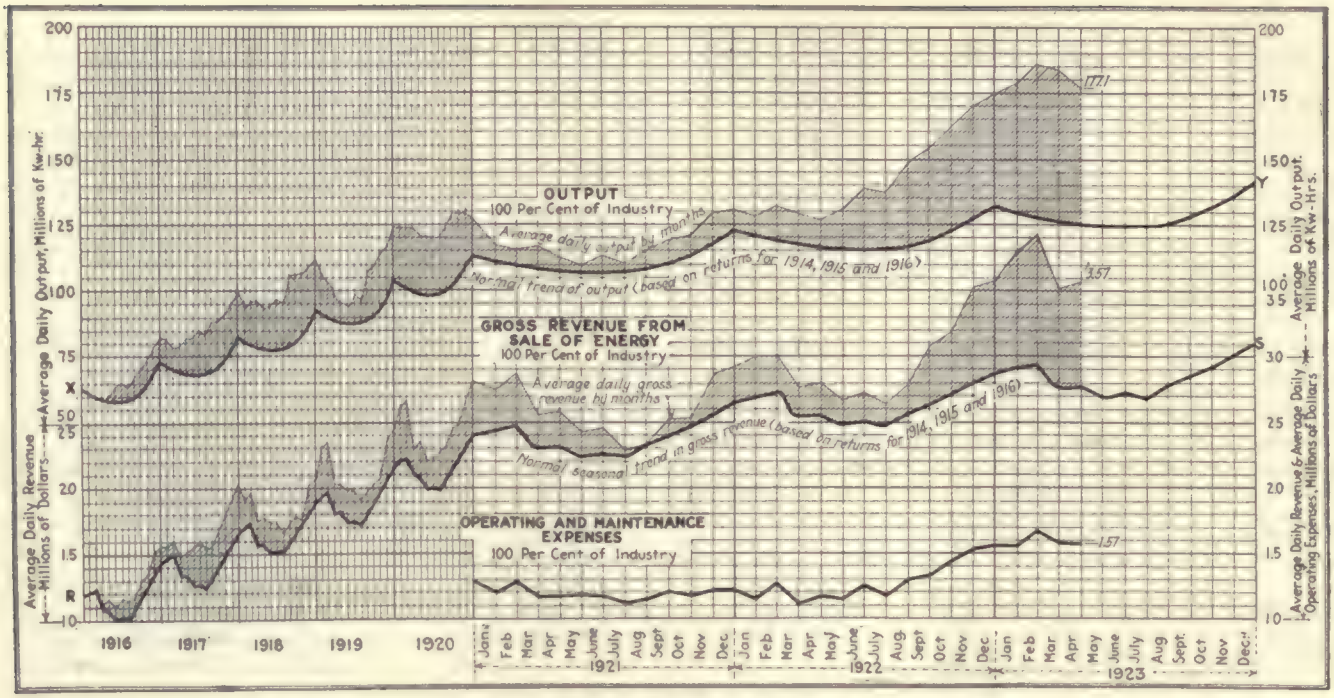
Particular reference was made to the wealth of information and detail regarding power-plant progress in the 1923 report of the electrical apparatus committee of the N. E. L. A. and the power generation committee of the A. E. R. A. Certain points were emphasized by the power stations committee (Nicholas Stahl chairman). For example, the committee pointed out that it is not improbable that the present tendency toward higher steam pressures and superheats, as well as of suggestions looking toward furnaces in which refractory material is substantially replaced by water-tube surfaces, may bring about a unit type of power station from the boiler to the bus which will have material influence on generator design. As it is important to keep the initial investment in a hydro-electric installation to a minimum, a more general appreciation of the influence of the flywheel effect on the initial cost will be beneficial to the industry, particularly in the case of low-head plants of moderate and small capacity. Small isolated, automatic low-head hydro-electric plants are becoming of increasing importance as they offer an economic and cheap means of developing the country's water power. Many companies have installed apparatus to fight fire by means of water or steam, and at least two have conducted extensive tests on the effect of injecting inert gas into a closed-circuit system to smother incipient fires.

Development in generator voltage regulators was reported, reference being made to the rheostatic type as well as the broad-range, vibrating type. Interesting equipments of centralized control apparatus have been built for automatic substations and hydro-electric generating stations in which one pair, or in some cases two pairs, of telephone wires are used to transmit the impulses or signals.

Synchronous condensers have come into general use for long transmission lines, and the installation of automatic hydro-electric power has been signalized by the Searsburg (Vt.) station.

The chief advance in disconnecting switches has been the development of improved types of mechanical interlocks of disconnecting switches and their associated circuit breakers. For the first time benchboards have been constructed of metal instead of the slate or stone previously used. A general tendency has also developed to provide a terminal room for all control cable and wires reaching to the switchboard so that utmost flexibility, ease and speed may be had in inspection and repair or replacement.

The increasing use of radio by power companies for the transmission of intelligence between stations and outlying districts and for the general purpose of load dispatching has led many engineers to think that future system intercommunication will be accomplished altogether by the means of radio.



THE AMOUNT OF ELECTRICAL ENERGY CONSUMED BY CENTRAL-STATION CUSTOMERS DECREASED DURING APRIL, BUT THE GROSS REVENUE INCREASED

Seasonal Decrease in Output During April

REPORTS received by the ELECTRICAL WORLD for the month of April from central generating and distributing companies representing 73 per cent of the installed generator rating of the country indicate that the average daily output was about 4 per cent under that reported for March. This drop in energy consumption is undoubtedly accounted for by the advancing season and consequent reduced requirements for lighting purposes.

The average daily output during April was 177,133,000 kw.-hr., which, while almost 7,000,000 kw.-hr. below the figure reported for March, was 26.5 per cent in excess of that reported for April, 1922. Government figures indicate that industrial activities during April were about on a par with those of March, and the decrease in energy requirements must, therefore, be attributed almost wholely to the cause already named. The average daily revenue from sales of energy during the month was $3,573,000, which was slightly above the figure reported for March. A falling output and a rising revenue is a most favorable condition for any industry. It is probable that some portion of this revenue is a hang-over from the large amount of energy

TABLE I—CENTRAL-STATION RETURNS FOR THREE MONTHS

Mos.	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting) 1923 Thousands	1922 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting) 1923 Thousands	1922 Thousands	Per Cent Increase
Feb....	72	3,733,633	2,918,626	28 0	68	$74,695	$61,838	20.8
Mar....	72	4,108,373	3,236,954	27.0	68	74,209	61,507	20 6
April..	73	3,879,288	3,065,251	26.5	68	72,912	60,788	20.0

Mos.	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies Reporting) 1923 Thousands of Dollars	1922 Thousands of Dollars	Per Cent Increase	Operating Ratio: Steam Plants 1923	Steam Plants 1922	Hydro Plants 1923	Hydro Plants 1922	Combined Systems of Steam and Hydro 1923	Combined 1922
Feb....	56	26,139	21,520	21 4	46.0	46.1	24.0	26.6	42.0	41 2
Mar....	56	27,457	22,314	23.0	46.8	48.3	23.6	27.1	42 5	40 7
April..	56	26,324	21,169	24.4	48.2	49.0	30.8	28 8	44.7	42.0

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A THREE-MONTH PERIOD

Month	New England States: Percentage of Installed Ratings Represented	1923 Thousands	1922 Thousands	Per Cent Increase	Atlantic States: Percentage of Installed Ratings Represented	1923 Thousands	1922 Thousands	Per Cent Increase	North Central States: Percentage of Installed Ratings Represented	1923 Thousands	1922 Thousands	Per Cent Increase	South Central States: Percentage of Installed Ratings Represented	1923 Thousands	1922 Thousands	Per Cent Increase	Pacific and Mountain States: Percentage of Installed Ratings Represented	1923 Thousands	1922 Thousands	Per Cent Increase
KW-HR. OUTPUT:																				
Feb......	72	295,811	227,309	30.1	75	1,410,596	1,089,617	29.6	70	1,186,475	924,837	28.2	55	184,157	136,619	34.8	87	656,594	540,244	21.5
Mar.....	73	322,180	247,522	30.2	75	1,552,684	1,211,447	28.2	70	1,311,500	1,036,947	26.5	55	194,070	150,926	28.8	86	727,939	590,112	23.4
April....	73	300,314	225,002	33.4	75	1,460,816	1,128,704	29.4	70	1,228,953	986,660	24.6	55	187,268	139,481	34.2	86	701,937	585,404	19.9
REVENUE:																				
Feb......	72	$7,954	$6,716	18.4	70	$29,336	$24,343	20.6	59	$22,255	$17,674	26.0	55	$5,130	$4,393	16.8	87	$10,020	$8,713	15.0
Mar.....	73	7,778	6,256	24.4	70	29,266	24,286	21.1	59	21,958	17,670	24.2	55	4,762	3,960	20.2	86	10,445	9,335	11.9
April....	73	7,458	6,157	21.1	70	28,734	23,795	20.8	59	21,467	17,587	22.1	54	4,666	4,092	14.0	86	10,587	9,157	15.6
OPERATING EXPENSES:																				
Feb......	43	$2,302	$1,808	27.4	54	$9,021	$7,543	19.6	49	$8,957	$6,956	28.8	55	$2,395	$2,073	15.5	86	$3,456	$3,402	1.6
Mar.....	44	2,375	1,822	30.3	54	9,884	8,035	23.0	48	9,274	7,212	28.6	54	2,255	1,932	16.7	85	3,669	3,313	10.8
April....	44	2,102	1,635	28.6	54	9,722	7,636	27.4	48	8,789	6,808	29.1	54	2,193	1,881	16.6	85	3,518	3,239	9.7

sold during March. In fact, it is very doubtful if there is any direct comparison between gross revenue and output for any one month. Output will, of course, be reported direct from the generating plants, while the revenue must wait the payment of bills by customers. Another most favorable aspect of the April report on revenue is that the average daily revenue was 20 per cent above that reported for the same month last year.

Expressing the financial phase of the returns in terms of the operating ratio, or ratio of operating expenses to the gross revenue from the sale of energy, shows that the industry is practically on a par financially with 1922. The operating ratio reported for April by companies having steam plants only, taken in the aggregate, was 48.2 per cent, against 49.0 per cent for April of last year. It is encouraging to note that whereas during the first four months of last year the seasonal increase in the operating ratio was 3.7 per cent over that of the previous January, in 1923 the increase was only 0.5 per cent for the same period.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Working for Unborn Generations

To the Editors of the ELECTRICAL WORLD:

Not long ago the death by suicide of a prominent professor of physics was reported in this paper. He was a man of about sixty, well known in this country and abroad for his splendid contributions to mathematical physics and for several noteworthy devices invented by him. A generation of American physicists has grown under his direct or indirect influence, and the United States government called upon him to fill a responsible post during the war. Yet in his last note he expressed the feeling that his professional career was a failure. Deeply as his untimely death is to be regretted, it may be hoped that it will at least serve as a lesson and point a different way out for those original thinkers who feel that their contributions to the welfare of humanity are not appreciated by their contemporaries. May it also supply food for thought to those whose duty it is to see to it that advanced workers in science receive at least some patting on the back now and then.

When we look back upon the past ages of humanity we find that great scientists have worked mainly for future, then unborn, generations. How much did the contemporaries of Galileo, Newton or Ampère benefit by their discoveries as compared with the boundless blessings that came to later generations? The way out for our original thinkers is to keep this experience in the history of humanity constantly before their eyes and to learn to find their life satisfaction in the work itself and in the faith that it will benefit future generations. Just suppose that by some imperial edict we were forced to assimilate immediately all the advances in the various sciences and to apply them at once in our industries and in our mode of thinking. Life would become such a burden that many of us plain folks would be forced to suicide, instead of unappreciated geniuses.

Let our advanced workers in science take the position that most of their discoveries are for the future generations, which will erect them monuments and name streets in their honor. All that these workers need to attend to is to see that their essays are either published or at least deposited with a proper "undying" institution in manuscript form. Then let them be human outside their working hours and let them enjoy in common with the rest of us the little pleasures of friendship and sport that fate has kindly placed at our disposal.

Correll University,
Ithaca, N. Y.
V. KARAPETOFF.

What Is Meant by Relay Maintenance?

To the Editors of the ELECTRICAL WORLD:

The importance of protective relay equipment is beginning to be more fully appreciated by operating companies since more attention is being given to relay application and maintenance than has been the case heretofore. Some companies have already established a system of routine, checking and recording the performance of relays, the work in many cases being under the supervision of their meter departments. Most of this work, however, covers only alternating-current protective relays, and while these are the most important, there are a large number of other classes of relays that are still receiving the same amount of systematic attention that the alternating-current protective relay received in the past—which was usually none!

The Cleveland Electric Illuminating Company has for a number of years past maintained a separate relay maintenance division of the operating department under the supervision of the chief operator, which takes care of the maintenance, testing, checking and calibration of all relays that are in use, both alternating and direct current. These include, of course, all excess current and directional relays, all series overload trips on low-tension oil switches, all protective or other relays such as overspeed devices, all signal or alarm relays, all relays used on automatic or remote-controlled apparatus and all contact-making voltmeters and auxiliary relays for the control of the automatic feeder-voltage regulators with which all lighting and some power feeders are equipped.

In short, the work of the relay maintenance division covers any and all relays that are in use on the transmission and distribution systems and also in the generating stations and substations. The total number shown by the relay record system is in excess of 2,700 and includes twenty-four classifications. It will be seen that a large share of this is work not ordinarily associated with relay maintenance but just that portion which in the past was "everybody's business" and therefore all too often "nobody's business." The responsibility for failure could never be placed because "nobody" was responsible. A systematic and orderly method of maintenance and records fixes this responsibility and furnishes a basis for judging the performance of the equipment. Any scheme of maintenance to be of real value must be sufficiently broad in its scope to take in any kind of relays that are likely to be used. The field of relay application and maintenance is much too broad to be confined to two or three types or classes and our early recognition of this fact has been more than justified by the results obtained.

Cleveland Electric Illuminating Company,
Cleveland, Ohio.
A. H. NICHOLSON,
Chief Operator
Electrical Department.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Testing and Inspection of Relay Systems

Routine Maintenance Schedules and the Keeping of Records of Utmost Importance in Modern Protective Systems

IT IS highly important that after relay protective systems are installed and in service regular routine tests and inspections be made, for without this the most carefully planned system of protection is practically useless.

At intervals of from two weeks to a month, depending upon the importance of the relays, they should be operated electrically to make sure

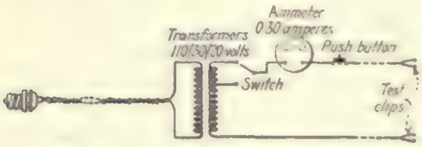


FIG. 1—BELL-RINGING TRANSFORMER FACILITATES RELAY TESTING

that they will function properly when required to do so. This test can be carried out very easily if the circuit breakers controlled by the relay are not in service, by closing them and applying current, as described below, to the relay terminals so that it will trip the circuit breakers.

If two breakers, one for each bus, are on a line which cannot be taken out of service, this test may have to be carried out on one breaker at a time by having the relay trip wire on the breaker which is carrying the load current open during the test. The load should then be changed to the other bus and the second breaker tested. Every precaution should be taken to make sure that the trip wire is closed after the test. As a rule no difficulty is experienced in making the various circuit breakers available for this check, particularly where the double-bus system is used throughout.

The test referred to in the preceding paragraphs can be easily carried out by applying current to the relay terminals by means of a small test set which consists essentially of a bell-ringing transformer connected as shown in Fig. 1. This device can be plugged into any lighting receptacle to obtain the current for testing. The taps on the low-voltage side of the transformer can, if desired, be arranged so that the different voltages are available to test relays requiring either large or small operating currents.

This routine operation of the relays need not necessarily be made by an experienced relay man. If any failure to function is observed, it should be reported to the proper person, who can then make the necessary inspection and adjustments.

Once a year all relays should be gone over thoroughly by a competent relay man who is prepared to make all the necessary adjustments, minor repairs, etc., which may be needed. At this time the conditions in the immediate vicinity of the relay installation should be carefully noted, for even though they may have been satisfactory at the time of the installation of the relays, changes or addition of other types of equipment may produce very unsatisfactory conditions for the proper functioning of the relays.

After the inspection has been completed the setting of the relays should be carefully checked and corrected if necessary. It will, of course, be necessary to set the relays again if during the inspection any repairs or changes of any kind are made.

If difficulty is experienced at the time of faults in obtaining selective action of the relays, it would be a good plan, in addition to checking the settings at the time of their failure to function, to make a check just before the annual inspections are made. This will help to show whether or not the calibration of the relay is constant.

Complete data on the settings of the various relays throughout the system should be kept in some form, preferably in a card index. These cards should contain complete information on the setting actually given the relay as well as the date and the initials of the man who made the setting. A form made up along the

RELAY SETTINGS

STATION ________ APPARATUS NO.___ RELAY TYPE____

PHASE	CUR TRANS RATIO	MIN OF CURRENT PRIMARY	MIN OF CURRENT RELAY	CYC FOR OPERATION AT MIN. AMP.	CYC FOR OPERATION AT—AMP.	SET [illegible]	DATE

FIG. 2—COMPLETE DATA ON RELAY SETTINGS SHOULD BE AVAILABLE

general lines shown by Fig. 2 will no doubt be found satisfactory for this work. It will be noted that in this figure the card is shown which calls for records of the minimum operating current of the relay and the corresponding primary current and that the time of operation in cycles is called for, both at the minimum operating current and at some larger current at which the relays are set.

If it is decided to set relays with a current which causes them to operate on the flat part of the characteristic curve, then some calibrating current, such as 40 amp. or 50 amp., can be selected for all relays. If the setting is made in this manner, it is not important that the current have exactly the value selected for this nominal standard, and there is

RECORD OF ______________ RELAY OPERATION

DATE	STATION	APPARATUS	RELAY TYPE	RELAY SETTING	NATURE OF FAULT	OPERATION INCORRECT	OPERATION CORRECT	REMARKS

FIG. 3—CARD RECORD FORM FOR NOTING ABNORMAL CONDITIONS

therefore very little to be gained by keeping a record of the exact current used for setting each relay. If the magnitude of the short circuits to be expected or other conditions indicate that it is advisable to set the relay on the sloping part of the characteristic curve, then the exact value of the current used when the time is measured is important and should be recorded in every case.

It is generally advisable to keep a complete record of abnormal conditions of the system, including information as to whether or not all relays functioned properly. These data are of considerable value in pointing out improper relay applications, faulty types of relays, or that the relay systems are not carefully kept in operating condition. Fig. 3 shows a card record form arranged for this purpose which classifies the data according to the type of relays.

Whether the service supplied by the utility is classed as satisfactory or unsatisfactory may under certain conditions hinge on whether or not relay applications are correctly made and have proper care. This fact, combined with the possibility of minimizing the damage to equipment at time of failure by means of relays, brings out forcibly the necessity of insuring proper functioning of relays. RAYMOND BAILEY,

Assistant Chief Electrical Designer.
Philadelphic Electric Company,
Philadelphia, Pa.

Extracts from an Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

Inspection and Care of Boiler Instruments

THE rules given below on the routine care and maintenance of boiler room instruments have been taken from the operating code of the Philadelphia Electric Company. They cover drafts, gages, CO_2 recorders, flow meters, V-notch meters and pressure gages.

DRAFT GAGES, OIL GAGES

1. Check daily for zero and replace leakage.
2. On becoming sluggish and dirty, tubes should be cleaned with kerosene and blown out with air.
3. Check every six months with standard gage.

GAGES OF THE PRECISION TYPE

1. Check the zero and scale at least monthly.

CO_2 RECORDERS

1. Blow out the sampling pipes daily and see that they are kept free from soot.
2. Replace the filtering material daily.
3. Check for zero daily.
4. Check for leaks daily.
5. Replace the caustic when necessary.
6. Check for accuracy, weekly, with Orsat and report the results to the plant test engineer.
7. Clean the machine externally weekly.
8. Clean internally every six months.

G. E. AND BAILEY FLOW METERS

1. Blow out the nozzle plugs and piping weekly, or more frequently if necessary.
2. Clean the meter externally weekly.
3. Clean the mechanism yearly.
4. Check the meter annually, or oftener if necessary.

REPUBLIC FLOW METER

1. Blow out the piping and plug every month.
2. Clean the meter externally weekly.
3. Clean internally and replace with new oil every six months.
4. Check the meter annually, or oftener if necessary.

NOTCH METERS

1. Check the zero monthly.
2. Check the clock and integrator monthly.
3. Lubricate when necessary.
4. Inspect the float annually for leaks.
5. Inspect the weirs for corrosion and change in level.

PRESSURE GAGES

1. Calibrate annually, or oftener if necessary.

Operating Street-Lighting Transformers

THE information given below relative to constant-current transformers for street-lighting service has been abstracted from the operating code of the Philadelphia Electric Company.

A constant-current transformer consists of a stationary primary coil and a movable secondary coil. When the secondary coil is closest to the primary coil there is a very small amount of magnetic leakage and the voltages in the primary and secondary coils are almost in the ratio of their numbers of turns. The design of the transformers is such that when the coils are separated considerable magnetic leakage takes place and the secondary voltage is correspondingly lowered. The automatic adjustment of the position of the secondary coil to give the proper voltage is accomplished in the following manner:

The secondary coil is equipped with a counterweight which does not quite balance the weight of the coil. The additional force required for a complete balance is produced by the repelling effect of the primary and secondary currents upon each other. The only current which will produce the proper repelling force for a complete balance at any position of the coil is the current for which the transformer has been adjusted. Should the current increase (or decrease), owing to a decrease (or increase) in the impedance of the external circuit, the repelling force will increase (or decrease), raising (or lowering) the coil and thereby lowering (or raising) the voltage until the current again reaches the adjusted value.

The adjustment for the desired current is made by varying the number of small weights provided on the counterweight.

When the transformer is shut down, the secondary coil falls to the end of its travel, since the counterweight alone cannot balance it. If it were left in this position, the closing of the primary oil switch at the next starting time would impress maximum voltage on the circuit and cause violent repulsion of the secondary coil. To prevent these effects the latch for holding the coils at their maximum separation is provided, so that the transformer may be started with the minimum current on the circuit and allowed to build up gradually to the adjusted value for that transformer.

Cost of Coal Crusher for Chemical Analysis

COSTS of installing a No. 00 Sturtevant rotary coal crusher of the motor-driven type for use in preparing coal for chemical analysis, as filed with the Massachusetts Department of Public Utilities expenditure records for 1922, are given in the accompanying table.

COAL CRUSHER INSTALLATION COST FOR LABORATORY WORK IN CENTRAL STATION

No. 00 rotary crusher	$390.00
Type KT 2-hp., 550-volt, 1,200-r.p.m., three-phase motor	59.75
Freight	4 53
Labor (outside company)	6.74
Foundation	2 90
Paint	0 71
Bolts	0.50
Electrical fittings	38 11
Company labor	59.04
Total	$562.28

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Concrete Reinforced Poles Not Favored

ACCORDING to tests of poles reinforced with a concrete collar around the butt, newly reinforced poles give a strength at the ground equal to, if not greater than, that of the original pole, according to L. B. Snyder of the Westchester Lighting Company, who presented a paper covering this point at the recent convention of the Empire State Gas and Electric Association at Utica, N. Y. Subsequently defects develop, however, such as shrinking of the pole within the concrete collar and troubles resulting from the accumulation of moisture. At best, this method postpones replacement of the pole only a few years, Mr. Snyder contended, and when replacement becomes necessary the added cost of removing and disposing of the concrete bases more than offsets the gain derived from the added pole life.

Mr. Snyder's conclusions were based on results obtained by the Westchester Lighting Company in experimenting with this method. In 1911 this company started to reinforce poles. A special gang was organized and worked extensively, concreting more than 300 poles each season for several years. Soon after some of the poles had been reinforced it became necessary to remove them owing to highway changes, and a pulling test was applied to see how efficient the reinforcement was. In several cases the pole broke off half way up and the concrete held intact. In other cases the concrete cracked but still held until the pole was pulled nearly to the ground. It was found by these tests, as already stated, that on newly reinforced poles the reinforcement gave a strength at the ground line equal to, if not greater than, the original pole.

Later tests developed, however, that some of the reinforced poles had decay at the heart. This was overcome by boring the butt before attempting to reinforce the pole, together with a liberal application of pole preservative on the pole after the decay had been removed and before the reinforcement was applied.

For a time this plan overcame the difficulties. Subsequently, however, the defects in the process began to develop. As the reinforcement aged the pole shrunk inside the concrete collar, leaving a recess in which water collected. This, together with the weather cracks or checks in the pole, allowed the water to seep down inside the concrete collar. Thus the concrete, while protecting the pole at the ground line, allowed the water to get in from above. Moreover, in a number of cases where the reinforcement appeared to be in perfect condition and where there appeared to be no possibility of water penetrating it was found that decay had taken place inside the concrete collar and that nothing held the pole but the reinforcing rods.

After reinforcement it was practically impossible to judge the true condition of an apparently good pole. A pole might seem to be sound, but in a great many cases it was found that a shell of wood so solid the inspector could not penetrate it with his bar covered a heart decay that left no strength in the pole whatever. Several seemingly good reinforced poles broke off, and serious and costly accidents due to the failure of one pole thought to be in good condition were narrowly escaped.

Assuming that the life of a pole can be prolonged five years by reinforcing, the financial comparison is as follows: Take the cost of labor and material necessary to concrete a pole, plus interest at 6 per cent for five years, together with the cost of removing the concrete butt when the pole is replaced later. Offset this by the first five years' depreciation of a new pole set now, plus interest at 6 per cent for five years on money spent for labor and material in setting a new pole and changing over.

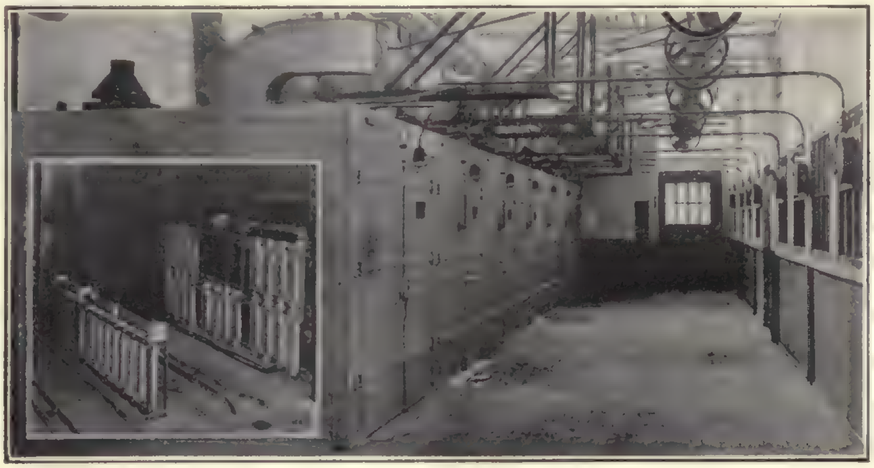
Because of the false sense of security imparted and increased opposition on the part of the municipal authorities toward the method, the Westchester company has found that the reinforcing of poles is not an efficient method of maintenance.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Rejection Reduced to 3 per Cent in Electric Oven

ELECTRICALLY heated ovens have been substituted for gas japanning ovens by the Ritter Dental Company of Rochester for japanning its products. These ovens form a total connected load of 280 kw., 230 volts, three-phase, and are used in japanning metal parts ranging in size from pedestals 5 ft. high to pieces the size of a watch. The temperatures used range up to 450 deg. F. according to the class of work being done.

The high finish that is required on the parts, which was difficult to obtain satisfactorily with gas ovens, caused the company to install the "electrics." The result has been that not only has the volume of production increased, but the number of rejections due to imperfect baking of parts has dropped from more than 20 per cent to between 3 and 4 per cent.



JAPANNING OVENS WITH HEATING ELEMENT SHOWN IN INSERT

In speaking of these ovens C. B. Lawrence, production manager, says: "We find the cost of operation is equal to that of the gas-burning ovens. However, since these ovens are controlled by recording thermometers and automatic regulators, we are able to hold a constant temperature and distribute the heat more uniformly and thereby reduce the spoilage.

"As a matter of fact, the percentage of spoilage due to overbaking or underbaking is practically nil. Knowing that our work is always baked at the same temperature naturally increases the quality of product. The baking time is less than that required with the gas ovens and thereby increases production during the same number of working hours. We should hesitate a long time be-

fore going back to the gas-heated ovens for japanning."

The ovens employed are rather large, owing to the size of some of the parts to be baked, the interior dimensions being 7 ft. x 7 ft. x 7 ft., with room for two truckloads of material at once. The heating units in each oven are disposed partly on the sides and partly on the floor of the oven in such a way as to give the most uniform distribution of heat throughout the oven interior.

The work to be baked is sprayed in the adjoining room, loaded onto the trucks and wheeled into the ovens. An interesting feature in the construction is that, in order to do away with vibration in the oven, the ventilating fans are mounted on platforms slung from the ceiling, instead of directly on top of the ovens themselves.

The control is automatic, the instruments being mounted on the wall opposite each oven, and the contactor panels and control switches are installed in a small room adjoining the oven room. In this control room the panels carrying the contactors, overload relays, etc., are mounted on one wall, while on the other are panels carrying double-pole double-throw switches for each oven, by means of which the heater connections are changed from Y to delta in order to obtain high or low heat, as desired. An interesting feature of the control system is a small panel mounted in the room with the ovens that is known as the main control panel. It carries a push-button switch and pilot light for each oven.

In operation, pulling the handle of any switch closes the circuit of the holding coil of the main contactor on that oven's control panel, causing the contactor to close and putting full voltage on the heating elements of the oven. At the same time, the red pilot light alongside of the switch is lighted, so that by merely glancing at the panel the operator can tell which ovens are in operation and which are not.

A further safety measure consists of a switch on the oven door which is opened when the door is opened. This switch on opening breaks the main circuit to the heaters and eliminates the danger of any one's coming in contact with the heating units when they are alive. The heating units and automatic control panels were furnished by the General Electric Company.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Types of Aërial Cables for Distribution

THREE types of aërial cables for power distribution or transmission are now being used, and considerable difference of opinion seems to exist as to their relative merits. It is believed that this difference of opinion is due mainly to the fact that each of the different types fits in with certain particular conditions and that, if the good and bad points of each type of cable are analyzed, it will become evident that the question of choice is not so much a matter of opinion as to the general superiority of one type over another, but should depend, rather, upon a study of local conditions.

The make-up of the three kinds of aërial cable is as follows:

1. Varnished-cambric insulation with rubber-filled cotton tape over the belt insulation, asphalted jute and two galvanized steel tapes applied helically.

2. Impregnated-paper insulation with the outer part of the belt insulation consisting of rubber fabric, somewhat similar to ordinary garden hose, to protect the paper against moisture, asphalted jute and steel-tape armor.

3. Paper insulation with lead-antimony sheath.

DESCRIPTION OF EACH TYPE OF CABLE USED

Type 1 is the most expensive of the three, but it is the lightest in weight. For very large three-conductor, 500,000 circ.mil, 13,000-volt or 350,000-circ.mil, 26,000-volt cables the question of weight becomes important. It may also be important where it is proposed to place a cable on an already heavily loaded line or one which might require a great deal of extra guying, replacement of poles or decrease of pole spacing if the heavier cable were used.

The disadvantages of this type are that it does not have the best of protection against moisture, that the dielectric losses with varnished-cambric insulation are higher than with paper, that steel-tape-armored cable cannot be pulled through supporting rings, and that it cannot be taken down and placed in underground conduit if later conditions of growth necessitate the abandonment of aërial construction.

Type 2 embodies the advantages of paper insulation and lightness and is intermediate in expense between types 1 and 3. The fact that the insulation is paper makes type 2 more desirable for the higher voltages, say above 13,000, than type 1. That is probably its controlling advantage, because in spite of its lower cost the greater difficulty of obtaining moisture-proof joints is a serious drawback. Type 2 aërial cable has, similarly to type 1, the disadvantage of not being suitable either for pulling through rings, because of the steel tape armor, or reinstalling in underground conduit. The manner in which this type of cable is made up, at least by some manufacturers, results in a greater diameter than that of either of the other types, which, under adverse sleet and wind conditions, seriously reduces the advantage of its initially lighter weight, especially in the smaller sizes.

Type 3 cable is the least expensive of the three, has the most efficient electrical characteristics, the most effective and durable protection against moisture, can be pulled through rings previously attached to the messenger wire, and is suitable for reinstallation in underground conduit. Its principal disadvantage is its weight, which may become serious with large cables or where it is attached to old weakened or insufficiently guyed pole lines or lines already carrying a heavy load or with long spans. Nevertheless, it should be remembered that many telephone lines carry several crossarms of open wires in addition to a very heavy cable.

Summarizing, it may be said that type 1 aërial cable should be used for the lower voltages (up to and including 13,000) and for large sizes where lightness is the prime consideration; type 2 for the higher voltages and large sizes where economy in weight is necessary, and type 3 in all cases where its weight does not exceed, let us say, that of a 350,000 circ.mil, three-conductor, 13,200-volt cable, which is the largest aërial cable now known to be in service. Type 3 will probably have a wider application than either of the others.

It may be of interest to know that, among the larger companies, type 1 is used by the Duquesne Light Company, types 2 and 3 by the Public Service Electric Company of New Jersey, and types 1 and 3 by the Westchester Lighting Company.

F. A. WESTBROOK,
Field Engineer.
Habirshaw Electric Cable Company,
Yonkers, N. Y.

Easily Manipulated System Diagram Saves Time and Uncertainty

AN EFFICIENT and inexpensive system diagram used at the Montville station of this company is illustrated herewith, an interesting feature being the use of different colors and thumb-tack applications for various symbolic representations of operating conditions. The diagram is mounted on a yellow-pine frame of stock 3½ in. square and is 8½ ft. long by 4 ft. 9 ft. wide, the bottom being about 2 ft. above the floor. The frame is mounted on casters and is thus readily portable. The background is of white-pine boards neatly matched and planed down to give the appearance of one piece. This was painted with several coats of flat white followed by two coats of enamel, each coat being sandpapered.

Feeders are represented by strips of white pine $\frac{3}{16}$-in. square fastened to the board by common pins with their heads removed. This facilitates making changes in the location of feeders without marring the board. These strips were painted before putting in place and extra strips are kept on hand. Blue strips represent 66,000 volts, dark gray 33,000 volts, brown 11,000 volts and buff below 11,000 volts. The number of each feeder is painted in white in several places along each feeder strip.

Transformers are represented by small blocks of wood $\frac{3}{16}$ in. thick and marked with a zigzag line of the standard voltage color for primary and secondary. Oil circuit breakers, disconnecting switches and generators are represented by colored thumb tacks. The oil circuit breakers utilize plain thumb tacks, red to denote the open and green to indicate the closed position. Disconnecting switches are of the same color as the oil breakers, but each has a white line across its face, this line being placed parallel to the feeder when the switch is closed and at right angles when open, giving a double check on the position of the switch.

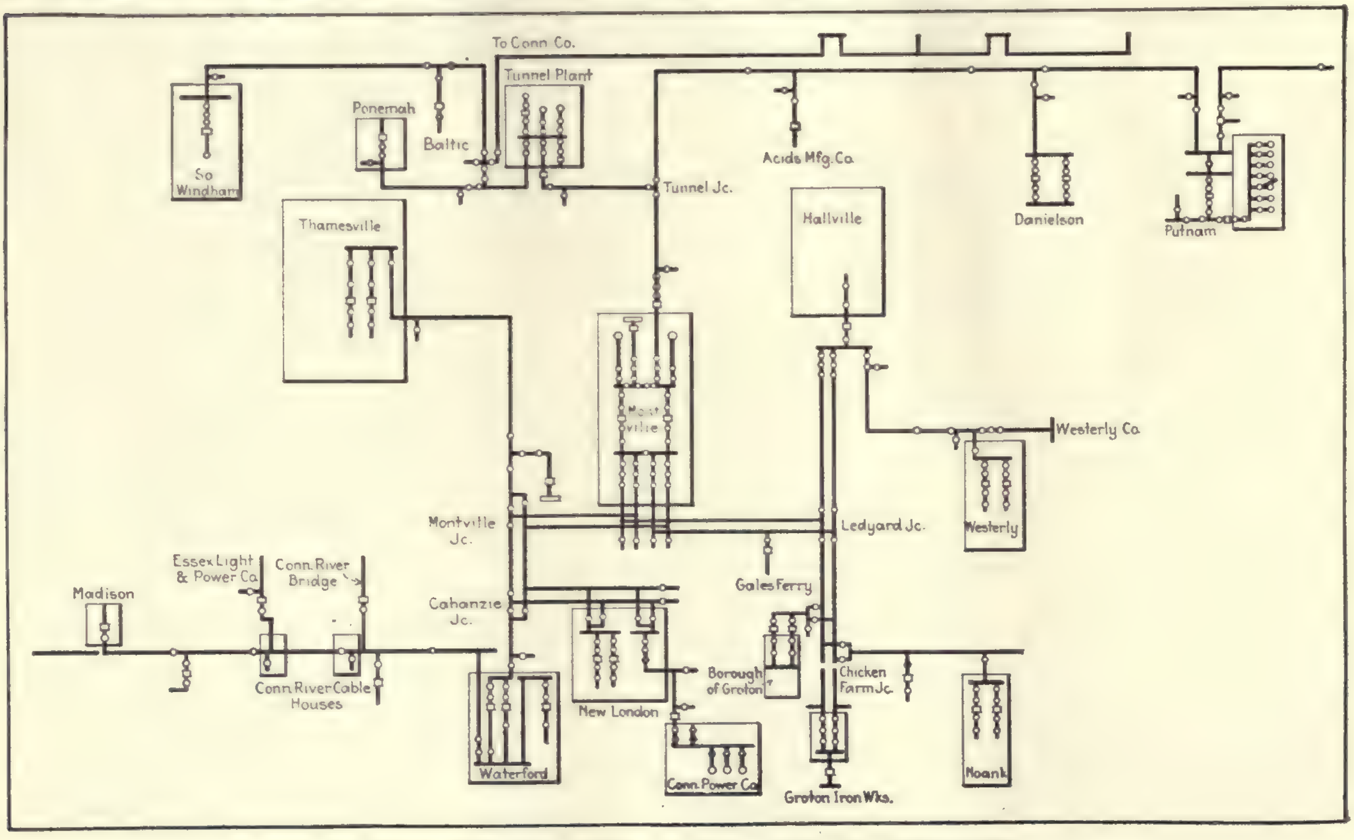
All switches are numbered, those in stations running from 1 to 99 and having the initial of the station before them. Those on the feeders are numbered in the same hundred as the feeder; i.e., switch No. 108 is on No. 1 feeder, and No. 208 is on No. 2 feeder. "Disconnects" in conjunction with oil breakers are lettered "A" and "B"; thus disconnects 100 A and 100 B are on either side of oil breaker No. 100.

Steam turbo-generators are indicated by black thumb tacks slightly larger than those used for switches, with the machine capacity lettered upon the top in white. Hydro-generators are shown by a plain nickeled thumb tack the same size as the turbo-generator tacks and similarly lettered. Rotary converters are represented by buff-colored thumb tacks and frequency changers similarly, except for a cycle sign on the face. Lightning arresters are shown by bright yellow map tacks.

The oil and disconnecting switches are easily changed, a supply of spare thumb tacks of the various denominations being kept at the lower right-hand corner of the diagram. All station buildings are outlined with thin strips of wood painted green.

A system of tagging switches in imitation of the actual tagging operation is carried out in connection with the diagram. Whenever a switch is ordered opened and tagged by the power director he immediately changes the thumb tack which represents the switch in question and also fastens under the thumb tack a small metal tag, which has a hole in one end for this purpose, painted red and bearing the number of the person for whom the switch is tagged. Every person authorized to order a switch tagged is given a number and has several of these metal tags hanging on the diagram directly under his name.

R. E. WATROUS,
Power Director.
Eastern Connecticut Power Company,
Norwich, Conn.



MANUALLY OPERATED SYSTEM DIAGRAM HELPS LOAD DISPATCHING

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Conditions Which Delay Prompt Service Connection

By J. B. Redus
Assistant General Manager Harrisburg (Pa.) Light & Power Company

ARTICLES appearing recently in the ELECTRICAL WORLD showing the time required to give service after application has been made are of more than passing interest. They indicate thinking along the right lines, and this will result to the advantage of the utility companies. These articles have been read by a great many executives, officials, operating-department heads and employees of utility companies. They have, no doubt, also been read by consulting engineers, manufacturers of electrical equipment, electrical dealers and contractors. It would be surprising indeed if it had not occurred to a number that similar data should be compared for a period sufficient to show the average time applicants have waited for electric light or power service after application has been made.

A great deal of educational work has been done in past years by utility companies to bring the prospective consumer to consider and decide upon the use of central-station service at the earliest possible moment. In many instances, during the option period in the purchase of property, before the final transaction has been closed, if electric service is not available at the location, it is necessary to ascertain whether the utility will make the necessary extension, in order that the service shall be available when the prospective customer's construction is completed. This is an established practice among utilities and it has proved to be in the interest of both the company and prospective consumer. Comparisons, therefore, based upon the actual elapsed time between the signing of the application and the starting of service, should in such cases include the time necessary for the construction of overhead or underground extensions and the installation of the service connection from the main to the consumer's property, the time to obtain the necessary permits, insurance inspection and other requirements, as well as sometimes unavoidable delay in shipping material for such work.

Application for service must be made when convenient for the applicant, which, whether by telephone or upon call of solicitor or at the company's office, may be just before closing time on a day before a holiday or Sunday, or when a holiday immediately precedes or immediately follows a Sunday, thus greatly increasing the time between the application and the starting of the service, for it is unavoidable that the applicant shall be without electric service during that period.

For a period covering one year from May 1, 1922, to April 30, 1923, the Harrisburg Light & Power Company received and executed 1,540 applications for service where it was only necessary to set a meter. There were 3,154 applications for service where the meter was already installed and the service available for use. There were also 2,206 applications for service where it was necessary to make extensions of underground mains or of overhead distribution system, to construct an underground service connection from the main to the consumer's property or to run the service from the overhead-main extension to the consumer's property and install a meter. The territory served by the company is 17 miles long by 6 miles wide with a number of rural lines and considerable construction on farms or property of the applicants. In several instances during this period applications for power service were made where from two months to nearly a year was required for the applicant to make his own construction before service was started. The elapsed time which has been used in compiling these data includes all such periods.

Some time ago the company put in effect, for experiment, the plan of leaving the meters installed when customers discontinued the use of service. The main switch was opened and the handle secured by a meter seal. A colored card was attached to the bottom of the hall chandelier or other place in the main entrance where it could not but be seen stating that the service was available on the premises by closing the entrance switch and telephoning the company that service was to be used. The result of the experiment exceeded the expectations of the meter department, where the plan originated. The reduction in the work which would have been necessary by the meter department had these meters been removed made it possible to postpone taking on an additional employee. Not only was this saving made, but additional revenue was realized because of the service being available and used earlier than would have been possible had the meter been removed. Since this plan was first tried no loss has been suffered by failure of applicants to pay for the

A Customer's Appreciation of Service

Harrisburg Light & Power Company,
Harrisburg, Pa.

GENTLEMEN — The Harrisburg-Rocbond plant is now completed and going, and when we come to think of what has been accomplished on this operation, starting as we did from the ground up late in July, we realize that without good service and co-operation from those who had a part in the building and equipping of this plant the record established would not have been possible.

We wish to thank the Harrisburg Light & Power Company for the personal interest and attention shown us. The service provided by your company stands out as being of an unusually high order, thoroughly dependable and attentive in the little things—details which mean so much in the making or marring of service.

We, of course, realize Mr. K——'s part in making these things possible and sincerely appreciate his personal interest and attention in seeing that a promise made means its fulfillment. That's service.

service, and the plan has been permanently put in effect.

During this period 1,540 applications required setting of meters, and the elapsed time from signing the application to the time of starting service was 134,722 hours. For the 3,154 applications for service where the meter was already set and the prospective applicants started to use the service no elapsed time occurred. This means that 3,154 of 6,900 applicants had no delay in securing service. The 2,206 applications for service where extensions of underground or overhead system, including running service and construction of substation on customer's premises, were necessary required 798,112 hours.

These results may appear unfavorable as compared with the very short periods required by some utility companies, but they show how conditions created by the customer and over which the company has no control sometimes affect the length of time intervening between the service application and actual connection.

Customers as a rule appreciate prompt service and attention to their requirements, even though they do not always so express themselves to the company. However, the letter on page 30, showing the attitude of one customer who acknowledged the company's effort to serve, is not a solitary instance. In this instance a period of five months elapsed between the original application and the actual connection of the service.

Plans for Development of Industrial Heating

WHILE the load-building possibilities of industrial electric heating have been clearly demonstrated, there is still need for the enlightenment of many central-station executives as to its revenue-earning value. Lack of accurate data on actual installations and more or less unfamiliarity with the subject on the part of power engineers have tended to prevent a more rapid growth of this load. Within the last two years the N. E. L. A. Power Bureau has accomplished remarkable results through educational courses carried out with the assistance of manufacturers, and Wirt S. Scott, chairman of the industrial heating division, in his report at the annual convention in New York last month, recommended a program for the development of industrial heating along the following lines:

1. The continuation of the educational program either by means of a school or by some other similar method.

2. The active collecting of data for each new installation on central-station lines, the classification and compilation and then the broadcasting of these data.

3. Active cross-representation with other societies and organizations interested in the electric heating art.

4. Each central station should (a) at once train its men in the industrial electric heating art, (b) make a thorough survey of the industrial heating possibilities of its territory, (c) then go after and obtain the industrial electric heating business which will help the industrial establishments in the severe commercial competition of the future.

5. That the executives and managers of the many central stations give consideration to obtaining the capacity which will be necessary to supply the industrial heating load of their territories, as indicated by the results of surveys made.

6. Each geographic division should hold a semi-annual industrial electric heating symposium in order that power and heating salesmen may become familiar with new developments and actual installation, become better acquainted with the problem of the heating art and exchange the data, sales ideas and methods used in the successful obtaining of heating business.

7. Each central-station power salesman should at once start a library for industrial electric heating information.

This condition makes it absolutely essential that the central stations have on their staff men who (a) have a knowledge of the fundamentals and principles of industrial electric heating, (b) are familiar with the apparatus on the market, their operating characteristics, limitations and adaptability to the process, (c) have an intimate knowledge of similar installations made in other parts of the country, and (d) have access to publications on industrial electric heating.

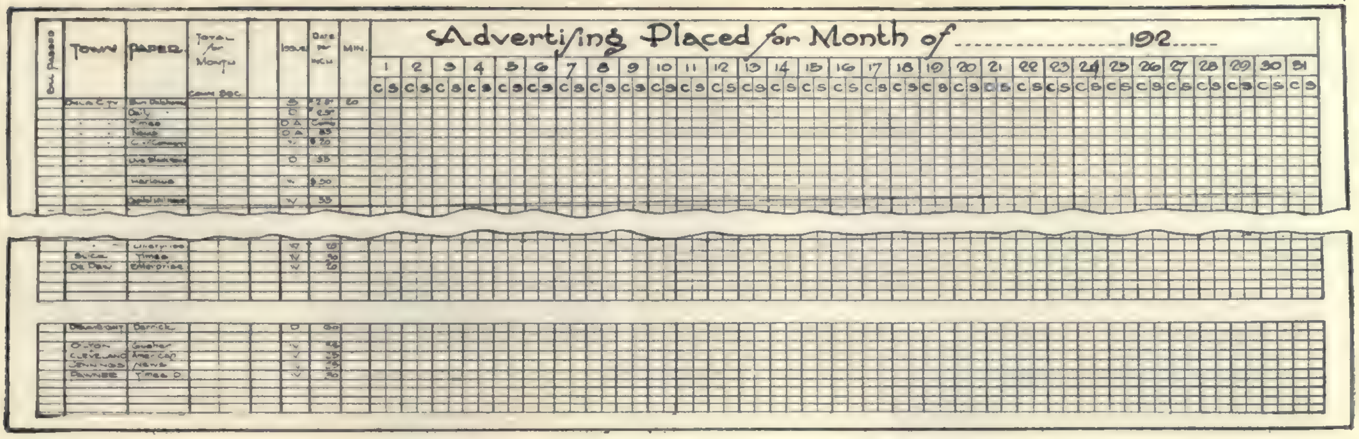
Portable Window-Lighting Exhibit

THIS portable window-lighting exhibit is being used successfully by the California Co-operative Campaign to stimulate interest in better display window lighting with great success. The exhibit, which was described on page 586 of the March 10 issue of the ELECTRICAL WORLD, has had eight showings before two thousand merchants in various cities of California, and the amount of new business derived is estimated at several thousands of dollars. To transport the exhibit around the state the Co-operative Campaign has recently purchased the truck shown in the accompanying illustration. The body of the truck is 6 ft. 3 in. wide and 12 ft. long and is designed to carry all equipment used in connection with the exhibit.

TRUCK FOR DEMONSTRATING PROPER WINDOW LIGHTING TO CALIFORNIA MERCHANTS

The exhibit is constructed after the fashion of stage scenery and can be assembled in a minimum of time. The lighting equipment is complete and of the latest type and includes a complete window trim of the highest quality. It is the usual practice to co-operate with a local merchant, obtaining from him the material to be displayed in the window at the time the lecture on proper illumination is given.

A field representative accompanies the exhibit and acts as chauffeur, stage hand, electrician, lecturer, illuminating engineer and salesman. In the larger cities the lecture is given by an illuminating engineer furnished by one of the manufacturers.



FORM FOR KEEPING MONTHLY RECORD OF ADVERTISING PLACED

Policies in Central Station Advertising

JUST what the advertising policy of a utility should be varies with different companies, if the expressions of utility men at recent conventions can be taken as an indication. What it is in the case of the Oklahoma Gas & Electric Company is not a matter of doubt to the man who takes the time to follow its ads in the communities in Oklahoma which it serves.

There is a very definite philosophy back of the advertising of the company. It is the same as that on which the general business of the company is conducted and may be stated as follows:

1. The company is a part of each community in which it does business.
2. It has a story that can be told only by advertising.
3. Newspapers are a part of the community and business life that it is the duty of the company to use for business purposes.

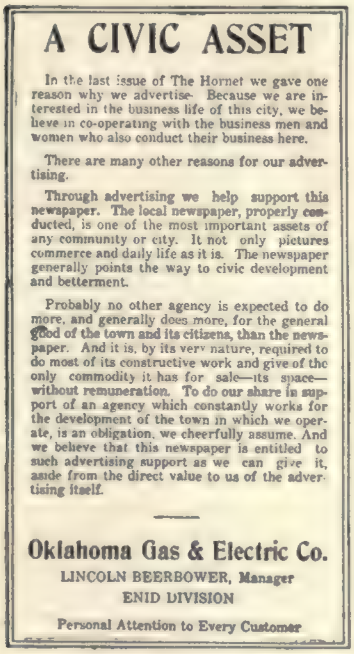
The two advertisements shown at the right and left below give the company attitude. These have been used in various local papers in the territory to answer questions that have been asked in regard to the use of advertising.

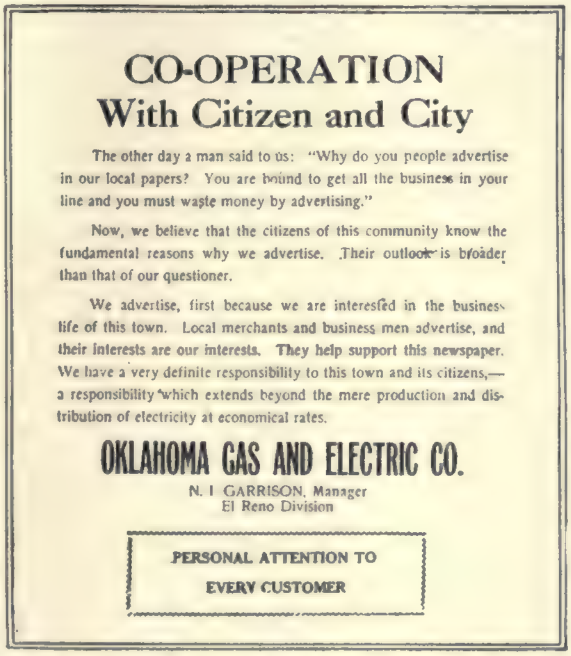
The company does no merchandising at the present time, so naturally does not carry on direct selling advertising campaigns. Its advertising is devoted to "selling" the company as a part of the community. Among other things it advertises the taking on of big or unusual loads as shown in the center below. Advertising of this kind seems less a company advertisement than is usual because care has been taken to tell about the others who are interested in the particular project and the place of the project in community affairs.

Another type of advertisement used is that telling of the process that is gone through when some occurrence that necessitates unusual methods and hard work in maintaining service is met. A few months ago a neighboring utility company met with misfortune in losing its plant by fire. The Oklahoma Gas & Electric Company by unusual efforts was able to supply the service in a short time, and this story was told in advertisements in a number of communities.

Advertising is also carried in papers in the towns where wholesale service is given. These "ads" are built around some subject showing the relation of the company to community affairs.

A complete record of the advertising placed each month is kept on the form shown above. This is supplemented by monthly district reports showing the total by districts and a consolidated summary for the entire system which is made up from a detail sheet shown.





ADVERTISEMENTS EXPLAINING A UTILITY'S POSITION IN A COMMUNITY AND THE APPLICATION OF ITS SERVICE

HOW SMALL FLOOR AREA IS UTILIZED TO GOOD ADVANTAGE

Effective Sales Arrangement in Limited Space

BY SUBDIVIDING its recently completed store into partitioned sections opening into the front of the office and facing the entering customer, the Pittsfield (Mass.) Electric Company has avoided the "jumble-shop" effect often encountered in central-station appliance departments and has separated socket devices into service classes for the convenience of customers.

In as small an area as 2,000 sq.ft. E. P. Dittman, sales manager, has established a demonstration of electric kitchen, sewing-room and living-room equipment utilizing the front portion of the office for the display of lamps, toasters, flatirons and table appliances. About fifty outlets are provided for demonstration and lighting service. The display area is illuminated by eight 200-watt units, fourteen 100-watt lamps being installed for window lighting.

What Other Companies Are Doing

Indianapolis, Ind.—For the first four months of 1923 the merchandise sales of the Interstate Public Service Company of Indiana were $95,446, an increase of 59.6 per cent over the corresponding period in 1922. During this period 1,665 new customers were added to the lines with an increased lighting load of 2,204 kw.

Louisville, Ky. — The Louisville utilities, including the Louisville Railway Company, Louisville Gas & Electric Company, Louisville Home Telephone Company and Cumberland Telephone & Telegraph Company, aided by the Louisville Automobile Dealers' Association, the Standard Oil Company and the Louisville Taxicab & Transfer Company, co-operated in advertising in the local papers to aid the campaign for Safety Week. These organizations freely inserted advertisements, 6 in. x 6 in., scattered through the local papers, calling attention to what can be and should be done to aid in reducing accidents.

Dayton, Ohio.—During the four weeks from April 18 to May 18 the Dayton Power & Light Company received applications for service from 221 new houses and 313 old houses, and there were 1,277 transfers, at the rate of forty-nine per day. Residential power was installed for ranges and refrigerators in thirteen instances. Twenty-five power customers were added, with an aggregate load of 234 hp.

Dallas, Tex. — The Texpolite Building & Loan Association has been organized here for the purpose of assisting employees of the Texas Power & Light Company to own their homes. The association is capitalized at $5,000,000 and the incorporators are James E. Van Horn, secretary and assistant treasurer of the Texas Power & Light Company; W. G. Schmauder and J. B. DeBow, also officials of the company. The association will operate at a lower rate of interest than is generally charged by such associations and is intended to be non-profit-making. Following establishment of this association it is planned to extend its operations to include employees of all the subsidiary companies.

Boston, Mass. — Twelve electric utilities under the management of Charles H. Tenney & Company showed a gain of 23 per cent in energy output for the last reported week as compared with a year ago, only one company showing a reduction in output. The Montpelier & Barre (Vt.) Light & Power Company headed the list with a gain of 121 per cent, the second company being the Bristol & Plainville (Conn.) Electric Company, with a gain of 41 per cent. Appliance sales are very active in the Tenney companies at present, the total to May 20 this year in ten companies, electric and combination, being $219,785. For the first quarter of 1923 the total appliance sales in ten of these companies was $120,991 against a quota of $104,674. Cyrus Barnes, general sales manager of the Tenney organization, states that merchandising in these companies this year is being conducted with a quota of one million dollars total sales, the slogan being "A Million or More Before '24."

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Hydro-Electric Development and Steam Equipment

Preparation, Transportation and Combustion of Powdered Coal.—JOHN BLIZARD.—A 127-page account on the many methods, advantages and disadvantages of preparing and burning powdered coal. Manufacturers and operators of coal-fired furnaces cannot afford to disregard the possible advantages of pulverizing their coal before burning it. Hence the purpose of this bulletin is to give statistics that will aid manufacturers and operators in making the proper estimates, enabling them either to abandon their present methods of burning coal on grates or stokers and to install the pulverizers, conveying system, powdered-coal feeders and burners best suited for burning powdered coal in their plant, or to reject as uneconomical the replacement of their present system by the system described. The following are some of the conclusions reached by the author: Powdered coal has proved an economical fuel for steam raising, cement making, metallurgical furnaces and many other purposes. For steam raising, with a properly constructed boiler and furnace, a continuous efficiency of over 80 per cent may be maintained. For other purposes a high temperature with no regenerators may be maintained by using powdered coal, with less coal consumption then when using producer gas, stokers or hand firing. The unit system alone is economically applicable for small installations where less than 10 tons a day is used. For larger installations the multiple system, with Raymond or Fuller mills and with indirectly fired driers, seems to be preferable. To distribute the coal, screw conveyors are recommended to convey large quantities of coal short distances and either the Fuller-Kinyon pump or compressed air to convey it long distances. The Quigley weighing tank is a valuable adjunct to the compressed-air distribution. The direct low-pressure system of distribution should be used solely to distribute coal short distances to small furnaces, where the cost and inconvenience of using separate bins and feeders for each furnace is unwarranted.—*Bulletin* 217 *of the Bureau of Mines.*

The Benson Superpressure Plant.—P. W. SWAIN.—There is nearing completion at Rugby, England, a plant designed for a minimum boiler pressure of 3,200 lb. The most interesting feature of this plant from the scientific point of view is the generation of steam without ebullition, by operating the steam generator in what may be called the "superpressure" region, that is, the region above the critical point. The claims made for this plant are a large saving in fuel cost, reduction in initial cost and a substantial saving in floor space.—*Power,* May 22, 1923.

Generation, Control, Switching and Protection

Constant-Potential Dynamo. — H. CHARLET.—A type of direct-current generator is described for train and automobile illumination, which is suitable for isolated hydro-electric and wind-driven plants and similar outfits where the automatic maintenance of a constant potential is necessary at variable speed of the prime mover. This machine utilizes a magnetic cross-field similar to the Rosenberg dynamo. The brushes of the neutral zone are, however, not directly short-circuited but deliver current through a tertiary winding around the stator poles. By proper connections of the two series windings the machine can be used advantageously as a starting motor of the automobile engine, and it fulfills in this case the double purpose of starter and generator. On a number of diagrams the electrical characteristics of this new dynamo are shown for different connections and purposes.—*Elektrotechnische Zeitschrift,* May 17, 1923.

Steam-Turbine Governors and Valve Gears Adjusting Speed and Speed Regulation.—E. H. THOMPSON.—The no-load speed of a turbine depends primarily on the tension or compression of the main governor spring. Increasing the spring resistance to the centrifugal pull of the moving weights or flyballs will ordinarily raise the no-load operating speed. Governor speed regulation, which is the relation between speed and the load in the unit, can be adjusted by one or more of the three general methods. Changing the speed adjustment will affect regulation to some extent and vice versa, while auxiliary devices present other complications.—*Power,* May 22, 1923.

Transmission, Substations and Distribution

Parallel Operation of Glass-Bulb Mercury-Arc Rectifiers. — A. ROTHENBERGER. — For direct-current variable-load supplies a considerable saving may be realized by installing, instead of one large metal-vessel mercury-arc rectifier, several small glass-bulb units, any number of which may be connected in parallel, conforming to the existing load demand. The author describes an automatic and a manual system for such operation. For both of these an electromagnetic tilting cradle is provided for each bulb. In the bus circuit of the automatic apparatus is a current relay with an adjustable time-lag element which adds each rectifier as it is demanded and disconnects them when the load falls off. Provision is made to cut out all bulbs if the supply should fail and to start them again with returning current. The hesitating relay is usually set to eight or ten seconds. The first bulb, which has to stay on the line at all times, has to be started by hand or by remote control. The non-automatic system is simply a contactor-operated remote control with push-buttons. — *Siemens Zeitschrift,* May, 1923.

33,000-Volt Interconnector Cable. — A complete description is given of the equipment of a 33,000-volt underground cable installed in England. The various tests made on the cable before installing, tests of joints, protection systems, etc., are considered.—*Electrical Review,* (*London*), May, 1923.

Units, Measurements and Instruments

Resistivity of Aluminum of Different Temperatures.—G. GRASSI.—Very little is known about the resistivity of aluminum on account of the great difficulty of getting this metal pure. This paper, presented before the Royal Academy of Sciences in Turin, gives a report of the experiments and studies the author made on many samples of aluminum 97.6, 98.3 and at 99.7 per cent pure. The proceedings are clearly explained and illustrated, and practical formulas are given to determine the resistivity of any commercial grade of aluminum and its variations at different temperatures. — *Elettrotecnica,* April 15, 1923.

Electric Carbon-Monoxide Meter.—M. MOELLER.—To obtain a perfect control of the operation of a boiler plant, the constant observation of both carbon-dioxide and carbon-monoxide are essential. For measuring both of these gases electric indicators can be used based upon the different heat conductivity of the gases as compared with air. Two short platinum wires are each inclosed within a tube, through one of which passes air and through the other the gas to be volumetrically measured. The wires are electrically heated and change their ohmic resistance according to the amount of CO_2 or CO which passes through the respective tubes. Connecting the air wire and the gas wire into a Wheatstone bridge, a millivoltmeter in the bridge can be directly calibrated in per cent of CO_2 or CO. Both instruments are installed side by side near the boiler, and the gases are forced through their gas tubes by a partial vacuum created by a small water-jet pump. Any number of indicating or recording instruments may be remotely connected to these two sending apparatus. It is claimed that these instruments give far more accurate indications of the amount of these gases in the flues than any chemically operating types. — *Siemens Zeitschrift,* May, 1923.

Design of Current Transformers.—G. L. E. METZ.—In designing a new transformer the first of the type built must be carefully examined and checked to obtain information that will lay the foundation for future design. The author takes up briefly the theoretical design of transformers. While the electrical side of current transformer design is of primary importance, the mechanical aspect, he points out, must also receive careful attention.—*Electrical Review* (*London*), May 26, 1923.

Illumination

Specifications for Large Tungsten-Filament Incandescent Electric Lamps.—This circular gives the specifications that have been officially adopted by the federal Specifications Board for the use of the departments and independent establishments of the government in the purchase of incandescent electric lamps. It includes general specifications, test specifications, tables of tolerances and comparison data.—*Circular No. 13 of the Bureau of Standards.*

Daylight Illumination on Horizontal, Vertical and Sloping Surfaces.—H. H. KIMBALL.—The report summarizes sky-brightness and daylight-illumination measurements made during the year ended April 6, 1922. For ten months the measurements were made in a suburb of Washington that is comparatively free from city smoke. During the other two months, one in summer and the other in winter, the measurements were made in the smoky atmosphere of Chicago. This paper was presented at the Swampscott convention last fall, but has been revised and extended.—*Transactions of the I. E. S.*, May, 1923.

Motors and Control

Resynchronizing Characteristics of Synchronous Motors.—O. E. SHIRLEY.—The resynchronizing of synchronous motors under heavy load is a new engineering accomplishment. Successful results were obtained only by redesigning certain features of the motor and by originating several new auxiliary devices. The author discusses factors for successful operation, torque characteristics and tests under operating conditions. He then shows the results of interruption in power supply and concludes his article with some remarks on general operating characteristics.—*General Electric Review*, June, 1923.

Electrification in the Pulp and Paper Industry.—H. W. ROGERS.—At present the total primary power in this industry is approximately 2,250,000 hp., of which somewhat over 600,000 hp. represents electric power. Consequently there is some 1,650,000 hp. still unelectrified. The author points out how electricity is the only practical power-distributing agent that permits of centralized power-generating apparatus and at the same time affords a flexibility in transmission which allows a mill to be designed entirely with a view to its manufacturing efficiency. This industry also lends itself to individual machine drive by direct application, with its attendant economy in power consumption, maintenance and space. The author discusses the various types of machines used, individual drive, variable-speed mechanisms, importance of process steam and various systems of electrification applicable to paper mills. The accompanying table gives an approximate power requirement for a 100-ton mill.—*N. E. L. A. Bulletin*, June, 1923.

APPROXIMATE POWER REQUIREMENTS FOR A 100-TON MILL (80 per Cent Ground Wood and 20 per Cent Sulphite)

	Hp.
Yard conveyors	178
Wood preparation	150
Ground-wood mill:	
Grinders	4,650
Pumps, screens, conveyors	450
Sulphite mill:	
Chippers	112
Digester and acid	61
Screens	435
Pumping	290
Machine room:	
Paper machines, beaters, agitators, fans, air compressors	1,628
Machine shop	34
Miscellaneous	50
Total	8,028
Boiler hp. for heating, drying, cooking, etc.	1,100

Heat Applications and Material Handling

Problems of Selecting Type of Motor Drive for Large Mine Hoisting Plants.—G. BRIGHT.—Developing mines for a large output means high rope speeds and large hoisting loads, or both. These two factors introduce many important problems, among them being the proper selection of the type of drive, exacting precautions to provide continuity of operation and low cost of upkeep. The author discusses these factors, pointing out the limitations of the various types of drive. Some interesting graphs are given showing the hoisting cycle with forced and naturally ventilated motors and a comparison of the alternating-current and direct-current motor-hoisting cycle.—*Coal Age*, June 7, 1923.

Traction

Truck-Overhauling Methods.—The several practices commonly used in overhauling trucks are described, the account being based on a survey covering fifty electric railway shops. The best methods to be followed and the most effective equipment to be used are discussed. An overhead crane provides the most efficient means of handling materials.—*Electric Railway Journal*, May 19, 1923.

The Buenos Ayres Western Railway.—The electrification of its suburban lines by this company includes a power station of 25,000 kw. capacity, 72.5 miles of high-pressure cables, four traction substations with 15,000 kw. of converting plant and the electrical equipment of 70 miles of single track. In addition, the supply of power and lighting calls for transforming plants to the extent of 7,000 kw. distributed in four static substations and two traction substations. A very complete description is given of the generating station, substations, transmission systems, electrical equipment of track and rolling stock.—*Electrical Review* (*London*), May 18 and 25, 1923.

Telegraphy, Telephony, Radio and Signals

French High-Frequency Generators.—H. EALES.—Four standard sizes of motor-generators for radio service are described, ranging from 25 kw. to 500 kw. output and designed for 32,400 cycles to 15,000 cycles alternating current. The peripheral speed of the rotors is 150 m. per second, which is considerably less than in modern steam-turbine practice. The laminations vary in thickness from 0.5 mm. to 0.9 mm., according to frequency, and are insulated from each other by enameling. The largest two types are totally inclosed and their rotors run in a partial vacuum (200 mm. mercury column). The smallest type has a water-cooled stator; the others are oil-cooled.—*Jahrbuch der Drahtlosen Telegraphie und Telephonie*, April, 1923.

Power Company Communication Developments.—In the annual report of the sub-committee on communications of the Pacific Coast Electrical Association three types of communication used by Western power companies have been studied. Troubles on wire communication lines are discussed as well as the developments of space radio and carrier-current radio for power-company use.—*Journal of Electricity and Western Industry*, May 15, 1923.

Alternating-Current Resistance and Inductance of Single-Layer Coils.—C. N. HICKMAN.—An integral-equation method is used to develop formulas for the alternating-current resistance and inductance of a system of parallel "go and return" circuits. It is shown how these formulas may be applied to single-layer coils. The formulas are applied to several coils in which the skin effect is quite pronounced. These coils are measured at several frequencies and the results compared with the computed values. The methods of measurements are explained and a discussion pertaining to the distribution to the effective resistance in a coil is included. The eddy-current losses due to dead ends are measured and discussed. A simple formula for the mutual inductance between coaxial circles of the same diameter is also developed.—*Scientific Paper No. 472 of the Bureau of Standards.*

Automatic Telephones in the Power Station.—A short description is given of the automatic telephone system installed in the Glasgow Corporation Electricity Department. The apparatus has a capacity of 200 lines. An outstanding feature in connection with this board is that, being power-driven and its action being very positive, all the switching and connecting apparatus can be made more robust and therefore better able to stand the wear and tear of prolonged use.—*Electrical Times* (*London*), May 24, 1923.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Why Davis Was Ousted

Politics and Water Users, Not Power Companies, Caused Reclamation Chief's Resignation

INQUIRY made at Washington by the ELECTRICAL WORLD has failed to discover any foundation for the press reports that Western water-power companies were largely responsible for the forced resignation of A. P. Davis, former director of the Reclamation Service, whom Secretary of the Interior Work replaced by former Governor D. W. Davis of Idaho. The change in control is declared by those in a position to know to be unquestionably the result of pressure from water users and of a desire to use the Reclamation Service in politics.

In defense of his removal of A. P. Davis from the post he had filled so long and in answer to protests emanating from the Federated American Engineering Societies and other sources Mr. Work said: "We don't need two engineers in charge of the Reclamation Service. In the future the service head will be known as the chief of the Bureau of Reclamation and will be qualified first to aid the farmers rather than supervise engineering works on the projects. D. W. Davis, former Governor of Idaho, is such a man and I have appointed him as the bureau chief, have abolished the office of director and placed F. F. Weymouth, former assistant chief of the service, in the position of chief engineer of the bureau." Mr. Weymouth has been stationed at Denver.

PROTEST OF THE F. A. E. S.

In explanation of the stand of the Federated American Engineering Societies, Secretary L. W. Wallace issued a statement saying in part:

"The displacement of the director of the Reclamation Service and the appointment in his stead of a man who apparently is not technically trained and fitted to direct an important technical service of the government is looked upon with grave concern by the engineers and technical men of the United States, because such summary action will undermine the morale of all the technical agencies of the government.

"The work of the Reclamation Service is essentially of an engineering and technical nature. There are business aspects to be true, but so far as is known there has been no criticism of the business direction of the service, other than perhaps by certain interests in the West that have endeavored to secure a reduction in or have endeavored to repudiate payments for reclaimed lands purchased."

Northwest Association Listens to Outsiders' Viewpoint

Public relations and the attitude of the public toward the utilities were among the chief topics discussed at the sessions of the Northwest Electric Light and Power Association convention, which was held at Seattle last week with a registration of more than 250. The program this year was unusual in that a number of speakers from outside the industry were invited to discuss the problems of the utilities as they are viewed by those unconnected with them. A report of their remarks and of other convention proceedings will appear in an early issue of the ELECTRICAL WORLD.

A. M. E. S. Elect Officers

At the closing session of the summer convention at New London, too late for inclusion in the report last week, the Associated Manufacturers of Electrical Supplies devoted the afternoon to routine business, principally the reports of committees and the election of officers. The ways and means committee, W. W. Nichols chairman, recommended that the A. M. E. S. become a sustaining member of the American Engineering Standards Committee, but action was deferred. F. L. Bishop, Hartford, Conn., was elected vice-president of the association, and the following were made members of the board of governors: M. C. Rypinski, Sears B. Condit, W. W. Mumma, A. G. Kimble and F. T. Wheeler. The other officers continued.

Illuminating Engineering Society Elects Officers

National officers of the council of the Illuminating Engineering Society have been elected for the fiscal year 1923-1924 as follows: President, Clarence L. Law; general secretary, Samuel G. Hibben; treasurer, L. B. Marks; vice-president, D. McFarlan Moore; directors, James P. Hanlan, Howard Lyon and H. F. Wallace. Section chairmen and secretaries will be: New York, L. J. Lewinson and J. E. Buckley; New England, W. V. Batson and Julius Daniels; Philadelphia, H. Calvert and J. J. Reilly; Chicago, F. A. Rogers and E. J. Teberg.

N. F. P. A. Hearings

New Under-Floor Duct System and New Electric Wiring System to Be Submitted July 17

THE committee on new developments of the electrical committee of the National Fire Protection Association announces through Chairman Dana Pierce that on July 17 it will hold a public hearing on a new under-floor duct system, using a special form of fiber duct with suitable junction boxes and other fittings, submitted to the committee for approval by the Johns-Manville Company of New York. This system is proposed for use embedded in concrete floors of fireproof buildings. Its purpose is to provide a flexible system of wire distribution for electric lights and other devices connected to building electric service, and also for the distribution of communication wires for telephones, call systems and the like.

Two types of systems are under consideration. One of these is a double-duct system in which entirely separate duct systems are laid in the floors, one to contain electric light wires and the other to contain communication wires. In this case it is proposed to use in the electric light ducts ordinary rubber-covered wire for the circuits. In the second, or single-duct, system it is proposed that the electric light wires be run in standard grounded armored cable on the loop system, in which case the communication wires will occupy the same ducts with such cable.

Both systems provide junction boxes or manholes, from which all fishing operations are conducted, and in both systems it is possible at any time to establish new floor outlets by cutting through the concrete above the duct and installing a special threaded insert. In both systems the circuits within the box are supplied by feeders run from a center of distribution in steel conduit to a junction box of the under-floor system. In its present forms this system is proposed for use only for branch circuits, that is, circuits which may properly be protected under the new code rules by 15-amp. fuses.

NEW ELECTRIC WIRING DEVICE

The hearing will take place in the assembly room of the New York Board of Fire Underwriters, 123 William Street, New York City, at 10:30 a.m. (daylight-saving time), and all persons having an interest in this question are invited to present their views to the committee in the form of briefs, which may be filed at the time of the hearing or immediately thereafter. At 2 p.m. on the

same day (July 17) the committee will hold a similar hearing on a new form of two-conductor material for general wiring consisting of rubber-covered wires with special non-metallic protective coverings. This is intended for wiring circuits in both open and concealed work without insulating supports and without metal armor, conduit or flexible tubing, the protection of the conductors and their insulation being furnished by the coverings on the conductors themselves. The coverings consist of rubber, windings of paper and cotton braids with fire-resisting and moisture-proof impregnations. This hearing concerns "Romex," a new electric wiring material submitted by the Rome (N. Y.) Wire Company.

John A. Britton Dies Suddenly

Vice-President of Pacific Gas & Electric Company Had Just Returned Home from N. E. L. A. Convention—Pioneer in Western Hydro Field—His Engaging Qualities

JOHN ALEXANDER BRITTON, first vice-president and general manager of the Pacific Gas & Electric Company, known in the West as the "Dean of the Electrical Industry," and with many friends in all parts of the country who were attracted to him by his genial nature and lovable attributes, died in San Francisco on Friday, June 29, after a short illness caused by ptomaine poisoning, at the age of sixty-eight.

Mr. Britton attended the convention of the National Electric Light Association in New York in early June and was then in his usual health. He took an active part in the proceedings, making two speeches of considerable length in the ready and forceful manner that always roused his hearers to applause. One of these speeches was on water power. The other was on another of his favorite topics—customer ownership. In it he related the early history of this movement, of which he was the father, telling of its success in the territory of his company and of the part it played in defeating the proposed constitutional amendment for state ownership and operation of water-power developments in California. So effectively did he speak that his hearers were aroused to great enthusiasm, and when he ceased an ovation that lasted several minutes was given to him.

At this convention Mr. Britton was elected first vice-president of the association in succession to Walter H. Johnson, the new president. This election would, in the usual course of events, have brought the presidency of the N. E. L. A. to Mr. Britton next year.

NOT A "NATIVE SON"

Though no man was more closely allied with Pacific Coast growth or more imbued with the progressive Western spirit that John A. Britton, his birthplace was in Roxbury, Mass. (now a part of Boston), in 1855, and he was thirteen years old when he removed to San Francisco. A year later he left school and went to work in a grocery store, toiling sixteen hours a day and longer on Saturdays. In six months he became a bookkeeper in a musical institute, where his meager salary of $6 a week was in part compensated by the opportunity to pursue the musical studies in which he always delighted. Another year saw him a

JOHN A. BRITTON

clerk in a lawyer's office, and a lawyer he would almost surely have become had not incessant work and study undermined his health and forced him, three years later, as a temporary expedient, to seek out-of-doors employment. He procured a place as a collector with the Oakland Gas Company, and his life work began. This was in 1874, when Britton was still under twenty.

GAS, THEN ELECTRICITY

He mastered various phases of the gas business, rising to be secretary of the company about 1879, and decided to abandon the law for engineering. The first electric arc-lighting plant on the Pacific Coast was erected at San Francisco in 1880, and young Britton was in at the birth. The Oakland Gas Company made its first electric installation in January, 1885. "I bought every book I could buy on electricity," he said many years later, "and studied every phenomenon I could hear of. I attended night school for electrical engineering. As we installed machinery in Oakland I knew exactly what it was, what its functions were, so I could take it apart and put it together. I designed and built the first electrical plant in Oakland. All the improvements and extensions of the company's properties from 1897 were designed and built under my direction."

In 1895 he became chief engineer of the Oakland company, and in 1898 he was elected president. When the company was merged into the California Gas & Electric Corporation Mr. Britton occupied the new presidential chair, and in 1905 the process was repeated when the smaller companies became subsidiaries of the new Pacific Gas & Electric Company. Three years later, however, his title was changed to the one he bore at the time of his death—vice-president and general manager—a position which kept him in closer personal touch with the everyday activities of the organization. One of the secrets of his popularity as an executive head was his policy of "the open door." He was accessible not only to visitors but to employees.

NEARLY FIFTY YEARS' SERVICE

Next year would have been the fiftieth anniversary of Mr. Britton's connection with the erstwhile Oakland Gas Company. His was the longest record in the service. During that half century the electrical industry on the Pacific Coast grew from nothing to its present vast proportions, and he might have said with Virgil: "All of these things I saw, and a great part of them I was." He was identified with public utility work long before the first hydraulic station in California was placed in operation and sixteen years before the famous single-phase transmission line at Telluride was completed in 1890. His life was part and parcel of the story of how water power was harnessed and high-tension lines were built and interlaced on the Pacific Coast. For the Pacific Gas & Electric Company, which now, with 650,000 customers, serves eighty-nine incorporated cities, 142 villages and towns and a suburban area of 35,000 square miles, with twenty-eight hydro-electric and four steam plants, he had charge of all construction work, and he was responsible for the operating and financial policies of the company in all its departments.

His work as an executive engineer, however, was by no means the sum total of his achievements. As member and chairman of the public policy committee of the N. E. L. A. he did a most important task extremely well. His furtherance of the sale of company securities to customers has already been alluded to. The California Electrical Co-operative Campaign owes much to his foresight and initiative. He was a member of the board of regents of the University of California, a prominent director of the Panama-Pacific International Exposition, and to him was accorded by common consent a conspicuous place among the "builders of the West."

HIS WINNING CHARACTER

Courage, energy and ability to estimate accurately future possibilities Mr. Britton had in abundant measure. With these qualities and with his natural ability as an engineer and executive and his tireless industry he joined characteristics of humanity and

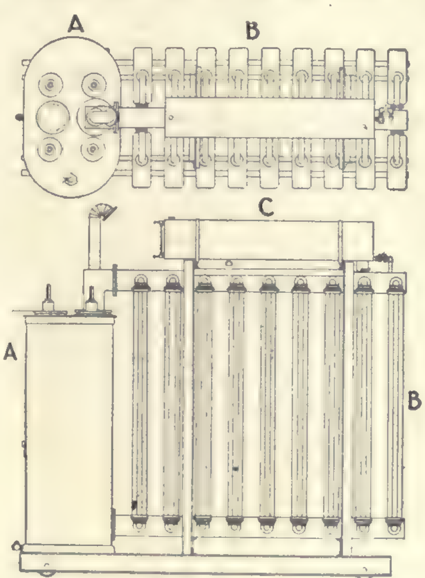
native kindliness that made him sincerely esteemed by even casual associates and beloved by those who came into intimate contact with him. To these characteristics, to his readiness to regard the rights of others and extend help to them, has been ascribed the unrivaled esprit de corps displayed by the Pacific Gas & Electric Company under his management. His ability as a speaker was always at the service of the causes in which he believed, his love of music found expression in promoting musical enterprises in his home city, and his public spirit was exemplified in his work as chairman of the San Francisco chapter of the Red Cross and as chairman of the district Liberty Loan publicity committee during the war. He was a member of the American Society of Mechanical Engineers and the American Society of Civil Engineers as well as of the American Institute of Electrical Engineers, and he belonged to a number of social clubs and benevolent societies. He had been president of the Bohemian Club, which was devoted largely to the promotion of music and drama in San Francisco. He leaves a wife, who was Miss Florence Eastman, and three children.

Wigginton E. Creed, president of the Pacific Gas & Electric Company, and several of the officials and employees of the company, as well as other citizens, paid tribute to Mr. Britton's memory in the San Francisco press. The funeral services were held on Monday last under Masonic auspices.

Recent Notable Transformers of General Electric Make

A notable example of large single-phase self-cooled transformers is furnished by seven 60-cycle, 10,417-kva. auto-transformers which will soon be put in service by the Brooklyn Edison Company. These transformers, now being completed in the Pittsfield works of the General Electric Company, will step up the generator voltage from 13,800 to 27,600. They will have a transformer rating of 10,417 kva., but since they are auto-transformers of a one to two ratio, each will transform a total of 20,834 kva., so that the total output of a bank of three transformers will be 62,502 kva. This is probably the largest amount of energy transformed by any single bank of self-cooled transformers. A novel feature of the design is the arrangement of the radiators. They are arranged in a double bank mounted on two large manifolds connected to the top and bottom of the transformer tank proper. The whole structure will be mounted upon a truck to permit the complete transformer to be run into its cell. A door or baffle will be built in between the transformer tank and the bank of radiators so that the transformer in its cell will be completely separated from its bank of radiators. This construction, which was dictated largely by space limitations, may find many applications.

The General Electric Company has also just completed at its Pittsfield works, for the Kansas City Gas & Electric Company, two three-phase 60-cycle, 15,000-kva. self-cooled transformers provided with three windings for simultaneous operation. Each transformer will be capable of delivering the full capacity of the transformer. These transformers are noteworthy not only on account of their large kva. rating, but also on account of the high voltage and other complications entering into the design. The high-voltage windings were designed for 132,000 volts, Y-connected, and are provided with full-capacity taps down to 120,000 volts. The intermediate voltage winding was designed for 72,000 volts, Y-connected, and is provided with full-capacity taps down to 60,000 volts. The low-voltage winding was designed for 12,470 volts without taps. The transformers may be operated from either of the high-voltage windings at full kva. capacity to the low-voltage winding as straight transformers in either case. They also may be operated as auto-transformers from 13,000 volts to 72,000 volts and at the same time deliver load at 12,470 volts. The multiple-circuit windings with solidly grounded neutral developed, which were first used by the General Electric Company for the 220,000-volt transformers on the Pacific Coast, are employed for the high-voltage windings of the Kansas City transformers. Interleaved disk coils are used for the high-voltage auto-transformer windings, and "helical" coils for the low-voltage winding.



A-Transformer B-Radiator C-Conservator

RADIATOR DESIGN FEATURE OF G. E. SELF-COOLED TRANSFORMERS

Niagara, Lockport & Ontario Expansion

Petition has been made to the New York Public Service Commission by the Niagara, Lockport & Ontario Power Company for permission to acquire all capital stock of the Lower Niagara River Power & Water Supply Company and to purchase land in Niagara Falls and Lewiston held by the North End Land Company of New York City.

The purchase price for the property is set at $500,000 and includes 1,259 shares of stock and 916 acres of land. The stock now is held in trust for the benefit of the power company, which thinks the time has come for an expansion of its service. The development contemplated involves the transmission of energy to sixteen counties in western New York. Cheektowaga, Lackawanna and other places near to Buffalo will get energy from the development, and a certain amount, it was said by counsel for the company, will probably be sold to the General Electric Company of Buffalo.

Advertise More, Sloan Tells Empire State Men

Central-station companies should spend at least 1 per cent of their gross income for advertising if they expect to build up and hold the good will and confidence of the public, declared M. S. Sloan, president of the Brooklyn Edison Company, before the Commercial Section meeting of the Empire State Gas and Electric Association held at Briarcliff Manor, N. Y., June 28 and 29. He deplored the fact that few companies are now spending even as much as one-half of 1 per cent of their gross revenue on newspaper publicity. "It is up to the commercial men," said Mr. Sloan, "to wake up and make their executives spend more money for advertising. It is as much the duty of the sales departments to sell the industry to the public as it is to sell gas and electric appliances to the individual customer. Only when the people know the story of the industry and the truth about water-power development can the central-station feel safe from municipal or state ownership."

A most comprehensive report and plan for the development of rural service lines was presented by Bert H. Shepard, chairman of the rural lines committee. Mr. Shepard stated that the association's work along this line had progressed to a point where it expected to meet with the Public Service Commission in the near future to formulate definite rules and regulations to govern rural-line practice in New York State.

Speaking on the service of the utility company from the viewpoint of an outsider, H. W. Bell of the Utica Savings Bank described the central station as the modern purveyor of fire, which, since the dawn of history, has been the chief factor in the advancement of civilization. He urged central-station men not to neglect their opportunity to keep constantly before the public the importance of the service which they furnish.

At the close of the meeting H. A. Doering was unanimously re-elected to

serve his third term as chairman of the Commercial Section and W. J. Reagan was unanimously elected vice-chairman.

A. S. T. M. Considers Electric Specifications and Tests

Specifications for condenser tubes, standardization of tests and test procedure for electrical insulating materials, and characteristics and insulation tests of electrical slate were among the subjects of interest to electrical engineers discussed at the twenty-sixth annual meeting of the American Society for Testing Materials, at Atlantic City June 25 to 29.

The report of the committee on electrical insulating materials was accepted with all recommendations. This report covers dielectric strength tests for cambric tape, sludging tests for transformer oils, the effect of rate of raising potential in dielectric strength tests of sheet materials and a method of test for power factor and dielectric constant of insulating materials at commercial frequencies. Tentative standards for test of electrical insulating materials for voltage effects at radio frequencies and a method of testing cable splicing and pothead compounds were also passed. Several sections were added to the tentative methods of testing insulating varnishes, covering a draining test, an evaporation test and a test for non-volatile matter.

A general discussion of the characteristics, tests and application of slate for electrical uses was held by both producers and users. Oliver Bowles presented a paper a part of which was devoted to desirable standards and tests of electrical slates. Dean Harvey and J. J. Keyes reviewed the more important application of slate for use in electrical apparatus, set forth the requirements of good slate and gave the characteristics of typical slate. They also discussed the various tests for electrical slate. R. M. Spurck described the early methods of testing the insulation of electrical slate and discussed the development, characteristics of and the results obtained by a new method of making insulation tests.

The committee on rubber products presented tentative specifications for rubber matting for use around electrical apparatus on circuits not exceeding 3,000 volts to ground. These specifications were accepted and covered the manufacture, mechanical and electrical tests, dimensions, inspection and rejection of mats. The tentative specifications for rubber gloves were advanced to standard specifications.

The method submitted by the committee on magnetic properties for testing the magnetic properties of iron and steel permits the use of any method which yields result within the specified limits of accuracy. Reference methods were specified by which the accuracy of permeameters can be determined.

June Financing Shared by 27 Utilities

NEW electric light and power public utility offerings of stocks, bonds and notes during the month of June amounted to $54,471,450, comparing with $52,026,000 during the preceding month. The bringing out of a large number of small issues was responsible for the total reached, for the largest single offering was the $4,500,000 issue of first mortgage bonds of the Northern Canada Power Company, Ltd., offered at 99½ and yielding 6.56 per cent. Fourteen of the remaining twenty-six offerings were less than $2,000,000. The rate of return yielded the investor, which had advanced consistently from 6.08 in January to 6.47 in May, dropped to 6.30 during the month of June. Although seven of the issues were offered in whole or in part for refunding purposes, most of the offerings represent applications for new capital. The financing was substantially of a long-term nature.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN JUNE

Name of Company	Amount of Issue	Period, Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Wisconsin Power, Light & Heat Co.	$350,000	3	Collateral gold notes, series A	Refunding and other corporate purposes	6½	99½	6.75
Potomac Edison Co. (Md.)	3,900,000	25	First mortgage gold bonds, series A	Refunding and additions	6½	97	6.75
Dubuque Electric Co. (Ia.)	3,000,000	19	First mortgage gold bonds	Refunding and other corporate purposes	6	98½	6.15
Central States Electric Corp. (Va.)	4,000,000	2	Secured gold notes (with stock purchase warrants)	To increase working capital	7	100	7
Niagara, Lockport & Ontario Power Co. (N. Y.)	3,000,000	3	Convertible gold notes	Additions and improvements	6	101	[illegible]
Oklahoma Gas & Electric Co.	1,000,000	18	First and refunding mortgage gold bonds, series B	To pay floating debt	6	94½	6.50
Western States Gas & Electric Co. (Cal.)	2,000,000	24	First and unified mortgage gold bonds, series A	Additions	6	96	6.30
Consolidated Power & Light Co. (W. Va.)	1,500,000	..	Cumulative preferred stock	Additions	7	93½	7.50
Jersey Central Power & Light Corp.	1,156,250	..	Cumulative participating preferred stock	Additions and corporate purposes	7	92½	7.57
Mountain States Power Co. (Ore.)	3,100,000	15	First mortgage gold bonds, series B	Refunding and to provide working capital	6	95½	6.50
New England Power Co. (Mass.)	1,800,000	28	First mortgage sinking-fund gold bonds of 1911	Additions and extensions	5	97¾	5.15
Northern New York Utilities Co.	2,212,200	20	First lien and refunding bonds, series C.	Additions	6	99	6.10
Southern Canada Power Co., Ltd. (Que.)	1,500,000	..	Cumulative participating preferred stock	Additions	6	[illegible]	6.67
Carolina Power & Light Co. (N. C.)	2,500,000	30	First and refunding mortgage gold bonds	Additions and corporate purposes	6	97½	6.15
Jamaica Public Service Co., Ltd. (West Indies)	1,000,000	20	First mortgage sinking-fund bonds, series A	Additions	6½	100	6.50
San Joaquin Light & Power Corp. (Cal.)	2,500,000	29	Unifying and refunding mortgage gold bonds, series B, non-callable	Additions, and corporate purposes	6	99	6.05
Adirondack Power & Light Corp. (N. Y.)	1,250,000	27	First and refunding mortgage gold bonds, series of 6's	Additions	6	99½	6.05
Binghamton Light, Heat & Power Co. (N. Y.)	358,000	23	First refunding mortgage gold bonds of 1916	Additions	5	88	6
Memphis Power & Light Co. (Tenn.)	2,000,000	25	First and refunding mortgage gold bonds, series B	To reimburse for expenditures and for other corporate purposes	6	99½	6.05
Toledo Edison Co. (Ohio)	1,050,000	24	First mortgage gold bonds	To reimburse for construction	5	91	5.70
Scioto Valley Railway & Power Co. (Ohio)	1,400,000	20	First mortgage sinking-fund gold bonds	Refunding	6	97½	6.20
Consumers' Power Co. (Mich.)	3,500,000	29	First lien and unifying mortgage gold bonds, series C	To reimburse for construction	5	89½	5.75
Electric Bond & Share Co. (N. Y.)	2,750,000	..	Cumulative preferred stock	General corporate purposes	6	97½	6.15
New Bedford Gas & Edison Light Co. (Mass.)	1,145,000	15	First mortgage gold bonds, series C	Additions	5	100	5
Northern Canada Power Co., Ltd. (Ont.)	4,500,000	15	First mortgage sinking-fund bonds	Refunding, additions, betterments	6½	99½	6.56
Sierra & San Francisco Power Co. (Cal.)	1,000,000	26	First mortgage gold bonds of 1909	To reimburse for construction	5	87	[illegible]
Savannah Electric & Power Co. (Ga.)	1,000,000	2	Gold notes	Additions	6½	99½	6.75
Total	$54,471,450						

Water Power in New York

State Authorities and Federal Power Board May Reach Understanding —St. Lawrence Suits

PROGRESS in overcoming the legal difficulties which have so far thwarted development of the state-owned water power of New York State has been made, according to Albany advices to the ELECTRICAL WORLD, as the result of the conferences between the State Attorney-General's office and the federal government. It has already been intimated in these columns (May 19, page 1162) that as a result of such conferences the pending litigation to determine the state's rights under the Esch law may possibly not be pushed by the New York officials. It is now asserted that Attorney-General Sherman will recommend to Governor Smith that the pending suit be withdrawn.

The federal government's disclaimer of any intention to exercise supervision over water-power development on canalized inland streams and its expressed willingness to co-operate with New York in statutory plans for the development of water power either by private lease or by the state itself are taken at Albany to mean that the United States government will not seek to establish the position of primary federal supremacy in regulation of the development of all water power, under the superpower development plan favored by Governor Pinchot of Pennsylvania, and that applications now pending with the New York State Water Power Commission may be approved and development maintained, or that the state itself may by appropriation of money or by bond issue undertake a comprehensive system of development of state-owned power.

This does not mean, however, that the state will abandon its suits pending against about eighty owners of mostly undeveloped private water-power rights and riparian rights in the St. Lawrence River watershed. These actions have been brought with the idea of securing to the state the sovereignty over all of the units of the St. Lawrence power essential to its successful development either by the state itself or through private capital. The history of these particular power and riparian rights dates back to 1826, and the state is seeking to determine through legal adjudication just what it owns within its boundaries and what it may use or lease. One course favored is a special act of the Legislature taking possession of the dam on the south channel of the St. Lawrence River and such power and riparian rights as are needed and allowing the various parties aggrieved to come into the court of claims for compensation.

The Ferris amendment to the New York State Constitution allowing the building of transmission lines and power stations on the lands of the forest preserve goes to the people for approval at the general election in November. So far the press has paid little attention to this important matter. Its failure of ratification will mean that the St. Lawrence power, if developed, cannot be economically transmitted to the capital district and New York City, because under the constitution as it now stands transmission lines cannot be built through the forest preserve in the Adirondacks.

The New York State Water Power Commission is preparing a report based on the negotiations had by the state agencies with the federal authorities which will very soon be submitted to Governor Smith. The report will outline suggestions for immediate steps to secure power development.

Iowa Men's Convention Is Comprenensive

Invulnerable Securities, Ranges and Merchandising, Plant Design, Transformer Maintenance, Valuation Bases and Rate of Return Are Discussed at Mason City

SECURITY of such order that bonds and preferred stock shall be absolutely protected, adequate reserves for maintenance and the keeping of speculation away from public utility issues were three essentials named by Frank T. Hulswit, president of the United Light & Railways Company, in discussing utility financing before the Iowa Section of the National Electric Light Association at Mason City last week. Mr. Hulswit analyzed the financing of a utility undertaking, pointing out the place of bonds, preferred stock and common stock in the financial structure. He criticised past practices which had led to attempts to finance largely by bond issues and said that unless the proper relation between the various classes of securities is maintained it is only a question of time until a weakened financial structure will give trouble. He said also that unless security of a high order is placed back of the issues the industry must eventually get into a predicament which will make the troubles of the past seem child's play and will in time bring municipal ownership.

The sale of "electric cookery" was suggested as a better term than the sale of the electric range by H. D. Mitchell of Cedar Rapids in discussing this appliance Mr. Mitchell declared that manufacturers of ranges must be progressive, must not quibble over backing up their product by the replacement of defective parts, and also that the range must be designed so as to be pleasing to the eye of the buyer. He advocated a thorough training of the utility forces in the handling, use and servicing of electric ranges before any campaign of sales is undertaken, so that the entire organization including office employees and linemen, shall be thoroughly "sold" on their use and able to back the campaign.

TRAINING THE HOUSEWIFE

Mr. Mitchell urged the need of training the housewife in the proper use of the electric range, advocating daily reading of the range meter for two or three weeks and every three days for a period thereafter to detect and correct tendencies toward inefficient use which will prove expensive. The subject was discussed by V. O. Stafford of Humboldt and J. F. Reach of the Edison Electric Appliance Company.

"GOOD-WILL" MERCHANDISING

Merchandising operations that are first self-sustaining and then builders of good will were advocated by H. L. Green of Waterloo, who took the stand that appliance salesmen must be taken out of the class designated as "door-bell pushers" and developed into employees who represent service ideals in their contact with customers. He urged a combined salary and commission basis that would attract men of the best type in this sales work.

In discussing the servicing of appliances C. A. Nash of Davenport said that repairs should be made first and the question of who sold the appliance and how payment for repairs should be rendered settled afterward, the object being to keep appliances in service. Speaking of advertising, Mr. Nash took the position that there should be less use of graphs, curves and mechanical data and a greater use of the human-interest appeal by telling what can be done with electrical energy and how its use makes for better living.

DISCUSSION OF HEAT BALANCE

Strong emphasis was placed on the consideration of heat balance by G. T. Shoemaker of the United Light & Railway Company in discussing "Modern Power-Plant Design" before the joint session with the Iowa Electric Railway Association on Thursday. Bleeding of steam from the main turbines to obtain steam for the auxiliaries and to help in maintaining the heat balance was advocated by the speaker, who said that among other advantages it would be possible to avoid the use of high-pressure piping for the auxiliaries if this method of insuring steam supply were taken. Preheating of the air both through heaters that take heat from the waste gases and by use of the warm air from the turbines for use in the furnaces was discussed. The difficulties due to extra-pressure drop in the waste gas heaters and the troubles involved in keeping the heaters clean were pointed out by Mr. Shoemaker, and the possible advantage of using steam bled from the turbines was discussed. He also pointed out the much better economies obtainable with

present turbine designs and suggested careful consideration of old plants equipped with older types, saying that in many cases even the smaller sizes of turbines could be economically replaced with new machines. A careful study of the fuel supply and a careful fitting of equipment to fuel was urged.

C. G. Johnson of the Union Utilities Company of Chicago, pointed to the tendency toward supplying large areas from plants located at convenient points and told the convention that it is necessary to consider carefully the problem of any new plant, especially in a small town, to avoid the possibility of its becoming obsolete long before it is worn out by the construction of more economical plants in the territory which would make it advantageous to purchase power.

Transformer Maintenance

C. R. Stahl of Davenport described a method of transformer maintenance by which the losses of transformers in Davenport have been reduced to a negligible quantity, even though it has been the practice to operate the distribution transformers on the system at an overload during the annual peak averaging 114 per cent of the installed transformer capacity for the entire low-voltage distribution system. The fact that the maximum load comes in the fall and early winter months when temperatures are low is one of the reasons why this can be safely done. In addition to the usual records of the transformers, consisting of the history card and location records, an inspection schedule is maintained which calls for two inspections a year. The first is in the early spring and consists of a thorough going over of the transformers to see that fuses, fuse blocks, lightning arresters, grounds and oil are in good condition. At this time the oil is either filtered or replaced and all the items of equipment in each installation are put in good physical condition. The next inspection is during October, November and December, when load tests are made and the loading conditions adjusted as the tests show to be necessary. The first inspection under the present method revealed some startling load conditions on the distribution system.

Accounting Discussed

C. J. Anderson of Chicago and George F. Meyers presented discussions of uniform accounting and customer accounting respectively. The discussion which followed developed into a question-and-answer cross-fire on the "bookkeeping without books" method first used in customer accounting at Baltimore which revealed a great deal of interest in the method and much satisfaction with its results.

John A. Reed of Cedar Rapids discussed the effect of the latest court decisions on fair values, depreciation and rate of return, taking the position that these decisions have not changed materially the basis on which valuations for rate-making purposes should be made. He cited decisions to show that no single basis has been fixed by the courts for such valuations, but that reproduction costs at current values, original costs and all the other bases must have consideration before a value can be fixed. Mr. Reed also discussed taxation matters as they affect Iowa utilities, urging the need of careful attention to assessments to see that the local bodies which have authority over all property except transmission lines do not discriminate against utilities and make assessments on a higher basis than those for other kinds of property. He asked for careful attention to the transmission-line assessments made by the state executive council for the same reason.

Rural lines and inductive interference came in for discussion at the convention, the work of the national committees being canvassed. G. E. Turner of Chicago, representing the stock casualty insurance companies, spoke on government control of insurance companies and on the advantages of co-operation.

The officers for the coming year will be: President, C. A. Sears, Keokuk; first vice-president, Don Sterns, Humboldt; second vice-president, J. A. Reed, Cedar Rapids; secretary-treasurer, M. G. Linn, Des Moines.

Lighting-Fixture Men Meet

Manufacturers Discuss Design Problems and Popular Education at Buffalo Gathering

ABOUT sixty representatives of fixture concerns were registered at the annual business convention of the National Council of Lighting Fixture Manufacturers, held at Buffalo on June 26-28.

Tuesday's session was given over to a discussion of design matters, under the direction of E. T. Caldwell of Edward F. Caldwell & Company. M. Luckiesh, director of applied science, Nela Park, Cleveland, made a plea for greater consideration of the illuminating features of fixtures and demonstrated the artistic effects and relief from glare which can be accomplished by modern glassware.

Wednesday was devoted to a discussion of plans for general publicity to popularize lighting fixtures and particularly the lighting industry's slogan, "Notice the lighting equipment." C. C. Parlin of the Curtis Publishing Company and R. B. Wagner of the International Displays Company were the speakers.

At the business session of Thursday morning Col. E. T. Miller of the United Typothetæ of America spoke on "Why Trade Associations Should Promote Cost Accounting."

President Biddle of the National Council of Lighting Fixture Manufacturers, in his official address, urged that all manufacturers of lighting equipment join with the membership of the council, rather than "ride without paying fare." The maximum dues of the organization, he pointed out, are hardly one-third of the salary of an office boy. So far $114,604 has been pledged to the campaign for popular publicity, but this burden has been borne by a relatively small fraction of the makers of fixtures, and President Biddle urged every manufacturer of fixtures or parts to join the movement. "Money spent competitively," he pointed out, "is spent largely in a fight for existing business, but money spent co-operatively will develop new business for all branches of an industry."

Central Diesel-Engine Plant for Rio Grande District

Although the Central Power & Light Company of St. Louis entered the Texas field only a few years ago, it has quickly, through its subsidiary, the Texas Central Power Company, acquired a number of important electric light and power street railway and ice-making utilities, and among the cities in which it operates are Laredo, Corpus Christi and Del Rio. It has devoted itself especially to the development of the fertile Lower Rio Grande Valley and has ice and electric plants at Mission, Mercedes, San Benito, McAllen and other places, as well as at Matamores, Mexico, just across the river from Brownsville. The Central Power & Light Company has now decided to build a large central station at the load center of this group and tie the cities together by 66,000-volt transmission lines, and to carry out this plan it has determined to install Diesel engines instead of steam turbines.

The first section of the plant will consist of two 1,125-b.hp. Diesel engines, each directly connected to a 750-kw. generator with directly connected exciter. The engines are being furnished by the Busch-Sulzer Brothers Diesel Engine Company, and the electrical equipment by the Westinghouse Electric & Manufacturing Company. As the plant is expanded much larger Diesel units will be installed.

This semi-arid country requires irrigation for about six months during the year. Most of the pumping plants are now steam-operated, at heavy expense. It is expected that electrical energy can be supplied to the irrigation companies at a rate sufficiently low to warrant displacing the steam pumping plants with motor-driven machines.

The diversity of load—ice making, irrigation, cotton ginning and electric lighting—will result in a comparatively high station load factor. It is expected that the Diesel plant will deliver 11 kw.-hr. at the switchboard per gallon of fuel oil consumed. The two Diesel units will be operated by an engineer and an oiler per shift.

The Central Power & Light Company has operated Diesel engines in a number of its Texas properties for several years, so that it has its own knowledge of Diesel costs. Prior to this purchase it owned and operated twelve Diesel engines, with a total rating of 5,295 hp.

Water Power on Boundaries

Temporary Niagara Agreement Desired While New Treaty Waits—Rio Grande Plans Blocked

WHILE the governments of Canada and of the United States are maneuvering so as to secure maximum advantage in any reallocation of the diversion from the Niagara River, the power interests are advocating a temporary agreement whereby each side may use water up to the installed capacity of existing plants pending the ratification of a new treaty. It is recognized that the making of a treaty under the existing conditions must be a long-drawn-out process. The situation both in western New York and in Ontario is such that there is an imminent need for more power. It is an established fact that the manufacturing growth of western New York must be curtailed within the next few months if additional power cannot be secured. The situation is almost as bad in Ontario.

An important influence on the whole situation will be exerted by the completion of the development of the Niagara Falls Power Company, which will leave an installed capacity of 115,000 hp. lying idle while water far in excess of scenic requirements is tumbling over the falls. This will come at a time when the industrial progress of a populous area will have been very noticeably curtailed. The situation will be accentuated in Canada when the three new units of the Ontario Hydro-Electric Power Commission are installed. It will require 6,000 cu.ft. per second more than is granted by the treaty to operate them.

Since the treaty may have to include such highly controversial matters as the drainage diversion at Chicago, the diversion at the Welland Canal and through the New York Barge Canal, it is apparent to those most directly concerned on each side of the river that a temporary agreement must be set up. The main thing making for delay is the determination of the United States government to secure a greater proportion of the diversion. Under the existing treaty Canada gets 36,000 cu.ft. per second, while the United States gets but 20,000 cu.ft. per second. Canada naturally is maneuvering to hold the advantage she now enjoys.

SITUATION ON RIO GRANDE

No development of hydro-electric power on the Rio Grande can be expected for some time to come. The Federal Power Commission has been compelled to reject a preliminary permit requested by R. W. Morrison of San Antonio in connection with his plans to utilize water power for public utility use in Laredo, Tex.

The proposal was referred to the International Boundary Commission, which has jurisdiction over boundary matters between the United States and Mexico. Gustavo P. Serrano, the consulting engineer for the Mexican section, reported adversely on the project on the ground that it would violate the existing treaty, which provides that the Rio Grande must be kept open for navigation. The State Department concurs in the opinion of the Mexican engineer. Since no amendment to the treaty can be undertaken when there is no recognition of the existing Mexican government, it would seem that an indefinite period must elapse before any power development can be undertaken on the Rio Grande.

Institute Seeks Solution of Utility Credit System

The Institute for Research in Land Economics and Public Utilities, whose headquarters are at the University of Wisconsin, announces in its first official publication, "Institute News," that it has undertaken a study of public utilities to ascertain if the cost of the service with which they provide the public cannot be reduced by a solution of their credit problem.

"This study is entered upon for the purpose of discovering what is wrong with a public utility relationship which makes it necessary that these essential industries pay from 1 to 2 per cent more for their cheapest money, and up to 4 per cent more for their dearest money, than is paid by public corporations," says the institute's publication. Regulation should aim to eliminate risk and uncertainty from the investment of capital in these industries so that the rate of return would be comparable with that received from loans to public corporations. "Great advances have been made on the part of the corporations themselves. Management is on a very high plane; owners are appreciative of their public obligations as never before, and great economies in the processes of production and distribution have been achieved.

"The major public utility problem today, however, consists in establishing such a relationship between the corporations and the regulating agencies as will eliminate the risk and uncertainty from these enterprises and thus reduce the cost of the service—not by penalization of one or another party to the bargain—but by eliminating the necessity for the payment of a high risk reward. That public utility securities are gaining in favor with the investing public and that the cost of money to public service companies is rapidly coming back to normal levels are indicated in a study of the relative borrowing power of public service corporations for the last twenty-five years made by Herbert B. Doran of the institute.

"Establishment of the facts with regard to the cost of money to public service corporations is a preliminary step to an intensive study by the institute of the credit problem of regulated industries. Having determined the facts, the investigation will take the form of a detailed analysis of all the factors which make for the high cost of capital in these essential industries. Solution of the credit problem of regulated business, it is believed, is the way to true economy and important reductions in the cost of service. Reduction in the cost of capital is one way of reducing costs which does not, on the one hand, demand sacrifice in the service rendered or, on the other hand, a reduction of the wages of labor, with its attendant possibilities of decreased efficiency or increased dissatisfaction."

Richard T. Ely, professor of economics, is director of the Institute for Research in Land Economics and Public Utilities.

Brief News Notes

Metropolitan Edison Acquires York Haven Company.—The Metropolitan Edison Company of Reading, Pa., has acquired the stock of the York Haven Water & Power Company formerly owned by the York Railways Company. With this purchase the Metropolitan Edison Company now owns practically all of the capital stock of the York Haven Water & Power Company.

Tampico Plant More than Doubled.—When the new electric power plant of the Tampico (Mexico) Electric Light & Power Company is finished, which will be about July 15, it will have a rating of 16,500 kw., as compared with 7,000 kw., the present capacity. It is stated that the power lines will be greatly extended and the service generally improved.

San Diego Company Buys Office Building.—The San Diego Consolidated Gas & Electric Company has been forced by expanding business to seek larger office quarters and has purchased an eight-story fireproof building in San Diego of steel and concrete construction which it is now occupying. The building, formerly known as the Timken Building, has been renamed the Electric Building.

Michigan Standards for Electrical Service.—The "Standards for Electrical Service," as embodied in Order No. 1692 of the Michigan Public Utilities Commission, effective July 1, 1923, have been printed by the commission. They embody rules for service entrances, meters and meter tests, transactions with consumers, operating standards, extension of lines and other matters and contain forms for records and reports. Manfred K. Toeppen is chief engineer.

Idaho Power Company Files New Rates.—The Idaho Power Company has filed a new schedule of rates with the Public Utilities Commission, to go into effect Oct. 1 and apply to all Idaho territory served by the company. These rates are based on a valuation of $16,769,328. Thirteen classes of service are recognized under the proposed schedule.

Residence lighting customers are to pay 10 cents per kilowatt-hour for the first 12 kw.-hr., grading off to 4 cents. The active-room principle is used in determining all residential rates. Two other classes of service are specially classified for residential customers, domestic heating and cooking service and general residence service.

An Oregon Development.—Engineers of the Pacific Power & Light Company are making surveys over a 10-mile area along the Deschutes River, Oregon, in the vicinity of Ketchum station, about 20 miles from the mouth, with a view to the ultimate construction of a hydro-electric power plant to cost between $2,000,000 and $3,000,000. E. V. Lorenz, who was chief engineer at Hood River during the construction of the great power plant there, is in charge of the engineering party along the Deschutes, where a permanent camp has been established. The same company filed on power rights at this point more than a year ago. The proposed plant will develop 40,000 hp.

Tri-State Utilities to Control Wapsie Valley Power.—The Tri-State Utilities Company of Minneapolis has purchased a controlling interest in the Wapsie Valley Power Company from F. C. Cross of Cedar Rapids, Iowa. The entire property of the company is valued at $2,000,000. The Wapsie Valley holdings started in 1910, when Mr. Cross constructed a dam across the Wapsipinicon River at Central City, constructed a power house and began furnishing light and power to the towns of northern Linn County. The business was expanded rapidly until today eighty-three towns in Linn, Delaware, Buchanan and Jones Counties are served.

Church Tablet Celebrates Radio.—An unusual kind of church tablet has recently been put in place on the outside wall of Calvary Church, Pittsburgh. It is of bronze, designed and built by James H. Matthews & Company, Pittsburgh, and represents an outline map of the United States bearing an impression of the church building in the proper geographical location, from which lightning flashes are radiating. The inscription says: "January 2, 1921, from Calvary Church, for the first time in history, a church service was broadcasted by radio wireless by the Westinghouse Electric & Manufacturing Company. This tablet was placed (1923) by the unseen congregation."

Annual Report of Engineering Foundation.—In its annual report, just made public by Chairman Charles F. Rand, the Engineering Foundation tells of numerous achievements in the past year made in association with the National Research Council and other agencies. Among these are a nation-wide campaign to check the ravages of the shipworm, an investigation of arch dams to solve problems centuries old and a project for the study of concrete arches in co-operation with the American Society of Civil Engineers. An annual loss of millions to American industry through fatigue of metals has been shown to exist, and paint-on-wood research is now under way. The Engineering Foundation has co-operated with the division of engineering of the National Research Council.

West Penn Power May Need $50,000,000 New Capital for Expansion.—A recapitalization plan has been issued by the West Penn Power Company to make possible the raising of a large amount of new capital to finance the expansion program of the company. The terms of the plan include the offering of new 7 per cent preferred stock to holders of the $8,500,000 of 6 per cent cumulative preferred. A total of $41,945,300 of the new 7 per cent cumulative preferred will be authorized. There will also be authorized 500,000 shares of common stock, which will be exchanged share for share for the outstanding common stock, amounting to $22,500,000. According to officials of the company, its rapid growth may necessitate as much as $50,000,000 increased capital in the next few years.

Bridge Building Not Allowed to Interfere with Utility Service.—The legal authorities of Wisconsin have informed the Highway Commission of that state that there is no way to enjoin the Wisconsin-Minnesota Light & Power Company from continuing the functions of the company's Wissota dam on the Chippewa River at Eau Claire, which the Highway Commission claims is interfering with the construction of a bridge over this river. The opinion says that "a public service corporation may not be enjoined from impounding water during the night and releasing it during the day in the necessary operation of a power plant on a stream, even though the resulting fluctuations in the height of water of the stream below the dam impede the work of construction of the public bridge across the stream, where the contract for the construction of the bridge was made with the conditions at the bridge site in the minds and contemplation of the parties to the contract."

Convention Delegates Travel 120,000 Passenger-Miles in Automobiles.—In providing transportation to the equivalent of more than 120,000 passenger-miles without mishap or delay the transportation committee of the National Electric Light Association accomplished a noteworthy piece of work during the recent convention in New York. More than two hundred vehicles were used. There were 7,500 convention delegates and something was on the committee's program for every morning, afternoon and evening. As entertainment features for the wives and families of the delegates there were three automobile trips; inspection trips to local industries called for special transportation facilities; there were a number of shorter trips in the city, and it was necessary to have facilities always at hand for any unforeseen development. Only one of the many trips was made by train, that to the Harrison Lamp Works of the General Electric Company.

Associations and Societies

Michigan Electric Light Association.—This association, which is the Michigan Division of the N. E. L. A., will meet at the Hotel Pantlind, Grand Rapids, on Sept. 18 to Sept. 20—not, as previously announced, on Sept. 11-13.

National Electrical Credit Association.—This association will hold a "silver jubilee convention" at Boston on Aug. 9 and 10. Almon Foster, Foster-McDonald Company, Boston, is the general chairman of arrangements.

Mountain Division "Electragists."—Arrangements are being made to hold a convention of the Mountain Division of the Association of Electragists International at the Albany Hotel, Denver, on July 16. James R. Strong of New York, who is president of the association, will address the convention, as will also John F. Greenawalt, Lawrence W. Davis and Arthur P. Peterson.

New England System Operators to Meet in Schenectady. — The System Operators' Club of New England, of which H. G. Jenks, Salem, Mass., is chairman of the executive committee, will hold a meeting at Schenectady, N. Y., July 12 to 14, under the auspices of the General Electric Company and in accordance with arrangements made by C. T. Mosman of the Boston office. Oil-switch and relay performance will be the subjects for discussion, with factory tests and demonstrations. The club is composed of system operators and load dispatchers of plants which are interconnected by high-tension transmission lines throughout New England. It was organized several years ago by R. S. Hale of the Edison Electric Illuminating Company of Boston and now has about fifty members.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published on the last page of this issue.]

Ohio Electric Light Association — Cedar Point, July 10-13. D. L. Gaskill, Greenville.

National Electrical Credit Association—Boston, Aug. 9-10. F. P. Vose, 1347 Marquette Bldg., Chicago.

New England Division, N. E. L. A.—Swampscott, Mass., Sept. 6-8. Miss O. A. Bursiel, 149 Tremont St., Boston.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 17-19. O. A. Weller, 900 15th St., Denver.

Michigan Electric Light Association—Grand Rapids, Sept. 18-20. Herbert Silvester, Detroit Edison Co., Ann Arbor.

Illuminating Engineering Society—Lake George, N. Y., Sept. 24-28. S. G. Hibben, 29 West 39th St., New York.

Association of Iron and Steel Electrical Engineers — Buffalo, Sept. 24-28. J. F Kelly, 513 Empire Bldg., Pittsburgh.

Indiana Electric Light Association—French Lick Springs, Sept. 26-29. T. Donahue, Northern Indiana Gas & Electric Co., Lafayette, Ind.

American Electrochemical Society—Dayton, Ohio, Sept. 27-29. Colin G. Fink, Columbia University, New York.

American Institute of Electrical Engineers —Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

Commission Rulings

Investment Made with Honesty and Best Judgment Sustained.—Refusing to order the Lawrence Gas Company to reduce its gas rate or to cut down its net electric rate of 11¼ cents a kilowatt-hour, the Massachusetts Department of Public Utilities has just decided against the Mayor of Lawrence in a finding terminating a case which had been on the board's docket for a year. Action was deferred to permit expert examination on behalf of the city to determine what reduction, if any, could be made in rates. The return paid to the stockholders on their investment for the past ten years averaged slightly over 5½ per cent. The city attacked the amount of generating equipment owned by the company as excessive, but the company gave a reason in every instance for the existing size and equipment of its plant and properties. The commission held that, even though the company's judgment might in some instances be mistaken, a fair return should not be refused the company on capital "honestly and in the exercise of its best judgment invested in the plant."

Receipts from Sale of Appliances Must Be Reported as Miscellaneous Revenue.—Reflecting on what it regarded as a monopolistic tendency in the appliance-merchandising business of the Baltimore Gas, Electric Light & Power Company, though at the same time recognizing the popularity of this service with the company's customers, the Maryland Public Service Commission said, in the course of its recent order making heavy reductions in the company's gas and electric rates: "Under these circumstances we feel that we should not comply with the request of certain dealers who ask that the company be restricted in its merchandising activities and practices. We do not concede, however, as contended by the company's counsel, that the commission is powerless to prevent a public service corporation, enjoying the privileges of a monopoly through the protection afforded by the commission pursuant to legislative will and current economic thought, from employing those special rights and advantages to extend its monopolistic control over lines of endeavor that otherwise would remain individualistic and competitive. Yet, in the absence of an expressed or ascertainable public opinion on the subject, we believe that we should not at this time interfere with the company's merchandising department other than to order that the revenues from this branch shall be reported by the company and considered by the commission as other miscellaneous revenue. If the company desire that this revenue be treated in any other way, then capital for the merchandising department must be provided from an independent source and charges for rent and services must be made at adequate and remunerative rates."

"Average" Bills Where Meter Does Not Register Condemned.—A ruling affecting the collection of "average bills" by an electric or a gas utility from a consumer where the meter is found to be registering less than the full amount has been made by the California Railroad Commission, with the object of discouraging the presentation of such bills. The ruling was made as the result of the application of a gas corporation in southern California for permission to disconnect the service of a patron who had refused to pay an average bill presented by the company to reimburse itself for the alleged loss due to a defective meter. Investigation by the commission resulted in a report that the company had been lax in maintaining its meter-testing shops at the highest possible efficiency and had depended upon presenting average bills in cases of loss. The commission took the position that a utility is responsible for the condition of its meters, and that any loss occasioned by their inaccuracy should be borne by the utility unless it can prove that it was not at fault. Remarking that the courts were open to seek enforced collection of the bill, the commission refused permission to discontinue service.

Recent Court Decisions

That Facts Are Undisputed Does Not Make Negligence a Question of Law if Reasonable Men Can Draw Different Conclusions from Them. — Asserting that contributory negligence is a question of fact for the jury, even when the facts are undisputed, if reasonable men may draw different conclusions therefrom, the Court of Appeal for the Third District of California affirmed a judgment for the plaintiff in Pezzalia vs. San Joaquin Light & Power Corporation. In this instance a telephone lineman with fifteen years' experience who climbed a pole to put new brackets thereon, with knowledge that a single telephone wire extended from such pole under the high-voltage electric power line on other side of road about 18 in. or 2 ft. from such wire, was injured when the pole swayed, causing the telephone wire to come into contact with the high-voltage wire. "It is true," the court said, "that the danger was increased by the act of appellants in placing their wires so close to the telephone wire, but it should be a clear case of recklessness and indifference to consequences on the part of plaintiff that would permit appellants to maintain that, by reason of their own negligence, he should have abandoned his business rather than have subject himself to the increased peril. At any rate, we feel sure that it cannot be said, as a matter of law, that plaintiff's conduct in ascending the pole in pursuance of his duty as a lineman manifested such imprudence and want of caution as to make the consequences of his injury necessarily imputable to his own negligence." (214 Pac. 285.)*

Service Wrongly Shut Off Because of Dispute Over Bill.—The St. Joseph Gas Company, sued by one Randolph, was ordered to restore service which had been peremptorily discontinued because of plaintiff's refusal to pay a bill the correctness of which he disputed. The Kansas City Court of Appeals found that the company's right, under a rule approved by the Public Service Commission, to shut off gas if bills were not paid was not absolute, and when there was a bona-fide dispute by a customer who had always paid promptly the shutting off of the gas was arbitrary and outside the company's rights. Nominal damages awarded to the plaintiff were sustained. (250 S. W. 642.)

"Attractive Nuisance" Theory of Liability Especially Applicable to Instrumentalities on Public Streets. — In Znidersich vs. Minnesota Utilities Company damages were sought for injuries to a boy who climbed an electric transmission-line pole adjoining a vacant lot used as a playground to release a kite and came into contact with uninsulated wires heavily charged. The Supreme Court of Minnesota sustained a verdict for the plaintiff, holding that the rule of liability for maintaining dangerous instrumentalities attractive to children was particularly applicable to poles carrying electric wires where the poles are equipped with permanent contrivances serving the purpose of a ladder for climbing and are out in the open and in no way protected from free interference by children. (193 N. W. 449.)

Contracts Entered Into by City in Its Proprietary Capacity Not Different from Others.—In City of Billings vs. Montana Public Service Commission, the city sought to prevent the commission from compelling it to pay for heating service, resting its case on a clause in the contract with the utility supplying the service which stipulated that certain municipal buildings should be heated without charge. The city held that, even conceding that it could not enter into an inviolable contract fixing rates for its inhabitants, it did have that right respecting rates for itself in its proprietary capacity. This contention was denied by the Supreme Court of Montana, which, after asserting the commission's power to invalidate contracts even where they antedated its own creation, said: "Nor is there any basis for the city's contention that it is entitled to preference where its inhabitants would not be. The city is a consumer, as are its inhabitants who patronize the utility. Where the city receives its heat free, the utility's other patrons foot the bill." (214 Pac. 608.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Dean Walker Heads S. P. E. E.

Perley F. Walker, dean of the School of Engineering of Kansas University since 1913, was elected president of the Society for the Promotion of Engineering Education at its annual meeting held recently at Cornell University, Ithaca, N. Y. Dean Walker is a graduate of the University of Maine, his native state, and spent four years there as instructor and three years as professor

P. F. WALKER

of mechanical engineering. Since 1905 he has been associated with the University of Kansas. In addition to his duties with this institution he served as consulting engineer of the Wichita Natural Gas Company, Bartlesville, Okla., from 1914 to 1916 and since 1916 has been natural-gas consulting expert on the cost of supply of gas to the city of Kansas City, Mo. He has written many articles and papers on varied topics for engineering and educational journals and is a member of the American Society of Mechanical Engineers as well as of the Kansas Engineering Society.

C. D. Vail, railroad and hydraulic expert for the Colorado Public Utilities Commission, has been appointed a member of the commission to fill temporarily the place of Judge Tully Scott, who is ill and unable to perform the duties of his office.

W. H. Onken, Jr., editor of the ELECTRICAL WORLD, sailed for Europe July 4 on the Leviathan, to be gone for about three months. During this time Mr. Onken will visit the principal European countries whose development and use of electrical energy has assumed any considerable proportions. His visit will be for the purpose of obtaining first-hand information on electrical developments in Europe for publication in the columns of the ELECTRICAL WORLD.

Dan Harley, formerly associated with the Montana Power Company in Butte, has been made manager of the Deer Lodge (Mont.) Electric Company.

James C. Bennett, secretary and controller of the Westinghouse Electric & Manufacturing Company, was elected a director at the recent annual meeting of stockholders. Mr. Bennett succeeds John R. McCune, deceased. Other directors were re-elected.

F. H. Worthington, associated with the Jacksonville (Fla.) office of the General Electric Company, has been appointed local manager of that office to succeed G. C. Henry, who recently resigned. The appointment was announced by E. H. Ginn, district manager at Atlanta and became effective on the first of July.

C. H. Roessner has been appointed district sales manager at Chicago for the Foxboro Company, Inc., Foxboro, Mass., manufacturer of recording and indicating instruments. A. F. Mundy, formerly of the Chicago office, will represent the company in southern California, with offices in Los Angeles.

Charles P. Holmes has recently joined the Los Angeles sales organization of the Western Electric Company as appliance specialist. Mr. Holmes was formerly connected with the Havens Electric Company of Albany, N. Y., General Electric distributor in that section.

George E. Cockings, manager of the Bristol & Plainville (Conn.) Electric Company, has been elected president of the Tenney Service Association, an organization of leading men in the utilities managed by Charles H. Tenney & Company, Boston. For the past twenty-seven years Mr. Cockings has been manager of the electric railway, gas and electric properties at Bristol.

Philip S. Biegler, professor of electrical engineering at the State College of Washington, Pullman, Wash., has severed his connection with that institution. At the end of July Professor Biegler will leave for Los Angeles, where he will become head of the department of electrical and mechanical engineering at the University of Southern California. He is a graduate of the University of Wisconsin and has been associated with the electrical engineering departments of Purdue University, the University of Montana and the University of Illinois. Previous to his appointment at the State College of Washington Professor Biegler was an associate editor of the ELECTRICAL WORLD.

J. K. Bass Vice-President of Electric Power Club

James K. Bass, who was elected vice-president of the Electric Power Club at its recent convention at Hot Springs, Va., is the treasurer and general manager of the Kimble Electric Company, Chicago. Mr. Bass has been prominent in the activities of the Electric Power Club for a number of years. He became a member in 1911 as executive representative of the Kimble Electric Company, and in 1915 was elected chairman of the entertainment committee, serving in this capacity for five years. In 1921 he was elected to the board of governors and was appointed treasurer of the club. Mr. Bass was born in Chicago in 1872 and is a graduate of North-

J. K. BASS

western University. He has been treasurer and general manager of the Kimble Electric Company since 1909, and during that time has promoted the development and application of the single-phase variable-speed motor to numerous new fields, specializing particularly in the development of alternating-current motors for printing and allied industries.

F. W. Smith has been appointed division engineer of the Blackstone Valley Gas & Electric Company with headquarters at Pawtucket, R. I.

Stephen S. Mason has been appointed division engineer of the Blackstone Valley Gas & Electric Company with headquarters at Woonsocket, R. I.

E. F. Pearson, electrical engineer with the Northwestern Electric Company of Portland, Ore., was recently elected chairman of the Portland Section of the American Institute of Electrical Engineers. Mr. Pearson has been associated with the Northwestern Electric Company since 1912 as field engineer on transmission and distribution work, assistant superintendent of transmission and distribution and, since his return from service during the war, as electrical engineer. During the past year he served as secretary-treasurer of the Portland Section of the American Institute of Electrical Engineers.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

The Value of Uniform Cost Accounting*

The Basis of Price—the Influence of Interpreting Cost—Practical Benefits of Uniformity—How to Organize and Establish a Standard

By S. I. Whitestone
Comptroller General Electric Company

According to the latest reports compiled by the Chamber of Commerce of the United States, more than 125 trade associations have officially adopted uniform methods of cost figuring, and it is reported that a large majority of the members of these associations have been successfully operating under these systems. There are several reasons for the use of uniform cost methods by the members of any association.

If the contest for business is to be a healthy and fair contest, it must be conducted according to uniform rules well formulated and understood by all. As the price of an article is generally the prime consideration in the award of an order for supplies of like construction and quality, the attention of the contestants must be focused upon the rules which govern the establishment of the price. Of course, there are several ways of establishing a price. One is by agreement among manufacturers, but that is frowned upon by the government and has been put in the discard. Another is by cutting a competitor's price regardless of cost, and that is not done in good society.

Governing Selling Price

Another method of governing selling price is to add a percentage of profit to costs determined without regard to the competitor's cost methods, which sometimes results in a selling price so much in excess of the competitor's selling price that the figure must be arbitrarily cut to secure business, although the competitor's cost may be the wrong one. Finally, there is the setting of a selling price by adding a fair percentage of profit to the cost determined on the basis of a uniform system of cost accounting used by the majority of manufacturers of the same article.

Effect of Interpretation

Those who have been in intimate touch with the practical work of cost finding will appreciate that, notwithstanding strict adherence to general principles, it is possible to produce more than one cost result for a given article, depending upon the interpretation or application of any one of these general principles. For example, a manufacturer of fifty different kinds of electrical supplies may, in accordance with the manual, charge the cost of boxing, packing and shipping to "general manufacturing expense" and then apply it, as part of the overhead burden, prorated on the productive labor in the cost of each of the fifty devices. His procedure is correct and the cost of his product as a whole will be correct, but a competitor manufacturing the same fifty devices decides that containers for certain devices should be charged against the direct cost in the same way as raw material and that the balance of the boxing and packing expense which is not readily traceable to specific devices should be a part of the overhead. His cost will be correct as a whole, but will differ from the first manufacturer's cost for each of the fifty devices. Still another manufacturer may feel justified in applying untraceable expense of this character only to those of the devices which are not directly charged with the traceable cost of boxing. His costs will be correct as a whole, but will differ for the individual devices from those of the other two manufacturers. The same applies to the treatment of other factors entering into costs, such as transportation on incoming raw materials, cash discounts on purchases, shrinkage, spoilage and obsolescence, treatment of piece rates, day rates and bonus systems, overtime, cost of warehousing and many other factors too numerous to mention.

One of these methods and only one is correct; the others may not be so far off as to result in serious consequence; therefore the important thing for a trade association to decide is which of the various applications of general cost principles is the best one to meet the conditions. By having the members follow the methods so determined upon assurance is given that any difference in the cost of the devices represents an actual difference in the cost of production and not merely a difference in figures.

Structure Needed

When the majority of the interests constituting an association are sufficiently convinced of the advisability, or perhaps the absolute necessity, of uniformity of cost finding, then and only then may practical effect be given to these conclusions. That task will consist of five principal movements:

1. A "bureau of cost methods" should be established under the supervision of a committee of not more than three. It is essential that each of the members of this committee be one who has had practical experience in cost accounting and who is unequivocally in favor of uniform cost accounting. It may be desirable to empower this committee to employ one or more accountants on a salary and expense basis, as it will be the function of this committee to assist and guide members in the organization of their individual cost work.

2. The next step will be the appointment by each section or department of the association of a 'cost committee," which should include a representative from every member company, and preferably these representatives should be the

*A paper read before the Associated Manufacturers of Electrical Supplies, New London, Conn., June 27, 1923.

accounting officers of the member companies. It shall be the duty of these committees to study the methods of accounting and cost finding now in use by the section member companies and whenever certain features of these methods are not now treated alike by all the members to agree among themselves as to the best one of these methods to adopt as a standard. Individuals selected for membership upon these committees must be willing to devote much time and hard work to their task. They must be qualified by practical experience in accounting and cost work and by familiarity with the production problems of their respective industries to exercise sound judgment in the adoption of standards, to present convincing arguments in support of their ideas and to accept the viewpoint of others when such a course is deemed best for the membership at large. The chairman of each of these committees should, in addition to these qualifications, be possessed of considerable executive ability, without which the success of the committee work might be jeopardized. The selection of the right men to head these committees I consider of paramount importance.

3. These cost committees should agree upon a standard classification and definition of all accounts in one case, based upon the classification, definitions and terminology adopted by the Electrical Manufacturers' Council and set forth in the published manual. So far as possible the cost committee should adopt standard forms of records and reports which, if properly designed, will then be an important factor in encouraging adherence to the prescribed methods.

4. The cost committee's work should be preserved in the form of a manual which may be revised from time to time as found expedient, and that manual should then serve as a guide for all member companies. As such it will prove particularly helpful when for one reason or another a company finds it necessary to engage a new bookkeeper or cost accountant.

Financial Support

5. If the work of the committee is to be of real and lasting value, the sections must be willing to appropriate the necessary amount for maintenance of the "bureau of cost methods" and for the services of an accountant whose duty it shall be to review the accounting methods of every member to make sure that the agreed-upon standards are followed and, if not, to assist the delinquent member company in effecting such revisions as may be necessary. He should be provided with such assistance as he may require and be permitted to render similar service to non-members when the "bureau of cost methods" considers it to the best interests of the section to have such non-member instructed in the correct methods of determining and using costs.

I do not believe in the policy of maintaining a uniform accounting service by an association merely for the optional use of those members who are willing to pay for it. If the work is considered of value to the industry, the expense should be met by the association and become a part of the dues of the member companies so that all will be entitled to service.

It should be made very clear that with at least 90 per cent of the member companies of this association the adoption of a standard system will mean only slight changes in some details, but will accomplish important improvements. The other 10 per cent may have poor accounting systems and have done nothing to improve them because of

(1) inertia,

(2) confidence in occasional test checks or estimates without depending upon systematic records,

(3) unwillingness to incur expense, or

(4) fear of figures or inability to understand them.

Some Practical Advantages

The procedure for standardizing cost-finding methods, if applied to general accounting, will inevitably result in the adoption of standard forms of financial and operating reports. Just as the purchasing agent or engineer who buys a product must have greater confidence in the fairness of the selling prices when he is told that they are based on costs calculated on a standard basis, so will the bank and investor have greater confidence in and better understand financial reports when they are assured that the accounts shown therein are stated on the basis of standard definitions adopted by the industry.

In dealings with government departments smoother sailing will be enjoyed when the department is convinced that accounts and costs are determined according to a published standard system adopted by the majority of an industry. Regulatory and investigating government bodies seldom fail to recognize the propriety of practices openly and publicly concurred in as peculiar to an industry when not indulged in for unlawful purposes.

Compensating Workers

It is a trend of the times to compensate workers as nearly as possible in accord with their accomplishments rather than by periodical fixed salary payments, and any manufacturer who considers joining the large procession of companies that are supplementing the fixed salary and wage payments by compensation based upon operating results will find that the real value of such plans depends upon the confidence which the participants under the plan have in the accuracy of the figures that determine the amount of compensation they are to receive. When assurance is given to them that the basis for determining the results is one recognized as correct and adopted by other companies manufacturing the same product, it will avoid any question on the part of the employees as to the propriety of using such a system for the determination of their compensation.

In conclusion, I offer these concrete suggestions for the organizing of a cost-accounting service by a trade association and recommend it as a procedure for this body:

1. Canvass the membership for the names of those qualified to deal with this problem.

2. From this list select the names of three to serve on the committee of the association constituting the "bureau of cost methods"—one of these three to be made chairman or manager of the bureau.

3. Let the members of each of the sections submit to the "bureau of cost methods" the names of the individuals selected by them for membership upon their "cost committees."

4. Have the "bureau of cost methods" draft a general outline of the procedure for organizing the work of the cost committees and then arrange for a meeting of the chairmen of these committees to agree upon a program.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

NEW business continues to reflect quieter conditions in the electrical industry, although little apprehension is being expressed as to the future of trade. Central-station operations continue at a record-breaking pace both in output and in appliance sales. Back orders are far from fulfilled in manufacturing circles, and retail trade is healthy for this season.

Interest in electric ranges and refrigerating apparatus is widespread, but in the Northeast the fan trade has been poor owing to cool weather. Contractors are busy on wiring jobs, although the volume of new wiring business in sight is somewhat tempered by the slowing down of building projects resulting from inordinate wage demands on the part of organized labor.

In New England telephone service has been impaired in a few exchanges by a strike which began June 26 for higher wages and shorter hours, but the great majority of operators remained loyal to their duties and communication has been well maintained in most cities and towns of New England, Connecticut being outside the strike area.

Jobbers' stocks are reported adequate to meet current requirements, with firm prices in most lines and some weakness in flexible armored conductor and weatherproof wire. Careful financing is the rule in the electrical industry at present. A seasonal increase in radio apparatus sales is expected in about three weeks. Sockets and switches are moving a bit slowly this week.

Chicago Business More Active Last Week

GENERAL business in and around Chicago seems to have been a little more active this week than last. Wire is being offered in some cases at a lower figure, and from the indications it would seem that a lower price will be announced very shortly. Wiring-devices sales have been normal, high-tension equipment sales have kept up, and pole-line hardware demand is good. It is hard to obtain poles in some of the larger sizes, although some of the independents have considerable quantities on hand.

The conduit situation is getting worse. Shipments are lengthening into ten to fourteen weeks, although promises of delivery are made earlier. A careful analysis of the situation, taking into consideration the so-called slump in business and based upon the general situation as it appears here in relation to contracts already under way, indicates the possibility of a greater shortage of rigid iron conduit during the months of August, September and October than perhaps ever before in the history of the country.

Western Business Stimulated by Approaching Rate Raises

SAN FRANCISCO'S June building permits were $4,213,346, as against $3,336,701 for June last year. It is significant that the number of permits shows a 34 per cent increase as against 26 per cent value increase.

Retail business has been quite fair, the usual vacation season slump having been offset by the effect of numerous conventions. Factory ordering has been very heavy, stimulated by approaching increases of steamer rates and also by the fact that new carload and less-than-carload rates will be differentiated about 50 per cent. Hitherto they have been the same.

Tremendous crops are predicted, although net returns will not run much over last year because of considerably lower prices and dissension among several growers' associations. Exceedingly backward weather is reported in the Sierras with much snow still on the ground. Prices are fairly steady.

Reserve Board Says General Business Is Strong

THE Federal Reserve Board made public last week a summary of general business and financial conditions based upon statistics for May and June which was interpreted as an indication that the board did not find any alarming elements in the situation which might threaten a collapse of prosperity.

The board summed up its findings by declaring that the production and shipment of general orders continued in heavy volume during May, with the volume of employment sustained and many wage advances reported. The reports received showed that wholesale commodity prices declined during May and the early weeks of June.

As to the agricultural situation the board found that the condition of winter and spring wheat was less favorable than a year ago and the condition of the cotton crop slightly better. Banking and credit conditions were reported to be highly satisfactory.

"Production of iron and steel, cement and petroleum was larger in May than in any previous month, and mill consumption of cotton was close to maximum," the board says. "The high level of production in these industries, together with increases in practically all other reporting lines, is reflected in an advance of 2 per cent in May in the Federal Reserve Board's index of production in basic industries.

"In the building industry there was a further decline in principal cities in the value of permits granted which represent prospective building operations. Contract awards, however, which represent actual current undertakings, continued to increase, though declines are reported in the New York and Chicago districts.

Growing Interest in Electric Refrigeration

MANUFACTURERS of electric refrigerating plants report a well-sustained interest in this equipment, although during the past few weeks the demand has quieted down slightly as compared with the heavy volume of sales handled in the late winter and early spring. Central-station companies are becoming more aroused as to the value of this class of load, and power engineering departments are more active in soliciting this business. Apartment-house installations are multiplying and considerable development work is being done in the manufacturing field along the line of smaller outfits suited to medium-sized homes.

Advanced designs are receiving much attention, and producers report gratifying success in the field where some of these newer equipments have been on trial as it were for upward of a year. Prices are firm and steady since the advance of some months ago. Raw material and labor are still none too plentiful, and the outlook for the total business of this year is believed to be excellent.

Car Loadings Stay at 1,000,000 Mark

The car loadings exceeded the 1,000,000 mark for the week ended June 23, according to the American Railway Association. This marks the third week in which loadings have passed the 1,000,000 mark.

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.034	$0.034	$0.0252
Cold finished shafting, per lb.	0.042	0.042	0.0325
Brass rods, per lb.	0.1850	0.1913	0.155
Solder (half and half), per lb.	0.2862	0.2812	0.22
Cotton waste, per lb.	0.1231	0.1231	0.104
Washers, cast iron (½-in.), per 100 lb.	4.66	4.66	4.00
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.08	2.96	3.11
Machine oil, per gal.	0.349	0.349	0.34
Belting, leather, medium, off list	42½%	42½%	46½%
Machine bolts, up to 1-in. x 30-in., off list	44¼%	44¼%	59½%

German Manufacturers and Electrical Construction Costs

DIRECTORS of several of the largest German electrical manufacturing companies at the recent annual meetings of their companies lamented the fact that the necessarily high prices of their products have prevented extensive purchases by central stations in Germany of larger-capacity units. An interesting commentary on the tremendous paper-mark investment required to build and equip new hydro-electric stations is afforded by the request of the Prussian government for additional funds with which to complete the several stations it has planned and started in the upper regions of the Weser River. The 1913 estimate for the new constructions was 10,000,000 marks. Work was interrupted by the war. It was not resumed until early in 1920, when the estimated cost was raised to 30,000,000 marks. From that time until the beginning of 1923 the estimate was repeatedly increased, until in January, 1923, it was placed at 5,918,870,000 marks.

Among the power plants under construction is the Talsperren-Kraftwerk Hemfurth, which will be used as a main station and which will be equipped with six turbines and generators. The estimated additional expense connected with this undertaking on account of high prices obtaining today is 475,000,000 marks.

Enlargement of the Kraftwerk Helminghausen by the Prussian State calls for an additional sum of 350,000,000 marks. The Werra Kraftwerk "Letzter Heller" will cost 1,200,000,000 marks more than originally estimated.

Extension of the transformer station at Bueren requires a further expenditure of 760,000,000 marks in order that it may be able to serve the Bueren and Brilon districts satisfactorily. A power station at Berka calls for 785,000,000 marks more than originally estimated. This station serves the districts Nordheim, Duderstadt and Osterode.

To improve the service given to the city of Cassel a transforming station on the Losse River will be built at a cost of 254,000,000 marks in excess of the original estimate.

Among the more important transformer stations which are to be completed at a further expense, as estimated in January, 1923, of 90,000,000 marks each are those at Frankenberg and Borgholtz.

The Metal Market

MOST of the larger producers still adhere to the 15-cent level, and whether they will reduce their price below this or not remains to be seen. It is purely a nominal quotation, and this price has not been realized except on an occasional carload. Some of the inquiries have been for small tonnages for prompt shipment, but there seems to be an aversion to buy for other than immediate requirements except at marked concessions. The reduced prices

NEW YORK METAL MARKET PRICES

	June 28, 1923 Cents per Pound	July 3, 1923 Cents per Pound
Copper, Electrolytic	14.87½ to 16.00	15.00
Lead, Am. S. & R. price	7.25	7.00
Antimony	7.50	7.50
Nickel, ingot	27.00 to 32.00	27.00 to 32.00
Zinc, spot	6.00	5.80
Tin, Straits	41.00	41.00
Aluminum, 98 to 99 per cent	26.00	26.00

at which some custom smelters have been willing to do business only hold for comparatively large lots.

It is encouraging to note that some large buyers have taken substantial tonnages at 14.625 and 14.75 cents, delivered, indicating that they think copper a good "buy" at those levels. Should a buying movement of even moderate dimensions set in, the amount of copper available below the nominal quotations of most of the producers would be taken up quickly.

The export market has also been unsatisfactory during the week, though one good-sized order was received. Germany has taken nothing, and the other European countries only moderate amounts. The price, however, has been from ⅛ cent to ¼ cent above that realized on domestic business.

The official price for lead of the American Smelting & Refining Co. was reduced from 7.25 cents, New York, to 7 cents. The reduction was caused by the fact that weakness in the foreign market again made importation possible.

The lower price increased buying in the East somewhat, though the market has certainly not been active. Producers are well sold up with current production, however, and specifications continue good, so that there is no pressure to sell below the level of the Smelting company.

Gain of Only $31,142 Shown in May Electrical Exports

TOTAL exports of electrical machinery, apparatus and appurtenances for May were $5,396,943, a gain of only $31,142 over May, 1922, when the total amounted to $5,365,801. In April, 1923, total electrical exports amounted to $5,981,191. The accompanying figures are supplied by the Bureau of Foreign and Domestic Commerce.

ELECTRICAL EXPORTS FOR MAY, 1923, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

Articles	Value May 1922	Value May 1923
Turbines	$137,005	$47,603
Generators:		
Direct-current:		
Under 500 kw	70,511	73,459
500 kw. and over	33,170	50,780
Alternating-current:		
Under 2,000 kva	9,469	1,557
2,000 kva. and over	12,729	34,600
Accessories and parts for generators	49,828	54,445
Self-contained lighting outfits	54,579	74,869
Batteries:		
Primary	106,755	115,742
Storage	140,220	229,229
Transforming and converting apparatus:		
Transformers—		
Power	515,366	129,494
Other	46,302	63,680
Rectifiers, condensers, double-current and motor generators, dynamotors, synchronous and other converters	74,832	33,831
Transmission and distribution apparatus:		
Switchboard panels, except telephone	253,490	156,760
Switches and circuit breakers above 10 amp	194,229	119,316
Fuses and fuse blocks	15,442	30,983
Meters and measuring instruments:		
Watt-hour and other measuring instruments	40,132	39,709
Volt, watt and ampere meters and other recording, indicating and testing apparatus	76,308	74,561
Lightning arresters, choke coils, reactors, and other protective devices	66,765	23,372
Motors, starters and controllers:		
Motors under 1 hp	76,472	236,970
Stationary motors 1 to 200 hp	206,933	238,544
Stationary motors over 200 hp	37,312	20,715
Railway motors	2,245	19,391
Electric locomotives:		
Railway		206,484
Mining and industrial	10,900	3,525
Other motors	29,760	13,712
Rheostats, controllers, and other starting and controlling equipment	67,239	133,703
Accessories and parts for motors	100,370	142,600
Electrical appliances, etc:		
Electric fans	70,794	54,788
Electric lamps:		
Incandescent—		
Carbon-filament	5,751	3,923
Metal-filament	97,109	92,691
Other electric lamps	24,578	20,596
Flashlights	23,797	47,447
Searchlights and projectors	3,509	8,772
Motor-driven household devices	53,722	78,678
Domestic heating and cooking devices	47,554	84,121
Industrial electric furnaces and ovens	6,132	16,828
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc	59,058	84,558
Signal and communication devices:		
Radio and wireless apparatus	186,525	213,025
Telegraph apparatus	6,835	23,317
Magneto telephones	(*)	31,259
Other telephones	434,287	20,986
Magneto switchboards	(*)	5,934
Other telephone switchboards	(*)	130,190
Railway signals, switches and attachments	8,239	29,214
Bells, buzzers, annunciators and alarms	5,176	5,628
Other electrical apparatus and appurtenances:		
Spark plugs, magnetos, and other ignition apparatus	103,705	90,433
Insulating material	83,854	132,634
Metal conduit, outlet, and switch boxes	15,147	54,418
Sockets, receptacles, and lighting switches	20,963	125,738
Other wiring supplies and fixtures	102,968	139,010
Other electrical apparatus not elsewhere specified	876,791	636,756
Globes and shades for lighting fixtures	43,300	34,538
Electrical glassware, except for lighting	10,246	16,012
Electrical porcelain	117,588	123,284
Electrical carbons, carbon brushes and electrodes	132,582	190,968
Insulated wire and cable (iron or steel)	21,104	33,678
Other manufactures of aluminum	88,386	102,975
Copper—		
Bare wire	140,067	100,969
Insulated wire and cable	146,671	293,941
Total electrical machinery, apparatus and appurtenances	$5,365,801	$5,396,943

(*) Not separately stated prior to Jan. 1, 1923.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Electric Range Factory Opened by Landers, Frary & Clark

To meet the increasing demand for electric ranges, Landers, Frary & Clark, New Britain, Conn., have recently built a new factory six stories in height, 160 ft. long and 60 ft. wide, for exclusive use in range production, and at this writing are occupying the plant and beginning active manufacturing therein. Representatives of the company state that interest in electric cooking is growing throughout the country, the South in particular having recently developed very actively as a field, following a long period of less apparent interest.

A. F. Wakefield Elected Vice-President of Wakefield Brass

A. F. Wakefield was elected vice-president of the F. W. Wakefield Brass Company of Vermilion, Ohio, at the annual meeting held recently, the other officers remaining unchanged. Mr. Wakefield joined the company four years ago as assistant to the sales manager and has made rapid strides in the organization.

Standard Underground Cable Appoints G. H. Hawley Manager

George H. Hawley has been appointed manager of the metal departments of the Standard Underground Cable Company's Perth Amboy (N. J.) works to fill the vacancy caused by the death of C. C. Baldwin, which occurred on June 7.

Mr. Hawley has been production manager for the past three years of the departments in question, which include the melting furnaces, rod, wire brass and tube mills and those for the manufacture of weatherproof and magnet wire. He has had wide experience in such work and before going with the Standard Company was connected with the National Conduit & Cable Company at Hastings-on-the-Hudson and for many years with the American Brass Company at Ansonia.

Cowan Truck Appointments

New representatives of the Cowan Truck Company, Holyoke, Mass., have been appointed as follows:

American Machinery & Supply Company, 1113 Howard Street, Omaha; Hendrie & Bolthoff Manufacturing & Supply Company, Denver; E. E. Johnson, 207 S. & L. Building, Des Moines; H. A. Hildebrandt, 324 Fourth Avenue South, Minneapolis, and H. K. Dyer, 178 Middle Street, Portland, Me.

J. M. Eaton, general manager of the Cowan company, stated last week that owing to increasing interest in material handling by industrial electric lift trucks, hand-lift trucks and skid bodies, increased factory facilities are being provided at Holyoke. Business is well diversified and widely distributed.

General Electric's New Plant at Philadelphia

The General Electric Company has decided to proceed with the erection of a new plant at Philadelphia, initially projected a number of months ago, and has taken bids on a general contract for the first plant unit, to be two story, 190 ft. x 604 ft., estimated to cost about $500,000, including equipment. The award will be made at an early date. The company has a tract of land on Elmwood Avenue between Sixty-eighth and Seventieth Streets, totaling about 21 acres, providing space for proposed later expansion.

Pelton Water Wheel Appoints E. M. Breed Sales Manager

E. M. Breed, for several years past assistant manager of sales for the Pelton Water Wheel Company, has been appointed sales manager, with his headquarters in San Francisco. Mr. Breed has had a wide experience in hydro-electric work, having been connected with the Pelton Water Wheel Company in various capacities for the past fifteen years.

Acquires the Washkosh Power Washing Machine Business

Perry E. Haworth, Chicago, has taken over all of the tangible property of the bankrupt Washkosh Manufacturing Company, Milwaukee, maker of the Washkosh power washing machines. This business was formerly conducted by J. Bolduc of Cleveland, who was president of the concern, and Warren Lee, secretary. Mr. Haworth's bid of $10,000 was accepted by the trustee in charge of the sale.

It is the plan of the new owner to continue the manufacture of the machines in Milwaukee, where the business was started. For the present the old plant will be operated and activities will start as soon as the title has passed and operation is possible. A force of twenty-five or thirty men will be employed.

The sale included all of the complete equipment of the plant, together with patents, good will, raw material, partly finished machines and some completed washers. A voluntary petition in bankruptcy was filed by this company in May, scheduling liabilities at $100,440 and assets at $20,262.

Elliott Company Changes in Sales Organization

The Elliott Company, manufacturer of power accessories, Pittsburgh and Jeanette, Pa., announces the following changes in its sales organization:

M. C. Sickels, formerly district manager of the Cleveland office, is now in charge of the Chicago office. C. H. Swett, who has been connected with the Philadelphia office for a number of years, becomes district sales manager of the Cleveland office.

After one year's apprentice training through all of the departments of the shop, engineering department and office, the following men have been assigned to sales work in district offices, as follows: R. W. Fox, New York; J. H. Strickler, Pittsburgh; J. A. Gerlach, Cincinnati; C. H. Hosterman, Detroit; C. F. Harms, Chicago.

All of the above changes concern also the sales work of the Liberty Manufacturing Company and Lagonda Manufacturing Company, subsidiaries of the Elliott Company.

Roller-Smith Appointment

The Roller-Smith Company, 233 Broadway, New York City, announces the appointment of H. D. Baker, 525 Woodward Avenue, Detroit, as its representative in Michigan. Mr. Baker will handle the Roller-Smith Company's lines of instruments, circuit breakers and radio apparatus in that territory.

Allis-Chalmers Bookings Totaled $14,912,015 in Five Months

Bookings of the Allis-Chalmers Manufacturing Company far exceeded production. In the first five months of the year they totaled $14,912,015, an increase of 58.7 per cent, and unfilled orders now exceed $13,000,000, compared with $8,215,545 Jan. 1.

Although demand has increased in practically all lines, it is felt most in the electrical and steam-turbine departments. Sales in the former line are now 40.5 per cent of total business, compared with 35.5 per cent a year ago, and turbine sales are 15.5 per cent compared with 10 per cent. Difficulties in getting sufficient unskilled labor and semi-skilled foundry workers are largely responsible for keeping operations at only 70 per cent of capacity. Actual billings against the $14,012,015 orders in the first five months of the year have been $9,158,378.

May net after taxes was $203,044, or $20,907 in excess of monthly dividend requirements on both classes of stock. Early in the year earnings were slightly under dividend requirements, so that the five months' figure of $862,172 was $48,515 less than the dividends for the period.

This means that $230,650 must be earned in June to meet dividends in the first half year. Officials believe this can be done since earnings have shown a steadily increasing tendency for some time.

In 1922 total annual dividend requirements of $2,185,641 on the 16,500,000 7 per cent preferred and $26,000,000 common, on which $4 a share is paid, were earned with some margin. Net income after taxes was $2,208,549, compared with $2,215,468 in 1921.

Westinghouse May Bookings Were $18,000,000

The Westinghouse Electric & Manufacturing Company's May bookings were about $18,000,000, compared with $17,741,000 in April. Orders for the current month are expected to be some 10 to 12 per cent lower on account of the combination of a recession in business, which is partly seasonal and which is regarded as a temporary condition, and the fact that June is a short month.

In the first quarter of 1922 bookings totaled only $32,118,924, less than the combined orders for the first two months this year, and Westinghouse has not included the $15,000,000 Virginian Railway electrification contract in its monthly orders yet, indicating the tremendous volume of incoming business received this year.

Sales billed for the first two months of the fiscal year were $23,000,000, and June billings will be substantially better than either of the two preceding months. For the first quarter last year ended June 30 billings were $25,713,707.

Westinghouse is increasing its production as rapidly as possible and is establishing a gain of 10 to 15 per cent monthly in this direction. As with the majority of industries, Westinghouse faced a labor shortage at the beginning of the year, but the situation has improved. The company is estimated to be operating now at around three-fourths of capacity.

Its cash position has improved substantially since the first of the year, and the company has on hand a comfortable supply of cash and Liberty bonds. As of March 31 this item amounted to $7,848,691, but with sale of $14,962,530 additional common stock in April its position was strengthened materially.

Link-Belt Sales Schools

The Link-Belt Company, 910 South Michigan Avenue, Chicago, announces that it has adopted the policy of holding annual sales schools. The most recent of these schools was held at the Link-Belt Indianapolis factory June 4, 5 and 6. The salesmen, eighteen in number, came from the Detroit, Pittsburgh, Toronto, Chicago, Boston, New York, Kansas City, St. Louis and Dallas offices.

Not only does this school permit the men to see and inspect the various malleable and steel chain manufactories and meet the offices and department heads of the plants, but the interchange of ideas among the men themselves, coming as they do from such widely separated points, makes for better feeling, fraternity and a dissemination of valuable sales information.

George Torrence, sales manager, with headquarters at Indianapolis, said with regard to the last school: "This is the third sales school we have conducted, and the value of such schools becomes more apparent every year. The men are inspired and benefited by their association with the factory and home-office men for three days, and the increased volume of sales resulting from the men who have attended our schools has shown us conclusively that the schools are a paying investment from a dollars-and-cents standpoint. This is aside from the intangible yet great value obtained through the better understanding and the clearer perspective that are naturally consequent upon such a gathering."

The Enamelight Company, 546 Book Building, Detroit, recently organized to manufacture electric lighting equipment, has plans for the establishment of a new works. Permission has been received to dispose of preferred stock in the amount of $80,000 for initial operations.

The C. M. Hall Lamp Company, 1033 East Hancock Street, Detroit, manufacturer of electric lighting equipment, has awarded a general contract for a one-story addition, 80 ft. x 175 ft., to cost approximately $75,000.

The Bates Standard Steel Truss Company, Chicago, manufacturer of poles for transmission lines, is erecting an experimental and testing plant adjoining its East Chicago (Ind.) works.

The 44 Safety Electric Lantern Company, Inc., 623 Calvert Building, Baltimore, recently organized, has tentative inquiries out for equipment and materials for electric lantern manufacture.

The American Electric Motors, Inc., 57 Erie Street, Milwaukee, manufacturer of electric motors, has increased its capital stock to finance purchases of additional equipment and materials and generally accommodate increased business. The preferred stock has been increased from $100,000 to $150,000 and the common shares from 3,000 to 3,500. C. L. Daun is president and general manager.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has awarded a contract to the Somersville Ornamental Iron Works, Sharon, Pa., for the erection of an addition to its Sharon plant, soon to be occupied for the manufacture of transformers. Other buildings will be constructed at a later date on adjoining property recently acquired. It is expected to have the plant ready for production by Oct. 1.

The Robert Findlay Manufacturing Company, 100 Lexington Avenue, Brooklyn, N. Y., manufacturer of lighting fixtures, has filed plans for extensions and improvements in its plant to cost $22,000.

The Western Electric Company has advised the municipal officials at Kearney, N. J., the site of its proposed Eastern plant, that plans are being developed for a larger works than initially projected, to make a total investment of $20,000,000 during the next twenty-four months, instead of $5,000,000, as previously announced. Other plant units will be constructed and the works materially enlarged over the first plans. Ground will be broken for the initial group of buildings at an early date.

The Line Material Company, New York City, has leased space in the building at 524-26 East One Hundred and Thirty-fourth Street for local operating and warehouse service.

The General Electric Company will commence the erection of a small one-story addition to its Sprague Works, Lawrence Street, Bloomfield, N. J. Superstructure work is under way for additions to the plant on Norman Street, Everett, Mass., comprising three one-story buildings, 50 ft. x 75 ft., 65 ft. x 140 ft., and 41 ft. x 60 ft., to cost about $60,000.

The Century Electric Company, Pine Street, St. Louis, is considering plans for enlargements in its plant, including the installation of additional equipment, estimated to cost $350,000.

The Connecticut Blower Corporation, Hartford, Conn., has been incorporated with capital stock of $250,000 to manufacture mechanical-draft equipment, including blowers, exhaust, conveying and ventilating systems. The corporation is successor to the International Blower Company, the Connecticut Blower Company and the Hartford Sheet Metal Works.

The George Cutter Manufacturing Company, North Notre Dame Street, South Bend, Ind., manufacturer of outdoor electric lighting equipment, etc., affiliated with the Westinghouse Electric & Manufacturing Company, has tentative plans under consideration for the erection of an addition to its plant, to be used for increased production.

J. B. McIntosh, formerly purchasing engineer of the National Lamp Works of the General Electric Company, Cleveland, has opened an office in the Keith Building, Cleveland, as purchasing and consulting engineer, under the name of the J. B. McIntosh Company.

The Magnus Electric Company, Inc., New York, has established a Chicago branch office at 231 North Wells Street, Leo Hirschfell and M. B. Geiger in charge.

The Majestic Appliance Company, Inc., San Francisco, recently organized, has taken over the local plant and business of the Majestic Electric Development Company, 656 Howard Street. The new company will continue in the manufacture of electric heaters and plans for expansion for production of a line of electric appliances. A. T. Burt is president and T. M. Simpson, vice-president and general manager.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Algiers, Africa (No. 6,994), for electric automobiles.

Purchase and agency is desired in Christiania, Norway (No. 7,044), for electrical cooking and heating devices, vacuum cleaners, etc.

Purchase is desired in Warsaw, Poland (No. 6,977), for military telephone and telegraph systems.

An agency is desired in Helsingfors, Finland (No. 7,034), for wiring devices, porcelain insulators, copper wire, cooking and heating appliances, incandescent lamps, equipment for high-voltage systems, etc.

Purchase is desired in Calatayud, Spain (No. 7,025), of iron products and leaded iron sheets for insulating tubes.

PROPOSED IMPROVEMENT TO THE ALGERIAN TELEPHONE SERVICE.—In a report recently submitted by the Commercial Syndicate of Algiers to the colonial authorities at Paris, *Commerce Reports* states, changes and improvements needed in the Algerian telephone service are suggested. The equipment is twenty-five years behind that in the United States and the present repair requirements would be more onerous than would be the complete rebuilding of the system. The present long-distance service is hopelessly inadequate.

New Apparatus and Publications

DRYING TUMBLER. — A new clothes drier, "C. & F.," has been developed by the Carlisle & Finch Company, 221 East Clifton Avenue, Cincinnati.

SOLDERING OUTFIT. — An electric soldering outfit designed especially for jewelers and opticians has been placed on the market by the E. & J. Swigart Company, 28 West Sixth Street, Cincinnati.

INCLOSED SWITCHES.—The Mutual Electric & Machine Company, Detroit, has added to its "Bulldog" products a line of inclosed switches, under the name of "Junior."

TRANSFORMER TEMPERATURE SIGNAL.—The Packard Electric Company, Warren, Ohio, has placed on the market the "Packard" transformer temperature signal.

ELECTRIC FANS.—The Emerson Electric Manufacturing Company, 2018 Washington Avenue, St. Louis, is distributing bulletin No. 4,024-A, covering the "Emerson" fan motors for alternating and direct current.

COMMERCIAL LIGHTING UNIT.—A new commercial lighting unit, known as "Sol-Lux," has been brought out by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

ELECTRIC IRON.—The Russell Electric Company, 340 West Huron Street, Chicago, has developed a new "Hold-Heet" electric iron.

LIGHT METER.—The Holophane Glass Company, 342 Madison Avenue, New York City, has issued a booklet describing the new "Holophane" light meter and giving instructions regarding its use.

DEEP-WELL PUMP.—A new type of deep-well pump, under the name of "Axiflo" pump, has been developed by the Worthington Pump & Machinery Corporation, 115 Broadway, New York City.

WASHING MACHINE.—The Clements Manufacturing Company, 613 Fulton Street, Chicago, has placed on the market a new "Cadillac" washing machine equipped with a disappearing wringer.

WATER SOFTENER.—"Zero or One and One-Half, Which?" is the title of a booklet published by the Graver Corporation, East Chicago, Ind., describing the "Graver" hot-process water softener for treating boiler-feed water.

WOOD PRESERVER.—The C-A Wood Preserver Company, Arcade Building, St. Louis, is distributing a booklet entitled "Thirty-six Years' Evidence that 'C-A-Wood Preserver' (Carbolineum America) Will Stop That Rot," in which it describes the method of production of "C-A-Wood Preserver" and gives an outline of various uses of the preservative.

CENTRIFUGAL PUMP. — The Allis-Chalmers Manufacturing Company, Milwaukee, is distributing leaflet No. 2,064, describing its "S" pump line.

BOILER-FEED PUMPS. — The Bethlehem Shipbuilding Corporation, Ltd., Bethlehem, Pa., has issued catalog WC, covering the "Bethlehem-Weir" (land service) pumps for boiler feeding and other duties.

ILLUMINATING DATA.—The Holophane Glass Company, Inc., 342 Madison Avenue, New York City, has issued a new publication in which it gives illuminating engineering data and describes the "Holophane" lighting apparatus, etc.

CONTROL RELAYS.—Bulletin No. 47,-672, issued by the General Electric Company, Schenectady, N. Y., describes and illustrates its instantaneous-control type PB-53 hesitating-control type PB-54 control relays.

TEST TABLES.—A new catalog, No. 1, section 3, describing test tables for central-station meter departments, has been issued by the States Company, Hartford, Conn. The illustrations show table units, wiring connections and applications, with special tables designed for unusual conditions.

New Incorporations

THE TWIN BRANCH POWER COMPANY, South Bend, Ind., has been incorporated to furnish light, heat and power. The directors are T. F. English, J. F. Leftus, C. B. Calvert, J. W. McInery and A. H. Huguenard.

THE SHORE ACRES ELECTRIC COMPANY, Fairmount, Minn., has been incorporated by E. W. Edwards and H. H. Drewes. The company is capitalized at $25,000 and proposes to establish a light and power plant.

THE LONGVIEW (WASH.) PUBLIC SERVICE COMPANY has been incorporated with a capital stock of $2,500.000 to furnish water, light and power to the Long-Bell Lumber Company, Longview. The incorporators are: S. M. Morris, Wesley Vandercook, L. C. Smith, J. M. Legland and L. D. Beach.

THE EAST MISSOURI POWER COMPANY, Troy, Mo., has been incorporated with a capital stock of $100,000 by William Knight, V. K. Nickell and E. H. Bartow.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

HAVERHILL, MASS. — The Haverhill Electric Company has applied for permission to issue $376,740 in capital stock, part of the proceeds to be used for expansion.

HOLYOKE, MASS. — Preliminary work has started on the new boiler house and power plant for the Farr Alpaca Company in Jackson Street. The cost is estimated at about $1,000,000.

PAWTUCKET, R. I. — The Blackstone Valley Gas & Electric Company is preparing plans for the erection of an addition to its generating plant, additional substations and extensions to transmission lines, to cost about $2,500,000.

Middle Atlantic States

BROADALBIN, N. Y.—The Broadalbin Electric Light & Power Company has applied to the Public Service Commission for permission to construct an electric light plant in Perth.

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 17 for five electric grinders for the South Brooklyn Navy Yard. (Schedule 1029.)

CARTHAGE, N. Y.—Electric power equipment will be installed at the plant of the Carthage Sulphite Pulp & Paper Company in connection with the rebuilding of its plant, recently damaged by fire. The loss is estimated at about $200,000.

CHAZY, N. Y.—The Plattsburgh (N. Y.) Gas & Electric Company has been granted permission to extend its transmission lines in Chazy for which a franchise has been granted by the Town Board.

SCHENECTADY, N. Y.—The Adirondack Power & Light Corporation has issued $1,200,000 in bonds, part of the proceeds to be used for extensions to transmission lines and power plants, including a hydro-electric station of 30,000 kw. capacity.

VESTAL, N. Y. — The Vestal Lighting Company has petitioned the Public Service Commission for permission to extend its lines in portions of the town of Vestal.

BRANCHVILLE, N. J. — The Culvers Hydro-Electric Company has purchased the property of the Branchville Electric Power, Water & Light Company. Capital stock for $90,000 will be issued, the proceeds to be used to acquire the system and for proposed extensions.

ELIZABETH, N. J. — Electric power equipment will be installed in the printing plant to be erected at Broad and Chestnut Streets by the Elizabeth *Daily Journal*, to cost about $160,000. C. Godfrey Poggi, 275 Morris Avenue, is architect.

IRVINGTON, N. J.—The Public Service Electric Company, Newark, plans to construct an addition to its local substation.

NEWARK, N. J.—Electric power equipment will be installed in the printing plant to be erected by the Newark Call Printing & Publishing Company at 91-93 Halsey Street, to cost about $150,000.

NEWARK, N. J.—Bids will be received by Charles P. Gillen, director Department of Parks and Public Property, until July 10, for lighting fixtures for the new municipal Center Market and Parking Station.

NEWARK, N. J.—The Goerke Company, 701 Broad Street, will build a power plant on Halsey Street, with electric generating department for emergency service, to be used in connection with its proposed department store, to cost about $5,000,000. William E. Lehman, 738 Broad Street, is architect.

NEWARK, N. J.—Electric power equipment will be installed in the proposed meat-packing and refrigerating plant to be erected on Plum Point Lane by the Greater Newark Packing Corporation, recently organized with a capital of $500,000. Michael J. Quigley, 738 Broad Street, represents the company.

CARLISLE, PA. — The Carlisle Gas & Water Company has received permission to take over and operate the plants of the West Pennsboro & Carlisle Electric Company and the North Middleton & Carlisle Electric Company. The properties will be merged and extensions made in the systems.

HARRISBURG, PA.—The board of school directors will build a power plant at the new senior high school, Sixth and Division Streets. G. Howard Lloyd, Telegraph Building, is architect.

KENNETT SQUARE, PA. — The Tidewater Transit Company, recently organized to take over the West Chester, Kennett Square and Wilmington Electric Railway, contemplates improvements, including electric power apparatus, transmission and feeder lines, etc., to cost about $150,000. Samuel E. Cooper heads the new company.

OIL CITY, PA.—The Citizens' Light & Power Company contemplates altering its distribution system and rerouting the light and power lines, etc., to cost about $50,000. Day & Zimmerman, Inc., 611 Chestnut Street, Philadelphia, are engineers.

PHILADELPHIA, PA. — The Philadelphia Electric Company has issued $10,000,-000 in capital stock, part of the proceeds to be used for extensions and improvements.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company will make extensions and improvements to its power house at Thirteenth and Vernon Streets, to cost about $25,000.

PHILADELPHIA, PA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 10 for armature, brushes, holders, etc., for the Philadelphia Navy Yard. (Schedule 1027.)

RURAL VALLEY, PA.—The Rural Valley Borough Electric Corporation, recently organized, plans to install a system for commercial light and power service. McCahill, McCahill & Tabor, 908 West Penn Building, Pittsburgh, are representatives.

RUTHERFORD, PA. — Electric power equipment will be installed at the proposed local coaling plant to be constructed by the Philadelphia & Reading Railway Company, Reading Terminal, Philadelphia, to cost about $500,000.

SALFORD, PA.—The Salford Power & Light Company is being organized to install and operate a local commercial system for

light and power service. Thomas J. Perkins, Allentown, represents the company.

SHARON, PA.—Arrangements have been made by the Shenango Valley Electric Light Company to erect a transmission line, about 5 miles long, to serve the village of Hartford, Ohio. M. Pendleton is superintendent.

BEECH BOTTOM, W. VA.—The Kerr Portland Cement Company, Wheeling, has acquired about 800 acres of land in Beech Bottom, on which it proposes to erect a cement plant with an initial capacity of 3,000 barrels per day. The project will include power house and machine shop. The cost is estimated at about $1,300,000.

BLUEFIELD, W. VA.—The Premier Red Ash Coal Company plans to install electric power and mechanical equipment at its properties in the Clinch Valley section.

FAIRMONT, W. VA.—The Baltimore & Ohio Railroad Company has tentative plans for the electrification of its line from Fairmont to Keyser, W. Va., including substations and feeder system.

McDOWELL, W. VA.—The Pond Creek Pocahontas Coal Company plans to install electric power equipment and mechanical apparatus at its local mining properties. A fund of $1,000,000 is being arranged for expansion.

MULLENS, W. VA.—D. D. Moran plans to construct a power house in connection with a new lumber mill, to cost about $50,000.

POCAHONTAS, W. VA.—The Pocahontas Fuel Company plans to install electric power and mechanical equipment at its Wyoming County properties.

CLAREMONT, VA.—The City Council is considering granting a franchise for furnishing electricity in the town for lamps and motors.

KING GEORGE, VA.—The King George County School Board plans to install an electric plant for service at the local schools.

NANSEMOND, VA.—Electric power equipment will be installed in the proposed local automobile plant to be constructed by the Robe Motor Corporation of Virginia, Arcade Building, Norfolk, recently formed with a capital of $500,000. W. B. Robe is general manager.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, until July 18 for ammeter, relays and other miscellaneous equipment for the Canal Zone. (Circular 1541.)

North Central States

ALGER, MICH.—The installation of an electric lighting system is being agitated by local business men and residents.

LANSING, MICH.—The Public Utilities Commission has granted the Wolverine Power Company permission to issue $2,500,000 in bonds, the proceeds to be used for the construction of four dams on the Tittabawassee River in Midland and Gladwin Counties. The company proposes to sell its power to the Consumers' Power Company. The officers are: J. M. Bick, Toledo, Ohio, president; William P. Manchester, Detroit, vice-president, and R. Holland, Ann Arbor, engineer.

COLUMBUS, OHIO.—The Columbus Belt Railway Company contemplates building a belt line railway around the city, 12 miles, to cost from $12,000,000 to $15,000,000.

YOUNGSTOWN, OHIO.—The Pennsylvania-Ohio Power & Light Company is erecting a high-tension transmission line (10 miles long), with substation, to supply electricity to the village of Orangeville.

CROWN POINT, IND.—A power plant will be erected at the new local sanitarium, to cost about $350,000 for which bids will be received until Aug. 1. Karl D. Morris, Calumet Building, East Chicago, is architect. The Crown Point County Commissioners are in charge.

FORT WAYNE, IND.—The Wabash Valley Electric Company is negotiating for the purchase of the systems of the Martinsville (Ind.) Gas & Electric Company, Putnam Electric Company, Greencastle, Morgan County Light & Power Company, Morgantown; Spencer (Ind.) Light, Power, Heat & Water Company, Roachdale (Ind.) Electric Company and the Gosport (Ind.) Electric Company. The properties will be merged, and extensions and improvements made.

WARSAW, IND.—The Interstate Public Service Company has prepared plans for an electrically operated pumping plant for the local waterworks, to cost about $100,000.

JOLIET, ILL.—The Eagle Paper Company contemplates extensions to its power plant, including the installation of new equipment. Cahill & Douglass, 217 West Water Street, Milwaukee, are engineers.

VENICE, ILL.—The local power plant of the Madison County Light & Power Company, Granite City, was recently damaged by fire.

BEAVER DAM, WIS.—The Wisconsin Light, Power & Heat Company contemplates the erection of a high-tension transmission line along the Beaver Dam highway for a distance of 10 miles, to cost about $25,000.

PESHTIGO, WIS.—Plans are being prepared by the North Eastern Power Company, 559 Marshall Street, Milwaukee, for the installation of a 4,000-kva. generating unit and other improvements to its local plant, to cost about $50,000. Mead & Seastone, Journal Building, Madison, are engineers.

PHILLIPS, WIS.—Steps have been taken by the Phillips Commercial Club for the installation of an ornamental lighting system on Lake Street.

DULUTH, MINN.—Contract has been awarded by the McDougal Terminal Warehouse Company for the erection of a power house at 809 West Railroad Street, to cost about $20,000.

MANKATO, MINN.—The installation of a new street lighting system is under consideration by the City Council.

TOLEDO, IOWA.—The construction of a power house at the State Juvenile Home, to cost about $40,000, is under consideration. A. E. Kepford is manager.

WEST LIBERTY, IOWA.—The North Eastern Electric Company, 559 Marshall Street, Milwaukee, contemplates erecting a transmission line to West Liberty.

TROY, MO.—The East Missouri Power Company, recently organized, plans to install a light and power system in this section. William Knight is interested in the company.

NEW ENGLAND, N. D.—Plans are being prepared for a municipal electric plant.

KANSAS CITY, KAN.—The Fairfax Drainage District, Federal Reserve Life Insurance Building, plans to build a substation and transformer house for service in connection with its new drainage works. Electric power equipment will be installed for pumping service and other operations. Henry Reimer is chairman.

Southern States

ANDREWS, N. C.—Plans are being prepared for the construction of a municipal hydro-electric plant on the Hiawassee River, to cost about $300,000.

LITTLETON, N. C.—E. E. Wollert & Son are planning to rebuild their power house and portion of woodworking plant recently destroyed by fire, causing a loss of about $55,000.

SAVANNAH, GA.—The Savannah Electric & Power Company has concluded negotiations for the purchase of the Savannah Lighting Company. Extensions are contemplated to the system.

WASHINGTON, GA.—Davis & Kvaternick contemplate the construction of a power house in connection with a new stave mill, to cost about $45,000.

DELAND, FLA.—Bids will be received by the Board of Trustees of the City of Deland until July 17 for waterworks improvements, sanitary and storm-sewer improvements, etc., including three pumps, two pump houses, one generating unit and accessories. J. B. McCraray Engineering Corporation, Atlanta, Ga., is engineer.

NEW SYMRNA, FLA.—The purchase of an additional unit for the municipal electric light plant is under consideration.

OCOEE, FLA.—The town officials are reported to be considering the purchase of the local electric light and power plant owned by Maguire & Hawthorne. Dr. N. M. Jemsen is chairman of committee.

TALLAHASSEE, FLA.—The Brevard County Power Company, Munsey Building, Baltimore, Md., recently formed with capital of $200,000, plans to install a power plant and system for service in Brevard County, Fla. Herman A. Lang is interested in the company.

LAWRENCEBURG, TENN.—Surveys are being made and plans prepared for a hydro-electric plant on Shoals Creek for the municipal electric light system. The Freeland Roberts Company, Independent Life Building, Nashville, is engineer.

NASHVILLE, TENN.—Bids will be received by J. H. Kirkland, chancellor of Vanderbilt University, until July 16 for construction of hospital and laboratory, nurses' home, power plant and laundry, to cost about $2,000,000. Coolidge & Shattuck, Ames Building, Boston, are architects.

ROGERSVILLE, TENN.—The Kitzmiller-Kenner Company has leased the system of the Rogersville Electric Company. It is planned to enlarge the plant and install a new steam-operated generating unit.

BOAZ, ALA.—The proposal to sell the municipal electric light plant to the Alabama Power Company will be submitted to the voters.

EVERGREEN, ALA.—Arrangements are being made for the construction of a new municipal electric lighting and pumping plant driven by oil engines to replace the present steam-operated plant. Two units of 100 hp. and 50 hp. respectively, it is stated, will be installed.

FLOMATON, ALA.—One of the several substations to be erected by the Alabama Power Company, Birmingham, on the transmission line between Montgomery and Mobile, it is stated, will be located in Flomaton.

GEORGIANA, ALA.—Tentative plans are under consideration for the installation of a municipal electric plant, to cost about $40,000.

GREENWOOD, MISS.—Plans are under consideration for the installation of a new street-lighting system, consisting of about 28,000 linear feet, with single lamp posts.

CAMDEN, ARK.—The Arkansas Light & Power Company plans extensions and improvements to its local system, to cost about $100,000.

CAMDEN, ARK.—T. D. Fooks is planning to construct a power house in connection with a new lumber mill on the Ouachita River, to cost about $50,000.

EL DORADO, ARK.—The Arkansas Light & Power Company plans to build an ice plant here to cost about $80,000.

LITTLE ROCK, ARK.—Extensions to the local light and power plant, to cost about $75,000, are under consideration by the Arkansas Central Power Company.

PARAGOULD, ARK.—Tentative plans are under consideration by the Council for extensions to the waterworks, including the installation of an electrically operated centrifugal pump, control devices, etc.

MONROE, LA.—The Louisiana Glass Manufacturing Company plans to construct a power plant in connection with its proposed local works, to cost about $250,000.

ROSELAND, LA.—The Roseland Veneer & Package Company plans extensions in its power house, including the installation of additional equipment.

HUDSON, OKLA.—The Empire Electric Company plans to build a transmission line to Hudson, via Welch, a distance of about 15 miles.

DENTON, TEX.—An appropriation of $110,000 has been arranged for an addition to the power house at the State College of Industrial Arts, including the installation of new equipment.

HARLINGEN, TEX.—Work will soon begin on the construction of a large central power plant by the Valley Electric & Ice Company, San Antonio, for the purpose of supplying electricity for all towns and industrial plants on the Texas and Mexico sides of the lower Rio Grande Valley. The proposed plant, it is understood, will be located in Harlingen. The equipment will include two Diesel oil engines of 1,125 hp. each. Material has been ordered for the erection of a 33,000-volt transmission line to extend from San Benito to Mission.

HOUSTON, TEX.—Electric power equipment will be installed in the new cotton-compress plant now being constructed by the Houston Cotton Compress Company on the ship channel, to cost about $1,000,000.

ROCK SPRINGS, TEX.—The local electric plant has been purchased by W. E. Eaton, El Dorado, Ark. Improvements are contemplated to the system.

TEMPLE, TEX.—Plans are under consideration for extensions to the ornamental lighting system in the city park, public square and other sections in the downtown district.

Pacific and Mountain States

McCLEARY, WASH.—The McCleary Timber Company contemplates the construction of a power house in connection with the rebuilding of its local veneer plant, recently destroyed by fire.

SEATTLE, WASH.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 18 for one electric traveling bridge crane for the Puget Sound Navy Yard. (Specification 4861.)

VANCOUVER, WASH.—The Northwestern Electric Company will build an addition to its substation at King and Eighth Streets, to cost about $80,000.

HILLSBORO, ORE.—The North Coast Power Company is erecting transmission lines to supply electricity to the towns east of Hillsboro, Reedville and Huber.

ROSEBURG, ORE.—The California Oregon Power Company has applied to the State Railroad Commission for permission to purchase the plants and properties of the Douglas County Light & Power Company, which supplies electricity and water in Douglas County, Ore., and Siskiyou County, Cal. The local system will be connected with the high-tension line of the California Oregon company at Dixonville, 6 miles from Roseburg.

BAKERSFIELD, CAL.—The city planning commission has recommended the formation of a lighting district, comprising sixty blocks, to be improved with an ornamental lighting system. W. D. Clarke is city engineer.

CORNING, CAL.—Application has been made to the State Water Commission by W. H. Samson, Corning, and associates for permission to construct a hydro-electric plant on Clear Creek, Shasta County. The plans call for an initial development of 87,000 hp., to cost about $5,000,000.

FRESNO, CAL.—Plans have been prepared for the installation of an ornamental lighting system on portions of Kerchoff Avenue, Huntington Boulevard, and other streets, consisting of 155 single-lamp standards maintained by underground wires, to cost about $25,000. W. Stranahan is city engineer.

LOS ANGELES, CAL.—The Pacific Sash & Door Company will build a power house at its plant on San Fernando Road. Noice & Merrill, Washington Building, are engineers.

ST. HELENA, CAL.—The power plant at the St. Helena Sanitarium was recently destroyed by fire.

SAN BERNARINDO, CAL.—The installation of an ornamental lighting system on Mount Vernon Avenue between Third and Mill Streets, is under consideration.

SAN DIEGO, CAL.—Plans are under consideration for the removal of all overhead wires in the business section. F. A. Rhodes is city manager.

SISSON, CAL.—The Chamber of Commerce is preparing plans for the installation of an ornamental lighting system in a portion of the business section.

TORRANCE, CAL.—Electric power equipment will be installed by the Western Sheet Glass Company, in connection with extensions and improvements in its local plant, to cost about $800,000.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company has applied to the Federal Power Commission, Washington, D. C., for permission to construct a hydro-electric plant on the Green River, near the Utah-Wyoming State boundary, with initial capacity of about 50,000 hp. A steel-tower transmission line will be erected to connect with the present system. The cost is estimated at about $7,500,000.

WHITEROCKS, UTAH.—The installation of an electric lighting system in Whiterocks is under consideration. William Donner, superintendent of the Fort Hall Indian agency, will be in charge of the work.

Canada

WOODSTOCK, N. B.—The Town Council has applied for authority to issue $35,000 in bonds, the proceeds to be used to install an oil-engine-driven power plant of 250 hp. to supply electricity to operate the waterworks pumping station and for lighting the streets.

ST. CATHARINES, ONT.—The Niagara, St. Catharines & Toronto Electric Railway Company contemplates the erection of a passenger and freight terminal at Welland Avenue, Balfour and General Streets, to cost from $250,000 to $300,000.

TORONTO, ONT.—Tenders will be received by the chairman of Board of Control, City Hall, until July 24 for furnishing and installing two 2,800,000-imperial gallon centrifugal sewage pumps and motors (Tender No. 24).

MONTREAL, QUE.—The Canadian Paper Board Company, Seignieur Street, is preparing preliminary plans for developing 800 hp., partly by water turbines and partly by steam-driven turbines, on the Lachine Canal, to cost about $200,000. Kerry & Chace, Confederation Life Building, Toronto, are engineers.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 12, 1923)

1,458,902. CONTROLLER FOR REVERSING MACHINES; E. L. Dunn, Worcester, Mass. App. filed July 20, 1918. Apparatus for automatic control.

1,458,907. AUTOMATIC TELEPHONE SYSTEM; G. E. Mueller, Aurora, Ill. App. filed June 25, 1908.

(Issued June 19, 1923)

1,458,935. CONTROL SYSTEM AND APPARATUS; A. J. Hall, Winchcombe, England. App. filed July 30, 1920. For electric railways.

1,458,940. WEATHERPROOF ELECTRIC HEATER; L. P. Hynes, Albany, N. Y. App. filed Oct. 18, 1921. For thawing railway points, switches, etc.

1,458,947. MEASURING INSTRUMENT; P. MacGagan, Pittsburgh, Pa. App. filed Sept. 16, 1918. Method of centering core in direct-current instruments of permanent-magnet moving-coil type.

1,458,949. CARRIER RADIO TELEPHONE SYSTEM; H. W. Nichols, Maplewood, N. J. App. filed Jan. 7, 1922. Pure modulated wave and energy of fundamental carrier frequency transmitted.

1,458,957. COURSE DRAFTER FOR MARINE AND AERONAUTIC VESSELS; R. H. Schachenmeier, Karlsruhe, Germany. App. filed Aug. 20, 1919.

1,458,988. MEANS FOR EQUALIZING TRANSMISSION OVER LINES OF DIFFERENT ELECTRICAL CHARACTERISTICS; L. F. Morehouse, Montclair, N. J. App. filed Oct. 29, 1918. Relates to telephone systems.

1,458,999. ELECTRIC LIGHT DEVICE; C. L. Snyder, Marion, Ind. App. filed Jan. 21, 1922. Pull-chain lamp socket.

1,459,003 to 1,459,005. MEANS FOR EQUALIZING TRANSMISSION OVER LINES OF DIFFERENT ELECTRICAL CHARACTERISTICS; G. K. Thompson, Maplewood, N. J. App. filed Oct. 29, 1918. Relates to telephone systems.

1,459,013. COIL-WINDING MACHINE; E. F. Creager and S. Rogers, Anderson, Ind. App. filed Nov. 25, 1918. For winding reactances.

1,459,025. ENGINE STARTER; W. H. Huchins, Rochester, N. Y. App. filed Nov 2, 1916. Arrangement of gears between motor and flywheel.

1,459,047. GROUNDING BOX FOR ELECTRICAL PILOTING CABLES; A. Crossley, Washington, D. C. App. filed Feb. 5, 1921. Connection between box and armor by wedge construction.

1,459,049. ELECTRIC HEATER; A. de Khotinsky, Chicago, Ill. App. filed Aug. 15, 1921. Thermo regulator provided to produce desired temperature.

1,459,070. RHEOSTAT; A. P. Morgan, Montclair, N. J. App. filed June 28, 1921. For varying filament current of electric tubes.

1,459,083. ELECTRIC LAMP; A. W. Becker, Windsor, Conn. App. filed April 20, 1922. Hand flashlight.

1,459,121. STOPPER FOR CLOSING THE CONTAINERS OF ELECTRIC ACCUMULATORS; F. Van de Wiel, Paris, France. App. filed Oct. 25, 1920. Permits escape of gas.

1,459,147. MAGNETIC SEPARATOR; A. Dings, Milwaukee, Wis. App. filed Aug. 5, 1918. Drum type.

1,459,165. ELECTRIC DRIVE FOR VEHICLES; J. Schurch, Los Angeles, Cal. App. filed Jan. 4, 1921. Engine-generator-motor drive.

1,459,174. OVERHEAD ELECTRICAL CONDUCTOR SYSTEM; H. B. P. Wrenn and A. S. O'Donoghue, Cleveland, Ohio. App. filed Nov. 11, 1922. Catenary construction for heavy-duty railways.

1,459,175. TELEPHONE-EXCHANGE SYSTEM; F. Aldensorff, Berlin-Wilmersdorf, Germany. App. filed Dec. 31, 1914. Connections established through electromechanically controlled switches.

1,459,186. TELEPHONE-EXCHANGE SYSTEM; L. Polinkowsky, Antwerp, Belgium. App. filed April 30, 1920. Machine switching apparatus.

1,459,187. PROCESS OF REDUCING METALLIC OXIDES; E. B. Pratt, East Cleveland, Ohio. App. filed Nov. 2, 1920. Reduction of "flue-dust" ores in electric furnace.

1,459,202. METHOD OF SENSITIZING THE TELEGRAPHONE; L. F. Fuller, Palo Alto, Cal. App. filed Aug. 26, 1918. For high-speed radio-signal recording, etc.

1,459,213. ELECTRIC MEASURING APPLIANCE; G. Keinath, Berlin-Charlottenburg, Germany. App. filed Nov. 2, 1920. Transformers for measuring currents up to 40,000 amp.

1,459,229. MEASURED SERVICE AUTOMATIC TELEPHONE SYSTEM; T. G. Martin, Chicago, Ill. App. filed May 15, 1919.

1,459,249. LAMP STAND; E. G. Perkins, Youngstown, Ohio. App. filed July 12, 1921. Adjustable stand for supporting lamp.

1,459,274. ELECTRIC POCKET LAMP WITH SIGNAL PANE AND COMPASS; F. Yokoyama, Tokyo, Japan. App. filed Dec. 19, 1919.

1,459,283. ELECTRIC EMERGENCY LIGHTING INSTALLATION; P. Das, Delft, Netherlands. App. filed Aug. 2, 1921. Control arrangement.

1,459,307. ELECTRIC HEATING UNIT; C. A. Laise, Weehawken, and A. J. Gallagher, West Orange, N. J. App. filed April 8, 1922. For immersing liquids and solutions.

1,459,308. SIGNALING APPARATUS; D. G. McCaa, Lancaster, Pa. App. filed April 6, 1920. High-frequency wave system for telegraphy and telephony.

1,459,336. TESTING DEVICE FOR FLASHLIGHT BATTERIES AND LAMPS; W. Link, Ajo, Ariz. App. filed Oct. 21, 1921. Contact test board.

1,459,358. ENGINE STARTER; A. E. Buchenberg, Toledo, Ohio. App. filed April 14, 1919. Electromagnetic means for shifting driving wheel into operative relation with flywheel.

1,459,397. SELF-INDUCTION COIL; R. R. Herrmann, New York, N. Y. App. filed May 2, 1919. Employed to vary frequency of oscillation generator.

1,459,400. ELECTRON-EMITTING CATHODE AND PROCESS OF MAKING THE SAME; C. D. Hocker, East Orange, N. J. App. filed Nov. 17, 1916.

1,459,403. SIGNALLING SYSTEM; C. W. Keckler, Newark, and W. B. Strickler, East Orange, N. J. App. filed Sept. 22, 1919. Remote control of switch in power station.

1,459,412. THERMIONIC TRANSLATING DEVICE; A. McL. Nicolson, New York, N. Y. App. filed April 16, 1915. Construction of electron tube of large output.

1,459,417. ELECTRON DISCHARGE DEVICE; P. Schwerin, New York, N. Y. App. filed Nov. 1, 1916. Able to dissipate a large quantity of heat.

1,459,419. MULTISTAGE AMPLIFIER CIRCUITS; E. O. Scriven, New York, N. Y. App. filed April 30, 1919. Vacuum-tube radio circuit.

1,459,422. ELECTRICAL SYSTEM; H. M. Stoller, New York, N. Y. App filed Sept. 4, 1919. Provision of power to radio set in which thermionic devices are employed.

1,459,425. ARMATURE BACKSTOP; C. H. Wheeler, Midland Park Borough, N. J. App. filed Jan. 4, 1921. For relay armatures.

1,459,427 and 1,459,428. THERMIONIC REGULATOR; P. I. Wold, East Orange, N. J. App. filed July 29, 1918. For controlling voltage or current from generator.

1,459,431. CONTROLLING SYSTEM; L. M. Allen, New York, N. Y. App. filed Nov. 25, 1919. Registers at distant point controlled by operator's key.

1,459,434. TRANSMISSION SYSTEM; D. G. Blattner, New York, N. Y. App. filed June 24, 1919. Receivers for underwater signaling.

1,459,451. ELECTRIC IRON; J. M. Seche, Philadelphia, Pa. App. filed Feb. 6, 1923. Automatic cut-out to prevent overheating when not in use.

1,459,562. LAMP LOCK; R. E. Stouffer, Chicago, Ill. App. filed April 2, 1921. For lights on taximeters.

1,459,563. ELECTRIC LIGHT AND POWER PLANT; P. Thamm, New York, N. Y. App. filed April 21, 1920. Gas-engine drive for farm-lighting units.

1,459,651. HEADLIGHT PLUG; O. L. Carr, Baton Rouge, La. App. filed Oct. 24, 1921. For automobile lights.

1,459,659. ELECTROLYTE FOR STORAGE BATTERIES; H. Ellis, P. S. Hart and W. G. Nunnelly, New Florence, Mo. App. filed Nov. 28, 1922. Composed of $33\frac{1}{3}$ per cent of electrolyte and $66\frac{2}{3}$ per cent of oil.

1,459,663. TROLLEY-WHEEL GUARD; J. Trunko, Arden, W. Va. App. filed March 12, 1923. Guard prevents accidental dislodgment of wheel.

1,459,665. ELECTRIC IMMERSION LIQUID HEATER; S. Abel, Berlin, Germany. App. filed Jan. 21, 1922. For any voltage between 110 and 220.

Directory of Electrical Associations

Printed in the First Issue of Each Volume

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co., Birmingham, Ala.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill.

AMERICAN ASSOCIATION OF OPERATING ENGINEERS. Secretary, H. C. Bristol, Calderwood, Tenn.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Executive secretary, J. W. Welsh, 8 West 40th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Colin G. Fink, Columbia University, New York City.

AMERICAN ENGINEERING STANDARDS COMMITTEE. Secretary, P. G. Agnew, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 143 Liberty St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets bi-monthly. Sections and branches in the principal electrical centers throughout the country.

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AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

AMERICAN WELDING SOCIETY. Secretary, M. M. Kelly, 29 West 39th St., New York.

ARKANSAS UTILITIES ASSOCIATION. Secretary, R. I. Brown, Little Rock Railway & Electric Company, Little Rock, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, Frederic Nicholas, 30 East 42d St., New York City.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Preston S. Millar, 80th St. and East End Ave., New York.

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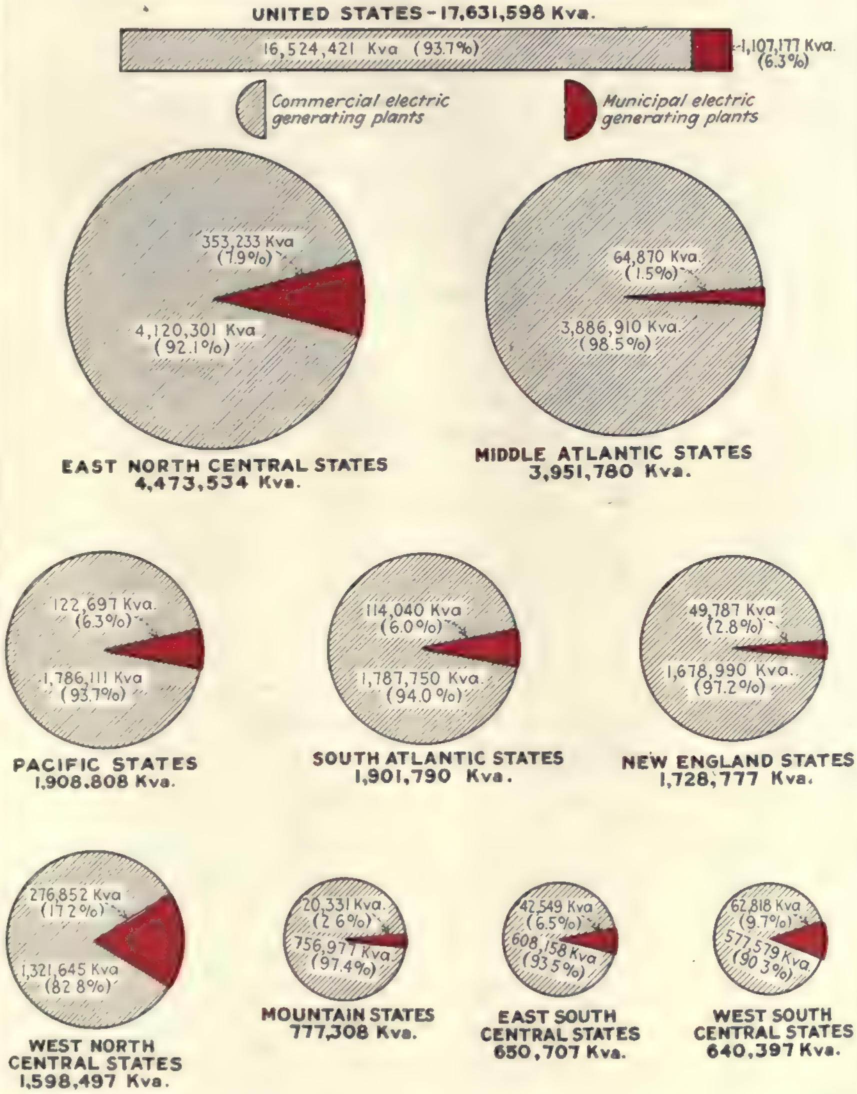
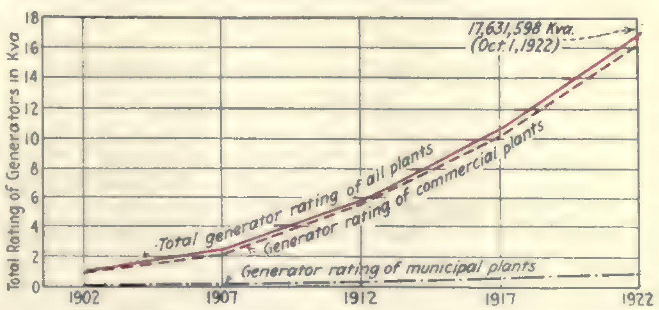
Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Only 6.3 per Cent of the Total Generator Rating of the Central Stations Is Installed in Municipal Plants



Commercial Central Electric Generating Plants Have Experienced an Ever-Accelerated Growth



Dwindling Importance of the Municipal Systems

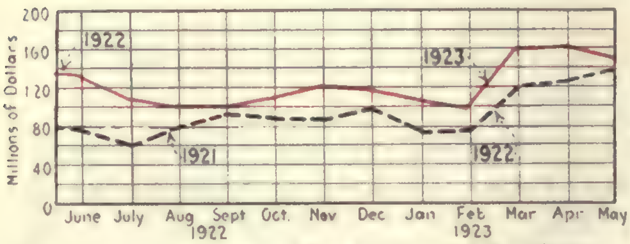
"To win public opinion is to win the race"

As a basic factor in the national economic life of the electric light and power industry the municipally operated generating plant is becoming of less and less importance as time passes. It is true that since the birth of the industry a large percentage of the operating systems of the country have been controlled by municipalities, but the activities of the unit systems thus operated have been almost without exception entirely local. Such being the case, the installed generator rating and the output of the municipal plants have been, and are at present, low in comparison with the generating equipment and energy output of the commercial systems which know no city, county or state boundary in their activities.

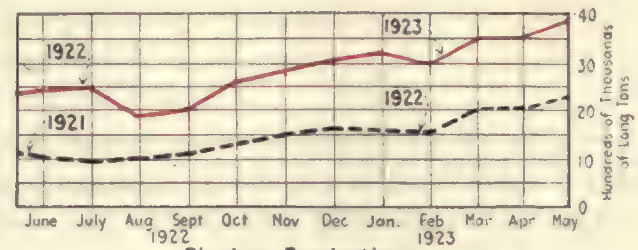
Back in 1902 only 9.6 per cent of the total generator equipment of the central stations of the country was operated by municipalities. This percentage has gradually decreased year by year until at the present time the municipal plants can account for only 6.3 per cent of the total central-station generator rating and only about 3 per cent of the output. Only in the West North Central States does the municipal system really become a near-controlling factor. In this section 43.7 per cent of the generating and distributing systems are owned by municipalities, but even in this territory only about 15 per cent of the total generator rating is municipally operated.

Freedom from politics and inefficiency due to "pull" rather than merit, interconnection which guarantees a supply of electrical power without interruption, low cost to the consumer as a result of bulk production of energy, and the gradual growth in the mind of the average citizen of distrust for publicly operated utilities, all taken in connection with the excellent public relations which have been cultivated by the commercial companies for the past forty years, are the fundamental reasons for the commanding place which the privately owned system has attained in the electric light and power industry. It is only another instance of the "survival of the fittest" as applied to commercial life.

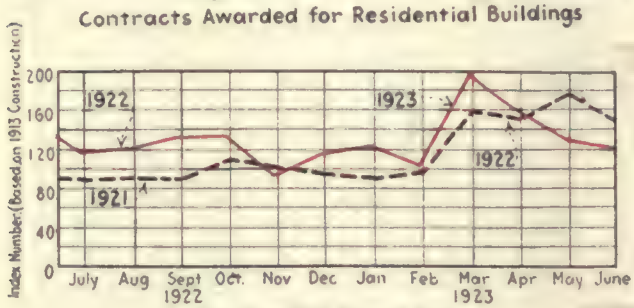
How the Primary Industries Are Trending



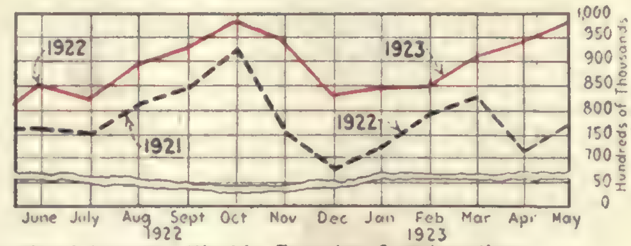
Contracts Awarded for Residential Buildings



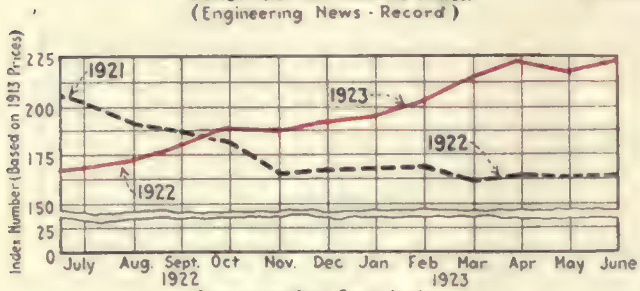
Pig-Iron Production



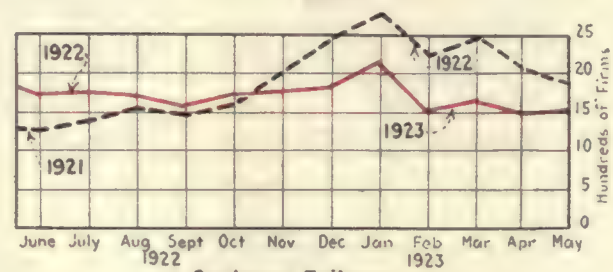
Construction Volume Index
(Engineering News-Record)



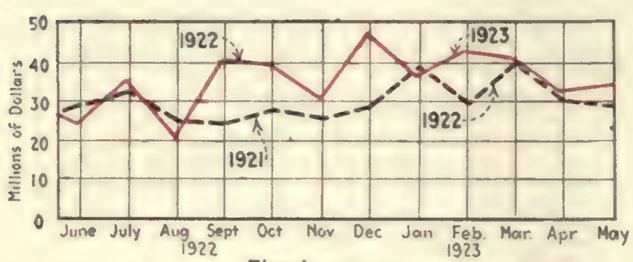
Total Average Weekly Freight-Car Loadings



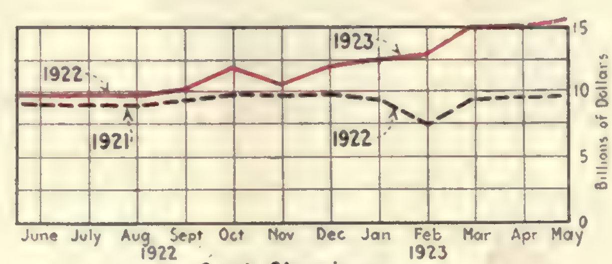
Construction Cost Index
(Engineering News-Record)



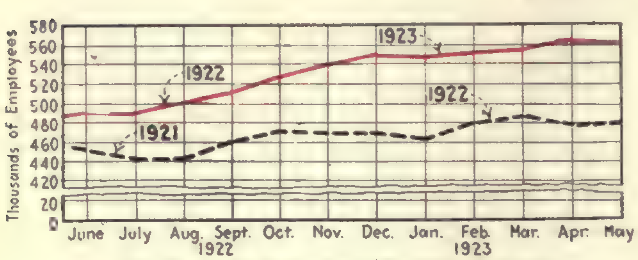
Business Failures



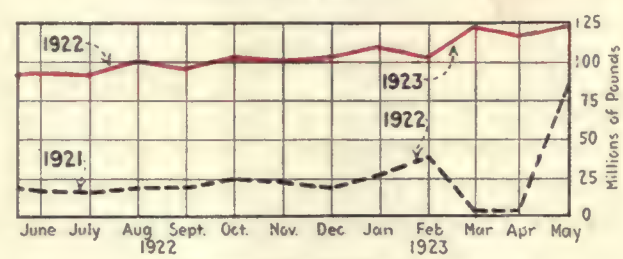
Fire Losses



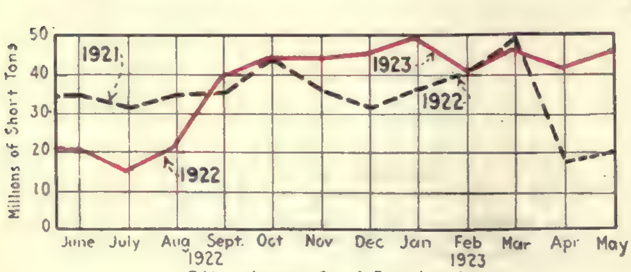
Bank Clearings
(Outside of New York City)



Employees in Factories of New York State



Copper Production



Bituminous Coal Production

Present Business Prosperity Will Continue

ALL prominent economic bureaus predict continued business prosperity. Money rates, banking figures and security issues present a picture of active and prosperous business. None of them, however, indicates that strain has thereby been placed upon the financial structure of the country, and so long as this remains true a continuance of present business prosperity may be expected.

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W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

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Selling the Public to the Utility

MEN of the central-station industry are apt to overlook the fact that there are two sides to the much-discussed problem of public relations. The industry must interpret and "sell" itself to the public — yes; but it is equally important that the public be interpreted and "sold" to the industry. There are two parties to this partnership. Yet most that is heard within the industry's ranks is of the *public's* lack of understanding. Now, how about the central station's own viewpoint—taken in the mass?

M. S. Sloan, president of the Brooklyn Edison Company, talked to the Commercial Section of the Empire State Gas and Electric Association the other day along this line. In making the point that it is just as much the duty of the sales department to "sell" the industry to the public as to sell appliances to individual customers, he said that the commercial men of the utilities must awaken their executives to the need for greater expenditures for advertising — an appropriation of at least 1 per cent of each company's gross sales, he believes, should be spent in telling the story. In short, they must interpret to their own people the vital need that the company's representatives themselves understand the public as an element in the business of electric service and get into a proper relationship with it.

This is sound doctrine. Good *external* public relations in the commonly accepted sense — meaning a friendly sympathy with and loyalty to the utility by the people of the community—have proved stout sword and buckler in more than one emergency. But *internal* public relations prove no less potent also, both as a defensive and an offensive influence.

An understanding of the utility by the public is undoubtedly a protection against political attack. But better understanding of the public by the utility would often prevent attack. And in offensive operations how great the gain would be! When central-station men, in general, some day begin to look out beyond their purely internal purposes and problems to study their market seriously and adapt themselves to public needs and inclinations, then will the development of every class of load begin to forge ahead, instead of merely swelling with the naturally growing popular demand as has virtually been the case.

Mr. Sloan's appeal deserves serious attention on the part of utility executives throughout the country. How well do their employees understand the public today? How many executives actually know?

Francis Cole Pratt

A firm grasp of engineering in its relation to manufacturing, an active interest in education and a broad outlook are among the possessions of this successful executive.

THE statement has sometimes been made—and no doubt with some show of reason—that relatively few engineers possess marked aptitude for executive work. If this may be taken as a truism in the engineering field, then the case of Francis C. Pratt, vice-president of the General Electric Company, is one of those exceptions which go to prove the rule. Mr. Pratt may indeed be said to combine in a peculiarly effective manner the practical ideals of the engineer-executive. Equipped with an extraordinary executive mind, he has devoted most of the years during which he has been connected with the General Electric organization to the upbuilding and improvement of an engineering service of world-wide reputation, first as assistant to the vice-president in charge of engineering and manufacturing and later as himself vice-president in charge of engineering.

Mr. Pratt has never lost sight of those things which count so strongly in the development of engineers—the education and training of students in the "test" courses and of drafting-room apprentices and students in other branches of the manufacturing divisions of the company. He is a careful student of engineering education and is an active member of organizations devoted to its development. Mr. Pratt's keen knowledge of men has always enabled him to fit the best man to the right job and thus attain the utmost in co-ordination of engineering efforts. By closely directing the developments of a large body of technical men he has been successful in developing both in the general office and the field an organization which may be said to stand second to none in the effectiveness with which it carries on its work. In combining the broadest principles of administration with thoroughness in attention to engineering detail Mr. Pratt has achieved distinction in his chosen work. He is noted as a man who gets things done.

Born in Hartford, Conn., Jan. 19, 1861, of New England stock, he was graduated with the degree of Ph. B. from Sheffield Scientific School of Yale University in 1888. In 1890 Mr. Pratt entered the plant of the Pratt & Whitney Company, Hartford, of which his father was president, the son advancing to vice-president. In 1906 he became associated with the General Electric Company as assistant to E. W. Rice, Jr. In 1912 he was appointed assistant to the president and in 1919 was elevated to the vice-presidency in charge of engineering. He is a member of the A. I. E. E., the A. S. M. E. and other bodies and has been active in services to industry, science and public affairs outside strictly engineering lines.

Editorial Comment

Electrical World, July 14, 1923

Volume 82 Number 2

Coal—Another Public Utility

IN A REPORT at once dignified, comprehensive and conclusive, and of a quality to be expected from the character of the men who compose it, the United States Coal Commission recommends definitely that the anthracite-coal industry be henceforth treated as a public utility. There is also an indication that this preliminary report on anthracite presages a similar conclusion in the bituminous field.

The direct interest of the electrical industry in the coal industry is largely confined to the assurance of an adequate and certain supply of coal at prices consistent with good business. And this interest, of course, is principally in the bituminous supply. But indirectly the fact that the coal industry is actually to be a public utility is of sufficient interest to existing public utilities to make a study of the situation of value. The report includes a measure of indictment of both operator and miner. There is quite evident, in fact emphatically evident, the assumption as a matter of course that whatever is done must be done in the public interest and the conviction that affairs of the industry have so far been handled in such a way that government must step in and supervise. On this point coal men have not been without advice from the operators of present public utilities who have learned by experience that the way to avoid government interference is to anticipate the demands of the public. As J. W. Gleed recently pointed out at Oklahoma City (an abstract of his address appears elsewhere in this issue), those in charge of any business have its destiny in their own control in so far as they show themselves able to exercise an intelligent control.

But more important than that coal should be declared a public utility is the fact that, declaring it a public utility, the coal commission, with all the facts in its possession, goes on record as strongly against government ownership and operation. It rightly concludes that the greatest success will be attained only through private operation—guided and guarded, on account of the nature of the business, by some governmental agency. And it should be well and gratefully noted that the commission has carefully differentiated between proper supervision or regulation on the one hand and management, which is an improper function, on the other.

Three times now in the past four years has some government agency investigated a public utility business and, with only the public interest in view, concluded that such business is best conducted by private agencies with suitable government supervision. The Esch-Cummins act, the result of Congressional deliberation over the railroad situation, is one example; the Federal Electric Railways Commission's investigation into and report on the electric railway situation is a second, and the Coal Commission's report is the third. It is a fitting tribute to the ability and character of public utility management that all investigations and analyses based on actual fact lead to this conclusion.

Why Not a Woman's Advisory Board?

EQUIPMENT and service for the home are steadily becoming a larger and larger factor in the business of the central-station company. In its advertising as well as in conversations with customers the utility is having more and more to say about household comfort and labor saving, which mean methods and management in housekeeping. Right here is where the feminine element should come in. A man-made home is no home at all, and the wise company will neglect no opportunity to enlist the aid and counsel of the women of its organization to save it from blunders like the one made in a recent home electric, man-planned, where the milk warmer was a feature of the guest room. Similar offenses against the good sense of the housewife, no less glaring to the feminine mind, often escape the notice of the denser sex.

There is need for the co-operation of a woman's committee composed of employees and perhaps members of employees' families—for both are literally members of the organization—to act as an advisory board on questions that concern the home and the manner in which the company approaches it and tries to influence it in all points of advertising, selling and service. It is in these relationships that the good name of the utility is established and the market for electrical appliances is developed, and without the appreciative good will of the housewife progress will be slow.

Agricultural Thinking on Electric Service Problem

TO HEAR a better analysis of some of the important phases of the rural electric service problem than most central-station men could give from a man unconnected with the electrical industry is rather startling. It was, however, the experience of the North Central Electric Association at Minneapolis last week when Prof. E. A. Stewart of the agricultural department of the University of Minnesota discussed the problem. He criticised rather severely the lack of uniformity in the practices and ideas of the central-station men on rural service, because, he said, it creates distrust and suspicion in the mind of the farmer who is not familiar with the matters involved. Professor Stewart among other things took a very strong stand against the forms of rates that attempt to conceal part of the fixed costs in high minimum or energy charges, saying that they discourage the use of energy. He made an equally strong plea for the use of a fixed charge form of rate in which the fixed charge shall

cover the cost of carrying the service and thus allow a low energy rate that will encourage usage.

It is probable that many central-station men will disagree with Professor Stewart in his views and in the provisions of the uniform contract he is trying to work out in Minnesota. Dissent from views of a subject on which central-station men have so far failed to reach a common ground of understanding is not a serious discredit. The significant thing is that the character of thinking exhibited by Professor Stewart is going on in the ranks of men who are the trusted advisers of the farmer. The incident is just another straw showing the extent to which the matter is becoming more than a central-station problem. It and similar incidents will serve as a spur to central-station men all over the country to make them study the problem and themselves take the lead in thought along this line. A conclusion must eventually be reached and the electrical industry should earn the credit for finding it.

A Dream—
But It May Come True

THE announcement made before the Technical Section of the N. E. L. A. last month by C. W. Stone of the General Electric Company that radical innovations may come to pass in electric transmission and distribution practice if electron tubes are further developed and applied in the power field can hardly be considered as a wild dream. Certain electron tubes are known to have characteristics which suggest many applications he mentions. How soon his prophecies will be fulfilled depends to a great extent on the further development of tubes to secure greater reliability in operation with adaptability to handling greater amounts of power, and upon the economic pressure which may force their adoption.

Electrical engineers have learned by experience that evolution of the art comes at a rapid pace. And without leaving the possible, though venturing into the probably distant future, it is inviting to dream a little further than even Mr. Stone did. For instance, assume that electron tubes can be made to act as perfect valves, a condition they already approach to a certain extent. Assume that at least one type of tube can convert direct current to alternating current of any frequency merely by adjusting the frequency through the magnetizing coil and that alternating current of any frequency can be converted to direct current by the reverse process. It is not difficult to imagine that such tubes might be used to replace circuit breakers, rotary converters or even pole-type transformers under some conditions. Where it is desirable to take advantage of high-voltage direct-current transmission the tubes could again be used for changing from alternating current to direct current at the generator end of the line and for changing back to alternating current at any frequency desired at the delivery end. In addition, imagine what might be done in simplifying the speed control of synchronous motors by utilizing the adjustable frequency output of a "direct-current-alternating-current" electron tube. Add to these possibilities the opportunity of using electron tubes as relays for remote control by carrier current or space radio, and the possibility of using an axial magnetron as a bushing-type insulator for supervoltage, and power engineers must see the need of brushing up on electron-tube theory before innovations outrun their theoretical knowledge.

Of course, no one will jump at the conclusion that tomorrow will see such a program realized. All know that much research is to be done, much experimenting to be carried on, that much sad field experience must be had before a real beginning can be made, even if it all does come true. But this much is certain, the advance and accomplishment already a fact in electron-tube engineering should make engineers who plan constructively for the future keep these developments in mind with an eye to their possibilities.

Need of New Viewpoint
in Wooden-Pole Specifications

THE wooden-pole purchase situation is in more or less confusion because of the apparent breakdown of the effort to revise the Western red-cedar specifications and the fact that there are a number of kinds of poles in the market for which there are no recognized specifications. The biggest supply of this latter kind is of the creosoted Southern yellow-pine pole, which has made rather rapid progress in some markets in the last two or three years. The old so-called N. E. L. A. specifications are still used in the purchase of Western red cedar, and the proposed specifications that were apparently accepted as a substitute at the Atlantic City convention have never become effective because the Western Red Cedar Association has not formally accepted them, its failure to do so being attributed to difficulties of production and yarding under the specifications requirements. The American Engineering Standards Committee is coming into the situation by the formation of a sectional committee for the consideration of this subject.

Under the circumstances there is a doubt as to what sort of action should be taken. There is legitimate ground to question whether the subject ought to be approached from the viewpoint of the old specifications or whether it should be taken up from a totally different angle. A prime consideration is the slowly diminishing supply of poles, and this requires that there be an effective conservation of the available supply. An attempt made recently to ascertain the understanding among the smaller central-station men of the meaning of the old classification, "A," "B," "C," etc., yielded the interesting result that most of them were assigning a meaning of "good," "bad" and "rotten" to a classification that is purely dimensional and therefore one of strength. The reason for this lies in the fact that timber quality and strength specifications have never been clearly differentiated and the dimensional classification has been associated in the mind of the user with specifications of quality. This has undoubtedly led in many cases to the purchase and use of a pole of higher strength than is necessary, which is really an economic waste.

As a purely engineering matter the wooden-pole specification might be written in two parts. The first part would be a timber quality specification applicable to poles of all dimensions and would vary with different kinds of wood. The second part would be purely a strength grading in which the older classifications by letters would be determined and stated as certain strength requirements. These would be nominal, based on the dimensions and average fiber strength of poles of a given kind of wood, since it is impossible for the producer to give more than a certain quality of timber

and certain dimensions, these being both matters of selection and not under the producer's control as is the case in a manufactured article. With such a specification the buyer would be forced to select first for quality of timber and next for strength. If properly written, the specification should go far toward wiping out the erroneous assumption that the present classifications represent quality of timber and should encourage the use of poles in accordance with the strength that is required.

There are other questions, of course, to consider in the general revision of pole specifications. A different specification for Southern yellow pine is needed; the chestnut supply is decreasing yet the chestnut specification may need revision; pole-treating methods should be considered in their relation to specifications. While the American Engineering Standards Committee is at work on the matter and everybody is in the mood for work, a complete job should be done. To accomplish this it will be necessary to do more than follow the beaten path.

Short-Sighted Action Should Cause Enduring Reaction

THE engineers of this country have risen in righteous indignation at the summary dismissal—for that is all it can be called—of Director Davis of the Reclamation Service of the United States. That such action should come from a professional man is surprising, if not astounding. For Secretary Work is a physician and past-president of the American Medical Society, and Director Davis is a leading civil engineer and past-president of the American Society of Civil Engineers.

The question involved is not a personal one nor a political one, but one of principle and the best interests of the country. Can engineers have failed in their efforts to be of public service? The records surely indicate the opposite, and emphatically so in this particular case, for Mr. Davis' accomplishments and ability in the Reclamation Service were well recognized by the engineering profession and the public in general. But, laying aside all question of personality, if there had to be a change in the executive head of the Reclamation Service, the proper sort of person to be that executive head was an engineer—some one with an engineering background whose decisions would be made with full knowledge and appreciation of the practical possibilities as well as of the social and economic consequences of action or inaction.

Engineering pride has been hurt—yes. But, more important, if this is the beginning of an effort to put the country's public works still further into the hands of amateurs, it is a situation which needs action, not mere bewailing. Is the public health service to be administered by a former carpenter, the Bureau of Standards by an economist, the Coast and Geodetic Survey by a retired fisherman, the Department of Justice by a clothing merchant? It is encouraging that the Federated American Engineering Societies and the American Society of Civil Engineers have immediately taken steps to try to have the whole situation investigated. Let it be hoped that this occurrence will lead to a public demand too strong to be disregarded that administrative functions which are almost entirely technical in nature be vested in those whose technical training and experience will give reasonable assurance of intelligent performance.

Practical Field Testing of High-Tension Insulators

IT IS not a difficult matter to apply break-down and flashover or similar tests to insulators assembled for service but not yet put out in the field. Such tests are effective in picking out merely those insulators which are initially faulty and which may have escaped detection in the factory. Once the insulators are out on the line, however, their active history begins, and experience has shown that a good many failures in service actually occur in spite of preliminary tests on account of one sort of deterioration or another. It therefore becomes necessary in line operation to find out something about the endurance of the insulators under the conditions of service; in other words, to detect signs of coming failure. If possible, some quantitative notion of the amount of deterioration should be obtained.

It is evident off-hand that whatever the test is it must not run the risk of starting a short circuit or of changing the leakage conditions at the insulator so as greatly to disturb the conditions of strain which normally exist. Of the methods which have been thoroughly tried out, the most promising are those in which contact with an insulator shell or around a shell is made by heavily insulated contact points so that the leakage current produces a characteristic buzzing in the connected telephone the amount of which varies roughly with the extent of the leakage. Other methods used depend on measuring the leakage current around an insulator shell by the length of the feeble arc sustained by leakage when the short circuit is open.

The general drift of practice is evidently toward the telephonic methods, which are rather more easily applied and produce a minimum amount of disturbance to the potential distribution in the insulator string. Good protection can be insured to the operator by any of these methods. The point is that all depends on a somewhat rough-and-ready method of estimating the leakage current. An experienced operator really picks out the bad insulators by the increase of noise in the telephones as compared with known good insulators. The relation is therefore a matter of skilled judgment rather than of measurement, but the fact remains that the field test even with this limitation gives good results.

For instance, on a certain line telephonic tests showed that about one-third of the insulators were likely to cause trouble. When these particular insulators had been removed there were no failures for nine months where previously there had been about one failure per week. In other instances the same sort of testing promptly detected a considerable number of faulty insulators on a new line and detected the bad insulators on an old line, which were then removed, but, the troubles continuing, it very soon turned out by further testing that the replacement insulators taken from stock were deteriorating rapidly. Comparison of the telephonic tests with subsequent break-down tests on insulators found to be defective showed a very high correlation between the field and the laboratory rating.

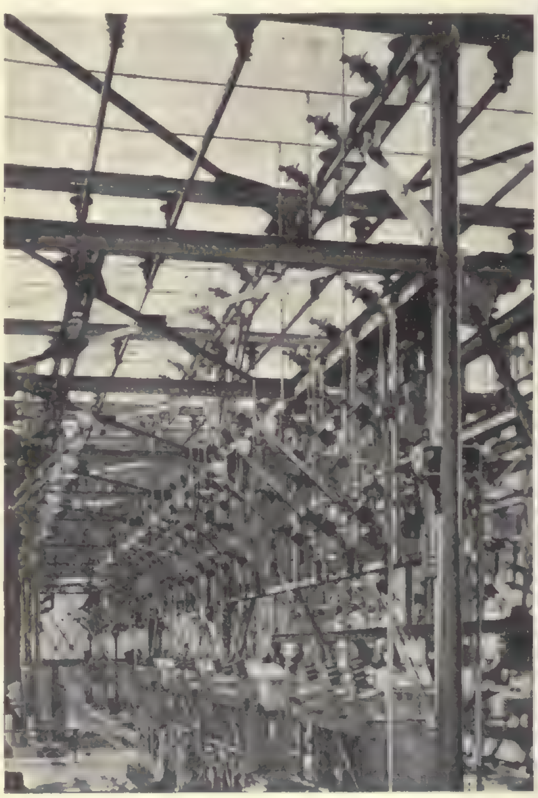
The weakness of the telephonic tester is that results are only qualitative as yet. While a first-class operator can obtain much valuable information by its use, it is a little difficult for him to compare notes with another operator. It would seem possible to devise a more accurate method of measurement such as the use of a milliammeter in the plate circuit of a radio tube whose grid charge will be influenced by the condition of the insulator under test.

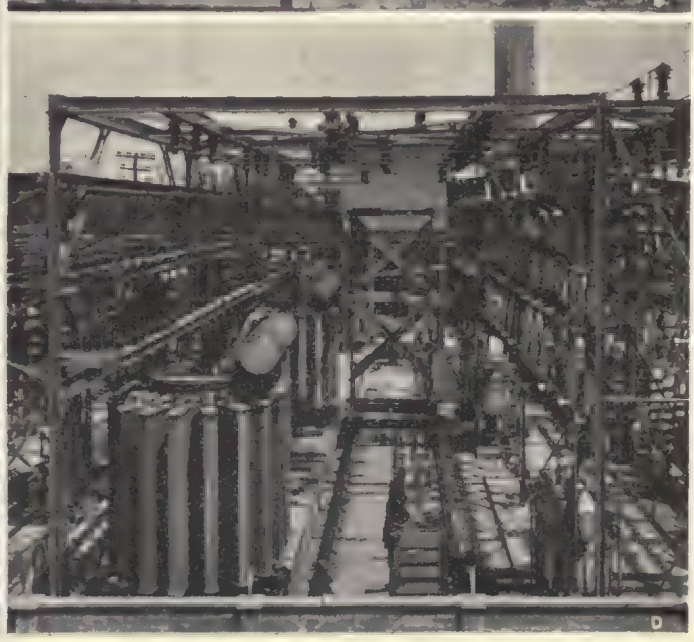
44,000-Volt Cable Loop Feeds This Substation of the Westchester Lighting Company

TO SERVE the rapidly growing needs of Westchester County, N. Y., a 44,000-volt cable loop has been installed and connected with the Sherman Creek station of The United Electric Light & Power Company. This loop supplants a now inadequate 13,200-volt network and is expected to meet the needs of the next fifteen years. Single-conductor 500,000-circ.mil cable is used having $\frac{39}{64}$-in. paper insulation between the core and lead sheath. The joints, as explained in the following article, are specially constructed.

Sections of the substation fed by 44,000-volt cables are shown in the illustrations: *A* is the 13,200-volt bay, *B* is the 44,000-volt bay, and *D* is the transformer bay lying between these sections; *C* shows some of the 13,200-volt feeder equipment. Three incoming 44,000-volt cables may be discerned rising out of the concrete work in the right center of *B*.


A




D

Underground Transmission at 44 Kv.

Growth of System and Economical Operation Dictated the Use of Single-Conductor Cables with This Rating—Details of Installation and Type of Joint Used—18,000-Kva. Self-Cooled Transformers

By R. E. DENNIS* and H. R. SEARING†

DEMANDS on the Westchester Lighting Company for energy have grown so rapidly during the last several years that the 13,200-volt network fed from the Sherman Creek station of the United Electric Light & Power Company would have become inadequate this year if plans had not been laid in the fall of 1921 to cope with the situation. An analysis showed that raising the existing voltage to 22,000 volts would not have provided adequate service long enough to justify the expense of change-over. However, it was ascertained that the provision of a 44,000-volt loop could be justified as to expense if the use of such high-voltage cable as might be needed was found advisable from an engineering viewpoint.

Since the last plan involved the installation and operation of 44,000-volt underground cables for the first time in this country, attention was first directed to the practicability of such a system and then to the cost.

Information obtained concerning systems in Europe using equally high-voltage underground cable systems indicated that there was no reason to believe that a similar system would be unsuccessful here. Accordingly, plans were begun for the first part of a comprehensive construction program which would eventually complete a 44,000-volt loop system (Fig. 2). It was decided to begin by installing the two 44,000-volt cable feeders between Sherman Creek station and New Rochelle, with the necessary step-up and step-down substations and of sufficient capacity to care for the estimated loads for a period of fifteen years. To do so, six single-conductor, 500,000-circ.mil cables would be required, and at the estimated peak loads to be supplied from New Rochelle a regulation, under normal operating conditions, of 1½ per cent, and with one feeder out of service of 4 per cent, would be had. Such cables would have current-carrying capacity sufficient also for emergency operating conditions.

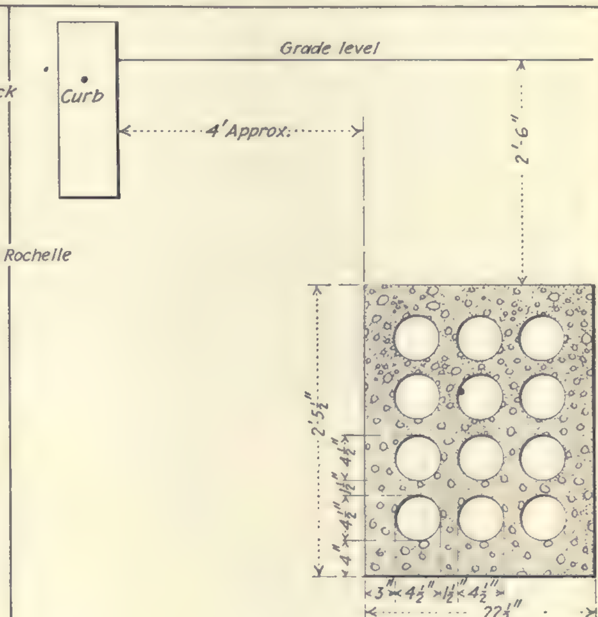


FIG. 1 (LEFT)—13,200-VOLT FEEDERS FORMERLY SUPPLIED THE WESTCHESTER LIGHTING COMPANY. FIG. 2 (CENTER)—44,000-VOLT CABLE LOOP WILL SERVE INCREASED DEMANDS. FIG. 3 (RIGHT)—TWELVE DUCT RUNS PLACED 2½ FT. BELOW GRADE LEVEL AND 4 FT. FROM CURB

TWELVE 4-IN. DUCTS USED

Underground ducts were already installed between the Sherman Creek station and the New York City line which could be altered to supply room for the new feeders. There was no duct system beyond this point, so in the spring of 1922 construction was started on a subway to contain nine 4-in. ducts for 44,000-volt cables from the New York City line to a point near the Mount Vernon-Pelham line where three ducts for 13,200-volt cables were added, making twelve 4-in. ducts from this point to the step-down substation to be provided at the company's generating station in New Rochelle. The route covered approximately 23,000 linear feet, or a total of 250,000 duct-feet. This subway was of standard design with ducts (Fig. 3) using standard (socket-joint) fiber conduit. Manholes (Fig. 4) were placed

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†Assistant electrical engineer The United Electric Light & Power Company.

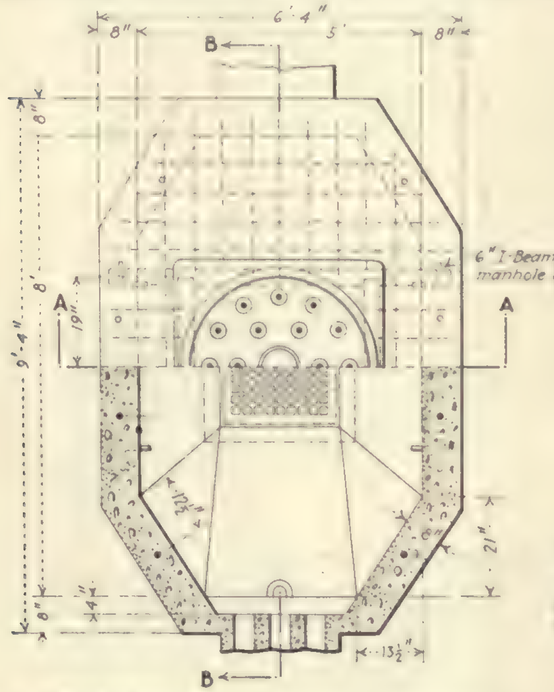
approximately 300 ft. apart except where special conditions required other spacing.

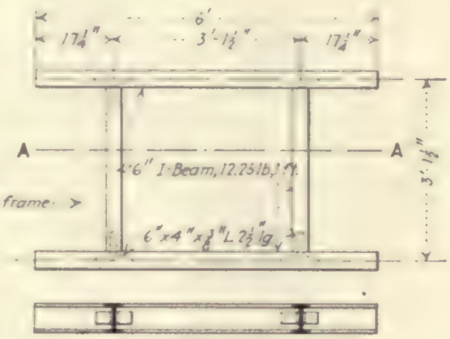
The contract for the construction of the subway was awarded to the Hickey Contracting Company of New York City, specialist in this type of work, and was completed early in the fall. The specifications for this subway called for the very best of materials and labor, with inspection of every foot, and the construction work was carried on in such a way as not to interfere with vehicular traffic over virtually the entire route.

The length of subway from Sherman Creek to the northern line of the city of New York was 34.535 ft. and required very little alteration for the new installation. The route was north on Manhattan Island, across the Harlem River in submarine cables, and through the Bronx to Pelham. The total length of cable was approximately 346,000 ft., or 66½ miles, made up of two feeders of three cables each, and all the cable was 500,000-circ.mil, $\frac{20}{32}$-in. paper insulation, ⅛-in. lead cover.

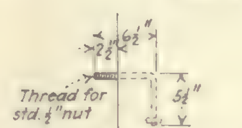
The cable was ordered, in specified lengths, from the Safety and Habirshaw companies. The orders were arranged so that each feeder would be of one make of cable only. Cable delivery was started in the autumn of 1922, but severe weather conditions prevented installation during the winter. The installation work was done by the transmission and distribution department of the United company. The storage of the cable as it was delivered taxed the facilities of the United company, as at one time there were 700 reels of 44-kv. cable in the yards.

With the opening of the season the work of pulling in the cable was resumed. Using two cable gangs with gas trucks, an average of 30,000 ft. of cable was installed per week. The cable was hauled from the cable yard to the job at night, using the same trucks which pulled in the cable in the daytime. In order to insure the cable against moisture, a splicer accompanied each cable gang and wiped a seal on the end of the cable

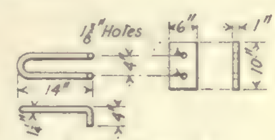




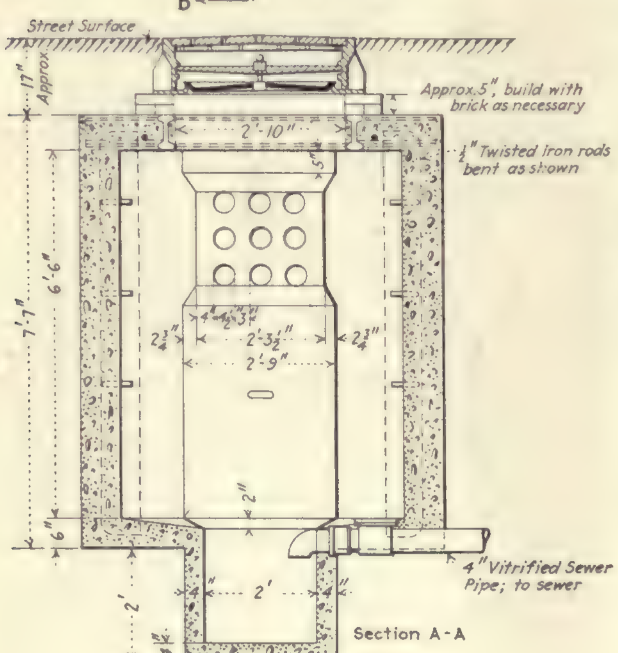
Detail of Manhole Casting Suporting Frame



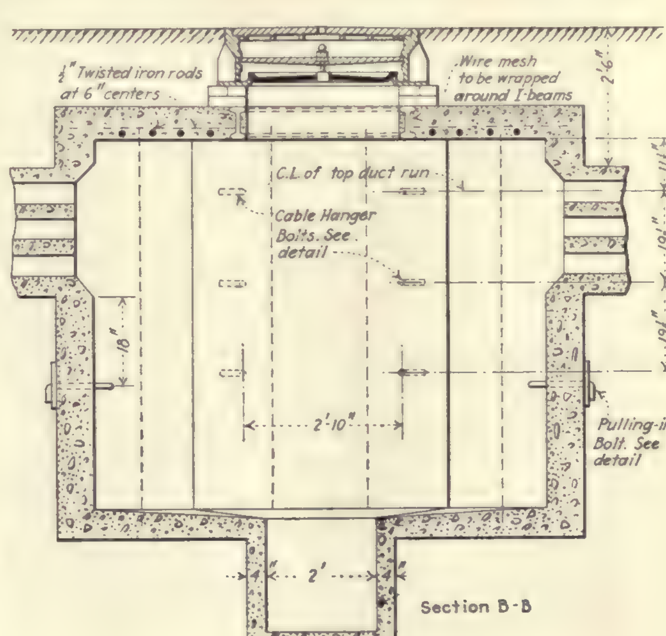
Detail of ½" x 12" Galvanized Iron Bolt for Cable Hangers



Detail of Pulling-in Bolt



Section A-A



Section B-B

before installation. The subway system throughout the route of the feeders was very wet on account of the low elevation and proximity to Long Island Sound. It was felt that this precaution was well paid for, as no "wet ends" were experienced.

The crossing of the Harlem River was provided for by special submarine cables, lead-covered, jute-served,

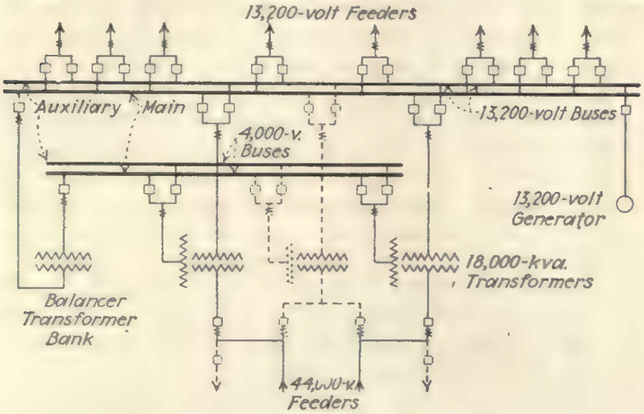


FIG. 5—SINGLE-LINE DIAGRAM OF TRANSFORMER STATION CONNECTIONS

steel-wire-armored and jute-served over all. The insulation on each cable was increased to $\frac{24}{32}$-in. paper. Precautions were taken in laying on the armor wire to prevent adjacent strands touching, so as to minimize the loss due to flux interleakage and sheath currents.

The ducts were selected so that the three cables of one feeder formed a right-angle triangle with a spacing of 5 in. - 6 in. on the sides and 7 in. - 9 in. on the hypotenuse.

The existing subway lines from the east bank of the Harlem River is composed of iron pipes under the New York Central Railroad tracks. In order to make use of vacant pipes on this run and still avoid the heavy loss due to the magnetic effect of the iron, the following expedient was resorted to:

A copper-bond cable was installed with each single-conductor cable and the ends bonded together. This combination acted like a current transformer, each bond cable carrying approximately the same current as the line cable. The flux density in the iron was negligible and the effective copper loss double that of cable alone, compared to fifteen times without the bonding.

Forced to Develop a Splice

The type of splice to be used received careful consideration. While a single-conductor splice was simple in respect to the nature of the stresses developed, these stresses were high and had to be provided for. Accordingly, as soon as the line was projected, development work was begun on a joint. The United company had previously developed satisfactory joints for three-conductor operation up to 26 kv. and had a corps of able splicers to undertake the new installation.

The story of the development is too long to give here, but the results verified the facts already recognized. Successful joint construction is a problem of workmanship. Air and moisture must be excluded, and the insulation must be homogeneous and free from foreign matter.

Illustrations show the method of making up the type of joint finally adopted. The conductors are joined by a standard connector with beveled edges, the mill insulation is penciled down, and the insulation built up to its level with black cambric tape. The joint is then wrapped with a paper strip 14 in. wide and 55 ft. long, tapering in width to 10 in., so as to form a tube, when tightened up, of $\frac{10}{32}$-in. wall. The outside dimensions are 26 in. long and 4 in. in diameter. The joint is filled with petrolatum obtained from the cable manufacturer, of the same grade as that used to impregnate the cable.

Referring to the design, the cambric tape was used because of its mechanical qualities, not its dielectric strength. It is possible to wind on the cambric much tighter than paper tape of the same width. The result is the reduction of entrapped air, especially along the penciling. Another point in favor of cambric is the higher permittivity, resulting in a grading effect, distributing the stress throughout the joint.

The paper tube was adopted because of the fact that it could be wound tightly on the cable, while a solid tube of equal insulating value would have to be larger in diameter than the cable in order to slip over it during joining. The space between the cable and the tube might not be completely filled with compound, causing ionization of the entrapped air.

Tests on this joint, made over a number of hours, indicate that it is superior to the best of the cable. The questions of the life of cambric tape under stress and the migration of petrolatum from the joint can only be answered by time, although no fear is entertained by the designers.

This joint requires about four hours' time to make and the work of splicing was undertaken at the rate of three joints per day per man. By cleaning up a manhole in a day (one feeder) the actual cost per joint

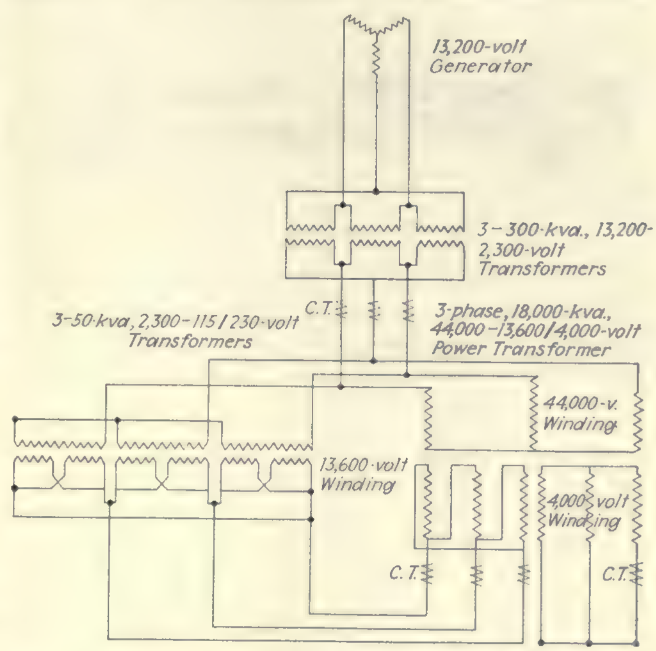


FIG. 6 — THREE 50-KVA., 2,300-VOLT TRANSFORMERS USED TO BUCK 13,600-VOLT WINDING OF 4,000/44,000-13,600-VOLT TRANSFORMERS TO PERMIT PROPER LOADING

was reduced on account of overhead charges (automobiles, pumps and supervision).

Transformer Stations

A description of the step-up equipment at the Sherman Creek station appeared in the March 31, 1923, issue of the ELECTRICAL WORLD. The neutral of the 44,000-volt Y is dead-grounded at this point, since it

was felt that overcurrent disturbances could be more easily handled than overvoltage disturbances.

At the receiving end provision is made for the two incoming 44,000-volt feeders and the future extension of two similar feeders to Mamaroneck; also for eight 13,200-volt feeders, a connection to a 13,200-volt generator and a balancer transformer bank (Fig. 5).

The transformers are arranged for an ultimate installation of three units of such size that two of them will equal the carrying capacity of one of the 44,000-volt feeders, which is about 35,000 kva. for two hours. The cost of cooling water made self-cooled units advisable, and so self-cooled three-phase transformers with a rating of 18,000 kva., two hours 55 deg. C. rise, were decided upon. To avoid double transformation a two-winding secondary was adopted to supply the local distribution load as well as the transmission system, the capacity of the transformer being divided between 12,000 kva. on the 13,600-volt winding and 6,000 kva. on the 4,000-volt winding. The change from a two-phase to a three-phase distribution system was to be made at the same time these transformers were installed, and thus it was possible to use a direct three-phase transformation with the 13,600-volt winding as a tertiary. Two transformers were purchased for the initial installation. They are core-type, of General Electric manufacture, with a circular-coil 44,000-volt winding Y-connected, a circular-coil 13,600-volt winding delta-connected and interleaved with the 44,000-volt winding, and a helical 4,000-volt winding concentric with and inside of the other two. They are reported to be the largest of this type yet manufactured.

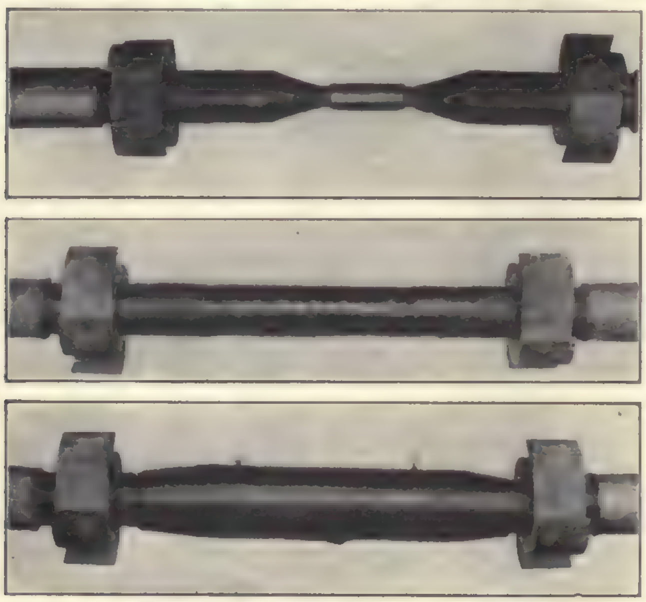


FIG. 7—SINGLE-CONDUCTOR 44-KV. CABLE JOINT

Top—Connector in place before building up insulation. Middle—Paper wrapping in place. Bottom—Cambric tape applied.

Since the proportion of capacity available in the 13,600-volt and 4,000-volt windings might not agree with the demands, a balancer transformer bank was arranged to step from 13,600 volts to 4,000 volts when additional capacity was needed at one secondary voltage and was available at the other. Likewise, a connection was made to a reserve 13,200-volt generator.

On account of the liability of dangerous transients being set up in the cable feeders in case of short-circuit or as a result of switching operations, it was considered advisable to insulate the substation throughout for 66,000 volts, with the 44,000-volt cable end bells designed for a working pressure of 73,000 volts. All insulators and spacings on the 44,000-volt bays, therefore, are standard for 66,000-volt operation. The high-tension windings of the transformers received a high-potential test of 133,000 volts for one minute, and as additional protection 66,000-volt oxide-film lightning arresters with plates for 44,000-volt operation are connected to the buses adjacent to the end bells. No choke coils, however, are used.

Until such time as the additional transformer and 44,000-volt extensions to Mamaroneck are installed the two transformers are considered an integral part of the feeders. The 44,000-volt switches are therefore non-automatic, and the 13,600-volt and 4,000-volt switches are automatically operated by reverse power relays. The 44,000-volt bus connections are made so as to provide selectivity of feeders and transformers with the present installation and yet be capable of parallel operation when the additions mentioned above are made.

The oil circuit breakers were furnished by the General Electric Company, and 400-amp., 73,000-volt, form 9 A-S, and 400-amp., 15,000-volt, form 6 B-S, both type FKO-36, are used.

The disconnecting switches and busbar supports were furnished by the Electrical Engineers' Equipment Company. The disconnecting switches are of the construction known as tongue type, and those used for both 66,000 volts and 15,000 volts are illustrated. The switches and bus supports were required to have all parts above the insulator of either copper or brass to obviate the necessity of painting galvanized metal, owing to the severe atmospheric conditions of this locality. Both switches and bus supports were specified to pass a standard wet test of 135,000 volts for 66,000-volt service and 60,000 volts for 15,000-volt service. The metal fittings are clamped both to top and bottom of the insulators with detachable three-point brass rings using a cushion of woven-copper ribbon underneath to protect the porcelain from strain due to irregularities in the surface or unequal tension of the clamps. In addition, a standard pin is cemented into the bottom of the insulator. The result is a strong, rigid structure with mechanical strength greatly in excess of that required even under extreme conditions.

The standard soldered lugs were not desired for connections from buses to equipment, and special Frankel solderless connectors were used. Terminal posts on end bells, switches, etc., are designed for their use. By this means attachments are made which can be easily and quickly connected and disconnected. The same device, somewhat modified, is used for joining sections of the high-tension buses. Some of the various designs used are shown.

The construction work was done under drawings and specifications prepared by Thomas E. Murray, Inc. It was originally intended to have a steel structure galvanized throughout, but, when partly completed, difficulties encountered in galvanizing the long members and other circumstances made it necessary to abandon this plan.

The specifications stipulated that all wires and cables, high-tension, low-tension or control wires should enter and leave the substation under ground. To avoid carrying all the instrument and control wires to the switchboard, an outdoor terminal house was installed at a convenient place in the structure. Two sources of direct current are carried to buses in this house, and

the disconnecting links for testing, etc., are placed there. Automatic relays provide for a continuous supply of direct current as long as either source is alive.

The size of the transformers prevented shipping them filled with oil. The core and coils were shipped as a unit and the rest of the transformer was assembled on the ground. Weather conditions were not favorable at the time for out-of-door assembly, and so particular care was taken in drying them out. After the core and coils were put into the tank, the radiators and all fittings were assembled as though the transformers were being made ready for service. They were then filled with warm oil and the usual impedance heat run started. Difficulty was immediately encountered in loading up the three windings equally. Moreover, even winding sufficiently to permit loading the 45,000-volt and 4,000-volt windings. When these connections were made, and with the other means described above, it was comparatively easy to raise the top oil to about 80 deg. C. After seventy-two hours of continuous filtering at this temperature the samples of oil drawn withstood a test of 35,000 volts with the standard gap. As this was the limit of the voltage range of the testing transformer, no effort was made to determine the actual dielectric strength of the oil.

Following full potential for several hours and a ratio check made on account of the field assembly of the tap changer, the transformers were considered ready for service.

It is interesting to note that the charging loads

FIG. 8—13,200-VOLT AND 66,000-VOLT DISCONNECTING SWITCHES

at a considerable overload it was impossible in this way to raise the temperature more than about 10 deg. C. above ambient. The transformers were then placed on their foundations and a wooden house built as closely about them as possible. A live steam line was run into the house, and a five-pipe heating coil was run the entire length on one wall just above the floor. Even after this was done it was impossible to obtain the proper temperature. The oil was lowered about a foot below the top of the radiators to prevent circulation, and a De Laval oil separator was used to circulate the oil through a heating coil (where a rise of about 10 deg. C. was secured) and filter it at the same time. By this means heated oil was constantly pumped into the tank during the heat run.

The unbalance in the loads taken by the three windings still prevented satisfactory results; so three 50-kva. standard 2,300-volt distribution transformers were connected as shown by Fig. 7 to buck the 13,600-volt

of one line is about 2,500 kva. leading. A network of such feeders would aid considerably in the improvement of power factor.

The operation of this installation will be watched with great interest. From the test results on cable and joints higher voltages on underground cable can be expected soon. Single-conductor cable will probably be used entirely for this class of work, because of its simplicity and the fact that faults can occur only to ground.

Many of the textbooks on civics were written before the regulation of utilities became a governmental function, either state or national, hence contain nothing in relation to the subject. But there is no longer any excuse for failure to include proper treatment of these subjects, and the lack of such text is a reflection on the intelligence of educators and textbook writers.—E. V. KUYKENDALL at the N. E. L. A. convention.

Cooling of Turbo-Generators*

Rating Limited Only by Temperature—Elaborate Experiments Show Rate of Heat Dissipation with Free and Forced Ventilation—Rotational Effects Determined and Comparisons of Air with Water and Oil Are Made

By GEORGE E. LUKE
Westinghouse Electric & Manufacturing Company

IN ORDER to improve the rating of electric machines, it has long been the practice to use forced air ventilation. Radiation plays very little part in dissipating the heat from the internal rotor surfaces. Most of these surfaces are at the same temperatures; hence the heat interchanged by radiation will be small if any. Thus the cooling action obtained with forced air convection is due almost entirely to the transfer of heat to the air by conduction and convection.

These forced air streams may be produced by the fanning action of the rotating parts on the rotor, by an external fan or by a combination of the two.

Axial Ducts

The cooling of a machine by forcing air to flow through axial ducts in the core is a type of ventilation that is used in many machines, especially in railway motors and turbo-generators. Some advantages of this system of ventilation are:

1. The heat may flow radially through the iron to the ventilating surfaces without passing through the laminations. This is an advantage since the resistance to heat flow across the laminations is from thirty to fifty times that along the laminations.
2. The air flows through the ducts at a uniform velocity since the cross-section is constant. This gives a minimum air pressure for a given average air velocity.
3. Owing to the rough surface obtained, a high rate of heat transfer is obtained.
4. The core length of a machine will be a minimum for a given magnetic flux.

Some disadvantages of the axial system of ventilation are:

1. A fan or blower is necessary to force the air through the ducts.
2. The axial ducts must be placed in the core where the loss per unit volume is a minimum. This will give a fairly long heat-flow path from the tooth zone, where the maximum losses are found, to the ventilating surfaces of the ducts.
3. Owing to the space required by the ducts, the over-all diameter of the core will be increased.
4. The maximum iron temperature will usually be found adjacent to the hottest air; that is, near the end of the ducts.

The heat dissipated from the ventilating surfaces of axial ducts is influenced by the air velocity, size and shape of ducts and the roughness of the duct surface.

Radial Ducts

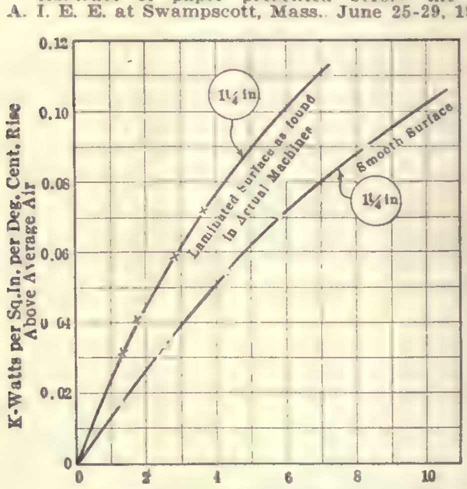
The most common method of cooling the cores of rotating machines is with the use of radial air ducts. Some advantages of the radial duct system are:

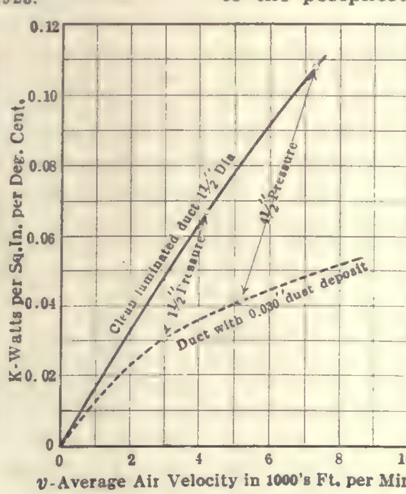
1. Radial ducts on the rotating element act as blowers, hence are self-ventilating.
2. Maximum air velocities are found where the losses are most concentrated; that is, in the tooth zone.
3. The air reaches the tooth zone before it has become appreciably heated, and the maximum air temperature is found where the iron losses per unit volume are a minimum.
4. Parallel ventilation of the end windings and the radial ducts is very simply accomplished.

Some of the disadvantages of the radial air duct system are:

1. On rotors having low peripheral speed the fanning action of the radial ducts is small, since the volume of air forced through is directly proportional to the peripheral speed for any given machine.

*Abstract of paper presented before the convention of the A. I. E. E. at Swampscott, Mass., June 25-29, 1923.





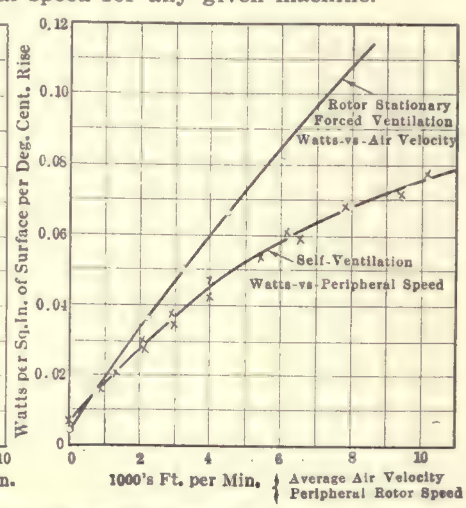


FIG. 1 (LEFT)—WATTS DISSIPATED FROM INTERIOR SURFACE OF AXIAL DUCT, SHOWING EFFECT OF SURFACE. FIG. 2 (CENTER)—EFFECTS OF COALDUST DEPOSITS ON DISSIPATION OF HEAT FROM AXIAL DUCTS. FIG. 3 (RIGHT)—DISSIPATION OF HEAT FROM SURFACE OF ROTOR 25 IN. IN DIAMETER AND 36 IN. LONG

2. The majority of the heat due to the iron losses in the interior of the iron packet between two ventilating ducts must be conducted to these ducts through the intervening laminations. Since the resistance to the flow of heat across the laminations is thirty to fifty times the resistance to the heat flow along the laminations, it is thus necessary to limit the length of the heat-flow path by close spacing of the radial ducts.

3. On high-speed machines, especially induction motors, the windage noise may be excessive for certain applications.

4. On machines using small widths of teeth the duct opening may be too small for effective ventilation and may become closed in service by dust and lint deposits.

5. On small diameter machines the air intake to the radial ducts in the rotor spider is apt to be restricted.

6. The radial ducts increase the gross core length and hence the distance between bearings.

The fingers or ventilating spacers used in the radial ducts are not only effective in mixing up the air flow streams but they also increase the ventilating surfaces. Calculations will show that on the average machine the average temperature of the ventilating spacers is at least 90 per cent of the main-duct surface temperatures. This additional ventilating surface on some machines will increase the effective duct surface as much as 30 per cent.

On machines of small diameter where the air velocity through the radial ducts is changing continuously the average heat dissipation can be taken on the basis of the average air velocity. This is justified by the fact that the heat-dissipation constant is practically proportional to the air velocity.

Tests have indicated that for all practical purposes the transfer of heat from the surfaces of axial or radial ducts is almost proportional to the average air velocity forced through these ducts. Experience, however, on the removal of heat from a rotating armature, for example, does not exactly agree with the above law. Furthermore, up to the present time no definite data were available regarding the effects of forced air convection currents along the surface of a rotating element. For these reasons this phase of the cooling problem was investigated on a model rotor.

According to data obtained with self-ventilation, the cooling curves bend over with high rotor speeds. This indicates that some of the hot air is carried around with the rotor. With forced ventilation, however, the air is forced to pass through the duct. The dissipation of heat is proportional to the number of air molecules passing a given surface and to the temperature difference between the surface and those air molecules. This is shown by the dissipation constant being roughly proportional to the air velocity with forced ventilation. The curve gives 0.004 watt per square inch per degree centigrade with zero air velocity. This is due to the fact that there was some air leakage caused by convection current. With self-ventilation about 0.008 watt per square inch per degree centigrade is dissipated with the drum stationary, owing to convection and radiation. It is estimated that with a peripheral velocity such as is obtained in turbo-generators of 20,000 ft. to 25,000 ft. per minute the dissipation constant will have reached its maximum value of about 0.10 watt to 0.12 watt per square inch per degree centigrade rise with natural ventilation. With forced ventilation under the conditions shown, there seems to be no limit to the amount of heat which can be dissipated. In practice, however, there are several factors which limit to a certain extent the maximum air velocity, such as friction and windage or blower input.

Although results of tests show that with respect to the rotor the heat dissipation is by no means proportional to the average air-gap velocity, yet with respect to the stator the conditions are entirely different and a heat dissipation roughly proportional to the air velocity is to be expected. With the high rotor speeds a high dissipation constant is obtained with low average axial air velocities. This indicates thorough mixing of the air and good scouring action of the rotor surface. However, under these conditions with a long core the temperature of air would rise to an excessive value, which would also mean an excessive iron temperature, unless other means of ventilation of the core were used.

Thus it is seen that under certain conditions more heat can be dissipated with the rotor stationary than when it is rotating with the same temperature rise and same quantity of air through the air gap per minute.

The air resistance along the stator is comparatively low, so that under these conditions high axial air velocities are found adjacent to the stator while the axial air velocity adjacent to the rotor is small. Thus with a rotor speed of 1,300 r.p.m. doubling the quantity of air through the air gap changes the axial air velocities

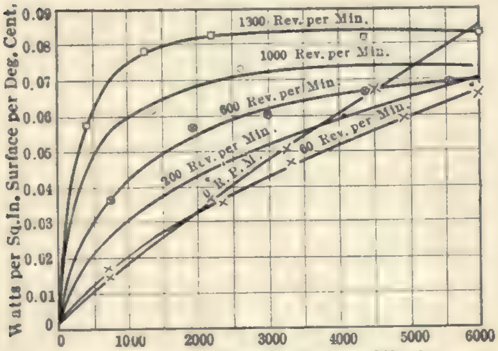


FIG. 4

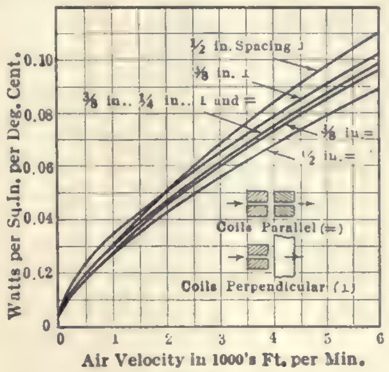


FIG. 5

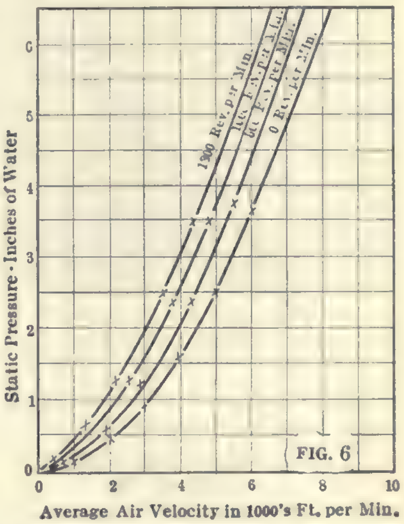


FIG. 6

Fig. 4—Watts dissipated from surface of rotor (25 in. in diameter, 36 in. long) with forced axial ventilation through single ½-in. air gap. It may be seen that with a high rotor speed (1,300 revolutions per minute) the heat dissipation constant is practically the same for air velocities ranging from 2,000 ft. to 6,000 ft. per minute. Conversely, it is seen that with the rotor stationary this dissipation constant is practically proportional to the air velocity through the air gap. With a rotor speed of 600 r.p.m. an intermediate condition is shown.

Fig. 5—Total static pressure required to force air through single ½-in. air gap (rotor 25 in. in diameter, 36 in. long).

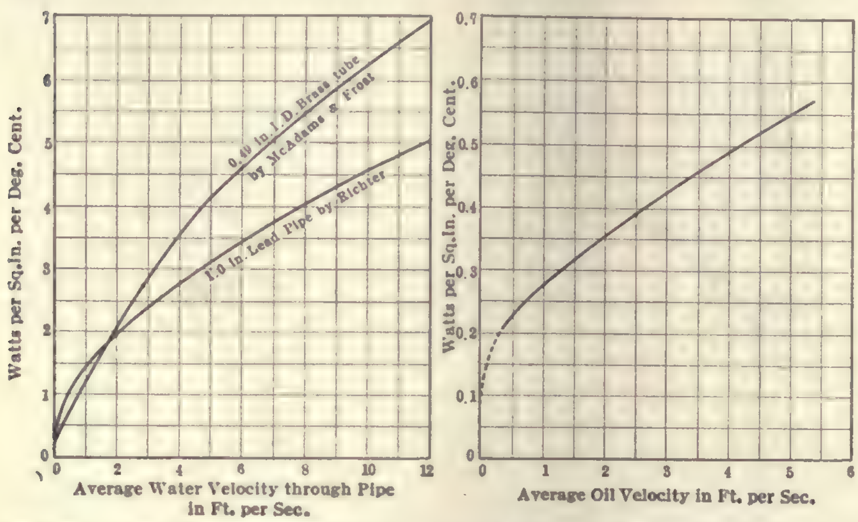
Fig. 6—Dissipation of heat from end windings by forced ventilation.

adjacent to the stationary air conduit, while the effective air velocity sweeping across the rotor surface is unchanged.

STATIC AIR PRESSURE

The disturbing influence of the rotating drum upon the flow of air through the air gap is shown by the accompanying static air-pressure curves. Thus an average air velocity of 3,000 ft. per minute through the air gap requires a total static pressure of 0.9 in. of water with the drum stationary. With the drum rotation at 1,300 r.p.m., or a peripheral speed of 8,550 ft. per minute, 1.97 in. of water static pressure is required to force through the same amount of air. Also, an average air velocity of 5,000 ft. per minute through the gap requires a pressure of 2.5 in. with the rotor stationary and 4.34 in. with a rotor speed of 1,300 r.p.m.

With a rotor peripheral speed of 20,000 ft. per minute, such as found in turbo-generators, and an average air-gap velocity of 5,000 ft. per minute, the total static air pressure which would be required for the apparatus tested amounts to 9.3 in. of water.



FIGS. 7 AND 8—COEFFICIENT OF HEAT TRANSFER BETWEEN METALLIC SURFACE AND FORCED WATER STREAM AND OIL STREAM RESPECTIVELY
(Viscosity of oil = 50 Saybolt)

DISSIPATION OF HEAT FROM END WINDINGS

The results of tests on the heat-dissipating qualities of end windings are shown in one of the accompanying curves. The values given for the ½-in. and ¼-in. air spaces are mean values for all the curves. This one curve is not only common for both types of ventilating spaces but is also common for both coil arrangements.

That is, the heat transfer coefficient is the same with the coil axes parallel and at right angles to each other. The values given for the ⅜-in. and ½-in. air spaces with the coils parallel lie below this mean curve, while the values for these spacings with the coils at right angles are above the mean curve. It should be noted that the rate of increase of the heat transfer per 1,000-ft. air velocity is practically the same as that given for the laminated axial ducts.

SUMMARY

Tests on the dissipation of heat show that the rate of heat transfer is approximately proportional to the average air velocity and not to the square root of the velocity, as has been previously published. Another unexpected result is that the unit rate of cooling of the small circular ducts tested was practically the same as that found for the larger ducts over a considerable air-velocity range. The rate of heat dissipation by radial ducts does not differ materially from that found for axial ducts; also, there is no great difference between the heat liberated from the narrow and from the relatively wide ducts.

The heat loss with self-ventilation, due to the rotation of a rotor, is not proportional to the peripheral velocity. The heat-dissipation curves for the rotor during rotation with separate ventilation along the periphery or air gap are very complicated, being influenced by both the peripheral velocities and the forced air velocities.

The great value of proper ventilation of the end windings in electric machines is shown by the rate at which heat can be dissipated from the surfaces with forced air ventilation.

Tests made with the air flow at right angles to cylindrical surfaces show a much higher rate of heat flow than was found from axial or radial duct surfaces.

A study of some tests for the heat dissipation constants obtained with water and oil cooling shows that the constants given for liquids are several-fold greater than those constants which apply for gases. Water is a medium which is particularly adapted to cooling apparatus, since it possesses a very high rate of heat transfer coefficient.

Forcing Most Economical Load Division by Reactors

SEVERAL typographical errors unfortunately occurred in the article by A. H. Sweetnam in the June 23 issue of the ELECTRICAL WORLD. The most confusing were in the explanation of the diagram on page 1464. The legend should have read as follows:

A—Total reactance required in No. 4/0 B. & S. line in order to divide current and kilowatt load with 300,000-circ.mil line (having 1-ohm external reactor) in accordance with respective cross-sections.
B—1-ohm external reactor in 300,000-circ.mil, 1-mile line.
C—1.482-ohm external reactor required in No. 4/0, 1-mile line in order that lines may divide current and kilowatt load in accordance with cross-sections.
D—1-ohm external reactor in 300-circ.mil, 5-mile line.
E—1.739-ohm external reactor required in No. 4/0, 5-mile line in order that lines may divide current and kilowatt load in accordance with cross-sections.
F—1-ohm external reactor in 300,000-circ.mil, 10-mile line.
G—2.061-ohm external reactor required in No. 4/0, 10-mile line in order that lines may divide current and kilowatt load in accordance with cross-sections.
H—2.382-ohm external reactor required in No. 4/0, 15-mile line in order that lines may divide current and kilowatt load in accordance with cross-sections.
J—300,000-circ.mil cable impedance.
K—No. 4/0 B. & S. cable impedance.

Under Table I, page 1463, a footnote appeared containing an equation giving the value of external reactance in ohms for No. 4/0, which should have read $1.4175(1 + 0.178N) - 0.188N$, where N = the length of the cable in miles. In Table II the fifteenth line of data should obviously have referred to a circuit 15 miles long. A parenthesis should have followed the figure 1.94 in the formula three lines below the cut in the first column on page 1464.

Effective Lighting Plan for a Small City

Fremont, Ohio, Affords Excellent Example of the Way in Which the Demand for Improved Illumination of Streets Due to Intercity Automobile Traffic Can Be Met in Places of Small Population

By EARL A. ANDERSON* and E. D. CHAPMAN†

THE tremendous increase in intercity passenger and truck automobile travel has brought better business to small cities situated on the line of travel. It has at the same time brought these small cities face to face with a condition of traffic and crime hazard which was not even thought of when street-lighting plans were being formulated a few years ago. There is not only a general increase in local traffic over the whole city, but also a cumulative concentration of traffic on main thoroughfares resulting from intercity traffic. Some of these highways now carry much more traffic than important streets in large cities. Unfortunately, with this traffic there has come the entry of reckless criminal elements from near-by large cities. Thus the small lamps and wide spacings of street-lighting systems which were once considered sufficient for towns and smaller cities are now totally inadequate; in fact, the street-lighting requirements on the principal thoroughfares in these towns are almost as exacting as those of the big cities.

Fremont, Ohio, a city of about 12,500 people, has been one of the first of the smaller cities to grasp the seriousness of this changed condition of traffic and to visualize the tremendous value of street lighting in advertising the progressiveness of the city to out-of-town users of its streets. At the expiration of the previous street-lighting contract the officials of the city determined upon a comprehensive redesign intended to meet the following points:

1. A closer spacing of lighting units on all residential streets which would eliminate dark shadows and create an atmosphere of safety and comfort for drivers and pedestrians, including women and children who had occasion to use the streets and sidewalks after dark.
2. A bright "white way" in the central business district which would attract trade and dispel an impression of deadness in the business district after nightfall.
3. Adequate lighting for the principal thoroughfare from city limit to city limit, making this highway thoroughly safe and comfortable for travel.

These desires had to be satisfied in as economical a fashion as possible, for Fremont, in common with most cities, was heavily burdened with other municipal expenditures. It was, therefore, not possible to provide for underground distribution except in the "white-way" system, and the choice of equipment throughout had to be made primarily on the basis of efficiency and neatness of appearance, with consideration of ornamental features a secondary matter. In view of the conditions involved it is believed that the new system installed has resulted in street lighting which serves its purpose to a degree exceeded by few installations elsewhere.

The old lighting consisted of a total of 328 lamps—that is, 238 4-amp. magnetite-arc lamps and ninety 80-cp. incandescent lamps. This system failed even to provide lamps for all the street intersections throughout the city. The new system employs 602 gas-filled street series lamps ranging in size from 600 cp. to 100 cp.

The "white way" lighting of Front Street is shown in Fig. 1. "Novalux" fixtures mounted on 13½-ft. pressed-steel standards equipped with 600-cp., 20-amp.

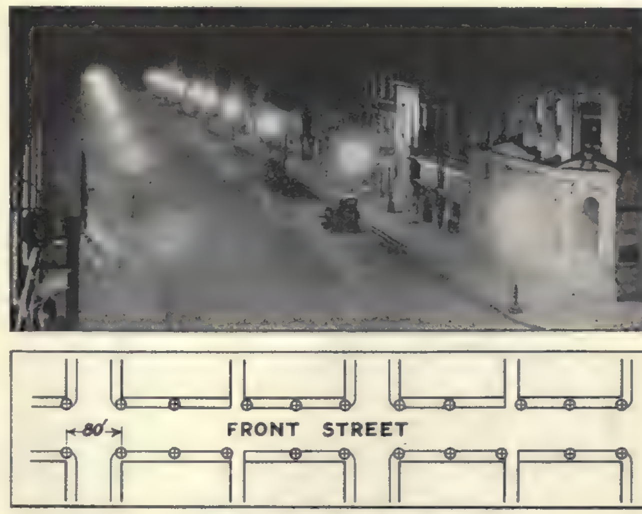


FIG. 1—ORNAMENTAL "WHITE WAY" LIGHTING, FREMONT, OHIO

600-cp. (6,000-lumen) gas-filled lamps, equipped with "Novalux" units, mounted on pressed steel posts are spaced from 80 ft. to 90 ft. apart on each side of the street. The mounting height is 13½ ft.

FIG. 2—NEW LIGHTING ON MAIN THOROUGHFARE OF PROGRESSIVE SMALL CITY

A part of the main highway between Detroit, Toledo and Cleveland. 600-cp. (6,000-lumen) gas-filled lamps in ornamental-bracket "Novalux" units; staggered spacing, one lamp for each 150 ft. of street; mounting height, 20 ft.

*Illuminating engineering staff, engineering department, National Lamp Works of General Electric Company, Nela Park, Cleveland.
†District manager Ohio Power Company.

lamps are spaced about 80 ft. apart on each side of the street.

The main highway through the city is State Street, carrying traffic between Detroit, Toledo and Cleveland. On this thoroughfare 600-cp., 20-amp. gas-filled lamps are used in bracket "Novalux" units as shown. As the street is wide, the lamps were placed on each side and staggered, with one lamp for approximately 150 ft. of street. Upward light on a thoroughfare of this character is of little value, but bright street illumination is of the greatest importance for safety. Accordingly, the equipment selected consisted of rippled globes with refractors which direct a large proportion of the light to the street surface. Fig. 2 shows the street

FIG. 3—STREET-LIGHTING REQUIREMENTS OF THE VARIOUS SECTIONS ARE MET WITH THESE TYPES OF EQUIPMENTS

Upper Left—Business district lighting; Form 9, "Novalux" ornamental unit. Upper Right—Thoroughfare lighting; Form 25, large "Novalux" basket-style unit with light alabaster rippled-glass globe and dome refractor. Lower Left—Residential district lighting; Form 6, "Novalux" pendent unit with clear rippled globe and dome refractor. Lower Right—Lighting in outlying districts; "Novalux" pendent unit with dome refractor.

surface appearing to the eye as a sheen of nearly uniform brightness against which objects stand out sharply and distinctly. The mounting height of 20 ft. places near-by units outside the ordinary range of vision of automobile drivers, and consequently even on dark, rainy nights the light sources are not annoying from the standpoint of glare.

For the less-traveled thoroughfares 400-cp., 15-amp. lamps in rippled-globe dome-refractor units mounted on mast arms at heights of 20 ft. to 25 ft. above the ground are used. On residential streets smaller dome-refractor fixtures without globes equipped with 250-cp., 6.6-amp. lamps are used suspended from mast arms. In alleys and for certain outlying districts the ordinary radial-wave reflectors with 100-cp. lamps are employed.

Both station-type and pole-mounted movable-coil regulators feed the series circuits. Individual-series two-coil transformers mounted in the base of the posts in the case of the "white way" lamps and overhead at the cross-arms in the case of the remainder of the system are used for supplying the 15-amp. and 20-amp., 400-cp. and 600-cp. lamps. These transformers avoid high voltage at the lamp fixtures and eliminate the possibility of open circuits due to breaks in the lamp loops. In order to reduce trouble from tree grounds, the small lamps in residential districts are grouped on one-to-one-ratio transformers connected into the high-tension series circuits.

The old lighting from the 328 units provided an approximate total of 102,000 cp. at a cost to the city of about $15,500 per year. The new lighting represents an approximate total candlepower of 182,000, or an increase of 78 per cent in quantity of light and an added improvement in the distribution of candlepower. The annual cost under the new lighting contract is approximately $22,000, an increase of only 42 per cent. The expenditure per capita for the new street lighting is $1.78 annually. This is more than double that in the average city where adequate street lighting under the new conditions of travel has not been worked out as yet, but is a very moderate investment for the value returned. A tabulated summary of the equipment employed and the rates adopted for the Fremont installation is given.

EQUIPMENT AND RATES, FREMONT STREET-LIGHTING SYSTEM

Kind of Street	Number of Lamps	Size, Cp.	Rate
"White way"	22	600	$60.00
Thoroughfare (Main)	67	600	55.00
(Secondary)	151	400	47.00
Residential	216	250	32.00
Outlying and alleys	146	100	22.50

Effect of Impurities in Storage-Battery Electrolytes

THE importance of obtaining information concerning the action of impurities in storage-battery electrolytes arises from the detrimental effects which many of them produce on the operating characteristics and life of the storage battery. Such information is necessary as a basis for the preparation of specifications covering sulphuric acid for use in batteries. A new method of measuring the rate of sulphation of storage-battery plates was recently devised at the Bureau of Standards. The same method and apparatus have been employed in the present investigation with some modifications, and the effects of small amounts of iron, manganese, platinum and copper have been determined. It was found that the presence of one part in ten million of platinum in the electrolyte increases the local action at the negative plates 50 per cent. The effect of copper is much less, while the effect of iron is of unusual interest because of its accelerating action at the negative plates. Manganese is deposited upon the positive plates in the form of manganese dioxide which covers the active material, closes the pores and causes a large amount of charging current to be wasted as gas. Work is being extended to include the effect of other impurities.

Friendship the Basis of Public Relations

Because Utilities Are Dependent on the Intelligence and Moral Sense of the Public, Friendship Is the Real Utility Need—The Public Can Be Taught Economic Truth

By J. W. GLEED
General Attorney Southwestern Bell Telephone Company

ONCE in a long time some man stands up in the company of his fellows and talks of the things of the heart. He lays open the personal and business conscience of his kind and examines and displays the contents. He talks of the value of these things and the uses they should be put to. And though all that he says is of the common knowledge and experience of all who listen, still it is not of the common thoughts of the average individual, whose busy-ness habitually crowds down and covers up these matters of the heart until they come to be quite unknown through pure unfamiliarity. And so the words of the speaker fall with all the strength of new thought, new truth, new light and a deeper wisdom.

Not long ago, at the joint convention of the Southwest Geographic Division, N. E. L. A., and the Oklahoma Utilities Association at Oklahoma City, a utility lawyer talked one morning on the value of friendship to the public utility, of the rights of the people to control the public service and of the responsibility of these their servants to assist them sympathetically to understand and make their regulation fair and helpful. And he spoke so plainly of the simple elements of justice in this relationship between the people and the public utility that his address made a very deep impression. Space permits the publication of little more than half of Mr. Gleed's address, but it presents with an unusual clarity of expression a most convincing argument for the revival of old-fashioned homely friendship in the business of the modern central-station company.

A FEW years ago the citizens of San Francisco passed a law reducing telephone rates. Observe, please, that the citizens passed it—not the Legislature, not a commission, not the city government. The voters passed it. It was an initiated measure—that is, a measure placed before the voters by the petition of a certain small number of private citizens, representing only themselves. There was no hearing, no evidence, no debate. The users of telephone service concluded they were paying too much and so they voted to pay less. At the same election the people recalled a judge because of an unpopular decision he had made.

In the State of Missouri we have this same institution of the initiative, and next fall, on the petition of a comparatively few voters, we could, I suppose, have a popular vote on universal state-wide telephone exchange service at a dollar a month and toll service at ten cents a call. I do not, of course, think that any such thing is likely to happen. I am merely pointing out that it might happen.

THE POWER OF THE PUBLIC

And the power of the public is by no means confined to states where the initiative and the recall have been adopted. In nearly all the states there exist public bodies having power to fix rates, and while all states have constitutions providing in substance that our property shall not be confiscated, yet constitutions can be changed; and, furthermore, the enforcement of constitutional provisions depends on men—men selected by the people, paid by the people, and if not subject to instantaneous recall, yet always subject to recall at the end of their respective terms. We have, of course, the national Constitution and the federal courts; but we have these only so long as the sovereign people permit, and that might not be forever. And, finally, constitutions and laws are as mere scraps of paper, anyway, unless they exist in the minds and hearts of the people. Mexico has a beautiful paper constitution but very poor government.

It is to be observed, furthermore, that while farm property, for example, has for its protection a great multitude of farm voters, utility property has practically no votes behind it at all. Stockholders are numerous in one sense, but stockholders plus employees, if employees choose to vote with the owners, amount to very few when compared with the whole number of voters. The Bell System in the United States has in round numbers 250,000 stockholders and 250,000 employees, but there are a hundred and sixty voters to every stockholder. Of course our "indirect" stockholders—that is, the creditors of the savings banks and insurance companies owning our stock—are very numerous, but their interest is too indirect to make them of material use to us.

The fact is that the company by which I am employed, the Southwestern Bell Telephone Company, has scattered about $150,000,000 worth of property over and under the streets and highways of five states and in the houses of Thomas, Richard and Henry; and there it is, all in the possession of the people. Much of it the law would not let us remove; much of it it would not pay to remove even if the law made no objection. To state the whole matter briefly, we are in the hands of the public; the public is our master. In the end we are compelled to accept as a reward for our endeavors just about what the intelligence and moral sense of the public awards us.

PUBLIC MORAL SENSE GOOD

Now, so far as moral sense is concerned, I think that our patrons and the patrons of all utilities are, taken as a whole, disposed to deal fairly with us, so far as they know. This may not be so in every instance, but generally I think it is true. Generally speaking, our patrons are disposed to be fair. But if not, there is no use getting mad about it. If the public should not be disposed to be fair it would still be true that the public has the power and it is our job to try to persuade it to be fair. And one of the best ways in the world to influence the public to be fair and patient and considerate is to be fair and patient and considerate ourselves.

We are all human beings. We think that we are entirely reasonable. We have a conscience; we have a sense of duty; we are fair; we are, anyhow, intelligent, and intelligent self-interest leads generally to the same

line of conduct as conscience and a sense of duty. I hope we would hesitate longer to exact a rate unreasonably high than the public would to impose a rate unreasonably low. I not only hope it, I believe it. But we are all human beings, and it is easy to deceive ourselves. Anyhow, before we censure the public too severely on the score of unfairness, let us be sure we are ourselves beyond criticism.

Our patrons have a disposition to be fair as far as they know. But the difficulty is to get them to know. We know, of course, what is fair to a utility. It is our business to know, but the public doesn't know. The public exercises the power of life and death over thirty billions or more of property in the United States—railroads, street railroads, interurban railroads, telephone and telegraph plants, and water, gas, light and power plants. The public has a general disposition to be fair toward this property, but it knows nothing about it. It is easily misled. It isn't really conscious of its own power, and therefore it is not conscious of its own responsibility. Now it seems to me—and I am voicing only my own personal opinion—it seems to me that the supreme problem in the domain of public relations is for the owners of this thirty billions of property to educate the public—to cause the public to know—to establish in the minds of the public sound opinions and sound theories about how this property should be handled.

> "EVERYBODY makes mistakes. Maybe we do. We must not argue too much nor use too much logic. If we go out to investigate a complaint, we must start in, not with argument, but with sympathy. We must not try to drive a man, but to lead him. If he thinks he has been wronged, he deserves our sympathy, whether he has been wronged or not. He may be suffering from a wrong, or he may be suffering from a wrong impression of his own. In either case he is suffering. We must sympathize with him. He may be wrong, but he isn't wrong so often as we think he is. He may be only half wrong. Now and then he is wholly wrong. We must first find out how he came to fee' so; there is generally some excuse for it. What we want mainly is friends — and only enough money to live on. Friends are the main thing."

The public, I know, is a pretty numerous and busy and unmanageable body, and an adequate knowledge of any one of these different kinds of industry is almost a lifetime work for any man with everything else neglected. What, then, do I mean by "getting the public to know"? What can the public be taught to know? The public cannot know, of course, what the general manager knows or should know. The public cannot know the details of any of these different businesses. But there are a number of general principles, a number of economic laws, a lot of political and psychological truths, all bearing on the proper treatment of public utilities, which the public can be brought fairly well to understand. Even that is a tremendous undertaking, but it seems to me to be a necessary undertaking, however great it may be.

Things the Public Can Be Taught

Let me mention some of the things which the public can be taught fairly well to know. The public can be informed, if it is a fact, that the commodity or service which we furnish is a very useful commodity or service, and that we very earnestly desire that it shall be as good and as useful as possible. And if this isn't a fact in each case it should be.

We are monopolies or quasi-monopolies and we are corporations. There is a certain amount of prejudice against monopolies and corporations. The public can come to appreciate that such prejudice is foolish and harmful. A corporation is just a convenient tool which society has created in order to satisfy a need or want. It is no more to be hated than any other tool—no more to be hated than a plow or a spade. We are monopolies only because the needs of the community can best be served by monopoly. A single company can give better and cheaper service in the long run than two or more companies in competition could give. We are monopolies or quasi-monopolies because in the very nature of things we ought to be.

The public can be brought to see that, although we are monopolies, we are, as a matter of fact, more patient and considerate and anxious to please than people engaged in competitive business. The public can be brought to see this, I say, provided it is so, and it ought to be so. Utilities ought to be more anxious to please, more anxious to make their work perfect, than people in other kinds of business.

If a man has been or thinks he has been wronged by his grocer, he gets relief by going to some other grocer, but if he thinks he has been wronged by a monopoly, his anger sinks in and sours, so to speak; and that is mighty bad for the monopoly. We ought, therefore, to do a better job of serving than anybody else. We utility people must be more polite and more kind and more considerate and more reasonable than anybody else, because we have prejudices and erroneous opinions to overcome. Before we can correct erroneous opinions we need to find out what those opinions are and how they came into existence. In other words, we must exercise patience and tolerance and broadmindedness and really get hold of the other fellow's view.

In all our transactions with the public let us remember these things—remember the power of the public—remember the prejudice of the public for which the public is not wholly to blame. Let us remember that the public does not know the facts and the troubles of our business. Let us be patient, tolerant, courteous and fair; let us be more than fair; let us be more than reasonable.

Convince the Public of Reasonableness

Remember that it is our duty not only to be fair and reasonable, but to convince, to persuade the public that we are fair and reasonable. Let us meet unkindness with kindness, meet distrust with trust. We must be friendly, anyhow. Any fool can make enemies for himself and his company. It takes a big, broad, kind-hearted man to turn enemies into friends. "Die when I may," said Abraham Lincoln, "I want it said of me by those who knew me best that I always plucked a thistle and planted a flower whenever I thought a flower would

grow." We must plant flowers, not thistles. Almost anybody we deal with needs kindness—the meanest most of all. We must try honestly and hard to see the other fellow's side, to see it as he sees it; to understand how he came to see it so and to feel so about it. And remember it is quite possible for us to be in the wrong. Everybody makes mistakes. Maybe we do. Very often we are right, very often we may have the power to settle it right; but the thing has been settled only half right if the other fellow hasn't been persuaded that it is right. We must not argue too much nor use too much logic. If we go out to investigate a complaint, we must start in, not with argument, but with sympathy. We must not try to drive a man, but to lead him. If he thinks he has been wronged, he deserves our sympathy, whether he has been wronged or not. He may be suffering from a wrong, or he may be suffering from a wrong impression of his own; in either case he is suffering. We must sympathize with him. He may be wrong, but he isn't wrong as often as we think he is. He may be only half wrong. Now and then he is wholly wrong. We must first find out how he came to feel so; there is generally some excuse for it. What we want mainly is friends—and only enough money to live on. Friends are the main thing.

The people must come to understand the difference between feelings and facts, and the necessity for respecting and being governed by the facts, and the toilsome processes by which facts must be established, and that nobody has a right to an opinion unless it is based on knowledge, that one man who knows is worth a thousand who guess and assume and talk, and that their real friend is not the man who tells them a dozen pleasant lies but the man who will tell them one unpleasant truth.

We ought to be always at work counteracting the influence of the social quacks and the demagogues. This is really our first and fundamental duty—to help sustain the truth, to help sustain sound sociological and economic opinion. The truth is that the institution of private property is necessary. It is right, wise, good, necessary and beneficial; not, I mean, from the standpoint of the rich, but from the standpoint of the poor. You would think that after the experience of Russia further work on this line would be unnecessary, but the sappers and miners are and always will be at work trying to undermine and overthrow the institution of private property.

No Conflict Between Rights and Property

There is no conflict between the rights of man and the rights of property, because the right of property is a right of man. As man is constituted, the most precious thing to him is life—the life of his family and his own life, today—and the next most precious thing—really a part of the same thing—is the means of life for himself and family tomorrow and the next day—that is, property. Property is life, especially under our present intricate and complex industrial system.

Constant war must be made on socialism; upon confiscation, whether open or masked; upon the well-intending dreamers who want to improve the world at the expense of the other fellow, and upon the demagogues with their words and phrases and slogans which mean nothing but confusion. Constant warfare must be made for the institution of private property, not for the benefit of the rich, but for the benefit of the human race. The hatred of the rich or the more prosperous is world-wide and history-wide. In the time of Moses there was need for the commandments "Thou shalt not steal" and "Thou shalt not covet."

It is our duty and it is to our interest and to the interest of our children that the people be taught the simpler economic truths; that no man can get something for nothing; that everything must be paid for in the end; that truthfulness, honesty, fairness and intelligence are the producers of wealth and of general welfare, and that falsehood, pretense, dishonesty, unfairness, ignorance and the disregard of facts are the producers of ruin.

After all, the great task is to spot the demagogue and teach the people how to spot him. Your great enemy and mine, the poor man's and rich man's great enemy, everybody's great enemy in this country, is not capital, not labor, not the corporation, not the monopoly, not the captains of industry, not organized labor, not the labor leader as such—not any of these, but the demagogue, the conscienceless, time-serving, popularity-hunting, vote-hunting demagogue. Able orators and able editors, liars and hypocrites, are boldly assuming this falsehood, eloquently proclaiming that falsehood, advocating any and every false or, still worse, half-true doctrine, regardless of its tendency and result, for which they can find willing ears and in return for which they can gather in votes or subscriptions. In the public interest we must continuously combat and foil them with the unconquerable power of enlightened friendship.

> "OUR patrons have a disposition to be fair as far as they know. But the difficulty is to get them to know. We know, of course, what is fair to a utility. It is our business to know, but the public doesn't know. The public has a general disposition to be fair toward this property, but it knows nothing about it. It is easily misled. It isn't really conscious of its own power, and therefore it is not conscious of its own responsibility. Now, it seems to me that the supreme problem in the domain of public relations is to educate the public — to cause the public to know — to establish in the minds of the public sound opinions and sound theories about how this property should be handled."

Louisville Gas & Electric Ranks Fifty-eighth in 1922 Output

THE Louisville Gas & Electric Company reports an output of 135,569,020 kw.-hr. during 1922. This report, just received, indicates that the company should have been included in the tabulation of generating and distributing companies having an output of more than 100,000,000 kw.-hr. in 1922 which was published in the April 7 issue of the ELECTRICAL WORLD. This company would have ranked fifty-eighth in the tabulation. The peak load, 38,275 kw., took place on Dec. 13, 1922.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Extent of Ionization in Dielectrics Still Undeterminable

To the Editors of the ELECTRICAL WORLD:

One of the most important of the technical problems which are facing cable engineers at the present time is to determine the weight which should be given to the fact that in some impregnated paper cables the power factor rises with increasing voltage. This phenomenon is known as air ionization or, more briefly, ionization, from the theory that this rise in power factor is due to the formation of ionized air within the insulation.

In 1912 W. Petersen called attention to the fact that air films in a dielectric of specific capacity K are subjected to a stress K times as great as that in the surrounding medium and that ionization may, therefore, occur therein at comparatively low voltages. F. Dubsky, in 1919, measured the dielectric strength of thin air films and was thus able to show the possible conditions under which air ionization was likely to occur in solid dielectrics. In the same year G. B. Shanklin and J. J. Matson measured the air ionization voltage in actual cables by making measurements of dielectric loss and noted the voltage at which the loss began to increase more rapidly that the square of the voltage. The work of these experimenters was amplified in 1921 by C. F. Proos, who adduced experimental evidence to show that the potential required to produce air ionization in a cable depends upon its previous history, as, for example, the various temperatures to which it has been subjected prior to the test. In 1922 J. E. Schrader, and in 1923 J. B. Whitehead, gave some specific data on air ionization in dielectrics which furnished a more exact basis.

So far the work of all these experimenters seems to point to the conclusion that air ionization is the cause of the phenomenon under consideration. In 1922, however, M. Hochstadter wrote a paper contending that the variation of the power factor with voltage is not to be explained by air ionization but by the peculiar properties of the impregnating compound. He did not say what these properties are and brought forward very little experimental evidence to support his theory.

There seems to be a growing idea that there is something wrong about a cable in which the power factor increases with the voltage, and a few cable purchasers have reached the stage where they wish to specify that there shall be no ionization in the cables that they purchase. It, therefore, seems that the time is opportune for taking stock of the known facts.

There appears to be no doubt about the fact that air ionization can take place in a cable and that it shows its presence by an increased power factor at high voltages, It is not so well established, however, that a power factor increasing with voltage really indicates air ionization or that such a rising power-factor characteristic is harmful. Cables which were made some years ago in such a way that air was necessarily entrapped by the layers of paper show a remarkably constant power factor over a wide range of voltages. On the other hand, some modern cables, made in such a way that the presence of air in any appreciable quantity seems to be out of the question, exhibit the so-called ionization phenomenon quite strongly.

However, some modern cables show a power factor which actually decreases with increasing voltage, a phenomenon which would be very hard to explain according to the air ionization theory. This fact suggests that in addition to the air ionization effects there is another phenomenon which influences the power factor at high voltages. The following theory is advanced.

If the impregnating compound contains particles of different specific capacities, those particles which have the highest specific capacity will align themselves in the oil and, if they have lower resistivity, will decrease the resistance of the path between the electrodes. This would increase the power loss as the voltage increases. If the oil is of uniformly low resistivity, the alignment of particles will have no effect on losses and the power factor will, therefore, be independent of the voltage. If, on the other hand, the particles which have the highest specific capacities also have higher resistivity, increasing the voltage will lower the power factor.

There is a certain amount of experimental evidence in favor of this theory which I do not yet feel at liberty to furnish, both because it is inconclusive and because it is intimately related with other matters which I hope to publish in detail at a future date. On the other hand, there are arguments against the theory. For instance, the particles of different specific capacity should more easily align themselves in fluid oil than in jelly. However, those modern cables showing a power factor increasing with the voltage exhibit this phenomenon strongly only at low temperatures, that is, at those temperatures at which the impregnating compound is jelly.

WILLIAM A. DEL MAR,
Chief Engineer.

Habirshaw Electric Cable Company,
Yonkers, N. Y.

The Power Company's Responsibility for Informing Customers About Circuits

To the Editors of the ELECTRICAL WORLD:

Our attention has been drawn to the appearance in your May 26 issue of a letter received by you from Walter C. Hecker of the Curtis Pneumatic Machinery Company at St. Louis. His letter very clearly states a distressing condition which many builders of small electrical machinery have encountered. I think your journal is to be commended for publishing the letter, and I wish that you might go a step farther and lead a campaign among power companies to the end that their own customers may know accurately what circuit is available in any spot.

Very often we find our customers have been unable to obtain reliable information, and we then take the matter up with the power companies directly. Even in those cases unsatisfactory results have been had, and invariably there is considerable delay in answering our inquiries. It seems that power companies are willing to spend money for advertising and sales effort to increase the number and extend the use of electric appliances, but they handicap this development by failure to make it convenient for their clients to install devices.

The experiences related by Mr. Hecker are not unusual. Unfortunately they are typical of a very frequent occurrence. I believe that this deplorable circumstance could be quickly altered if it were to be brought to the attention of the executives of power companies.

J. H. MEHAN,
Sales Manager.

Brunner Manufacturing Company,
Utica, N. Y.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

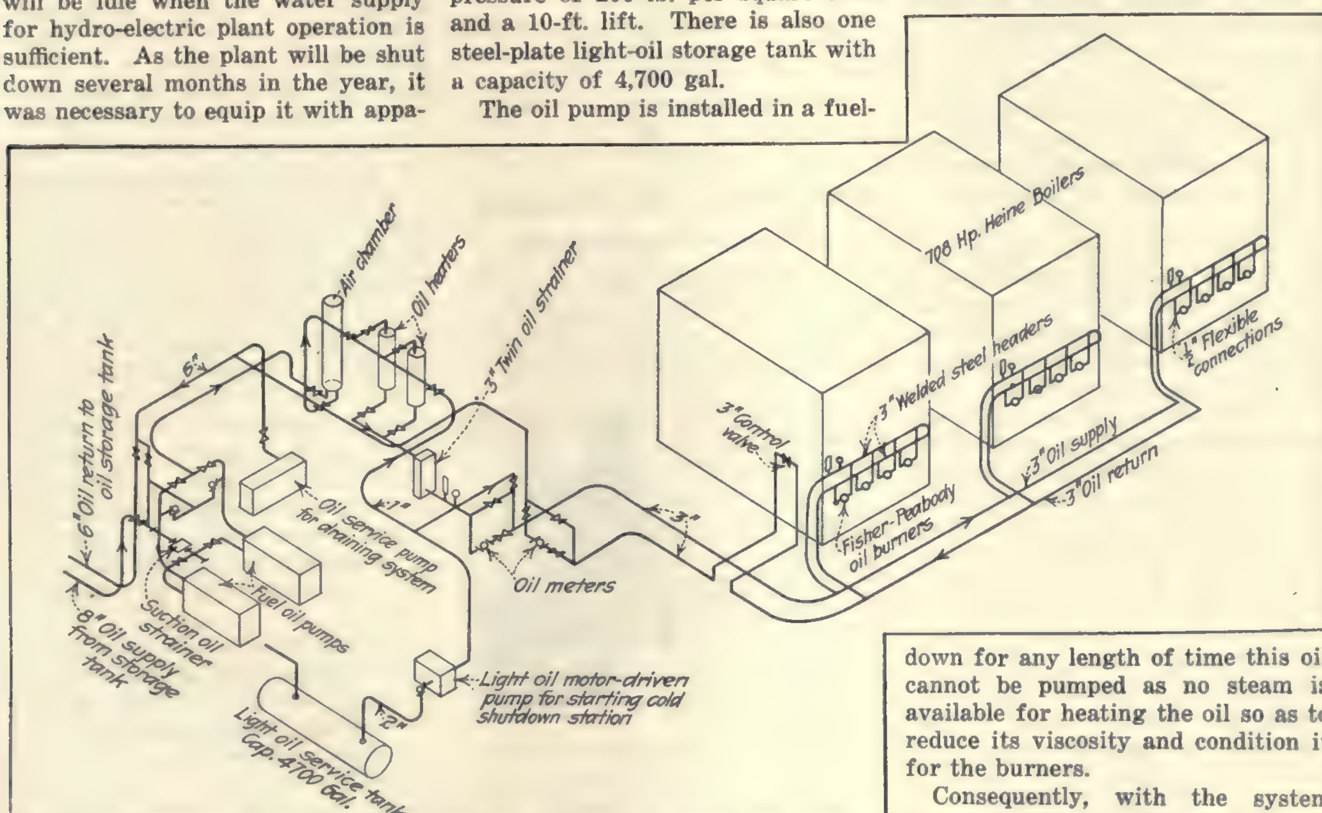
Light-Oil Starting System for Auxiliary Plant

THE new "Cape station" of the Cumberland County Power & Light Company, South Portland, Me., is a steam auxiliary to the company's hydro-electric plants and as such will be idle when the water supply for hydro-electric plant operation is sufficient. As the plant will be shut down several months in the year, it was necessary to equip it with apparatus suitable for starting up from a cold shutdown.

The station contains three 708-hp. Heine parallel-drum water-tube boilers, set 16 ft. high and designed for 300 per cent rating maximum operation. Each boiler is provided with four Fisher-Peabody fuel-oil burners, set in the lower front and in one row about 3 ft. 6 in. above the floor. These burners are of the mechanical type, usually requiring a fuel-oil temperature at the burners of approximately 230 deg. F. and approximately 250 lb. pressure.

Several methods for starting up were considered. The scheme finally adopted was the most convenient, positive and the least expensive from an operating standpoint. The starting-up equipment includes one 3-gal.-per-minute Kinney pump direct-connected to a 1½-hp., three-phase, 60-cycle, 440-volt motor. This unit is designed for a discharge pressure of 200 lb. per square inch and a 10-ft. lift. There is also one steel-plate light-oil storage tank with a capacity of 4,700 gal.

The oil pump is installed in a fuel-oil pump room at one end of the boiler room, and the oil storage tank is in the basement below the pump and can be filled by gravity from tank cars. The regular fuel-oil supply line to the burners is used for serving the burners with light oil when starting up by means of a connection from the pump to the oil-feed mains in pump room. Light gas oil, known as "Solar" oil, is used for this service. This oil contains approximately 19,000 B.t.u. per pound, Baumé 32 to 40, flash test 158 deg. to 160 deg. and viscosity 1.4 seconds at 70 deg. F. by Saybolt Furol.



SIMPLE VALVE MANIPULATION SUFFICES TO START PLANT FROM COLD SHUTDOWN

The general arrangement is shown in the accompanying drawing and indicates the relative position of supply tank, pump and burners.

Since the fuel used for regular operation is a heavy viscous oil averaging 11 deg. to 12 deg. Baumé and requiring heating before it can be pumped and fed to the burners, it follows that when the plant is shut down for any length of time this oil cannot be pumped as no steam is available for heating the oil so as to reduce its viscosity and condition it for the burners.

Consequently, with the system herein described, all that is necessary in starting up from a cold shutdown station is to start the motor-driven light-oil pump and supply the burners with oil at from 125 lb. to 175 lb. pressure through the regular fuel-oil piping system, drawing the supply from the 4,700-gal. supply tank. For this service no heating of oil is necessary. It is essential, however, that when the plant is shut down all fuel oil be drawn from the supply pipes between the fuel oil pumps and the burners so that the oil pipes will be clear and free from heavy oil, ready for starting up with light oil. Suitable and convenient cross-connections are available for drawing away the heavy oil and for feeding the light oil into the system,

these connections being installed in the fuel-oil pump room.

No changes in oil burners or tips are required for burning light oil when starting up; consequently there is no changing of parts for either light or fuel-oil burning.

STEAM PRESSURE RISES OVER 6 LB. A MINUTE

The light oil starting-up system has sufficient capacity to bring any one of the three boilers up to from 75 lb. to 90 lb. steam pressure in about sixty minutes, producing sufficient steam pressure for operating the turbine feed pump and oil heater and supplying steam to the coils in the large fuel-oil storage tank from which the regular supply is drawn. The total time required from cold shutdown start to time when the regular fuel oil is admitted to burners does not exceed ninety minutes. The light oil is not withdrawn from the system, but is simply followed by the fuel oil when this is ready.

The system is simple, requires no alternations or adjustments when changing from light to heavy or regular oil supply other than the manipulation of about five valves, requires no auxiliary heaters and avoids the danger of an overhead gravity system, besides fulfilling all the requirements for a convenient, accessible, efficient and quick service starting-up equipment for oil-fired boilers where the prime essential is to get a cold shutdown station into service in the shortest time possible.

Electricity is available for the light oil pump from a tie-in line tapped off the present system of distribution, while cold water for the boilers is obtained from the city water main, at about 85 lb. pressure.

CHARLES O. LENZ,
Consulting Engineer.
New York, N. Y.

Creosoted Posts and Poles Resist Fire

AN INVESTIGATION to ascertain the relative service life of untreated and treated fence posts subjected to fire hazard that may well be applied to distribution and transmission poles was recently made by the American Wood Preservers' Association.

Creosoted yellow-pine posts can be used advantageously in territories where the fire hazard is great. This is proved by records which have been kept on the Missouri, Kansas & Texas Railroad of the number of treated and untreated posts destroyed by fire during the burning of the right-of-way in 1920 and 1921. The total number of posts in service, the number destroyed by fire and the percentage of total posts in service which were destroyed by fire are shown in the accompanying table.

RELATIVE SERVICE LIFE OF TREATED AND UNTREATED POSTS

	Number	Per Cent
Posts in service:		
Untreated	1,651,333	81.3
Creosoted	378,578	18.7
Total	2,030,911	100.0
Destroyed by fire:		
Untreated	5,795	98.7
Creosoted	76	1.3
Total	5,871	100.0
Per cent of total posts in service which were destroyed by fire:		
Untreated		2.85
Treated		0.04
Total		2.89

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Simplifying the Stringing of Heavy Conductors

A BACK-BREAKING job is usually entailed in the placing of heavy conductors on the cross-arm after the conductor is pulled and ready to lay up. Usually two men are required on a pole and the job is a hard one. To get away from the heavy lifting the Kansas Gas & Electric Company uses the device shown in the illustration. It is merely a piece of 1-in. steel rod with an eye in one end and the other bent to fit over the cross-arm. A light snatch-block is hooked into the eye, and the ground man hoists the conductor into place.

LIGHT SNATCH BLOCK USED TO LIFT CONDUCTOR INTO PLACE

The rod to which the snatch block is attached is bent to fit around the arm, the end being under the arm.

Beside the insulator in the illustration is shown a cross-arm roller used to prevent the trouble encountered in sagging conductors due to the friction of the wire on the cross-arm. The conductor will run freely over the wooden sheave used. The sheave is mounted in an iron frame with an extension to fit snugly over the cross-arm.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

Heat-Treating Piston Rings Electrically

AN ELECTRICAL heat-treating furnace of the continuous-conveyor type has been in successful operation in the new plant of the Inland Products Company in St. Louis. The furnace is special in its design and in the manner of handling the work and is a development of Holcroft & Company.

The interior dimensions of the furnace are 8 ft. long x 4½ ft. high x 1 ft. 10 in. wide. There is a 4½-in. lining of fireclay backed by 9 in. of "Silocel," with ¼-in. boiler plate supported by angle irons on the outside. It has an electrical capacity of 92 kw. The heating elements are made up of three groups of nickel-chromium ribbons connected in Y to a three-phase, 60-cycle, 230-volt circuit. The furnace was designed for heating 1,800 lb. of metal per hour to 900 deg. F., the charge consisting of 3,000 rings and arbors. One kilowatt-hour is required to heat 20 lb. of metal to the required temperature. This furnace has been in operation for several months and is quite satisfactory, and the improvement in the quality of heat-treated rings is marked.

In speaking of this furnace C. C. Miner, president of the company, says:

"This furnace is automatically controlled, giving absolute uniform temperature, and as the speed of the conveyor is absolutely under our control, it is needless to say that the quality of the ring is greatly improved. It is quite obvious that the human element is entirely absent from both the heat-treating solution and the length of time under old methods that rings were submerged. Naturally the production is largely increased, and the efficiency of the plant is also increased because of the absence of the open heat-treating furnace creating an intense heat in the rooms, whereas with this furnace there is no perceptible rise in temperature ten feet away from the furnace. We consider this a much more economical method of manufacture than the old plan, yet one insuring a higher quality of product and enabling us to guarantee uniformity in tension."

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

Extracts from an Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

Mercury-Arc Rectifier Sets

WHEN starting mercury-arc rectifiers, operating the tube on short circuit for five to ten minutes to warm up reduces the danger of puncture from static accumulation within or on the tube, according to the operating code of the Philadelphia Electric Company. Static on the tube, brought in on the direct-current arc circuit, will often cause discharges in the tube from the cathode to the starting anode, or from anode to anode, or across the static dischargers. When such discharges occur the arc may be carried over to a starting anode and should be stopped by shaking the tube.

If the tube is operated on the exciter for more than one minute before plugging in the primary, the mercury thus vaporized will condense around the anodes and thereby necessitate running the tube a much longer period on short circuit to get it thoroughly dried out, and mercury in the vicinity of the anodes is likely to puncture the seals.

The time of cutting the water supply on or off will vary with the room temperature. For instance, if the room temperature is between 90 deg. and 100 deg. F., it may be necessary to apply the water shortly before the time for starting in order to get the best oil temperature for that particular tube. If the room temperature is between 50 deg. and 70 deg., it may not be necessary to apply the water until some time after the tube has been started, and the operator may be able to shut off the water some little time before the end of the run.

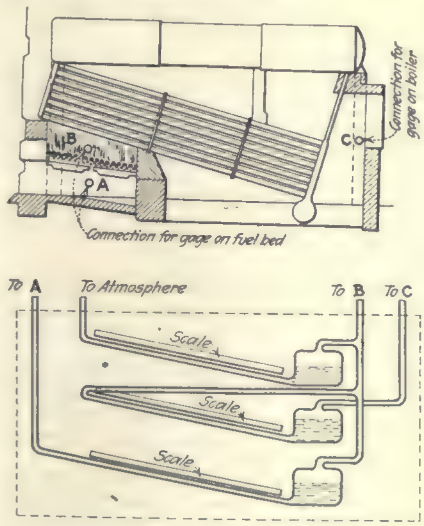
Trouble is sometimes experienced in getting a tube started in that it may operate on short circuit but will not carry the load, or will drop out every time the short circuit is removed. This is usually due to low vacuum, low temperature or to the transformer dashpot being too stiff.

If the tube will not carry the load after several attempts to start from short circuit, it is allowable to remove the short-circuiting plug and, after separating the coils of the constant-current transformer, start the tube directly on the circuit. This may start tubes operating when the vacuum is low, but a tube in this condition will not last long.

When a tube is too cold or its vacuum too low the mercury condenses so rapidly that the arc cannot be maintained while the constant-current transformer secondary coil is taking up its operating position. Therefore, when the short circuit is removed the arc goes out. Excessive stiffness of the transformer dashpot may cause a similar result. This stiffness may be corrected by opening the dashpot bypass valve on starting.

Locating Draft Gages and What Their Readings Mean

SIMPLE and explicit directions regarding the use and proper location of draft gages of the oil type are given in the operating code of the Philadelphia Electric Company. These directions are given below.



PROPER POINTS FOR CONNECTING DRAFT GAGES IN BOILER SETTINGS

As will be seen from the accompanying illustrations, the lower end of the bottom tube is connected over the fire at point *B* and the upper end of the tube is connected under the fire at point *A*. The liquid level of this tube indicates the difference in pressure between the wind box and the fire box. The lower end of the top tube is connected over the fire, at point *B*, while the upper end is open to the atmosphere. This shows the difference between the pressure in the fire box and the atmosphere. A negative pressure of not over $\frac{1}{10}$ in., indicated by a reading below zero, should be maintained in the fire box. This is essential, as a greater negative pressure causes more infiltration of cold air through the doors and leaky silting of the gases, thereby increasing the velocity of these gases as they pass through the boiler.

This results in a lowering of the boiler efficiency by decreasing the amount of heat absorbed by the boiler.

The lower end of the middle tube is connected to the last pass of the boiler or economizer nearest to the breeching at point *C*, while the upper end is connected over the fire at point *B*. The difference in pressure indicated by this tube is the drop through the boiler passes.

With a clean boiler and a normal fire, for any given rating, there will be a definite drop through the boiler corresponding to the best operating conditions. The values for various ratings are determined by tests and specified in the running schedule furnished with each boiler. A greater drop than specified shows either excess air through the fire or clogged passages due to clinker formation and soot. A smaller drop than specified shows either insufficient air to the fire or damaged baffles.

At any given rating excess air increases the volume of gases to be handled, thereby requiring a greater drop in pressure to force it through the boiler. If the boiler is dirty, a greater drop in pressure is necessary to force the normal quantity of the gases through the restricted gas passages. Insufficient air or damaged baffles require a smaller drop in pressure.

PRECISION DRAFT GAGES

The "precision" draft gage consists of three bellows-type pressure and vacuum gages, calibrated to read in inches of water. These are connected to the boiler at points *A*, *B* and *C*. The meter at *A* indicates the pressure under the fire. The one at *B* functions the same as the top tube of the oil-type gages. On the meter connected at *C* a higher or lower reading than specified indicates the same conditions of fire or boiler cleanliness as the middle tube of the first system.

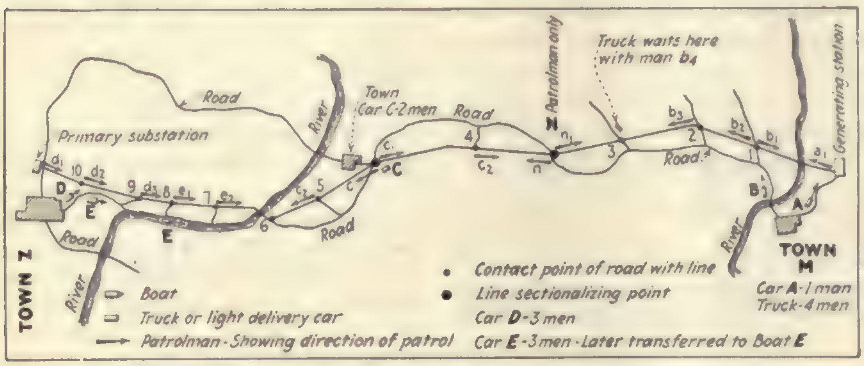
The readings of the "Precision" gage can be compared directly with those of the oil-type meter by making the subtraction which in the oil type meter is obtained by the differential connection of the tubes.

Emergency Patrol of High-Tension Lines

NO MATTER what care may be exercised in the maintenance of a circuit, a lightning stroke may shatter an insulator or cut a conductor in the span, a tornado may cross and twist a structure or tower out of shape, a bird may short-circuit wires and burn one in two, insulator strings may pull apart and other things happen which may cause an interruption of service and the switch at the substation cannot be made to hold. When this happens on the Alabama Power Company's system an emergency patrol is started at once. The emergency patrol as used may be divided into three major operations, as follows: (1) Sectionalization, for determining section of line in which trouble lies; (2) patrol, for locating trouble; (3) correction, involving movement of men and materials to location for repairing trouble.

There are physical limitations upon the speed with which service can be restored after an outage. Sectionalization involves the movement of various patrolmen stationed along the line to the switch or test loops for opening and closing in the process of testing. Perhaps the patrolman may be out on the line patrolling or doing repair work somewhere, or, at night, the men have to be aroused, and time is consumed in dressing and reaching the location of the various switches. These conditions and possibilities bring about certain delays which are difficult to overcome and, though sectionalization and patrol operations may for the most part begin at the same time, there is an overlapping of effort in a large number of instances which spells minutes in completion of repairs.

The time necessary for correction depends on the nature of trouble and the distance between the truck with men and the fault when it is found. For minor cases of repair two men are usually sufficient, whereas wire breakage or structure failure requires a larger crew. There have been instances where a number of towers have been blown over by a cyclone and conductors had to be restrung temporarily on trees along the right-of-way by large forces of men moved to the scene of trouble from a distant point. Fortunately, such cyclones are infrequent and the time consumed in correction is fairly constant.



SCHEDULE FOR EMERGENCY PATROL

Instructions like this are given for carrying on emergency patrol for each section of line on Alabama system. They are put in the hands of the local manager, who is required to rehearse them with the men under him, so that they are always informed and ready to carry on the operations without delay. On the actual instructions identifying points, markings, etc., are indicated to make them readily understandable.

The patrol operation is affected by a great many factors. Patrolmen must be stationed close to small communities where housing and supplies are available. The number of men along the line will be determined by the length of circuit, contour of country and transportation conditions. Furthermore, consideration must be given to balance between yearly operating costs and losses arising from outages, service requirements, good will, etc. Having one patrolman in each section, say 18 miles or 20 miles in length, would represent a minimum of expenditure for line operation, but, if trouble occurred, the time for patrol operation might approximate five hours; whereas by placing men 10 miles apart the time would be reduced to less than one hour. The most economical arrangement is not an easy one to determine and the answer lies in the nice judgment of those directing a company's policy.

The accompanying sketch will serve to aid in the discussion for a typical instance of the various phases of an emergency patrol. *M* and *Z* are towns of moderate size where there is employed a regular crew of four or five men to maintain the local distribution system. At these locations there is available a truck and a car for transportation. *C* is a small village where two men and a car are required for regular patrol of transmission line and for upkeep of local circuits. At *N* there is a sectionalization point, and a patrol-

TYPICAL LIST OF TOOLS AND EQUIPMENT REQUIRED FOR EMERGENCY PATROL

1. Each patrolman must have the following personal tools:
   - Pair 8-in. pliers, screwdriver.
   - Pair connectors for No. 10 to No. 2 wire.
   - 8-in. monkeywrench, safety belt, complete.
   - Pair climbers, complete.
2. Sylacauga substation:
   - Two test sets, complete with weatherproof covers.
   - Two extra test set batteries No. 752.
   - Two three-cell flashlamps, complete.
   - Two extra three-cell flashlamp batteries.
   - Two extra flashlamp bulbs.
   - Two Dietz-Vesta oil lanterns, complete.
   - Two carbide miner's lamps, complete.
   - Two carbide pocket containers.
   - Two water pocket containers.
   - Two cans carbide.
   - Company key for each patrolman, hand axe.
   - Woodman's single-blade axe.
   - Handsaw No. 7, carpenter's brace.
   - Two $\frac{13}{16}$-in. x 18-in. bits, two $\frac{11}{16}$-in. x 18-in. bits, $\frac{7}{16}$-in. x 12-in. bits, blowtorch.
   - 12-in. monkeywrench.
   - Pair splicing wrenches for No. 2/0 copper sleeves.
   - 8-ft. Johnson ground pole.
   - Six Johnson grounds, complete.
   - Two 25-ft. ground chains with 15-ft. $\frac{3}{8}$-in. sash cord on one end.
   - Two New Haven clamps for No. 2/0 wire.
   - Two New Haven clamps for No. 4 wire.
   - Pair Klein telephone slack blocks with 50 ft. $\frac{3}{8}$-in. sash cord.
   - Hand line, 150 ft. $\frac{1}{2}$-in. manila rope.
   - Set 4-in. blocks with 300 ft. $\frac{1}{2}$-in. manila rope.
   - Set 6-in. blocks with 300 ft. $\frac{3}{4}$-in. manila rope.
   - 4-in. snatch block, 6-in. snatch block.
   - Long-handle shovel, long-handle spoon.
   - Digging bar, straight spade.
   - Short handle shovel or "billy," four brush hooks, scythe, hoe, two pike holes
3. Goodwater patrolman:
   - Test set, complete with weatherproof covers.
   - Extra test-set battery.
   - Three-cell flashlamp, complete.
   - Extra three-cell flashlamp battery.
   - Extra flashlamp bulb.
   - Dietz-Vesta lantern, complete.
   - Carbide miner's lamp, complete.
   - Carbide pocket container.
   - Water pocket container.
   - Two lb. can carbide, company key, hand axe, woodman's singleblade axe, hand saw No. 7, carpenter's brace.
   - Two $\frac{13}{16}$-in. x 18-in. bits, two $\frac{11}{16}$-in. x 18-in. bit, $\frac{7}{16}$-in. x 12-in. bits, blowtorch, 12-in. monkeywrench.
   - Two New Haven clamps for $\frac{7}{16}$-in. messenger.
   - Two New Haven clamps for No. 4 copper wire.
   - Pair telephone slack blocks with 50 ft. $\frac{3}{8}$-in. sash cord.
   - Hand line, 100 ft. $\frac{1}{2}$-in. manila rope.
   - Set 4-in. blocks with 200 ft. $\frac{1}{2}$-in. manila rope;
   - Set 6-in. blocks with 300 ft. $\frac{3}{4}$-in. manila rope.
   - 4-in. snatch block, 6-in. snatch block.
   - 8-ft. Johnson ground pole.
   - Three Johnson ground clamps, complete.
   - Two 25-ft. ground chains with 15 ft. $\frac{3}{8}$-in. sash cord on one end.
   - Two brush hooks, hand grass blade, hoe, short-handle shovel or "billy."

man is stationed there ready for call at all times.

The emergency patrol operations have been carefully studied, and instructions have been issued to the patrolmen and each crew member as to his part of the work. Each man carries a telephone test set, climbing tools and night lighting equipment consisting of a lantern and pocket flashlamp and, when on patrol, is required to attach the test set and report to nearest substation every half hour for orders. Boxes containing repair tools and materials are ready at truck headquarters for immediate loading, and stocks of insulators and wire are kept in booths along the line. The men are kept familiar with road conditions and standard instructions by occasional test patrols which correspond to the fire drills of our boyhood days.

An emergency patrol is automatically set in motion when the station operator advises points along the line that the switch cannot be made to hold and the line is in trouble. Crews at *M* and *Z* are mobilized as rapidly as possible, and immediately car *A* moves to the generating station and man a_1 starts patrol to river. Truck *b* with crew journeys toward station 1. At upper end of line man d_1 begins patrol at once and car *D* starts for station 10. Truck *E* moves toward station 9.

In the meantime the substation operator calls upon locations *N* and *C* for sectionalization. Sectionalization and test are performed in the order in which the respective crews are able to reach test loops and operate them. If loops at *C* are first opened and upon energizing the line the test shows circuit clear, the trouble is beyond *C*, and crews from locations *M* and *N* are ordered to return home, and men at *C* are told to begin patrol to river. If loops at N are first opened and line tests indicate trouble beyond *N*, then when loops at *C* are opened and tests made, it is definitely established whether trouble is between *N* and *C* or *C* and *Z*. If fault lies between *N* and *C*, the operator advises these respective crews to patrol this section and orders crews from *M* to move to *N* and receive instructions. If the opening of loops at *N* does not clear "short" on line, fault lies between *M* and *N*, and then man at *N* is instructed to move toward *M*.

From a study of the sketch the movement of the truck and the cars can be traced along this section, depositing men at various stations for patrolling as the arrows indicate. After patrolmen have been distributed the truck and driver wait at the booth for news as to description and location of trouble. If correction of trouble will require other men besides himself and the patrolman, truck driver will arrange to pick up necessary help along line and hasten to the location of the fault. In the section *C-Z* it has been necessary to use a boat on the river instead of a truck because the low lands along that portion of the line are frequently marshy from high water.

The efficiency with which an emergency patrol operation is completed depends upon the thorough knowledge of each and every patrolman of his part of the work and upon the speed and effort he puts forth in doing his job exactly according to instructions. Proper functioning of all equipment is of vital importance. A defective test set may delay restoration of service an hour or more. Lack of oil in lanterns or a bad battery in a flashlamp spells longer outage and additional losses of many dollars to the customer in production and to the utility company in revenue. Therefore employees charged with these responsibilities should realize the great importance of the small details which affect completion of patrol, and the inspectors should maintain a watchfulness of patrol equipment. G. H. MIDDLEMISS,

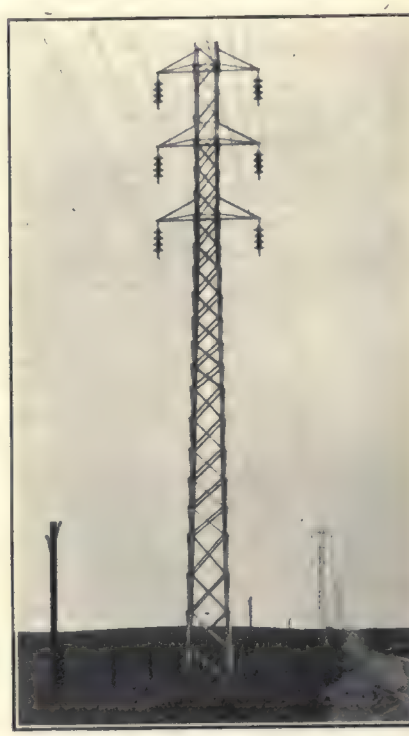
Superintendent of Distribution and Maintenance.
Alabama Power Company,
Birmingham, Ala.

TYPICAL LIST OF REPLACEMENT MATERIALS TO BE KEPT IN EMERGENCY BOOTHS

1. Sylacauga substation:
   - 1,000 ft. No. 2 bare copper wire,
   - 500 ft. No. 4 bare solid-copper wire.
   - Six Thomas 44-kv. pin-type insulators.
   - Six O.B. 44-kv. pin-type insulators.
   - Sixty-three O. B. suspension units.
   - Twelve No. 2 copper splicing sleeves.
   - Twelve No. 4 copper splicing sleeves.
   - Three 7-in. Lee pin stands.
   - Three 15-in. Lee pins, three 10-in. Lee pins.
   - Three standard 44-kv. creosoted cross arms.
   - Three standard bow braces.
   - Three $\frac{3}{4}$-in. x 18-in. through bolts with nuts.
   - Three $\frac{5}{8}$-in. x 14-in. through bolts with nuts.
   - Three $\frac{1}{2}$-in. x 6-in. carriage bolts.
   - 500 ft. $\frac{7}{16}$-in. messenger wire.
   - Twelve three-bolt clamps for $\frac{7}{16}$-in. messenger.
   - 200 ft. No. 10 copper-clad telephone wire,
   - 12 No. 10 copper sleeves.
   - Standard telephone cross-arm.
   - 16-in. x $\frac{5}{8}$-in. through bolt.
   - Two wood telephone pins.
   - Telephone transposition bracket.
   - Twelve telephone insulators.
   - Six $\frac{3}{8}$-in. x 5-in. lag screws.
   - Two telephone metal pins for transposition brackets.
2. Hollins Booth—Pole No. 193:
   - Two Thomas 44-kv. pin-type insulators.
   - Two O. B. 44-kv. pin-type insulators.
   - 200 ft. No. 2 bare solid-copper wire.
   - 200 ft. No. 4 bare solid-copper wire.
   - Four No. 2 copper sleeves.
   - Four No. 4 copper sleeves.
   - 7-in. Lee pin stand.
   - 15-in. Lee pin, 10-in. Lee pin.
   - $\frac{5}{8}$-in. x 14-in. through bolt, $\frac{3}{4}$-in. x 18-in. through bolt.
   - $\frac{9}{16}$-in. x 14-in. through bolt.
   - Three $\frac{1}{2}$-in. x $4\frac{1}{2}$-in. lag screws.
   - One hundred ft. No. 10 copper-clad telephone wire.
   - Six telephone insulators.
   - Six No. 10 copper sleeves.
   - Two telephone pins, wood, $1\frac{1}{2}$-in. x 9-in.

Steel-Pole Line Built for $4,700 per Mile

THE transmission line shown in the accompanying photograph is 33 miles in length and transmits power at 66,000 volts from the recently completed Don Pedro power plant of the Modesto-Turlock Irrigation District to the city of Turlock, Cal. The average cost per mile for labor and material was $4,700. The labor cost per mile in level country was as follows:



DOUBLE CIRCUIT LINE HAS CARRYING CAPACITY OF 40,000 KVA.

Digging holes and placing foundations	$212.00
Distributing material	77.60
Bolting up and erecting poles	99.20
Stringing wire	141.20
Miscellaneous	34.80
Total	$574.80

In the mountainous section, which comprised approximately one-third of the distance, the labor cost per mile was nearly double this figure. The spans in the open country vary from 500 ft. to 700 ft. The steel poles are 3 ft. 6 in. square at the base, 1 ft. 9 in. at the top and 60 ft. high. Two No. 1/0 stranded copper circuits are carried on suspension insulators. R. W. SHOEMAKER,

Superintendent Electrical Department,
Turlock Irrigation District,
Turlock, Cal.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Merchandising on a Good-Will Basis*

How a Central-Station Company Improved Its Service by Personal Attention to Customers and Realized a Profitable Increase in Appliance Sales

By William F. Moses
Commercial Manager Empire Gas & Electric Company, Auburn, N. Y.

A FEW years ago the Empire Gas & Electric Company, Geneva, N. Y., adopted a merchandising policy which at that time was considered a bit radical. New business departments were told to forget appliances sales and concentrate on the development of our customers' confidence and good will. The management predicted that appliance sales would not suffer if the new policy were correctly carried out. So with a little misgiving the work was commenced.

In order to go about the task intelligently and thoroughly, our city was divided into four sections. Each section was put in direct charge of an employee known as service supervisor whose duties were to canvass each home in his territory, adjusting appliances and instructing the housewife, maid, cook, and in some cases the husband, in their proper use. Instruction on reading meters and computing bills and information on the newest labor-saving devices and other points were given.

No direct effort was made to sell merchandise, but a card file was kept with a record for each customer. At frequent intervals literature of a sales nature was mailed to those customers whose records indicated they might be "prospects." Nearly a year was necessary to complete our first canvas, when to our surprise we found that the merchandising business far exceeded the previous year's record.

In addition, a stock-selling campaign was conducted, the entire issue being sold in five days. The following year a similar but larger issue was sold in three days, proving without a doubt that we were accomplishing much in building for the future. Since that time the service work has been continued successfully, with a little more direct sales effort in conjunction.

Sales Campaigns

During the past two years a schedule of sales campaigns on the major appliances has been carried out, and our service supervisors have in every case supplied 90 per cent of the prospects. Each man has his own business cards, which are used liberally, and rarely does a day pass without a request from our customers that a representative of the company call at his or her home. Invariably such a call means an appliance sale.

This effort is being enlarged this year among the manufacturing plants of the city with a power and an industrial engineer from our company working along similar lines.

It is true that if you look for trouble you will find it, and we are looking for it, finding it and earnestly trying to correct it in the belief that service rendered faithfully and honestly earns its own reward in greater returns to the company. With the increasing number and uses of appliances, every call for service means the possibility of a future customer. They should not be overlooked.

Some may say, "Sell your appliance first and then give service." Why not give service first, sell your merchandise second, and give it service also? Service is the "S" which when crossed with the two marks of confidence and good will makes the sign of the dollar.

Central stations of today with their earnest endeavor to give the best possible service should set an example as modern merchandisers of appliances.

During the past few years we have seen a number of companies disband their selling organizations and surrender their appliance departments to less experienced hands. We have recently seen these same companies getting back into the appliance game, reorganizing their sales staffs and launching forth in an endeavor to recover the steady increase in gas and electric sales which they frankly admit was being lost.

The merchandising of appliances by central-station companies is here to stay. We owe it to our customers to promote the sale of only the best and most efficient devices for home comfort and labor saving. Our customers are instinctively looking to us for advice on such matters, and we must be in a position to serve them well. This is no reflection whatever on the electrical contractor-dealers, the master plumber or the home-furnishing merchant. There is room for all, and good, clean competition is always an asset. The electric and gas utility has, however, a genuine selling task ahead to educate the electrical contractor-dealer, the plumber and all other merchants dealing in appliances to our ideal of service.

The year 1923 shows every sign of being a record breaker as far as domestic appliance sales are concerned. Business is good, non-employment is forgotten, wages are on the upward trend along with the price of all materials, home-building projects are rapidly taking form—all of which means a greater market for our products. Real merchandising will produce a new volume of sales in 1923.

But let us not for one minute think that this business is going to come to us without an effort. If the public has been "sold" on our sincere effort to serve well and on our attitude of good will, then the time is ripe for some "honest-to-goodness" new business effort. And, after all, there is only one way to obtain business, and that is to go after it. Our customers are waiting to be told about the appliances and their usefulness.

A carefully worked-out program of domestic sales campaigns on the major appliances, such as flatirons, ironers, electric cleaners, clothes

*From a paper presented at the Commercial Section meeting of the Empire State Gas and Electric Association at Briarcliff Manor, N. Y., June 28 and 29.

washers, dishwashers, modern lighting and so on, is very essential.

In the electric appliance field new devices in ever-increasing number are being perfected and find a ready sale. The modern electric laundry iron is one of our best friends and should be sold in every newly wired home as soon as the meter is installed. The electric washer market is striding forward, and every one sold opens the way for the lately improved and very practical ironer. Electric household refrigerators also offer us an increased load which in time can be developed to a marked degree.

We who are in the commercial field of the central-station business have a great responsibility and likewise a great opportunity. We are more than appliance sales promoters. We are rendering a service to the public, and every time we sell an appliance we first sell service. With such an attitude the appliance department cannot fail.

Standardization of Incandescent Lamp Voltages

THE increasing use of gas-filled tungsten lamps, a rapid falling off in sales of carbon lamps and satisfactory progress toward standardization of lamp voltages were cited in the report of the N. E. L. A. lamp committee (W. W. Freeman chairman) presented at the annual convention in New York, June 4-9. Summarized, the report said:

The demand for the more important sizes of vacuum and gas-filled tungsten-filament lamps during the past three year is shown in Table I.

While only a little more than 20 per cent of the total number of tungsten-filament lamps sold in 1922 were of the gas-filled type, their aggregate wattage was 44.4 per cent and aggregate lumens 52.4 per cent of the total.

The 40-watt vacuum lamp continues

TABLE I—PER CENT DEMAND FOR TUNGSTEN LAMPS, 1920-1922

Vacuum type:	1920	1921	1922
Sign	5.8	6.1	5.7
15 watts	5.5	3.5	4.5
25 watts	18.8	17.7	18.6
40 watts	20.1	20.2	19.5
50 watts	11.9	14.7	15.3
60 watts	12.3	13.1	12.5
Street railway	3.2	2.6	2.3
Miscellaneous	2.1	1.5	1.1
Total vacuum type	79.7	79.4	79.5
Gas-filled type:	**1920**	**1921**	**1922**
50 watts	1.8	1.4	1.5
75 watts	5.9	6.6	6.4
100 watts	6.3	6.5	6.4
200 watts	2.3	2.2	2.4
300-1000 watts	1.2	0.9	0.8
Street series	1.3	1.9	1.4
Miscellaneous	1.5	1.1	1.6
Total gas-filled type	20.3	20.6	20.5

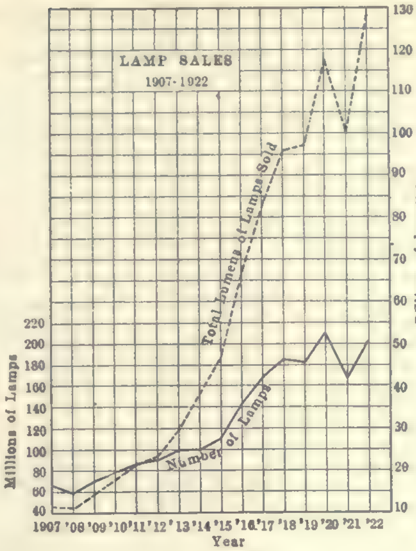


FIG. 1—LAMP SALES, 1907-1922

to be the most popular size, with the 25-watt a close second. The 50-watt is now a close third and has been increasing in popularity every year. The 75-watt and 100-watt lamps continue to be the most popular of the gas-filled type.

There were less than 3,000,000 carbon lamps sold in 1922, compared with 6,000,000 in 1921 and 9,000,000 in 1920. It is apparent that the carbon lamp will soon disappear from the market; it is now a negligible item in the total lamp sales.

The total sales of lamps during the years 1907-1922 are shown graphically in Fig. 1. The average increase during the past fifteen years has been a little over 9 per cent each year.

It will be seen that the percentage of the 115-volt group of lamps is still increasing and that of the 230-volt group decreasing.

The distribution of street series lamps by sizes during the past three years is shown in Table II.

The committee in its last two reports suggested that member companies consider the undesirability of using street series lamps of candlepower less than 60. While it will be noted from the above figures that the percentage of these lamps has slightly decreased during the past three years, the committee felt that it should again call this matter to the attenion of member companies. Lamps producing less than 600 lumens are inadequate and uneconomical under ordinary street-lighting conditions, so it was suggested that attention be given to the advisability of substituting a larger-size lamp in place of the great number of low-candlepower lamps now in use.

The distribution of lamps by ampere ratings during the past three years is shown in Table III.

It will be noted from the table that about 70 per cent of all lamps are operated on 6.6-amp. circuits, and, in the interest of standardization, it is suggested that member companies, whenever making any changes or additions to their street-lighting equipment, should use apparatus designed for this amperage.

Considerable progress has been made during the past year in the use of standard-voltage (110, 115 and 120-volt) lamps. In 1922 lamps of these three voltages constituted 91½ per cent of the total 115-volt group, compared with 87.2 per cent in 1921 and less than 47 per cent in 1913, when this matter was first agitated.

The data showing the trend during the past ten years toward the adoption of standard-voltage lamps is shown graphically in Fig. 2.

The activities of the sub-committee on voltage standardization during the past year have been directed toward the revision of the booklet of central station voltages which has been heretofore published by the incandescent lamp manufacturers. In it it is shown that standardization and unification of lamp voltage have been accomplished in respect of over 80 per cent of the electric lighting business of the country.

The report showed that the demand for 110-volt lamps was 26.3 per cent of the total, for 115-volt lamps 39.3 per cent and for 120-volt lamps 25.9 per cent.

These data confirm the trend, above

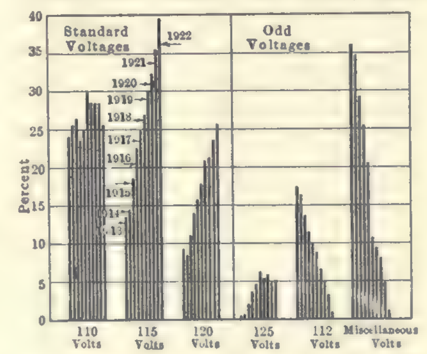


FIG. 2—STANDARD VOLTAGES, 1913-1922

indicated, toward heavy concentration at 115 volts. Investigation showed that there are 164 communities of five thousand people or more which either have not standardized as to voltage or in which unification of voltage for the entire community is not completed. If they were all completely standardized and unified, the percentage of complete standardization and unification for the country would rise from 83.5 to 98.0.

TABLE II—PER CENT DISTRIBUTION OF STREET SERIES LAMPS, 1920-1922

Size	1920	1921	1922
Under 600 lumens	13.9	13.8	12.4
Under 600 lumens	22.5	23.9	23.0
Under 800 lumens	11.7	9.4	9.5
Under 1,000 lumens	27.3	26.1	24.1
Under 2,500 lumens	10.6	11.8	12.8
Under 4,000 lumens	7.6	10.1	10.1
Under 6,000 lumens	5.5	4.3	6.4
Under 10,000 lumens	0.9	0.6	0.7

TABLE III—PER CENT DISTRIBUTION OF LAMPS BY AMPERAGE

Rating, Amp.	1920	1921	1922
4.0	13.0	9.8	9.0
5.5	8.5	8.7	7.8
6.6	57.5	61.7	60.1
7.5	13.7	11.3	12.0
Compensator (mostly 6.6)	7.3	8.5	10.3

Comparative Costs with Different Types of Prime Movers Used in Ice Manufacture

The assumed plant on which this table is based is a 100-ton high-pressure fresh-water plant, with 1,600 300-lb. cans, 35,000 feet of 1¼-in. pipe, four-can lift, automatic fill and 10,000-ton season ice storage; production, 32,000 tons per year.

ELECTRIC PLANT

Two Compressor Units, Synchronous-Motor-Driven

Ice-making machinery and water system, f.o.b. factory	$79,000
Freight, erection, ammonia, electric wiring and miscellaneous	15,000
Synchronous motors and switchboard, erected	12,000
	$106,000
Buildings, insulation, etc.-engine room, tank room, daily ice storage and office, at 11½ cents per cu.ft.	$34,000
Insulation of ice tank, daily storage, etc.	10,500
10,000-ton season ice storage, including insulation, elevator, doors, etc., at $9.80 per ton, complete	98,000
	142,500
Total investment, exclusive of land	$248,500

OPERATING COST PER YEAR

Labor:	
One chief engineer, at $225 per month	$2,700
Two watch engineers, at $175 per month	4,200
Three ice pullers, at $30 per week	4,680
Power:	
Yearly average, 46 kw.-hr. per ton, including storage; 32,000 tons, at 1.5 cents per kw.-hr. average	22,100
Oil, waste, ammonia and miscellaneous, at 7 cents per ton	2,240
Water for ice-making and tower make-up, 500 gal. per ton, at 10 cents per 1,000 gal.	1,600
Maintenance on machinery, at 2 per cent on $106,000	2,120
	39,640
Fixed charges:	
Interest, 6 per cent on $248,500	$14,910
Depreciation on buildings, 3½ per cent on $142,500	5,000
Depreciation on machinery, 6 per cent on $106,000	6,360
Insurance, taxes and miscellaneous, 1½ per cent on $248,500	3,720
	29,990
Total operating cost	$69,630

$$\frac{\$69{,}630}{32{,}000\ \text{(tons)}} = \$2.17 \text{ per ton}$$

UNIFLOW-ENGINE-DRIVEN PLANT

Two Compressor Units, Uniflow Engine-Driven Generator for Auxiliaries

Ice-making machinery and water system, with steam condenser and auxiliaries, f.o.b. factory	$98,000
Freight and erection, ammonia, salt, electric wiring, steam and exhaust mains (covered)	19,100
Two 200-hp. boilers, water tube, 165 lb. steam, 150 deg. superheat, with superheaters, stack, brickwork and boilerfeed pump, erected	22,000
100-kva. generator connected to uniflow engine	7,800
	$146,900
Buildings, insulation, etc., engine room, tank room, daily ice storage, boiler room and office, at 11½ cents per cu.ft.	$36,500
Insulation of tank, daily ice storage, etc.	10,500
10,000-ton season storage, including insulation, elevator, doors, etc., at $9.80 per ton, complete	98,000
	145,000
Total investment, exclusive of land	$291,900

OPERATING COST PER YEAR

Labor:	
One chief engineer, at $275 per month	$3,300
Two watch engineers, at $175 per month	4,200
Three ice pullers, at $30 per week	4,680
Three firemen, at $36 per week	5,616
Fuel:	
Average 2.8 i. hp. per ton ice, including storage, at 14.5—steam per i. hp.-hr. equals about 15½ tons ice per ton coal—32,000 ÷ 15½ = 2,060 tons coal, at $4.50	9,300
Oil, waste, ammonia, supplies, etc., at 9 cents per ton	2,880
Water for ice-making purposes and boiler and cooling tower make-up, 600 gal. per ton, at 10 cents per 1,000 gal.	1,920
Maintenance on machinery, at 3 per cent on $146,900	4,407
	$36,213
Fixed charges:	
Interest, at 6 per cent on $291,900	$17,514
Depreciation on buildings, 3½ per cent on $145,000	5,075
Depreciation on machinery, 8 per cent on $146,900	11,752
Insurance, taxes and miscellaneous, 1½ per cent on $291,900	4,378
	38,719
Total operating cost	$74,932

$$\frac{\$74{,}932}{32{,}000\ \text{(tons)}} = \$2.34 \text{ per ton}$$

(Equivalent to electric power at 1.86 cents per kw.-hr.)

OIL-ENGINE-DRIVEN PLANT

Full Diesel Type (Busch-Sulzer Type or Equal), Two Compressor Units, One Generator Unit

Ice-making machinery and water system, f.o.b. factory	$78,000
Freight, erection, ammonia, salt, wiring, etc.	14,000
Two oil-engine units for driving ammonia compressors by belts, erected, including oil piping, tanks, etc.	35,000
100-kva. generator, direct-connected to 150-hp. oil engine	20,000
	$147,000
Buildings, insulation, etc.—engine room, ice-tank room, daily ice storage and office, at 11½ cents per cu.ft.	$37,000
Insulation of ice tank, daily storage, etc.	10,500
10,000-ton season ice storage, including insulation, elevator, doors, etc., @ $9.80 per ton, complete	98,000
	145,500
Total investment, exclusive of land	$292,500

OPERATING COST PER YEAR

Labor:	
One chief engineer, at $275 per month	$3,300
Two watch engineers, at $175 per month	4,200
Two extra men, at $36 per week	3,744
Three ice pullers, at $30 per week	4,680
Fuel:	
Average 2.6 eng. b.-hp. per ton, including storage, 5½ gal. fuel per ton ice, at 5 cents per gallon	8,800
Engine lubricating oil, 1 gal. per 1,000 hp.-hr., equals 0.07 gal. per ton ice, at 50 cents per gallon	1,120
Compressor oil, waste, ammonia, etc., at 7 cents per ton	2,240
Water for ice making and cooling tower make-up, 500 gal. per ton, at 10 cents per 1,000 gal.	1,600
Maintenance on machinery, at 4 per cent on $147,000	5,880
	$35,564
Fixed charges:	
Interest, at 6 per cent on $292,500	$17,550
Depreciation on buildings, 3½ per cent on $145,500	5,100
Depreciation on machinery, 8 per cent on $147,000	11,760
Insurance, taxes and miscellaneous, 1½ per cent on $292,500	4,388
	38,798
Total operating cost	$74,362

$$\frac{\$74{,}362}{32{,}000\ \text{(tons)}} = \$2.32 \text{ per ton}$$

(Equivalent to electric power at 1.83 cents per kw.-hr.)

OIL-ENGINE-DRIVEN PLANT

Semi-Diesel Type (Fairbanks-Morse, Worthington or Equal) Two Compressor Units, One Generator Unit

Ice-making machinery and water system, f.o.b. factory	$78,000
Freight, erection, ammonia, salt, wiring, etc.	14,000
Two oil-engine units for driving ammonia compressors by belts, erected, including oil piping, tanks, etc.	19,000
100-kva. generator, direct-connected to 150-hp. oil engine	12,500
	$123,500
Buildings, insulation, etc.—engine room, ice storage and office, at 11½ cents per cu.ft.	$37,000
Insulation of ice tank, daily ice storage, etc.	10,500
10,000-ton season ice storage, including insulation, elevator, doors, etc., at $9.80 per ton, complete	98,000
	145,500
Total investment, exclusive of land	$269,000

OPERATING COST PER YEAR

Labor:	
One chief engineer, at $275 per month	$3,300
Two watch engineers, at $175 per month	4,200
Two extra men, at $36 per week	3,744
Three ice pullers, at $30 per week	4,680
Fuel:	
Average 2.6 eng. b. hp. per ton, including storage, 7 gal. fuel oil per ton ice, at 7 cents per gallon	11,160
Engine lubricating oil, 1 quart per 100 hp.-hr. equals 0.175 gal. per ton ice, at 50 cents per gallon	2,800
Compressor oil, waste, ammonia, etc., at 7 cents per ton	2,240
Water for ice-making and cooling tower make-up, 500 gal. per ton, at 10 cents per 1,000 gal.	1,600
Maintenance on machinery, 5 per cent on $123,500	6,175
	$39,899
Fixed charges:	
Interest, 6 per cent on $269,000	$16,140
Depreciation on buildings, 3½ per cent on $145,500	5,100
Depreciation on machinery, 9 per cent on $123,500	11,115
Insurance, taxes and miscellaneous, 1½ per cent on $269,000	4,040
	36,395
Total operating cost	$76,294

$$\frac{\$76{,}294}{32{,}000\ \text{(tons)}} = \$2.38 \text{ per ton}$$

(Equivalent to electric power at 1.96 cents per kw.-hr.)

WHILE electric drive for ice plants is recognized as the most economical because of the smaller investment, lower maintenance and repair costs and the advantage of employing less skilled labor than is required for other kinds of power, great economy has been claimed for both uniflow and oil-engine-driven plants. Actual comparisons show that electric drive is cheaper than either of these two forms of power. A careful analysis of the cost of operating ice plants with various types of prime movers has been made by J. R. McCoy, assistant commercial manager of the Texas Power & Light Company. In the above comparative tabulation it will be seen that the cost per ton of ice made in electrically driven plant is from 6 to 9 per cent less than in any of the three other plants under consideration.

Automatic Demonstration of Electric Range

TO STIMULATE interest in electric ranges, the Dayton Power & Light Company recently held a demonstration wherein a range was sealed and left to start operation automatically and cook a 5-lb. roast-pork dinner without any attention. This was the opening demonstration in the company's campaign to sell ranges on the easy-payment plan.

Realizing that in every community there are home economists whose acceptance of any household appliance or idea makes it desirable for every home, the Dayton Power & Light Company invited Miss Katherine Hardy, supervisor of home economics in the Dayton public schools; Miss Bessie T. Worman of the Dayton Women's Club, and Miss Verrall J. Craven, supervisor of home economics at the Moraine Park schools, to witness a dinner cooked automatically on the electric range.

These ladies arrived at 6 p.m. and saw the city sealer weigh the meat and put it into the large oven, three vegetables being put in the small oven. The oven doors were then shut and sealed so that they could not be disturbed. The alarm clock was set to start the cooking at 5:30 the next morning and the thermostat was set at the desired points. Then the range was left until the next morning, when the seals were broken and the roast was again weighed. During the cooking it had lost only 16½ ounces, or 21 per cent. This small percentage of shrinkage was due to the airtight construction of the oven retaining the stored-up heat. The graphic wattmeter indicated that both ovens had started to cook at exactly 5:30 a.m. The current in the small oven containing vegetables and apples was cut off twenty-five minutes later, while in the larger oven energy was stopped at 6:25 a.m. The energy consumed at the cooking rate cost only 9 cents.

The Dayton company is working in conjunction with the local dealers in developing a greater range load and is selling ranges direct to customers because it is felt that the company is better equipped to merchandise this type of equipment as the time payments can go along with the regular monthly lighting bills. This selling program extends over all the company's territory adjoining Dayton — Piqua, Xenia and Wilmington—where special demonstrations were also conducted.

HOME ECONOMICS SUPERVISORS WITNESS STARTING OF AUTOMATIC DEMONSTRATION OF ELECTRIC RANGE

U. S. Post Office to Use Electric Trucks

CONTINUED consideration over a period of years has resulted in the purchase of sixteen electric trucks by the United States post office authorities. These vehicles include four trucks manufactured by each of four companies—the Commercial Truck Company, the Autocar Sales & Service Company, the Ward Motor Vehicle Company and the Walker Vehicle Company. The trucks will be used in New York, Boston, Chicago, Philadelphia, Detroit, St. Louis, Washington and other cities. A careful record of operating costs as compared with gasoline operation will be kept, and the result will undoubtedly influence future purchases of electric trucks for post office use.

It is interesting to note that a few years ago W. G. Richards estimated that there would be an annual saving of $200,000 in New York City alone, and more than a million dollars the country over, if gasoline trucks were replaced by electrics for post office service.

What Other Companies Are Doing

Boston, Mass.—To May 1 the sales department of the Edison Electric Illuminating Company had contracted for 33,094 kw. of additional connected load. A quota of 100,000 kw. for the year has been set. New business gained has been highly diversified, and unusually active appliance sales are helping to increase the company's output throughout its territory of nearly 700 square miles.

Dayton, Ohio. — The Dayton Power & Light Company is about to launch a special selling campaign for electrical appliances in co-operation with the dealers who are the members of the Electrical League of Dayton. The plan provides that all persons wishing to purchase appliances can buy them from these dealers and pay for them at the utility office in monthly payments as they pay their electric light bills.

Vancouver, B. C. — The British Columbia Electric Railway Company recently entertained the Vancouver City Council and the mayors of surrounding cities at a dinner at the Stave Lake plant of the company. The occasion was the visit of Sir Ernest Maes Harvey, a London director of the company. George Kidd, general manager of the company, told the guests that three dams are being built at the company's hydro-electric plant to insure a continuous water supply at a cost of more than $1,000,000. This work will be completed in September and is giving employment to 275 men.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Hydro-Electric Development and Steam Equipment

Problem of Direct Transformation of Combustive Energy to Electrical Energy (the Combustion Cell).—GÖSTA ANGEL.—The author gives a historical review of this subject and mentions that, although it has not as yet passed the stage of laboratory experiments, the difficulties are not greater than those of other problems of the same nature which have been solved successfully. The three types of combustion cells which are being studied at the present time are: (1) The carbon cells. It is doubtful whether these will ever be practicable on account of the difficulties in obtaining pure carbon. (2) The gas cells. Thus far these have given the best results. The tendency for polarization has made it necessary to work with high temperatures, whereby the efficiency is limited to about 50 per cent. However, this represents a considerable advance above the average efficiency of a steam generator. (3) Cells with electrodes of metal. Very little is known about these as yet.—*Teknisk Tidskrift (Swedish)*, April 14, 1923.

Largest Low-Head Turbines Installed in Siphon Settings.—With the head low or the flow varying through a wide range, water-power developments are frequently uneconomical because of the high cost involved. Where both of these occur in the same installation, as in the case of Green Island (N. Y.) development of Henry Ford & Son, Inc., near Troy, N. Y., the possibilities of making the project a commercial success are greatly lessened. In the Green Island development the head varies from practically zero to 17 ft. and the flow from 2,000 cu.ft. per second to a maximum of 250,000. —*Power*, May 22, 1923.

Generation, Control, Switching and Protection

Frequency Converter Ties Between Large Power Systems.—J. W. DODGE.—With the advent of the "superpower zone" some means must be used of making power of various frequencies available over large areas. The author describes the various types of frequency changers applicable to these systems, discussing their relative merits and their fields of application. — *General Electric Review*, June, 1923.

Statistical Investigations of Disturbances Caused by Lightning in Electrical Installations. — SIGURD RUMP. — This paper contains statistical data furnished by a large Swiss manufacturer of disturbances caused by lightning on electrical installations. The investigation covers transformers, generators and an explanation of the formation of voltage waves in transmission lines. These waves may obtain a very abrupt front when a discharge to ground occurs which causes violent oscillations in the electrical circuits. A number of actual cases are cited to support the author's theory and a few suggestions for the protection of electrical installations against the effects of lightning are given.—*Teknisk Tidsskrift (Danish). Elektroteknikern*, April 18 and May 2, 1923.

Transmission, Substations and Distribution

The Power Balance and General Plans for the Distribution of Energy in Sweden.—NILS EKWALL.—This paper is a description of the work that has been done by a special committee for investigating the power balance in Sweden. Data are given with reference to the estimated power consumption during the next twenty years by various industries. Plans for superpower systems are outlined.—*Teknisk Tidskrift (Swedish)*, May 26, 1923.

New Type of Insulator for High-Tension Transmission Line. — LUIGI PEROTTO.—The successful operation of a transmission system depends to a large extent upon the degree of insulation attained, and the most important factor is the insulator. Some of the troubles encountered with present-day insulators are uneven distribution of the magnetic field and uneven mechanical stresses between the porcelain, metal and cement. The very large percentage of replacements of insulators after a line has been in operation a few years prove that we are still far from having a real apparatus on which we can safely rely. In this article a new type of insulator is described which the author claims avoids all the above-mentioned troubles. This insulator was tested at 520,000 volts and was then mounted in a 120,000-volt test transmission line, giving very satisfactory results.—*Elettrotecnica*, May 25, 1923.

Characteristics and Performance of Conversion Apparatus for Edison Systems.—T. F. BARTON and C. M. FULK. —The operators of Edison systems will find in this article information which will be of great value concerning the characteristics and performance of converters and motor-generators, particularly with regard to starting, synchronizing, low-voltage connections, direct-current voltage range, voltage characteristics, load limiting, three-wire operation, inclosing features, effect of alternating-current disturbances and re-energizing a system.—*General Electric Review*, June, 1923.

Units, Measurements and Instruments

Instrument Transformers and Continuous Service of Power Distribution. — GINO CAMPOS. — Instrument transformers may easily constitute a weak point of any installation, so that special care should be taken in the designing, mounting and grouping of them. This article deals with the most important troubles arising from such kind of apparatus and suggests the best ways to avoid them in order to assure the continuous service of the line. Instrument transformers for high-voltage circuits are also treated.—*Elettrotecnica*, May 15, 1923.

Electric Testing Laboratory. — J. B. BRETON. — Some of the electric machinery left in France by the American Expeditionary Forces has been acquired and salvaged by the French government and has been used to equip a national research laboratory, described in detail in this paper. The available motors, generators, converters, transformers, switchboards, etc., have been arranged so as to provide the most suitable and flexible testing equipment for all kinds of scientific research and technical routine work. A large number of neon high-voltage lamps have been installed where an optical indication of dangerous live parts has been deemed advisable. While the installed machine capacity amounts to many hundred kva., only 150-kva. is available to the laboratory through the main feeder from the Parisian power station.—*Revue Générale de l'Electricité*, June 2, 1923.

Method for the Accurate Measurement of Short Time Intervals.—H. L. CURTIS and R. C. DUNCAN.—A method is described whereby the time between two events which occur less than a second apart can be determined with a high degree of accuracy. The method consists of ruling on a moving film a uniform time scale simultaneously with the recording of the events to be studied. The time scale is obtained by throwing flashes of light on the film, the interval between flashes being governed by a special shutter fastened directly to and operated by the prongs of a tuning fork. The article includes a complete discussion of the necessary conditions for the best results, the sources of error inherent in the method and the accuracy which may be expected.—*Scientific Paper No. 470 of the Bureau of Standards.*

Illumination

Lighting Effects on the Stage.—L. HARTMANN.—The value of lighting in a theater and the lack of outfits in different theaters necessitate a complete electrical equipment for every play. The author describes lighting interior and exterior scenes of dramatic productions, calling attention to the difficulties encountered, such as the impossibility of obtaining pure color effects and the danger of over-illumination. He uses reflex glass as a medium for softening light on both reflectors and

lenses. In some cases footlights are dispensed with and overhead lighting alone is used. The most desirable stage lighting is simple in construction and not radical in effect.—*Transactions of the Illuminating Engineering Society*, May, 1923.

Electrophysics, Electrochemistry and Batteries

Electrolysis Investigation. — The Bureau of Standards has recently undertaken an extensive electrolysis investigation in the city of Galveston, Tex. The primary object of the work is to obtain additional data concerning the application of the earth-current meter to electrolysis testing. It is expected that the results will demonstrate further the utility and necessity of employing this method and instrument where reliable information as to electrolysis conditions and a quantitative measure of the degree of hazard are required.—*Technical News Bulletin No.* 72 *of the Bureau of Standards.*

Non-Magnetic Cast Iron.—GUMLICH. —A special kind of cast iron is being manufactured which has all the properties of other kinds but is almost totally non-magnetic. It can be used to great advantage in cases where magnetic leakage would cause additional losses in ordinary cast iron and where brass is being used now. In comparison with ordinary cast iron and brass the following data are of interest:

	Maximum Permeability	Ohms per m./mm.²
Cast iron	330	0.950
Non-magnetic iron ..	1.03	1.400
Brass	1.00	0.075

The metal has also a very low temperature-resistance coefficient and may therefore be used advantageously for cast resistor grids. The material is tougher and less sensitive to sudden stresses. While nothing is being said about the composition of the alloy, the author assumes it to be cast iron with 12 to 16 per cent of manganese.—*Elektrotechnische Zeitschrift*, May 24, 1923.

Traction

Overhead Line Construction Through a Six-Mile Tunnel.—G. MARKT.—The electrification of the Arlberg railroad in Austria required special construction for the overhead-line-supporting structures through the 6-mile Arlberg tunnel. The road is 16⅔ cycle, single-phase, 15,000-volt system with a double track through the tunnel. During the entire electrification period traction by steam was carried on through the poorly ventilated tunnel on regular schedule. This caused many difficulties from the effect of fumes and gases both upon the men and upon the line material. A simple catenary suspension with two copper conductors for each track on a bronze carrier cable was chosen and laid out in zigzag over the rails. A mean distance of 255 m. was maintained between the supports, which were fastened to the top of the tunnel with two heavy bolts. The rather limited overhead room and the relatively high potential required a double insulation for all live parts, which was made by a combination of double-bell pin insulators and porcelain rolls. The very uniform temperature within the tunnel made any automatic tension "take-up" of the wires unnecessary. In the middle of the tunnel oil switches to disconnect the line or to interconnect any of the four wires are installed. All structural steel used in the supports is coated by the Schoop metal-spray process first with a layer of zinc and then with a layer of lead. An interesting statement, made to give an idea of the extremely corrosive action of combined humidity and fumes in the tunnel, is that not less than 30 tons of steel is eaten away from the rails every year by rusting. This is about five times more than on the open road. A special six-car building train was used in the tunnel for line construction, including one car containing an electric lighting set. It is claimed that the profuse illumination of the working area within the tunnel added greatly to the quick erection, which averaged five supports per shift. —*Siemens Zeitschrift*, May, 1923.

Electrification of Swedish Railroads. Power Supply and Different Systems.— J. KÖRNER.—The electrification of the railroad between Stockholm and Gothenburg (about 300 miles) was tentatively decided upon in 1920 when the committee for investigation of this question recommended the single-phase system (15,000 volts, 16⅔ cycles). The Riksdag appropriated money for beginning the work under the condition that additional investigation should be made to establish definitely the disadvantages of the single-phase system. This paper is a review of the work of the committee chosen for this purpose. The question of power supply is outlined and a comparative economical analysis is made between the three systems under consideration (15,000-volt, 16⅔ cycle, single-phase; 1,500-volt direct current and 3,000-volt direct current. The results of this analysis indicate that even with the additional expense encountered in changing the telephone and telegraph lines the advantages of the single-phase system are sufficient to warrant the committee in adhering to the original recommendations.—*Teknisk Tidskrift* (*Swedish*), *Elektroteknik*, April 7, 1923.

Telegraphy, Telephony, Radio and Signals

Disturbances in Telephone and Telegraph Lines in Connection with Electrified Railroads.—ARVID HOLMGREN.— The author gives a general review of the subject and discusses the available methods for elimination of these disturbances. It is shown that an application of the single-phase system to the railroad from Stockholm to Gothenburg must be accompanied by a rearrangement of the present system of telephone and telegraph lines. The minimum distance between a single-phase railroad and a telephone or telegraph line is considered as 650 ft. This entails an additional expense for the single-phase electrification of this railroad of about 8,000,000 kroner, in spite of which the single-phase system in this case maintains its superiority.—*Teknisk Tidskrift* (*Swedish*), *Elektroteknik*, April 7, 1923.

Wireless Apparatus.—W. H. ECCLES. —The author discusses several new methods of radio transmission and describes apparatus that has been tested out in laboratories but not yet tried on a large scale.—*Electrician* (*London*), May 11, 1923.

Carrier-Current Communication Over High-Voltage Transmission Lines.—E. AUSTIN.—The author's comprehensive and practical treatment of this subject, concerning which there has been little published hitherto, is of particular value at this time. He discusses advantages and disadvantages, the more suitable types of carrier equipment, describes a few installations and prophesies as to the future.—*General Electric Review*, June, 1923.

Directive Radio Transmission on a Wave Length of 10 *Meters.*—F. W. DUNMORE and F. H. ENGEL. — The authors describe a series of experiments in radio-telegraph and radio-telephone transmission on a wave length of 10 m., using at the transmitting station a reflector consisting of short vertical wires arranged as elements of a parabolic cylinder. It was found that at least 75 per cent of the radiated power was confined to an angle of 40 deg. Studies were made of the effect of removing the wires near the center of the reflector, of removing alternate wires in all parts of the reflector, or detuning the wires, and of varying the aperture of the reflector. Constructional details of the apparatus employed are given.—*Scientific Paper No.* 469 *of the Bureau of Standards.*

Miscellaneous

Acid-Proof Coatings for Concrete Surfaces.—A bulletin dealing with acid-proof coatings for concrete surfaces, which has been recently revised. It contains many corrections and much new material, among which are specifications covering materials for acid-proof mastics and methods for their application as well as a detailed description of acid-proof asphalt flooring composition for cold application.—*Letter-Circular No.* 42 *of the Bureau of Standards.*

Development of Industrial Safety Codes. — M. G. LLOYD. — After giving statistics showing the need for accident-prevention work from both the humanitarian and the economic viewpoint, this paper shows the value of state inspections and national codes. It then presents a brief history of the American Engineering Standards Committee's activity in this field and of the Safety Code correlating committee. An outline of the manner in which safety codes are now formulated is given.—*Mechanical Engineering*, June, 1923.

New Books

Reviews of the Latest Contributions to Technical, Industrial and Commercial Literature of Particular Interest to Members of the Electrical Industry

Hydro-Electricity in Northeast Italy

Report of the Regional Commissary for the Generation and Distribution of Electricity in the Venetian Provinces.

This report by Prof. Lorenzo Ferraris, the commissary appointed by the state with full powers to regulate the operation of hydro-electric and steam plants and the curtailment of the use of electricity to all towns and rural consumers during the period of the exceptional drought in the Venetian Provinces between December, 1921, and March, 1922, describes the plan adopted and reproduces the rules and orders issued by the authorities, stating the results obtained. Independently of this specific information, the document is a most valuable analytical study of an extensive regional hydro-electric development covering the large territory of the northeastern Italian provinces, including the cities of Venice, Padua, Verona, Udine, Trento and Trieste.

The subject is treated in a comprehensive and thorough manner. Its every phase is analyzed with the acumen of a broad-visioned engineer who not only tries to co-ordinate the available resources to ameliorate the emergency conditions of the moment but also points out the possible improvements which would prevent a repetition of similar shortcomings. In this respect the report is full of suggestions which make it valuable to every one interested in hydro-electric power developments with a seasonable or variable flow of water.

The report is richly illustrated with photographs, maps and diagrams. The printing and reproduction are of a high standard and clearness.

PHILIP TORCHIO.

Depreciation of Public Utility Properties

By Henry E. Riggs. New York: McGraw-Hill Book Company, Inc. 211 pages.

Of all words subject to misunderstanding in public utility work "valuation" and "depreciation" head the list. Views held by honest engineers and accountants are almost as divergent as the colors of the rainbow. Nor is the highest court of the land, with all the vaunted skill of the legal mind to bring order out of chaos and clarity out of abstruseness, much better than they. Valuation and depreciation partake of the nature of chameleons and change color with circumstances, with the times and with the courts. Eventually we shall know what valuation and depreciation, legally defined and fixed, mean, but not now.

So the author attempts to find that middle ground of absolute fairness and justness which must be determined before the public utility issue may be considered as reasonably settled. He leads the reader through six chapters of germane and relevant matter dealing with regulation, investments, rates, operations, price fluctuations and fair value and then takes up replacement and depreciation and shows their relation to fair value and changes in the matter of price. He buttresses his arguments with numerous Supreme Court decisions bearing on the subject and adds an appendix of fifty-nine pages. The author has a good grasp of the subject and treats it with a broadness that is refreshing. The work is well done and ought to make a welcome addition to the library of any public utility executive and engineer engaged or interested in valuation work.

Wasserkraft Ausnützung und Wasserkraft Maschinen

No. 732 of the collection "Aus Natur und Geisteswelt." By F. Lawaczek. Leipzig and Berlin: B. G. Teubner. 116 pages, 57 illustrations.

All the booklets of this large collection treat their subjects in a popular manner easily comprehensible to the layman. The one under notice contains three main chapters: "Economical Basis of the Use of Water Powers," "Technical Basis of the Use of Water Powers" and "Hydraulic Machines." The first part is a beautifully written "hydraulic romance," if one may be permitted to use the term. The dwindling supply of coal, which at the present rate of consumption may be exhausted within eight generations, and, on the other hand, the never-failing watersheds will force mankind in its pursuit of energy-producing sources to turn more and more and eventually altogether to hydraulic power. The second part of the little book deals with the methods of measuring water energy and the use and principle of dams and reservoirs. The last section describes in a simple way waterwheels, turbines and hydraulic air compressors.

A. PALME.

Lighting Circuits and Switches

By Terrell Croft. New York: McGraw-Hill Book Company. 472 pages, 557 illustrations.

A practical reference book relating to electric lighting circuits and switches for interior building applications operating on low-potential systems (less than 600 volts). Most of the matter deals with 110-220-volt, two-wire and three-wire systems. The principal rules of the National Electrical Code which concern the subjects under discussion are interpreted. How to comply with these code rules is explained.

The simpler circuits are explained and described in the book, but its most important function is to show diagrams and give descriptions of the more complicated circuits and control methods. These are the methods with which relatively few men are familiar and which are in any case easily forgotten. The work consists largely of diagrams and drawings which it has been endeavored to make self-evident.

There is a closing division which discusses theater-lighting circuits. This includes complete specifications for the electric lighting of a modern theater.

Appareils et Installations Télégraphiques

By Prof. E. Montoriol, Ecole Supérieure des Postes et Télégraphes, with preface by A. Blondel. Paris: J. B. Baillière et Fils. 625 pages, 449 illustrations.

This work is a detailed exposition of the present state of telegraphy both in France and in other countries. The author begins by describing transmission apparatus, including printing devices, autographic apparatus, telephotographic devices and telautographic methods. Then he examines the different means of increasing line capacity, those relating to the conductors themselves such as the sectionalization of the lines, relays and transpositions; those which permit simultaneous transmissions such as duplex, quadruplex and multiplex systems, oscillating currents and the use at the same time of the same line for telegraphic and telephonic messages, and, finally, automatic and multiple transmission systems. The book concludes with a comparison of all the systems under review. This recapitulative study, based upon indisputable technical considerations, is complete and precise. The volume will be found indispensable to professional engineers.

Books Received

Atoms. By Jean Perrin. New York: D. Van Nostrand Company. 231 pages.

Elektrische Schaltvorgange. By Reinhold Rudenberg. Berlin: Julius Springer. 504 pages, illustrated.

Radio—Télégraphie, Téléphonie, Concert. By E. Reynaud-Bonin. Paris: Gauthier-Villars et Cie. 176 pages, illustrated.

Applied Personal Procedure. By Frank E. Weakly. New York: McGraw-Hill Book Company. 192 pages, illustrated.

Railroad Electrification and the Electric Locomotive. By Arthur J. Manson. New York: Simmons-Boardman Publishing Company. 332 pages, illustrated.

Atlas of U. S. A. Electric Power Industry. Outlining Suggested Regional Electric Power Districts and Proposed Constant-Potential Transmission Systems for the United States of North America. By Frank G. Baum. New York: McGraw-Hill Book Company, Inc.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Regulation of Coal Mining

President's Commission Recognizes Its Necessity—Upholds Power of Government to Control

IN A PRELIMINARY report on the anthracite coal situation, made public on Monday last, President Harding's fact-finding commission unanimously declares for government regulation with power in the last resort to seize the mines. It says: "Coal is quite as much a public necessity as gas, street-railway service or any other service or commodity that has been brought under public regulation." The commission admits that there is not sufficient basis in knowledge or experience as to just how far control or regulation should be exercised in insuring maximum service to the public by the coal industry, but the industry itself is asked to modernize its wage agreements and the machinery for interpreting them, to set up an adequate inspection service of its own and to improve its practices generally, and the public is called upon to exert itself for its own welfare.

The commission recognizes that any failure on the part of the industry to discharge properly its own responsibilities, thereby stopping the flow of coal long enough to imperil the public interest, would justify the government in taking over "the operation of the mines and the transportation and distribution and marketing of the product, with full power to determine the wages to be paid the mine workers, the prices at which the coal shall be sold and, subject to court review, the compensation to be paid to land and mine owners." Not more than a month ago the Supreme Court of the United States, in the Kansas Industrial Court case, said that since the adoption of the Constitution the vocations of the coal miner and the coal operator have not been regarded as public callings. The utterance of the court is a historical fact, but this jury of six representative Americans has decreed something different for the future. That jury holds "that a limited natural monopoly, like anthracite, held by a relatively small number of individuals, estates and companies, and supplying a necessity of life for millions of our people, cannot continue to be treated as if it were not affected by a public interest."

Exhorting operators and miners alike to "forget past differences and grievances and attack the problem in the spirit of justice and fair dealing, not only between themselves, but with due regard for the rights and sensibilities of the American people," the commission concludes:

"The commission recommends at this time no punitive legislation. It awaits with interest whether the next agreement entered into shall show a co-operative spirit, a clear idea of partnership on the part of all concerned in it, and a proper conception of the rights of the American people. These rights in the anthracite region are no different from those in the bituminous, and the judgment of the commission will be very largely affected by what takes place in the present negotiations."

Law Handicaps Louisville

City's Debt Limit and Other Barriers Give Company Advantage in Falls of Ohio Contest

IT IS so apparent that the city of Louisville is not legally competent to undertake the development of power at the Falls of the Ohio and on the Green River that it is difficult to see how it would be possible for the Federal Power Commission to grant the application of that municipality for rights in connection with this development. The city, however, is very much in earnest, and it is safe to assume that careful consideration will be given to all phases of the matter before any decision is handed down.

The Louisville Hydro-Electric Company, with the application of which Louisville's conflicts, is a subsidiary of the Louisville Gas & Electric Company, which has an existing steam installation of 90,000 hp., 30,000 hp. having been installed recently. The power market in Louisville and its vicinity is growing, but a report for 1920 shows the average load to be only 25,000 kw. with a peak demand of 61,000 kw. It is estimated that 75,000 hp. of secondary power can be developed at the Falls of the Ohio. The Louisville Hydro-Electric Company desires to use its existing steam power partly as a standby to this water power. The city of Louisville, which asserts it will not interfere in any way with the existing market of the Louisville Gas & Electric Company, proposes to supplement the Ohio River power by constructing a high dam in the Green River, near Mammoth Cave. Sufficient storage is planned to maintain 100,000 hp. output throughout the year from the combined plants. The estimate of its engineer, Gen. William L. Sibert, indicates that the Green River auxiliary will cost $5,000,000 and the Falls of the Ohio plant $10,000,000, or $150 per horsepower development.

Legal Barriers in City's Way

Under the water-power act the Federal Power Commission must determine the legal competency of any applicant. In this case it must consider the likelihood of the city's finding itself unable to finance its plans and must also satisfy itself that the city has the authority to transmit and sell power beyond the city limits and in another state. It is apparent that if an entirely new load cannot be brought in, there is not sufficient room for the two power-producing enterprises. In that case it would be necessary for the city to take over the plants and distribution system of the power company or compensate it for severance damages, which would be virtually equivalent to the purchase of the plant; but the city cannot take over the works of the power company without exceeding the limit of its bonded indebtedness.

Inland Electric Navigation

Ships Embodying Novel Features Will Go Into Service on Canal Route from Duluth to New York

CONSTRUCTION details of the electrically propelled ships planned by the McDougall Terminal Warehouse Company for operation between Duluth and New York have just been made public. These vessels will be built by the Great Lakes Engineering Works of Detroit.

The ships are designed for operation through the Great Lakes and Welland Canal and the New York State Barge Canal via Oswego and the Hudson River to New York and coast points. They will be of full Welland Canal dimensions—258 ft. long, 42 ft. beam and 19 ft. in depth—and built to the highest class of the American Bureau of Shipping for Great Lakes and coastwise trade. The class covers trade to the West Indies, Gulf of Mexico and Caribbean. On Barge Canal draft the ships will have a dead-weight capacity of about 1,700 tons and at sea about 2,600 tons.

The propelling machinery is to be of the Diesel-electric type, in which two six-cylinder Lombard-Diesel engines in each ship are coupled to and drive electric generators. These in turn will supply electric current to the motors, which will be directly coupled to the twin screws. The generators will also supply energy for all the auxiliary machinery equipment, such as pumps,

windlasses, capstans, steering gear, refrigerating machinery, fans, lighting, etc. The quarters will be heated electrically; the galley range will be of the electric type; the water for baths and other purposes will be electrically heated, and electric fans in every room will keep the quarters cool in hot weather. Even the whistle will be operated by a motor instead of by steam or compressed air. Auxiliary generating units will also be provided for use in port or when the vessel is not under way.

PROPELLER CONTROL

An unusual and interesting feature is found in the system of control of the propulsive units. The propeller motors will be controlled entirely from the pilothouse, both as to speed and direction, through especially designed controllers under the hand of the watch officer. No reversing or maneuvering of the main engines will be done at all. The engines driving the generators will run steadily at one speed and the engine room force will take no part in the handling of the ship. This arrangement, which gives extreme flexibility as well as centralization of control, is peculiar to the electric drive. A further advantage lies in the elimination of racing of propellers in heavy weather, with attendant risk of failure of propellers and shafts.

The plans and specifications for these vessels were prepared by Henry Penton, Cleveland, in collaboration with A. Miller McDougall, president of the Terminal company.

Reliability of Relays a Theme at Seattle

Forecasting Water Supply, Temperature-Cycle Tests and Demand Meters Are Other Topics—Commercial Section Discusses Range Load—Insurance Man Sees Public Ownership Menace

ALTHOUGH only one day was devoted to the technical and commercial sessions of the Northwest Electric Light and Power Association, which, as already reported in these columns, met in Seattle on June 27-30, a great deal was accomplished in this time and the meetings and papers were of more than ordinary interest and profit. To operating men attending the technical session the report and discussion on relays were perhaps the most instructive. It was made clear that nearly all power companies have either fully equipped their systems with relays or have comprehensive relay programs. S. C. Lindsay of the Puget Sound Power & Light Company said that out of eighty-four cases of trouble on that company's system in the past year there were only six cases where relays did not function properly. A manufacturers' engineer, joining the discussion, said that relays can be depended upon to operate 95 per cent effectively in a large number of cases of trouble.

FORECASTING WATER SUPPLY

The hydraulic power committee during the past year made a study of methods for measuring snow to forecast water supply. Information obtained from such studies was declared to be highly valuable to the power companies, and it was planned to carry on this work and attempt to develop a reliable system of forecasting. It was suggested that during the coming year this committee make efficiency tests on hydro-electric plants and study their operating and maintenance problems. It was pointed out also that there is need for greater efficiency in draft tubes.

Discussion of the overhead-systems committee's report indicated that power companies in the Northwest prefer kiln-fired cedar poles where these can be obtained.

M. T. Crawford of the Puget Sound Power & Light Company described the temperature-cycle tests on high-tension insulators which are being conducted in Seattle and asserted that the tests had not progressed far enough to draw definite conclusions, but that good results are expected.

Following the report of the meter committee, R. E. Thatcher of the Puget Sound Power & Light Company presented a paper on the proper selection of demand meters. This paper included curves to show the economical load to put on a meter. These made clear the large loss in revenue resulting from operating meters on heavy overloads.

A. H. Kreul of the Portland Railway, Light & Power Company stated that because of this loss of revenue and the burn-outs resulting from the large present-day appliance load on 5-amp. meters his company has adopted the 10-amp. three-wire meter as standard for its system.

RANGES ARE COMMERCIAL SECTION TOPIC

The Commercial Section has asked the executive committee of the association for an appropriation to employ a competent man to make a thorough investigation of the electric range load. The proceedings at the commercial session made it manifest that though all of the large companies in the Northwest have accepted the electric range as a desirable load builder, little is known about the characteristics of such loads. It is therefore proposed to investigate every phase of the range business—the demand of individual ranges and groups of ranges, the cost of serving and servicing ranges and the desirability of the electric range as a revenue producer. All of the larger power companies in the Northwest are in the business of selling ranges and are actively pushing sales because they have found that the electrical dealers are not able to give them the volume of range load they desire.

In a discussion on the compensation of appliance salesmen the consensus of opinion was that the group bonus system is preferable to the individual bonus plan.

OUTSIDERS SEE COMMON PROBLEM

The discussion on the first day of the convention of utility company problems by speakers invited from outside the industry was animated and showed on the part of some of these representatives of other interests a degree of distrust of public sentiment larger than the electric light and power company which cultivates good public relations is prone to entertain. H. S. Ives, an insurance man of Chicago, for instance, in speaking on "State and Municipal Ownership from the Insurance Man's Point of View," dwelt upon what he held to be the necessity for a realization on the part of utilities and every privately owned enterprise and industry that they have a common problem in combating the public ownership sentiment which he thought to be sweeping the nation and threatening to engulf the entire country in a reign of socialism.

After two days of hard work in Seattle, the delegates and those accom-

DELEGATES TO SEATTLE CONVENTION OF NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION

panying them to the number of more than 250 went by boat to Victoria, B. C., for two days of recreation. The annual golf tournament and banquet were held there and several sightseeing trips were made to points of interest.

NEW OFFICERS ELECTED

At the executive meeting following the banquet the following officers were elected: President, George L. Myers, Pacific Power & Light Company, Portland; vice-president for Washington, R. M. Boykin, North Coast Power Company; vice-president for Oregon, A. C. McMicken, Portland Railway, Light & Power Company; vice-president for Idaho, R. B. King, Idaho Power Company, Boise; vice-president for Utah, S. R. Inch, Utah Power & Light Company, Salt Lake City. L. B. Faulkner of Olympia, Lewis A. Lewis of Spokane and Lewis A. McArthur of Portland were elected members at large of the executive committee.

Sacramento Has Big Plan

River Sites in California, Tennessee, Virginia and Arizona Attract Promoters' Attention

SACRAMENTO has applied to the Federal Power Commission for a preliminary permit covering a large power irrigation and water-supply project which will involve the ultimate development of 260,000 hp. in Silver Creek in Eldorado County, Cal. The city desires to develop two reservoirs on the headwaters of the Rubicon River. The water then is to be diverted into a large reservoir on Silver Creek. Below this storage reservoir the plans call for three large power houses on Silver Creek. One is to be at the junction with Brush Creek and the South Fork of the American River and another at Caloma on the South Fork. The water from the tailrace of the Brush Creek power house will be carried through a siphon under the South Fork without any additional diversion, so as to avoid pollution. From the Caloma power house the water will be carried through an aqueduct to an equalization reservoir and thence to the city for water supply and irrigation.

The Sacramento project will conflict to a certain extent with the rights of the Western States Gas & Electric Company. That company makes use of water from the South Fork, including the natural flow of Silver Creek, at its plant below the mouth of Brush Creek. An adjustment will have to be arranged before the Sacramento plans can be carried into effect.

TENNESSEE DEVELOPMENTS

That serious consideration is being given to the power possibilities of eastern Tennessee is evidenced by the continued activity in that region. The Knoxville Power & Light Company, which some months ago filed an application with the commission for a preliminary permit covering four large developments on the Clinch River, is understood to have in contemplation the addition of two sites to that application. These sites are on the Tennessee itself below the mouth of the Clinch.

In addition certain Philadelphia interests have indicated their intention to file an application in the near future covering a development on another of the tributaries of the Tennessee in that region. The city of Andrews, N. C., recently has bonded itself for $350,000 to finance a proposed development on the Hiawassee.

POWER FROM THE ROANOKE

Norfolk interests are understood to have in mind a development on the Roanoke River between Roanoke and Clarksville. Use is to be made of a number of storage reservoirs on the principal three tributaries of the stream, it is said. In that region some of the bottom land is used for pasturage and can be purchased at comparatively low cost. A portion of the farming land adjacent to the stream, however, is so valuable that its use for reservoir purposes would not be justified, but this can be avoided by a series of low-head dams. There is an insistent demand for power in the region.

AN ARIZONA PROJECT

The demand for power in the copper-producing section of Arizona has led John L. Fish to apply to the commission for a preliminary permit covering a project on Salt River. He proposes to carry the water across a tract of land formed by a bend in the river. The details of his project have not been filed as yet.

Industrial Heating Courses Successfully Completed

A very thorough course of instruction marked the third year of the central-station school of industrial heating carried on under the auspices of the N. E. L. A., and the response met with among central-station companies has been so encouraging that it is planned to continue the school in future years and to organize similar schools in the different geographic divisions of the association.

The courses this year were given by the Westinghouse Electric & Manufacturing Company at East Pittsburgh and the General Electric Company at Schenectady and included lectures on practically every phase of industrial heating and inspection trips to plants where heating installations had been made. The program was arranged by Wirt S. Scott of the Westinghouse company, who is chairman of the Industrial Heating Division of the N. E. L. A. and who, in 1921, was the real originator of the whole idea of an industrial heating school. Mr. Scott also took personal charge of the class at East Pittsburgh and himself gave many of the lectures. Harold Fulwider of the General Electric Company was in charge of the class at Schenectady.

Federal Commission's Year

Fifty-one Applications for Permits and Fifty-three for Licenses Are Received in 1922-23

THE Federal Power Commission wound up its fiscal year on June 30 with a grand total of 425 applications. Of these 104 were received during the fiscal year of 1922-23, as compared with ninety-two during the fiscal year ended June 30, 1922. Fifty-one of the applications received during the fiscal year ended June 30, 1923, covered preliminary permits sought for purposes of investigation. The remaining fifty-three applications were for licenses covering construction. Of those seventeen covered major projects, thirteen covered projects of less than 100 hp. and twenty-three covered transmission lines. During the three years of its existence the commission has authorized a total of ninety-seven preliminary permits and 103 licenses. Of the licenses forty-two are for major projects, nineteen are for minor projects and forty-two are for transmission lines. More than one-half of the preliminary permits and licenses which have been granted during the life of the commission were issued during the past fiscal year.

The works involved in the forty-two licenses covering major projects are either constructed or under construction except in eight instances. It is believed that all but three or four of the forty-two projects will go ahead within the time allowed by the terms of the license.

MANY PRELIMINARY PERMITS UNUSED

With respect to the preliminary permits, however, the progress has not been so marked. Only five of the ninety-seven issued have been followed up thus far with applications for licenses. Twelve of them have been canceled. Most of the preliminary permits first issued have been amended to extend the time to the full three-year limit allowed by the law. The three-year limit will expire for several important projects next March. Among those is the White River project of the Dixie Power Company in Arkansas. Another is the large project of the Washington Irrigation & Development Company at Priest Rapids on the Colorado River, where a development of 350,000 hp. was contemplated. Another is the proposed Niagara Gorge development of the Lower Niagara River Power & Water Supply Company, a subsidiary of the Niagara, Lockport & Ontario Power Company. That development is being held up at present by the failure of the State of New York to grant the company the necessary permit.

Federal Power Commission officials think that of the eighty preliminary permits now outstanding about one-half show good prospects of going through. The other half, it is believed, will be canceled or will expire by limitation through failure on the part of the permittee to go ahead with the proposed development.

New Division N.E.L.A. Meets with Ohio Men

Cedar Rapids Convention Listens to Speakers from Kentucky and West Virginia—Public Relations the Main Theme of Opening Session—Metermen Co-operate

LAUDING the customer-ownership plan as being responsible for the sale of $8,000,000 of public utility securities direct to the people of Ohio during 1922, President E. L. Franklin opened the twenty-ninth annual convention of the Ohio Electric Light Association at Cedar Point on Tuesday afternoon of this week. He felt that this plan had been an important factor in the recent change in public sentiment toward utilities. Were politicians to realize that their schemes of municipal ownership would strike directly at the very people who owned these utilities, they would be forced to seek other means of political aggrandizement.

Regarding the trend toward superpower systems, President Franklin urged all operators who were planning long transmission lines to conform with the projects for nation-wide distribution of energy. He also reviewed the executive work of the association in this year, particularly that concerned with legislation. The most important result was the killing of a bill designed to abolish state regulation.

Secretary D. L. Gaskill, in his report, made for the executive committee, told of the expansion of the O. E. L. A. meter committee to allow joint action with the meter committee of the East Central Geographic Division of the N. E. L. A. This action, he felt, should greatly assist and further the activities of this new geographic division.

EAST CENTRAL DIVISION, N. E. L. A.

The Wednesday morning session was given over entirely to this year-old N. E. L. A. division, L. B. Herrington of Louisville, Ky., president of the executive committee, being in the chair. Donald McDonald, Louisville Gas & Electric Company, speaking on united utility effort, thought that one reason for the persecution of utilities in the past was the lack of the "herd instinct" of mutual protection among central-station men. They were too often very excellent electrical men but not good enough as public utility men to protect themselves against the onslaught of greedy politicians. The increasing number of stockholders among the public, Mr. McDonald considered, was one of the best means of protection of utility rights.

The promotion of sound public relations was discussed by Victor H. Morgan of Cleveland, formerly editor-in-chief of the Scripps-Howard newspapers of Ohio. He insisted that the responsibility of "helpfulness" was the greatest imposed on present-day utilities, if they desire to keep pace with advancing civilization. This was, he said, because the utilities are doing a service collectively which no man could do individually. Mr. Morgan also listed three factors upon which good public relations depend, namely, the prestige of the company locally, the mental attitude of the management and the value of direct advertising. Unless a corporation was endowed with the same characteristics as a well-bred, well-liked man, it could never expect to obtain this personality and have the charm of a living entity instead of a cold corporation.

MINE ELECTRIFICATION IN WEST VIRGINIA

A. Bliss McCrum, secretary Public Utilities Association, Charleston, W. Va., dealt with utility developments within his state, where utilities now sell 40 per cent of their generated power to coal mines and where 85 per cent of these mines are electrified.

On Thursday and Friday the sessions were devoted mainly to committee reports and to discussions of the generation of steam by powdered fuel and of mechanical stokers. Registration to Wednesday night totaled more than five hundred.

California Commission Tells of Overhead Inspection

The Railroad Commission of California has issued a statement concerning its progress in the task delegated to it by the Legislature of undertaking a detailed inspection of all overhead electric utility facilities, with the view to eliminating improper and hazardous construction, as a matter of protection to the public and the utility workers and for the maintenance of safe and efficient service.

The work has been under way for approximately one year, in which time the state has virtually been covered from Sacramento south. This area includes the facilities of more than fifty electric utilities, more than five hundred cities and a large number of individual services. Upward of 75,000 miles have been covered by the inspectors of the commission in the pursuit of the work. Completion of the preliminary inspection and the final inspection itself will require two years additional, it is estimated. The cost of conducting the work is being charged against the owners of the lines inspected.

The commission has felt that the greatest hazard to workmen and the public existed in the facilities of the power and traction utilities, and with this in mind inspection has been made of these properties before any attempt to inspect the lines of the telegraph, telephone and other signal companies, except in cases where in making inspection of supply lines a particular hazard has been discerned in the signal lines. The procedure in general is as follows: One company in a locality is notified a week or ten days in advance that the inspection is soon to follow, and the inspector fixes a definite date for starting the work. While examining the lines of the first company he so arranges his time and labors that he can go on to the overhead installations of other companies, private individuals and municipal plants in the territory without the expense of doubling on his tracks.

From the data gathered in the field the commission is enabled to make an accurate estimate of the cost and time necessary to make the correction in existing construction, and this information is incorporated in the decision which the commission hands the utility company concerned after the completion of the preliminary inspection. It is contemplated to make a final inspection of the facilities at the expiration of the time allowed in the decision.

Snake River Gorge Development a Future Problem

Owing to the remoteness of the time when it will be necessary to use the gorge of the Snake River between Homestead, Ore., and the mouth of the Grand Ronde River either for power development or for railroad right-of-way, it is probable that the Federal Power Commission will suspend indefinitely any ruling as to the use of the gorge.

The Oregon-Washington Railroad & Navigation Company, a subsidiary of the Union Pacific, has applied to the commission for a right-of-way up this gorge. In its application the railroad states that it is essential to a water-level route from the Snake River to the coast.

The commission already has an application from the Pacific Power & Light Company of Portland, Ore., a subsidiary of the Electric Bond & Share Company, asking a preliminary permit covering the power sites in the gorge.

A preliminary investigation of this stream by W. G. Hoyt, of the United States Geological Survey, shows that approximately 1,250,000 hp. can be developed in this section of the river. He suggests that the railroad be located so as not to interfere with the possible development of the power sites. He states his belief that the power should be developed at two high dams. If that plan should be followed, it would render the gorge useless to the railroad company. The side walls are steep and covered with slides of lava rock which would preclude the location of the right-of-way at any point except along the water line.

Ratings of Commercial and Municipal Plants in Error

A clerical error of considerable extent has been found to exist in the tabulations on central-station ratings which were used as a basis for the diagrams on page 57 of the July 7 issue of the ELECTRICAL WORLD. A check is now being made of these tabulations, and the corrected figures will be published in an early issue.

Another Gap to Be Bridged

Puget Sound Power & Light Company Will Build Transmission Line from Olympia to Tenino, Wash.

APPLICATION has been made to the County Commissioners of Thurston County, Wash., by the Puget Sound Power & Light Company for permission to erect a transmission line from Olympia to Tenino, Wash. This line will form a connecting link in the Stone & Webster system in western Washington and will make a continuous transmission system extending from Everett on the north to Kalama, on the Columbia River, on the south. The company has acquired the light and power system at Aberdeen, Wash., and construction work is in progress to connect Olympia and the Aberdeen plant through Montesano over the Olympia Highway. The Olympia-Tenino link will also serve to tie in the Gray's Harbor system with the plant of Kalama. This new tie is of significance because it brings nearer to a realization the interconnected transmission system from the Mexican to the Canadian border. Upon its completion there will remain only three small gaps in the system—a 10-mile gap between Jim Creek and Everett, Wash.; a 25-mile gap between Woodland and Vancouver, Wash., and a 4-mile gap between Eugene and Springfield, Ore.

Denver League Ready for Third Campaign

Preparatory to launching its third campaign in Denver, the Electrical Co-operative League of that city has elected O. L. Mackell, Denver Gas & Electric Light Company, as chairman, D. D. Sturgeon as vice-chairman and Dean D. Clark as treasurer. R. W. Elliott was re-elected secretary. The new chairman has appointed a skeleton committee to undertake the membership drive and fund-raising part of the league's program. The budget of $13,500 is $3,000 more than last year. Much of it has already been pledged.

GAP SOON TO BE FILLED AND THREE SMALL GAPS REMAINING IN INTERCONNECTED TRANSMISSION SYSTEM OF COAST

Regulating the Hudson

Plans Filed for Fifty-Million-Dollar Project Involving Water Power Totaling 200,000 Hp.

PLANS for an engineering scheme involving the ultimate expenditure of $50,000,000 in the construction of fifteen storage reservoirs for regulation of the flow of the Hudson River watershed were filed recently by the Hudson River Regulating Commission in twelve counties of New York State in which the reservoirs will be constructed. In the Hudson River regulating district are the counties of Albany, Columbia, Essex, Greene, Fulton, Hamilton, Rensselaer, Saratoga, Schenectady, Schoharie, Warren and Washington, and it is upon the cities, towns and villages in these counties that the cost of construction will fall.

"The importance of this comprehensive plan to scores of industrial plants owning and using water power on the Hudson and to the several cities and villages along the river, which will be benefited by a constant stream flow and the control of flood waters, can hardly be overestimated," said a statement from the commission. Aside from the promised guarantee of power and the prevention of floods, advantages claimed include an annual saving in coal of approximately 2,000,000 tons and an increase of the minimum flow at Albany from approximately 1,000 second-feet to more than 5,000 second-feet, increasing the depth of water in the channel by about 18 in., thus aiding navigation and improving sanitary conditions. It is also estimated that the development when completed will make possible the harnessing of 200,000 additional horsepower in the capital district, the dams required for the reservoirs being utilized as a part of a hydro-electric development system. Five years is given for completion of the storage project.

Thus the river-regulating plan performs two functions—the regulation of the flow of streams and the development of latent power. It is briefly a system under which the state lends its authority to the private development of water power under conditions meant to protect the state's interests completely. For instance, while the owners of water powers in the Hudson watershed assume the full burden of cost of power development, all the land and works constituting a regulating reservoir become the property of the state without expense to it. The power interests obtain only a fifty-year lease upon the property, which must be conducted as to finances, operation and rates in all respects as the state decrees. While the state will collect through its tax department the assessments levied upon property benefited by the improvement, this money being applied to interest on bonds, a sinking fund and reimbursement to the state for its expense, the state is not liable for either principal or interest on the bonds, which are to be issued by the regulatory district commission.

Power-Line Telephony

Consumers' Power Installs System at Jackson and Battle Creek, Mich., to Cover 600 Miles

THE feasibility of telephoning over power transmission lines received another demonstration last week when executives of large power companies from various sections of the United States formally opened a high-frequency automatic telephone system just installed on the lines of the Consumers' Power Company of Michigan by engineers of the Westinghouse Electric & Manufacturing Company. Only two sets are completed, these being at Jackson and Battle Creek, Mich. Four similar sets are to be installed, and in all there will be 600 miles of transmission line utilized for telephone service when the system is completed.

In the system as worked out two frequencies are used. The dispatcher's set transmits approximately 50,000 cycles and receives 60,000 cycles. The transmitter at Battle Creek transmits 60,000 cycles and receives 50,000 cycles. In effect, there are two transmitting sets and two receiving sets in service, working through single telephone instruments, with the result that the service is duplex and both parties may talk and listen simultaneously.

To communicate with Battle Creek the load dispatcher at Jackson has only to lift his telephone receiver from the hook. This automatically lights the tubes and starts up the radio transmitting apparatus about half a mile away in the Jackson steam plant of the company. The dispatcher then turns the dial on his instrument to the number assigned to the Elm Street steam plant in Battle Creek. The operation of this dial sends out modulated high-frequency impulses over the high-tension transmission line through a sending antenna strung parallel to the power line for about 1,000 ft. These impulses are picked up on the receiving antenna at the Elm Street plant and cause a selector there to step around and stop at the proper point, and, through the operation of a system of relays, a bell is rung or a horn sounded in the booth of the Battle Creek station.

Tests are said to have shown that in event of line failure the radio impulses jump the gaps and communication is not interrupted even when several miles of the transmission line is down. It is further claimed that communication between Jackson and Battle Creek has demonstrated that even lightning storms, which will interrupt service momentarily on the transmission lines, have no effect upon communication by high-frequency telephony.

Reaching Outlying Substations

When the system is extended all the outlying substations will use the same transmitting and receiving frequencies or wave lengths as Battle Creek; that is, the dispatcher will be able to talk with any station merely by dialing the proper call number of his desk telephone. Under this arrangement outlying stations would not be able in normal conditions to talk with each other, but by going a step farther in working out the intricate system of relays and wave-changing switches any substation operator, by dialing the number 10 on his telephone, will automatically cut in a spare set of tuning condensers for receiving and change his transmitting wave length so that he can talk with any or all other stations. Another detail of the installation is the arrangement of extra selectors at the various substations, through which the dispatcher, by dialing a general call number on his telephone, will ring all substations on the system and be able to transmit emergency orders simultaneously to all substation operators.

The high-frequency apparatus, or the radio units of the system, are installed at the various terminal stations. Two antenna wires are strung for a short distance on the towers which support high-tension power lines. One of these is a sending antenna and one is used exclusively for receiving. The antenna wire is given about 12 ft. clearance from the power-line wire. The upper or transmitting antenna is connected to the transmitting set and the lower antenna to the receiving set.

Frank A. Leach, Jr., Succeeds the Late J. A. Britton

Frank A. Leach, Jr.. former manager of the East Bay division of the Pacific Gas & Electric Company and more recently vice-president in charge of public relations and service, has been named vice-president and general manager of the company to fill the vacancy caused by the death of John A. Britton. The appointment was made by the directors on June 12.

New Officers for Canadian Electrical Association

At the executive meeting of the Canadian Electrical Association held subsequent to the convention at Montreal the following officers were elected: President, P. T. Davies, Southern Canada Power Company, Montreal (re-elected); vice-presidents, R. J. Beaumont, Shawinigan Water & Power Company, Montreal (re-elected); W. Paxton Little, Canadian Niagara Power Company, Niagara Falls, Ont., and J. B. Woodyatt, Southern Canada Power Company, Montreal; treasurer, C. Johnstone, Southern Canada Power Company, Montreal (re-elected); secretary, Louis Kon, Montreal Light, Heat & Power Consolidated, Montreal (re-elected). A. P. Doddridge, Quebec Railway, Light, Heat & Power Company, Quebec; M. A. Pooler, New Brunswick Power Company, St. John, N. B., and J. E. Tanguay, Public Service Corporation, Quebec, were elected members of the executive committee, succeeding W. L. Weston, W. Paxton Little and J. B. Woodyatt. The other members of the executive committee were re-elected. They are N. S. Braden, W. A. Bucke, A. B. Cooper, A. A. Dion, A. Monro Grier, K.C., W. O'Brien, M. K. Pike, J. C. Smith and W. H. Winter.

Iowa Authorities Talk About Rates and Valuations

Public utility representatives, attorneys, legislators and city officials from all parts of Iowa attended the first public utility rate-making conference sponsored by the College of Law at Iowa State University, which was held at Iowa City last week, and joined in an honest effort to set forth the problems of fair rate making and utility regulation.

Nathaniel T. Guernsey, vice-president American Telephone & Telegraph Company, asked for a fair division of the profits between the utilities and the consumers that will enable utilities to compete in the money markets for the tremendous amount of capital demanded annually. "The contention that because capital invested in public utilities is devoted to a public use it is therefore not entitled to relatively the same return as capital in private investments," he said, "will never be sound as long as the laws of demand and supply remain effective." He thought there was danger of over-regulation. Unless regulation is worth more than it costs, he said, it cannot be justified.

William Chamberlain, Cedar Rapids, general counsel of the United Light & Railways Company, gave a comprehensive outline of utility regulation in Iowa, which, he said, is the only state in the Union where the powers of regulation are delegated to every incorporated town. This system has proved superior in years of practice to that employed in many states where elaborate commissions have been created. It can only function, however, where the utility service is purely local in character. The weaknesses of the Iowa system as outlined by Mr. Chamberlain concern chiefly large electric distribution systems. "The growth of the electrical distribution systems to the point where a hundred towns or more are supplied from one distant point makes the local inquiry for rate-making purposes altogether inadequate," he said.

The importance of thorough valuation inquiries in determining what shall be fair rates for public utilities was dwelt upon by Dean William G. Raymond of the State University College of Engineering. Dean Raymond attacked the popular impression that a valuation inquiry is merely an engineer's guess or judgment of values. "Values are worked out with the utmost care, following economic laws so far as these apply and guided wholly in disputed questions on law by the attorneys who manage the cases, and are in all cases, when made by reputable and competent engineers, honest and fair estimates wholly without fictitious values of any kind," he said.

Other speakers were City Attorney O. N. Elliott of Cedar Rapids, Assem-

blyman C. F. Clark of Cedar Rapids, Mayor Alfred C. Mueller of Davenport and Commissioner Dwight N. Lewis of Des Moines.

Activities of New England Information Bureau

Plans for the establishment of a speakers' bureau this fall and a record of increasing activity during the past year are contained in the second annual report of the New England Bureau of Public Service Information, recently made public by Director Joseph B. Groce. A total of 129 utilities in New England are contributing to the support of this bureau, a gain of thirteen over the past year.

At present about three thousand copies of the bulletin issued by the bureau are being printed weekly, the circulation having doubled. The increase is due to an enlarged demand from contributing companies and also from utility executives outside New England. Nearly three hundred copies a week go to investment banking houses and are placed in the hands of security salesmen for their educational value.

Another Public Utility Information Committee

The Louisiana-Mississippi Committee on Public Utility Information is the latest body of its kind to be organized and will be the twenty-ninth in the nation. W. J. Aicklen is chairman. The membership includes the principal public utilities of the two states, embracing electric light and power companies, electric railways, gas, telephone and water companies. Executives from most of the larger towns attended the first meeting, held at New Orleans last week, and it is expected that virtually all the utility companies will join as soon as the work gets under way.

Dr. H. M. Blain, head of the department of journalism of Tulane University, New Orleans, who has had several years' experience in newspaper work and advertising, has been named director, with Sam B. Dunbar as assistant director. Headquarters of the committee are at 420 Maison Blanche Annex, New Orleans.

Overhead-Line Material Specifications Before A. E. S. C.

The American Electric Railway Association has submitted its specifications for overhead-line material for action by the American Engineering Standards Committee, to determine the question of sponsorship and to arrange for the submission of the specifications already developed by the A. E. R. A. to a duly organized sectional or working committee, which will make such revisions and additions as may be necessary to bring these specifications up to the full status of an "American standard." The special committee to consider the question of sponsorship and scope of the specifications, which are also of direct interest to other than electric railway interests, is headed by A. H. Moore, representing the Electrical Manufacturers' Council on the A. E. S. C., and includes representation from the National Electric Light Association, American Railway Association, Electrical Manufacturers' Council, American Institute of Electrical Engineers, American Electric Railway Association, American Short Line Railway Association and the Bell Telephone System.

The attitude of the A. E. R. A. in submitting its specifications for this action by the A. E. S. C. will very definitely favor the unification and elimination of conflicting specifications in this field, which is a very important one to a large group of industries and involves expenditures of great magnitude annually in construction, maintenance and replacement of power, light, telephone, telegraph and railway signal lines.

Brief News Notes

Wabash Valley Electric Company Established. — The long-pending consolidation of eight Indiana public utilities as the Wabash Valley Electric Company, which was for a time vigorously fought, was finally authorized by the Indiana Public Service Commission in an order issued June 28.

Electrical Show for Scranton.—The Electrical Association of Scranton, Pa., is planning to conduct an electrical show there possibly early in November. Full information can be secured from F. L. Smith, chairman show committee, 250 Wyoming Avenue, Scranton, or E. H. Reif, president of the Electrical Association, 119 Franklin Avenue, Scranton.

Public Ownership Movement in Washington.—A campaign which has for its object the construction of electric power lines throughout the State of Washington to be served by publicly owned plants has been launched by Oliver T. Erickson, chairman of the utilities committee of the Seattle City Council. Mr. Erickson contends that the city's Skagit development will ultimately produce 550,000 hp., which can be disposed of at a low rate to the factories, homes and farms, after the plan of the Hydro-Electric Power Commission of Ontario.

Kankakee Plays Safe.—The danger of Kankakee, Ill., ever being left without electric light and power, even in the greatest emergency, has been practically eliminated by the completion of the Joliet and Wilmington transmission line by the Public Service Company of Northern Illinois. This direct line from Joliet gives Kankakee 5,000 kw. more than heretofore, or, in other words, the city has double the electric power at its disposal that it had before the line was completed. Kankakee now receives electricity over three lines from as many different directions.

Washington to Retire Gas Lamps.—A program calling for expenditure of $1,500,000 on the Washington street-lighting system in the next five years has been agreed upon by the committee of experts that is preparing a plan for the Commissioners of the District of Columbia. The program calls for gradual elimination of gas street lamps and the substitution of modern electric lights. It also contemplates the erection of more elaborate posts on Pennsylvania Avenue and other main thoroughfares.

American Capital for Austrian Electrification Sought.—Representatives of Austrian provinces are in the United States seeking American financial aid in the development of power projects in that country the aim of which is to bring about the electrification of practically all the railway systems in Austria and furnish power for numerous industries there. The difficulty of obtaining adequate supplies of fuel has resulted in seriously handicapping industry throughout that country, and it is contended that the electrification of the railway companies, as well as the electrification of industrial plants, would revolutionize the commercial and industrial situation.

Electrical Progress at Chihuahua.—Formal transfer of the electric power plant and street railway system at the city of Chihuahua, Mexico, to the Mexico Northern Power Company by Juan Creel and his associates will take place Aug. 1, it is announced. In the meanwhile the Mexico Northern Power Company will construct a power transmission line from its hydro-electric plant at Boquilla to Chihuahua for the purpose of furnishing lights and power for domestic use and to operate the street railway. The construction of the power transmission line will be finished about Dec. 1, it is expected. The street-railway system will be extended and the city will have a twenty-four-hour electric lighting service.

Opposition to Competition in Indianapolis Still Waged.—The Indianapolis Light & Heat Company and the Merchants' Heat & Light Company have appealed from the Superior Court to the Indiana Supreme Court for an injunction to prevent the Indiana Public Service Commission from permitting the Terre Haute, Indianapolis & Eastern Traction Company to enter the Indianapolis power field. Asserting that the entry of the traction company into the general service business will mean an increase of rates to the consumer, "since it is a well-settled law that the utility companies are entitled to rates sufficient to yield a reasonable annual return on the value of their property," President C. C. Perry of the Indianapolis Light & Heat Company declares his desire to have the case reviewed by the courts on its merits.

Electrical Near East Relief.—The cheapest public utility in the world, it is said, is in a little refugee town of Russian Armenia, Djelal-Ogli, where the electric light plant generates power for the population of four thousand people at a total cost of $100 a year. The economy of cost came about quite by accident. A dynamo was discovered in the midst of some old ruins by Major R. M. Davidson, the American director in charge of Near East relief, who also found an abandoned watermill. Among the refugees there chanced to be an Armenian who once worked in the Edison shops in Pennsylvania. He assisted Colonel Davidson in harnessing the dynamo to the water power of the mountain stream along which Djelal-Ogli is built, and not only was the town lighted but part of the region was made productive by irrigating the tract allotted to the Near East relief association for raising food for the orphanage established in the town and for teaching the boys the Western principles of husbandry.

Electric Smelter May Produce 1,500 Tons Daily.—An electric smelter designed to have an ultimate capacity of 1,500 tons daily is to be constructed soon at Utah Junction, Col., by the American Electric Smelters & Refining Company. The first unit to be installed will have a capacity of 100 to 150 tons daily. Other units will be added as they are needed. Frank P. Bertschy, president of the smelter company, has announced that the company plans the transformation of one of the coal furnaces now in use in Utah Junction into an electric furnace. It is Mr. Bertschy's belief that within a year and a half the smelter will have a capacity of 1,500 tons daily. A study of the electrification of the smelter is being made by Robert M. Keeney, industrial heating engineer of the Westinghouse Electric & Manufacturing Company. It is the contention of the designers of the plant that it can be operated more cheaply than a blast-furnace smelter.

Columbia (S. C.) Company Opposed to Canal Project.—The Columbia Canal Commission in South Carolina has rejected an offer from the Columbia Railway, Gas & Electric Company to pay $75,000 to the state for release from its contract to complete the Columbia canal and to build a large hydro-electric plant near Columbia. The canal commission has delivered an ultimatum to the utilities company requiring it to begin work on the completion of the canal within sixty days. The company has ten days in which to answer. The commission takes the ground that it has no authority under the resolution appointing it except to bring about the completion of the canal or to prosecute the company if it fails to carry out the work. Since the company holds that completion of the canal would be a "useless waste of money," it is expected that the matter will go to the courts for final settlement. In making its offer of $75,000 to be released from any claims by the state the company did not admit liability for construction of the canal, but made the offer to secure a settlement and avoid litigation.

Street Posts Fed from Overhead Circuit.—The cost of installation of the street-lighting posts on Colorado Avenue, in Pasadena, Cal., was kept down by supplying service from an overhead circuit as shown here. The two-wire circuit feeding the posts is strung on the trolley-span wires and a flexible duplex drop enters the hollow posts near the top through a porcelain bushing.

Progress of Railroad Electrification in England. — According to United States Consul-General Robert P. Skinner, electricity will before long take the place of steam power on several hundred miles of railroad in the south of England and the Midland counties. Two of the routes on which it is planned to begin electrification immediately form part of the Southeastern & Chatham system and total more than 120 miles. These will be the basis for a more extensive electrification in the future. It is expected that the work will require about three years for completion. On the London, Brighton & South Coast Railway the plans cover the electrification of the lines from London to Brighton (50 miles) and ultimately the whole of the London-Brighton area. Within the next two years the electrification of the three lines from Waterloo to Guildford (London and South Western Railway) will be completed. The London, Midland & Scottish group are beginning the change-over on Manchester region lines.

Associations and Societies

National Council of Lighting Fixture Manufacturers Elects New Officers.—Herman Plaut was elected president, D. C. De Lancey vice-president and B. F. Klein treasurer of the National Council of Lighting Fixture Manufacturers at its recent Buffalo convention. Charles H. Hofrichter of Cleveland is secretary.

Spokane Section, A. I. E. E.—These officers have been elected by this section for the coming year: Chairman, E. R. Hannibal, Interstate Utilities Company; vice-chairman, G. S. Covey, Washington Water Power Company; secretary-treasurer, J. S. McNair, Washington Water Power Company. The executive committeemen elected are Joseph Wimmer, J. W. Hungate, J. B. Fisken and H. L. Melvin.

National Electrical Credit Association.—At the annual meeting of this association, to be held at the Copley-Plaza Hotel, Boston, on Aug. 9 and 10, Charles M. Wilkins will review the first quarter century of the organization; E. W. Shepard of the Western Electric Company will speak on the relation of credit to capital investment; S. E. Kennedy of the Central Electric Company, Chicago, on how new lines of merchandise affect credit; J. S. Thomas of the Elliott-Lewis Company, Philadelphia, on how mercantile agency reports can be improved, and Wallace B. Domham on business and laws as related to credit and collection. Addresses will be made also by Governor Cox of Massachusetts, Paul Hollister of Boston and other prominent men.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

National Electrical Credit Association—Boston, Aug. 9-10. F. P. Vose, 1347 Marquette Bldg., Chicago.

New England Division, N. E. L. A.—Swampscott, Mass., Sept. 6-8. Miss O. A. Bursiel, 149 Tremont St., Boston.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 17-19. O. A. Weller, 900 15th St., Denver.

Association of Edison Illuminating Companies—Dixville Notch, N. H., Sept. 17-21. P. S. Millar, 84th St. and East End Ave., New York.

Michigan Electric Light Association—Grand Rapids, Sept. 18-20. Herbert Silvester, Detroit Edison Co., Ann Arbor.

Illuminating Engineering Society—Lake George, N. Y., Sept. 24-28. S. G. Hibben, 29 West 39th St., New York.

Association of Iron and Steel Electrical Engineers — Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

Indiana Electric Light Association—French Lick Springs, Sept. 26-29. T. Donahue, Northern Indiana Gas & Electric Co., Lafayette, Ind.

American Electrochemical Society—Dayton, Ohio, Sept. 27-29. Colin G. Fink, Columbia University, New York.

American Institute of Electrical Engineers—Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

Association of Electragists International—Washington, Oct. 8-13. Farquson Johnson, 15 West 37th St., New York.

Commission Rulings

Power Company Ordered to Continue Service to Irrigation District Despite Default in Payment.—The Public Service Commission of Oregon has ordered the Idaho Power Company to continue service to the Payette Oregon Slope Irrigation District despite its failure to pay for the power delivered in 1922 and a balance due for 1921, amounting to a total indebtedness of more than $26,000. The commission holds "that it would be unjust and unreasonable on the part of the defendant to insist upon a cash payment from plaintiff at the present time as a condition precedent to the continuation of furnishing power for the current year, and it would be unreasonable and indefensible to permit the Idaho Power Company to discontinue the service for the crop season of 1923, provided plaintiff will first furnish to defendant adequate security for prompt payment thereof, particularly in view of the fact that plaintiff is a quasi-municipal corporation and has the power of taxation and therefore the ultimate payment of the money for this service is assured." The commission took note of the fact that "the conditions among the farmers, not only of said district but in the entire State of Idaho and that part of Oregon contiguous to Idaho, including the district in which plaintiff is operating, have been such that they have not been able to pay their bills during the years 1920, 1921 and 1922; and, in order to prevent the lands in said territory from going back to the desert condition, the defendant company has been compelled to extend credit in very large sums of money. But," the commission said, "it has not been compelled as a matter of law to do so, but by the necessity of the case, from the fact that its own interests are so interwoven with the irrigation districts, it has done so. A corresponding obligation on the part of the irrigation districts and the farmers therein requires that they should make every effort possible to secure the defendant."

Depreciation Under Investment-Cost Method.—The Public Service Commission of West Virginia in valuing the property of the Appalachian Power Company for rate-making purposes had this to say on depreciation allowance: "In ascertaining the value of a utility for rate-making purposes by the investment-cost method, depreciation does not apply in the same manner as it does in ascertaining the value by the reproduction new cost method. If investors skillfully and judiciously locate and construct a plant, operate it economically and maintain it efficiently, they are entitled to have their investment kept intact and undiminished by wear, deterioration or obsolescence unless the amount that the investment may have been diminished has been returned to the investors. The record shows that the plant of the defendant company has been wisely and judiciously located, planned and built, that the plant has been efficiently operated and maintained, and that the plant is in the nature of a perpetual utility, the termination of the life of which cannot be comprehended at this time. If all the units of the plant were of comparatively small cost, the investment could be kept intact and protected by a reasonable annual maintenance expense. Defendant's plant consists of many large and expensive units. When these large units have to be replaced, by reason of wear and deterioration or by reason of obsolescence, the expense of such replacements will be too great to be met by a reasonable annual operating expense. The active life and use of these large units are being consumed by the present patrons of the utility. It is the duty of these patrons to contribute to the defendant company a sufficient amount of revenue to pay operating expense and taxes, to maintain efficiently said plant, to provide a reasonable return upon the present fair value of the plant and to create a fund out of which said large units may be replaced so that the value or corpus of the plant of the investors will not be reduced."

Recent Court Decisions

Jury's Discretion in Fixing Damages.—Sustaining, in Maloney vs. Wisconsin Power, Light & Heat Company, a verdict of $9,000 damages to the widow of a man sixty years of age and earning not more than $3,000 a year, for whose death the company had been held responsible, the Supreme Court of Wisconsin said that in fixing damages the jury is allowed a wide discretion and where the trial court passes upon the question of damages the appellate court cannot upset the verdict. (193 N. W. 399.)*

Recovery of Damages Refused Where One Presumption Is Built Upon Another.—Quashing the record of the Court of Appeals, the Missouri Supreme Court, in State ex rel. Missouri Public Utilities Company vs. Cox, declared that in this case, where deceased was found lying dead directly under a high-tension electric wire, which would have been from 5½ ft. to 6 ft. above his head if he had been standing erect, and near a guy wire which, if swung by the wind, might have come into contact with live wires, liability could not be predicated upon a presumption that deceased touched the guy wire and that this was pushed or blown into contact with the high-tension wires, since to do so would be to base one presumption upon another in order to permit a recovery. In the absence of any showing of facts on which a charge of negligence might be based, the company could not be found guilty of negligence under the doctrine of *res ipsa loquitur* (the thing speaks for itself). (250 S. W. 551.)

Power of Receiver to Fix Rates.—In City of Minneapolis vs. Rand the United States Circuit Court of Appeals has modified a decree entered by the District Court and fixing rates for a gas company. The Circuit Court holds that the courts are without power to change rates fixed by a legislative body, but that a court which has appointed a receiver for a company may, on petition by the receiver for instruction, fix the rates to be charged by him during the receivership. The court said, among other things: "The gas company is entitled to the fair value of its property, even though that value has been increased as a result of the war, just as the laborer, the merchant, the manufacturer, the owner of land and the lender of money may require the prevailing prices for what they furnish. We recognize the practical difficulty in fixing this fair value to apply to the years 1920 to 1923, inclusive, if occasion requires the valuation to continue so long, inasmuch as the value fixed by the witnesses as fair for Jan. 1, 1920, may prove not to be the fair price thereafter. The valuation to be made is in part based upon experience and observed prices and in part upon prophecy of the range of prices for several years thereafter." (285 Fed. 818.)

Inter-Utility Contracts Not Subject to Nullification Unless Other Customers Are Discriminated Against.—Contract rates for electrical energy supplied by the Kansas Gas & Electric Company to the Wichita Railway & Light Company and two other railway companies having been raised by the Court of Industrial Relations, the litigation was carried to the Supreme Court of Kansas, which sustained the district court in upsetting the ruling of the regulatory body, declaring that if the revenue receipts under such contracts affect only the net profits or dividends on that portion of the power company's property used and useful in serving the traction companies, and do not require recoupment at the expense of other customers nor impair the service rendered to the public, there is no occasion or excuse for the intrusion of the state's police power to abrogate the contracts. The public utilities act did not automatically abrogate contracts between public service companies. The temporary high price of fuel oil, which made up 90 per cent of the cost of generating electricity but did no more than cause a temporary loss of dividends, and which high price was not likely to continue, was not, the court held, a fair and sufficient basis for increasing the rates for electrical energy to be exacted by the company, especially when the existing contract rates had been fairly profitable for a considerable period of years. (214 Pac. 799.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Dr. Harper Takes Up McAllister's Work on Standards Committee

Dr. A. S. McAllister, engineer physicist with the Bureau of Standards, who during the past two years has been liaison officer of that bureau and the Federal Specifications Board assigned to the headquarters of the American Engineering Standards Committee at New York City, has been recalled to Washington for special work by Secretary Hoover of the Department of Commerce. Dr. D. R. Harper, 3d, physicist of the Bureau of Standards, has been assigned to the American Engineering Standards Committee, succeeding Dr. McAllister. Dr. Harper is a graduate and former instructor of the University of Pennsylvania and has been associated with the Bureau of Standards since 1909. He has specialized in thermometry and heat measurements, particularly in heat transmission and in internal-combustion-engine physics. Dr. Harper will be concerned with those standardization projects in which the Bureau of Standards and the Federal Specifications Board are co-operating with the A. E. S. C.

Joseph E. Michaud, member of the provincial government of New Brunswick without portfolio, has been appointed a member of the New Brunswick Electric Power Commission. The appointment was made at a meeting of the Cabinet on July 6 when the resignation of L. A. Dugal of Edmundston as a member of the commission was received and accepted. Mr. Michaud will take up his new duties immediately.

Col. William Kelly, the chief engineer of the Federal Power Commission, will reach Washington July 17 after a two months' stay in Europe. He will arrive in time to confer with O. C. Merrill, the executive secretary of the commission, prior to the latter's sailing for London to assist in the arrangements for the World Power Conference. Mr. Merrill will be accompanied by J. B. Challies, the director of the Water Power Branch of the Canadian government and chairman of the Canadian committee of the World Power Conference. Mr. Merrill will return to Washington Aug. 15.

A. K. Ellis, for many years secretary, treasurer and general superintendent of the Wisconsin Traction, Light, Heat & Power Company, was elected general manager, secretary and treasurer of the company at a meeting of the directors held recently in Milwaukee. Not long ago the company was purchased by the North American Company, New York. S. B. Way, vice-president and general manager of the Milwaukee Electric Railway & Light Company, was elected vice-president and a director of the Wisconsin Traction, Light, Heat & Power Company at the same meeting. The Milwaukee company is controlled by the Wisconsin Edison Company, which in turn is controlled by the North American Company.

R. M. Howard Heads North Central Division of N. E. L. A.

R. M. Howard, who was elected president of the North Central Geographic Division of the National Electric Light Association at its convention held recently in Minneapolis, has completed twelve years of service with the Wisconsin Railway, Light & Power Company, Winona, Minn., and is at present one of its vice-presidents. His experience in public utility work covers a period of more than thirty years and includes the railway, light, hydro-electric and gas fields. He began his apprenticeship in Davenport, Iowa, where his father was manager of the Davenport Central Railway, one of the first street railways to be electrified. Ten years spent in the electric and machine shops there gave him a thorough training in the practical end of the work. Mr. Howard was manager of the Clinton (Iowa) Street Railway Company for ten years, during which time the tracks, barns, overhead lines and power circuits were completely rebuilt. Previous to his association with the Wisconsin Railway, Light & Power Company, he was vice-president and general manager of the Northern Hydro-Electric Power Company, the Green Bay Gas & Electric Company and the Green Bay Traction Company, which have since been combined into the Wisconsin Public Service Company.

R. M. HOWARD

Luncheon to Dr. E. F. Hyde

A farewell luncheon was tended to Dr. Edward F. Hyde, recently director of the Nela Research Laboratory, National Lamp Works of the General Electric Company, Cleveland, on Friday, July 6, by the officers and directors of the Illuminating Engineering Society on the occasion of his departure for Europe. In the unavoidable absence of Ward Harrison, retiring president of the society, Samuel G. Hibben, the secretary, presented Dr. Hyde with resolutions expressing the appreciation felt by the members for his work, wishing him the greatest degree of success and commissioning him as a special representative to report to the society regarding progress abroad and to suggest means of co-ordinating more effectively with European activities.

In responding, Dr. Hyde referred to his extended trip abroad as a sabbatical leave which had been accumulating for twenty-one years and recalled that the age of the Illuminating Engineering Society corresponded exactly with his period of active association with illuminating engineering. His plans, he said, would take him first to Switzerland, where he expected to spend the remainder of the summer, and he would then go to southern France for the winter months. He is accompanied by Mrs. Hyde.

Letters of regret were received from all the directors and officers of the society who could not be present. Those at the luncheon were Dr. Alexander Duane (an associate of Dr. Whitney), George G. Ramsdell, Preston S. Millar, L. B. Marks, Norman Macbeth, Samuel G. Hibben, D. McFarlan Moore, F. M. Feiker, W. J. Serrill, John W. Lieb, George H. Stickney, Alvin L. Powell and Dr. Ralph C. Rodgers.

Sir Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario, has been made a minister without portfolio in the government just formed by Premier George H. Ferguson in succession to the defeated Drury administration.

George Kidd, general manager of the British Columbia Electric Railway Company, Vancouver, B. C., was appointed president of the company by the board of directors at a recent meeting in London, England. Other appointments include W. G. Murrin, assistant general manager, as vice-president and A. T. Goward, manager of the Vancouver Island system, as vice-president at Victoria. These changes are the result of the recommendations of Sir Ernest M. Harvey, who made a recent visit to the company's properties in British Columbia, and were made in order that the titles of the executive officers should more clearly define their powers and responsibilities. No change in duties will take place. Mr. Kidd will remain in charge of the company's entire policies, holding power of attorney from the board of directors in London; Mr. Murrin will be in charge of the actual

operations on the mainland of British Columbia, and Mr. Goward will be in charge of operations on Vancouver Island. R. M. Horne-Payne is chairman of the board of directors as before.

Truman and Elias New Division Managers

J. H. Truman, Jr., has been appointed division manager of the Pennsylvania Power & Light Company at Allentown, Pa., in charge of the territory lying west and north of the Lehigh County line and to be known as the Allentown division, and D. A. Elias has been made division manager of what is to be known as the Bethlehem division, comprising the territory adjoining the Allentown division on the east. These territories were heretofore one unit, known as the Lehigh division, and were in charge of A. H. S. Cantlin, who has been transferred to the commercial department on special commercial engineering work covering the entire territory of the company.

Mr. Truman was graduated from the University of Illinois in the College of Electrical Engineering in 1911 and became associated with the Commonwealth Edison Company of Chicago, and later with the Central Illinois Public Service Company of Springfield, Ill. In 1919 he was appointed division manager of the Ohio Service Company at New Philadelphia, Ohio, retaining this connection during the ensuing four years prior to going to Allentown.

Mr. Elias was graduated in electrical engineering from Pennsylvania State College in 1908, and since 1910 has been associated with the United Service Corporation, Scranton, Pa., in the management of various properties. For a number of years he was in charge of the East Penn Gas & Electric Company, Bristol, Pa., which property was recently sold by the United Service Corporation.

George Stringfellow, formerly representative of the Edison Storage Battery at Washington, D. C., has been appointed general sales manager of the company. Mr. Stringfellow assumed the duties of his office on July 1.

Clarence E. Morrow, who has been connected with the corporation department of Merrill, Oldham & Company, investment bankers of Boston, since 1921, examining and reporting on properties whose securities were handled by that organization, has joined the Guaranty Company of New York in charge of the public utility bond division. Mr. Morrow will be associated with negotiations for the purchase of public utility bonds which are underwrritten by that company. He was graduated in 1910 from Whitman College and in 1912 from the Massachusetts Institute of Technology, where he became an instructor. For several years Mr. Morrow was chief draftsman with Stone & Webster, Inc., and subsequently engaged in appraisal and report work with electric properties.

C. L. Law New President of I. E. S.

Clarence L. Law, who was recently elected president of the Illuminating Engineering Society, as was announced in the July 7 issue of the ELECTRICAL WORLD, has specialized in lighting work since he entered the electrical industry in 1907, when he became associated with the New York Edison Company as a special inspector. Later he was made illuminating engineer with the duties of designing, lighting and wiring for commercial and industrial installations as well as exterior lighting. In 1910 he was made manager of the bureau of illuminating engineering, and in the spring of this year he was appointed assistant to the general commercial manager. Mr. Law has been a prominent figure in the society he has been elected to head. From 1915 to 1917 he served as vice-president and from 1917 to 1922 he was its general secretary.

C. L. LAW

His activities in the National Electric Light Association include the chairmanship of the Lighting Sales Bureau and of the industrial exhibits committee and the vice-chairmanship of the metropolitan New York company section. Mr. Law is also a member of the American Institute of Electrical Engineers and of the New York Electrical League.

Walter C. Whitaker, formerly connected with the Bureau of Power and Light, Los Angeles, is now associated with the General Electric Company in that city.

M. F. Behar has recently been made advertising manager of the Edison Storage Battery Company. Mr. Behar is succeeding Paul Sutcliffe, who has gone to California because of ill health.

Herman Plaut, president of L. Plaut & Company, manufacturers of lighting fixtures, and owner of Black & Boyd, designers and dealers in fixtures, New York City, has been elected president of the National Council of Lighting Fixture Manufacturers. Mr. Plaut has been a prominent figure in the council, having served as a director and for three years as president of the New York Section. He has also been active in the Illuminating Engineering Society.

Percy H. Whiting, manager of the securities department of the Central Maine Power Company, has been appointed manager of the customer-ownership division of the securities department of Henry L. Doherty & Company, with headquarters at New York. Mr. Whiting has made a brilliant reputation for himself as a pioneer Eastern developer of the customer-ownership idea in utilities circles, and aside from his effective direction of various campaigns for the Central Maine Company during the past few years, has frequently been retained as a consultant by central-station companies on this class of work. He has been active in the National Electric Light Association and has written extensively on public relations and security sales for the technical press.

Obituary

Charles T. Taylor, who for many years was secretary and treasurer of the William Cramp & Sons Ship and Engine Building Company, Philadelphia, died June 13, after a brief illness. He was 67 years of age. Mr. Taylor, who was a graduate of the University of Pennsylvania, entered the service of the Cramp company in 1892 and became secretary in 1898 and later was also made president. He was also secretary and treasurer of a number of affiliated companies, including the Federal Steel Foundry Company of Chester, Pa., and the De La Vergne Machine Company of New York, and was secretary and treasurer of the I. P. Morris Company until it was merged with the Cramp company. Mr. Taylor was the father of H. Birchard Taylor, vice-president of the Cramp company and president of the Pelton Water Wheel Company.

Louis Rau, founder of the first Edison company to be formed in Europe, died in Paris, France. When in 1880 Mr. Rau heard of Edison's electrical discoveries he made a hurried voyage to America in order to negotiate with Mr. Edison for their early introduction in France and adjacent countries. Upon his return to France he organized the French Edison Company, officially known as the Société Electrique Edison and later the Compagnie Continental Edison. As founder of the first Edison company in Europe he became its president and remained so during his life. His keen interest in electrical matters and early appreciation of the development of water power as a source of energy led him to organize the Société Hydro-Electrique de Lyon, of which he was president, thus helping to create one of the first large installations for the harnessing of water power. It was to Mr. Rau more than any other individual that the organization of the German Edison Company, Berlin, in 1883, one of the most influential electrical enterprises in Central Europe, was due. Mr. Rau was an honored member of the Edison Pioneers.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Delay in Changing the Code*

The Natural Resistance to Change that Comes from the Manufacturer —How "Special Supervision" and a More Liberal Inspection Might Help

By R. S. Hale
Chairman N. E. L. A. Wiring Committee

THE question has been asked: Why has it taken so long to bring about the changes in opinion within the industry that are now to be put into the National Electrical Code? The answer is that the central stations benefit only indirectly from savings in the cost of wiring. We can get no benefit until our customers have saved the money and then only if they utilize the savings to take more of our service. Obviously no single central station can afford to spend the time and money necessary to change general sentiment, though each of us can do something.

Resistance to Change

Even the N. E. L. A. wiring committee, representing all the central stations in the association, has been greatly handicapped by the fact that the other branches of the industry—or, rather, some individual members, such as individual manufacturers, contractors and inspectors—benefit financially from delaying improvements. A manufacturer, a contractor or an inspector who has developed his business and developed his skill according to one method necessarily suffers a financial loss if he is asked to change to an improved method. The longer he can delay the improvement the more money he can make out of his skill at the old method.

If it had been necessary to get a code changed before we could have used turbines instead of reciprocating engines, the reciprocating-engine people would not have helped to get such rules changed, and reciprocating engines would have stayed with us, just as 6-amp. fuses, on account of the code, remained in use long after 10 amp. was known to be safe. Even when individual manufacturers, contractors and inspectors are public-spirited enough to welcome a change, there is, nevertheless, a tremendous inertia which has to be overcome.

This inertia has been helped by the very proper custom and practice that the code committee would not put anything into the code until it had been developed and tried out by field experience and been proved to be satisfactory and safe, while at the same time the inspectors in many districts would not allow anything whatsoever to be even tried unless it was already in the code. The practice of the Electrical Code committee in not putting anything into the code until it had been proved to be safe meets with our commendation.

R. S. Hale

"Special Supervision"

It is the other feature—that is, the practice of the inspectors, or, rather, of some of them, in refusing to allow anything whatsoever, no matter how good, unless it is in the code—that would seem to be unwarranted. Improvements not in the code may properly be made subject to special supervision, but I believe that anything beyond requiring such special supervision as will make them safe is exceedingly bad for the industry. I believe that any good and safe wiring should be allowed under special supervision, whether specifically provided for in the code or not. I believe that there should always be three alternatives—first, the code; second, as good as the code; third, better than the code—and that any of these three alternatives should be allowed.

This does not mean that any Tom, Dick or Harry should decide for himself whether wiring is good or not. It does mean, however, that competent inspection authorities—and they should not be in authority unless competent—may at times decide that they will not allow wiring which is bad even if technically permitted by the code and that they may also at times allow wiring which they thing good even if technically barred by the code. A competent inspection authority should also be competent to decide whose advice it will take. We believe that the central stations and all of us should work co-operatively with the inspectors for safety, and I also believe that construction not in technical compliance with the code, but installed and used under special supervision, can usually be kept safer than the ordinary construction installed without such special supervision.

When there is really a question of safety there is reason for delay, but when it is clearly obvious that safety is not involved, or when it is clearly obvious that the extra supervision will make the improved installation at least as safe as the ordinary one, then the improved method should be allowed. No one seriously objects to this as a principle, but it is often difficult to get down to a clear-cut basis.

When some new and improved method is suggested, the interests who oppose any change are easily able to get up some kind of argument, often plausible, sometimes not even plausible, but an argument, and so long as they can argue on the question of safety they cause delay.

*A recommendation presented before the National Electric Light Association, New York, May 16, 1923.

Developing an Export Business

Asking Specific Questions for Special Lines Brought Wiring-Device Maker's Market Closer—Better Packing Reduced Breakage to Minimum

BY A MANUFACTURER

ABOUT ten years ago I was looking over the consular reports to see the value of electrical exports from the United States and came to the conclusion, with others of our company, that this business could be expanded as regarded our part in it. At that time we were exporting about $17,000 worth of goods yearly from our factory. Today less than 5 per cent of our own gross revenue comes from foreign sources, but we are much interested in the subject and the various steps which we took to develop the business which we handle may be of significance to others.

The first step was to obtain copies of various foreign trade periodicals. We went over these carefully and wrote to every advertiser, asking numerous comprehensive questions about exportation and making it clear that we were "new at the game." We received a magnificent response to these inquiries, and after going over these we wrote direct to many American consuls, taking care to ask specific questions rather than make general inquiries. One of these questions was whether the wires were run in iron pipe in walls in local installations or on the outside surface, and other detailed queries were made in order to throw light upon the exact conditions which prevailed in wiring practice abroad. The consuls responded with excellent service, and in some cases they turned over our letters to local engineers and central stations in order that a more complete answer might be furnished. As a result of this preliminary work we spent no money in trying to cultivate markets without local electrical service and we kept out of markets where the use of our fittings did not seem practicable or likely to become popular. We found that in Great Britain and her colonies there was little disposition to use American wiring-device designs.

South and Central America, Cuba and Mexico appeared the more attractive markets, with potentialities in continental Europe, notably at that time in Italy, Spain and France, with some pre-war Russian outlook.

We then prepared a catalog, carefully illustrated, and devoted considerable effort to securing satisfactory translation of our product terms into Spanish and Portuguese, having the reading matter retranslated into English before final publication. The catalog was issued in these three languages. The preparation of packing slips followed, the printing being in three languages, and after this we made a careful study of packing problems with the fundamental idea of doing as much as possible to prevent breakage. Many tests were made of packing schemes, including dropping from a height of 10 ft. upon a hard floor, and as a result we developed a packing practice which has reduced claims for damages to less than a hundred dollars in ten years, the cost of packing per thousand pieces being about the same as the unit cost of packing for domestic shipment.

Postage stamps were obtained from foreign countries, and we found it very helpful to inclose stamped envelopes to our foreign customers, actual and prospective. We exchanged commercial information about ourselves with various South American representative houses and started our expansion with a fair knowledge of the reputation and credit situation of these people. On the banking side we soon found that we could collect foreign drafts through our local bank, which cleared through the National City Bank at New York and the New York Clearing House. None of our drafts were held up by moratoriums at the outbreak of the war because each one bore on its face "Waiving all moratorium decreed or which may be decreed." At that time we had accumulated many orders three to nine months old, and we asked for a reconfirmation before proceeding to fill them. Ninety-five per cent of these were canceled, and we escaped the experience of many American manufacturers who filled orders at the outbreak of the war only to find the goods thrown back on their hands.

As the export business has developed, we have been convinced more and more that there is a close relationship between what happens in the United States and what goes on in the rest of the world. Gradually an effort is being made to bring the foreign customer to appreciate the value of American standards of design in wiring devices. Cheap goods at lower prices are still strongly welcomed in many countries, and some of the manufacturers in these nations are quoting prices which cannot at present be met here. Friendly and courteous trade exploitation along the lines of quality service appears to be the best outlook for the American manufacturer.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

SALES of electrical materials throughout the United States are reported as large as those for the corresponding period last year. During the week there have been several decreases in the price of wire, rubber-covered undergoing a cut of 10 per cent throughout the Middle West and Eastern States.

Lamp sales are increasing, the usual 80 per cent of production continuing to the market as replacements. Prices are approximately 16 per cent lower than a year ago, with almost a 15 per cent increase in new business.

The porcelain market in the knob, tube and cleat line continues at a slow pace because of the small amount of such material entering into new construction. Very little wiring of old buildings is being done in the Eastern territory, and the greater part of present business is being placed in the South and Southwest in connection with farm-lighting-plant installations and telephone-line construction. Tubes of the 3-in. size are selling at from $2.50 to $3 per 1,000 in barrel lots.

Conduit prices are firm, with good demand in the East and Middle West. Stocks are cleaned out from week to week, with the mills of Ohio and Pennsylvania struggling to keep up to requirements. What increase in price of conduit will result from the promised ultimate adoption of the eight-hour day in the steel industries is difficult to predict.

Denver Jobbers Report Slight Falling Off in Orders

JOBBERS in the Denver territory report a slight falling off in orders, but this movement has every indication of a temporary nature. Conditions

with the contractor-dealer are improving gradually with the better prices obtained for work. Heating appliances are slow while the fan business is picking up with warmer weather.

Weather conditions and conservatism have to some extent affected the forward trend of business indicated in this district during the earlier months of the year. Heavy rains have retarded farm operations, although damage from floods has been practically negligible as compared with adjacent territory to the east and south. The moisture, however, has been of incalculable benefit to agriculture and live stock, two of the chief industries of the district, and has therefore encouraged general business and banking.

Wholesale distribution of merchandise has been made in large volumes. Mining operations have shown no cessation, while crude-oil production is the highest on record.

Pacific Coast Contractors Report Slower Business

BUILDING permit figures are favorable to the electrical market in southern California, but elsewhere in the Pacific Coast territory contractors report a decided decrease in the number of large jobs. One large firm recently remarked that it had figured on only one set of sizable plans in two weeks' time, yet there is comparatively little non-employment.

Rubber-covered wire prices are rather unsteady, but so far have dropped very little. Railroad business is excellent, particularly in pole-line hardware. Power company business continues good, but slow or impossible deliveries on poles and insulators are the rule. Several large schedule material orders are reported which reflect the increasing manufacturing importance of California.

Electrical Machinery Business Expected to Gain 20 per Cent

ELECTRICAL machinery manufacturers report large unfilled orders at the close of the first six months of this year, which together with detailed accounts of operations for that period indicate that 1923 will be far ahead of last year's business to the extent of approximately 20 per cent. If this 20 per cent rate of increase is realized, it will mean that waterwheel generators totaling 240,000 kw. and turbo-generators totaling 650,000 kw. will be sold in 1923.

Earnings by electrical machinery companies for the first half of this year show only moderate improvement over those of the late months of 1922, but greater profits are expected in the last half of this year. Business as far as incoming business is concerned has been good since the fall months of last year. The past two months have witnessed some slight slowing up, but this is not taken as indicating any slump in the trade, but is rather looked upon as a temporary slowing up following on the heels of large orders earlier this year.

Improved earnings can be expected during the last half of this year reflecting the large amount of unfilled orders now on the books. Although orders began to come in volume more than seven months ago, this was not immediately reflected in larger billings, for the reason that the completion of the heavier class of machinery, including large turbines, takes considerable time. Another factor is that with a shortage of labor and inability to speed up plant operations the early months were comparatively poor ones.

Increased billings during April, May and June were not large enough to offset the early handicap. Earnings for the second quarter of this year showed marked improvement over those for last year.

One Company's Billings an Interesting Example

THIS inability to speed up operations immediately following an influx of orders is exemplified in the case of one of the leading companies. This company now has unfilled orders on its books of approximately $13,000,000, against $8,215,000 at the close of 1922. During the past two months billings have averaged $2,000,000, a gain of $300,000 over the early months. Net profits during the first quarter were equal to 70 cents a share on the $26,000,000 common stock, or 30 cents a share less than the one-dollar quarterly dividend requirement.

The earnings statement of this company for the second quarter, to be published shortly, will show the dollar dividend requirement to have been just about earned in the second three-months period. Current earnings of this company are now slightly ahead of the dividend requirements and are expected to continue so for the rest of the year.

Rubber-Covered Wire Reduced 10 per Cent in Chicago

CHICAGO electrical jobbers report satisfactory business. Several price changes were announced this week. Rubber-covered wire No. 0 and larger was reduced approximately 10 per cent, No. 1 to 6 double-braid stranded 15 per cent, No. 8 and smaller double-braid stranded 9 per cent, No. 4 and smaller single-braid stranded 9 per cent, No. 4 and smaller (solid) 9 per cent, duplex wire 9 per cent and fixture wire 15 per cent. Weatherproof base was reduced 1 cent. Lock nuts and bushings, ½-in. and ¾-in., were reduced 3 per cent. Certain types of motors were increased 10 per cent, while one type of insulator was increased 5 per cent.

Pole-line hardware remains in good demand. Transformer sales are normal for the time of the year and wiring device sales have increased somewhat. Conduit prices are firm and demand is good. The indications are that there will be a shortage in the fall months, due to the fact that in the summer months steel production is at a low ebb, as the hot weather affects this class of work very materially. It is believed that anticipation of future orders would be good judgment. Building permits are about equal to those of last year.

Radio Industry Showing Far More Stability This Summer

THIS time last year the entire electrical industry was watching with keenest interest the apparent paralysis and demoralization of the radio business. The manufacture and sale of radio equipment had grown to phenomenal proportions through the winter and continued until hot weather came, when suddenly with hardly a warning the bottom dropped out of the market and manufacturers, jobbers and dealers were left high and dry, choked with overstock and financially involved by an avalanche of canceled orders. This summer season has been approached, therefore, by the trade with extreme caution, lest the experience should be repeated.

This year, however, radio dealers, and jobbers' shelves are very low in stocks of both parts and complete sets, according to leading authorities in the market. The fear of inflation and consequent great losses has resulted in what is probably one of the most careful buying periods in the history of any commodity of the electrical industry. The demand for radio material, on the other hand, is considerably stronger. There has been no such collapse as was witnessed last season.

David Sarnoff, vice-president and general manager of the Radio Corporation of America, says that sales by his company are greater than last year at this time, and he is of the opinion that this careful buying will undoubtedly lead into a record-breaking year beginning some time within the next two months. "The outlook for radio is most favorable," said Mr. Sarnoff. "Past performances in the radio field coupled with present conditions give promise for the best business ever experienced by the radio dealer, jobber and manufacturer."

Sales of vacuum tubes are proceeding rather slowly, but are in keeping with the general trend of the market, although some dealers in the effort to attract trade are offering tubes at cut prices that allow no profit. No reductions have been made by the manufacturers. Stocks of tubes are sufficient for present needs. More elaborate and attractively designed cabinets are being developed for this year's displays. The concealed type with fewer controls is in increasing demand. Loud speakers with unseen horns are also growing in popularity. Business in parts is gradually falling off owing to the failure of the uninitiated to put together sets that are really efficient and satisfying. Units selling from $25 to $75, with tubes and dry cells, are in most favor.

Broadcasting is developing to new high standards far beyond the efforts of six months ago and is receiving par-

ticularly favorable comment this summer. The latest broadcasting station installed by the Radio Corporation of America, on the roof of Aeolian Hall, New York City, continues to send out two programs simultaneously on different wave lengths. This station cost approximately $225,000 to install and is operating at an expense of $10,000 monthly.

Wooden Pole Firms Unable to Keep Pace with Utilities

REPORTS from the wooden-pole industry indicate boom conditions in which it seems to be impossible for the shippers to keep up with the demand. Following the period of refinancing by utilities in 1922, pole orders began coming in about December of last year and have continued without let-up, so that shipments are being made just as fast as the poles can be taken out of the woods and butt-treated.

Authorities at different centers of pole supplies agree that this is the biggest year in the history of the pole business and predict that the present rate of demand will probably continue for two years more—a guess based on present indications of demand. Practically the entire country is demanding poles on a scale entirely beyond the capacity of the producers.

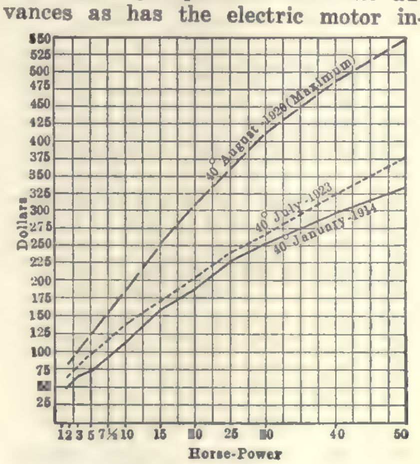
This demand seems to be spread pretty evenly over the country. In Western, Central, Southern and Eastern states utilities are busily engaged in replacements and line extensions; also in the East as far as Connecticut. From Connecticut north the demand is not so marked. It is estimated that about 50 per cent of the poles are being used in replacements and 50 per cent on new lines, many of them interconnection projects.

Virtually all shipments of poles today are being treated for butt preservation. This undoubtedly slows down delivery and is reducing somewhat the number of poles which suppliers can turn out. In the end, however, it will bring economy to the utilities through the conservation of both poles and replacement labor. It is not believed that actually it will make any reduction in the market for poles, since appropriations now spent in replacement work will be expended in purchase for extensions. There has been no change in butt-treating prices since December, 1918. Western cedar prices have not advanced since April 24 last, and no further advance is in prospect. The last price change in Northern cedar was on May 28, 1923, and no further advance is forecast. Both these advances were made to keep pace with increasing cost of labor.

Pole deliveries have been considerably retarded for the last few months by forest fires and delays in transit. A recent fire in Minnesota burned up 5,800 cut poles, all awaiting shipment to utilities, on order. Within the last three weeks floods in the Rockies have carried away bridges or caused washouts in twenty-two places along the main line, over which shipments of Western cedar must pass. Every effort is being made, however, to get the poles out of the woods to the treating yards and on the rails, so that central-station expansion programs may not be held up for lack of this essential material.

Comparison of Present Motor Prices with Pre-War Times

IT HAS been said by authorities that no other industry using any large amount of steel in its production has so completely liquidated war-time advances as has the electric motor industry. It is even believed that this liquidation has actually gone too far, and consequently there is every probability that the present price levels will not only be maintained but in due time will be conservatively increased as the motor industry works its way back to normal-capacity production.



COMPARISON OF RETAIL PRICES OF 40-DEG. SQUIRREL-CAGE TWO AND THREE-PHASE MOTORS AT 1,750 R.P.M.

In discussing recent advances of from 5 to 10 per cent which have been made by the leading electrical manufacturing companies on various types of electric motors, T. T. Richards, vice-president in charge of sales of the Wagner Electric Corporation, called attention to the present price position of the electric motor industry as compared with pre-war prices and also in its relation to the maximum price levels attained by the industry during the war and the post-war period.

These price movements are very clearly set forth in the accompanying chart. They are based on two-phase and three-phase squirrel-cage motors without auxiliary devices, ranging in size from 1 hp. to 50 hp. It will be noted that the present market is approximately within 10 per cent of the pre-war market of 1914. The chart shows that the maximum advance during the war and post-war periods of the motor market occurred in August, 1920, when prices were approximately 50 per cent above pre-war prices.

As an explanation of the present price situation of the motor industry, it is stated that while the motor market of the country during the last ten years has steadily expanded at a substantial pace, the production capacity of the country has grown at an even greater rate, resulting in a degree of competition not exceeded in any other large industry. The effect of this increase of productive capacity has been that during the present general trade revival the motor industry has not attained capacity production, but the various companies have been operating in their motor divisions variously between 50 and 70 per cent of capacity.

As the effects of increasing business become established, there will be steady growth in the employment of the productive motor-manufacturing capacity of the country. This will lead to the gradual elevation of motor prices to a level representing a fair relation of current prices to pre-war prices such as exists in other leading industries.

The Metal Market

COPPER weakened by another ⅛ cent last week and is now obtainable at 14.37½ cents, delivered. Although first hands avoided naming that quotation in the first part of last week, they clearly intimated that they would do this by inviting offers from consumers when the 14.50-cent price was not accepted. Copper is suffering from the depression current in all metals. Only finished steel is firm, although raw materials from which steel is made have been declining sharply of late.

Lead sales have been few and far between in the domestic markets during the last week. In the Middle West hardly enough business has been reported to establish prices, and consumers have been disconcerted by the rapid decline in New York.

NEW YORK METAL MARKET PRICES

	July 3, 1923 Cents per Pound	July 10, 1923 Cents per Pound
Copper, electrolytic	15.00	14.37½
Lead, Am.S.& R.price	7.00	6.85
Antimony	7.50	6.90
Nickel, ingot	27.00 to 32.00	27.00 to 32.00
Zinc, spot	5.80	5.76
Tin, Straits	41.00	38.40
Aluminum, 98 to 99 per cent	26.00	26.00 to 27.00

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.034	$0.034	$0.0252
Cold finished shafting, per lb.	0.042	0.042	0.0335
Brass rods, per lb.	0.1825	0.1913	0.155
Solder (half and half), per lb.	0.2862	0.2812	0.21
Cotton waste, per lb.	0.1231	0.1231	0.101
Washers, cast iron (½-in.), per 100 lb.	4.66	4.66	3.83
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.08	2.96	3.11
Machine oil, per gal.	0.349	0.349	0.34
Belting, leather, medium, off list	37%	37%	43%
Machine bolts, up to 1-in. x 30-in., off list	44½%	44½%	58%

Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Chain Belt President Retires

William C. Frye, for seven years president of the Chain Belt Company, Milwaukee, manufacturer of chains for electric use, has retired from active participation in its affairs and has been succeeded by C. R. Messinger, vice-president and general manager since 1917.

Mr. Frye is retiring after an active association with the company for twenty-eight years. During this time he has occupied nearly all the important executive positions of the company.

National Lead Battery Company to Have Kansas City Plant

The National Lead Battery Company, St. Paul, manufacturer of batteries, is remodeling a factory building in the Blue Valley district in Kansas City and expects to start operations there in August. There will be employed in this plant about 150 persons, including salesmen and office force. It is said that the branches in New York, Dallas, Oakland and Atlanta will be supplied from the Kansas City factory. The Kansas City property has been occupied until recently by the Kansas City Bridge Company. The property includes about two and a half acres at Sixteenth Street and Manchester Avenue. G. P. Castner, vice-president, is in charge.

Electrical Sheet Appointment

William J. Woolridge on July 1 was appointed manager of the electrical sheet department of the Mansfield Sheet & Tin Plate Company, Mansfield, Ohio.

Prior to this Mr. Woolridge was connected for about four years in the same capacity with the Whitaker-Glessner Company at Portsmouth, Ohio, resigning from there last May. For more than twenty-five years Mr. Woolridge was an electrical engineer with the General Electric Company, and during many of those years he specialized on electrical sheet-steel problems of all kinds.

Apex Electrical Distributing Has Tenth-Year Convention

The Apex Electrical Distributing Company, Cleveland, held its tenth-year convention in the first week of July, when 750 delegates from all parts of the United States met at the Hotel Cleveland to discuss production and merchandising problems of the company.

Signs in the convention headquarters stated that every minute of the convention was worth \$222.22. This figure was arrived at by adding together the expenses involved in bringing the salesmen to the convention, together with a reasonable allowance for their time.

Western Electric Acquires More Space in Chicago

The Western Electric Company, Chicago, has leased two floors in the Wrigley Building, at Ashland Avenue and Thirty-fifth Street, totaling 22,500 sq.ft., and a floor in the Midland Building at 1500-24 South Western Avenue, approximating 30,000 sq.ft., and will take immediate possession for extensions. The space first noted will be equipped as supplementary works for the manufacture of telephone switchboard equipment, while the Midland Building property will be utilized for the present for warehousing service.

This is the first time in its history that the company has found it necessary to use property outside of its own plants for manufacturing purposes. The working force at the Hawthorne (Ill.) works has reached a maximum of 32,000 employees, as compared with 26,000 operatives about eight months ago.

Geier Ends Cleaner Contest

The P. A. Geier Company, Cleveland, announces that 149 of its salesmen won prizes of either cash or electric cleaners in the spring housecleaning contest just ended. The company in a statement points out that many others were aided by the spirit of the contest to increase their sales and commissions far above normal, although they did not win prizes. The first prize of \$250 went to Harriman Eldridge, who sold the most of both machines and attachments.

Roberts Supply Opens Baltimore Branch Under J. F. Meyers

The H. C. Roberts Electrical Supply Company announces the opening of another supply house at 16 South Howard Street, Baltimore, with C. A. Williams in charge. This branch is under the general supervision of J. F. Meyers, who is also manager of the house in Washington.

The first general sales meeting of the Baltimore branch was held June 12, factory representatives being on hand to assist the organization in getting up speed. This is the fourth house now being operated by the Roberts company, the others being in Philadelphia, Syracuse and Washington.

Westinghouse Gets Contract for Largest Coal Hoist

The largest coal-mining hoist in the world will be installed at Orient No. 2 mine of the Chicago, Wilmington & Franklin Coal Company at West Frankfort, Ill. A contract for this hoist has been awarded to the Westinghouse Electric & Manufacturing Company and the Nordberg Manufacturing Company. The Westinghouse company will furnish the complete electrical equipment for the hoist.

The hoist contracted for will be twice as large as any coal-mining hoist in North America at the present time. The largest coal-mine hoist in North America now is equipped with a hoist motor having a capacity of 1,400 hp., and the capacity of the hoist motors of the Orient No. 2 hoist will be 4,400 hp., divided in two motors, one mounted at each end of the drum shaft and each having a capacity of 2,200 hp. at 40 deg. C. rise.

Diamond Power Specialty Firm Appoints More Representatives

The Diamond Power Specialty Corporation of Detroit has announced the appointment of Paul E. Theis as sales manager for the Cleveland district, with offices at 608 Rockefeller Building.

Burford, Hall & Smith, American Trust and Savings Bank Building, Birmingham, Ala., have been appointed district representatives for the sale of "Diamond" soot blowers by the Diamond Power Specialty Corporation.

The Boiler Equipment Service Company, Candler Building, Atlanta, is now selling "Diamond" soot blowers in the states of Georgia and Florida.

Carroll Electric Opens Branch Warehouse in Baltimore

The Carroll Electric Company, Inc., 714 Twelfth Street, N. W., Washington, D. C., jobber of electrical supplies and machinery, has opened a new branch warehouse at 38 South Calvert Street, Baltimore. This Baltimore branch of the company was established in May, 1923, when officials of the company purchased and absorbed the old Chesapeake Electric Company of that city. The Baltimore branch warehouse is in charge of T. Gant Hardesty, who for the last twenty years has been connected with the electrical supply business in that city.

Louis Carroll, sales director for the company, will make his headquarters at the Baltimore branch. This branch will cover Maryland, Virginia and Delaware and parts of Pennsylvania, West Virginia and North Carolina.

Officers of the company are: Harry R. Carroll, president; Louis D. Carroll, vice-president and director of sales, and Harry W. Clayton, secretary. The Carroll Electric Company was established in 1900. Another branch of this company is in Norfolk, Va.

Standard Turbine Corporation Buys Youngs Machine

The Standard Turbine Corporation, Wellsville, N. Y., which for some time has been engaged in the manufacture of steam turbines in capacities up to 750 hp., has just announced the purchase of the plant of the Charles Youngs Machine Company, Wellsville, where it is at the present time caring for the latter company's output.

A contract has been awarded to the Austin Company of Cleveland for the construction of a new steel building at Scio, N. Y., 4 miles from Wellsville, to be completed in August of this year. This will be the permanent location of the plant and the Youngs factory will be used only until the time this new building is completed. After that time the Youngs shop will be used for storage purposes by the comp ny.

The company reports increasing business. The Standard Turbine Corporation is managed by J. Y. Daalstrand, formerly chief engineer of the Carr Turbine Company of Wellsville and previously to that time connected in various engineering capacities with practically all of the turbine builders in this country.

G. E. Orders Gained 34 per Cent Over Like Period in 1922

Orders received by the General Electric Company for the three months ended June 30, 1923, were $84,249,710, an increase of 34 per cent over a similar period for last year, according to the quarterly report to stockholders signed by President Gerard Swope. For the six months ended June 30, 1923, orders totaled $164,263,755, or an increase of 44 per cent over a similar period of 1922.

J. F. Motz with Allen-Bradley

J. F. Motz has been appointed to succeed Gray E. Miller as district representative of the Allen-Bradley Company in the Pittsburgh territory. Mr. Motz will have charge of the entire line of Allen-Bradley equipment, including industrial-control equipment, starting equipment, mine-hoist control, etc., in the Pittsburgh territory.

Vrabeck & Kessler Appointed Champion Engineering Agents

Vrabeck & Kessler, engineers, 149 Broadway, New York City, have been appointed New York district representatives of the Champion Engineering Company, Kenton, Ohio, builder of electric traveling cranes, sluicegates, penstocks, automobile turntables and hydraulic machinery. J. W. Spensley, representative of the Champion company in New York for a number of years, recently resigned to devote more time to sales of domestic and industrial oil burners with the Brooklyn Oil Burner Company, Brooklyn, of which he was an organizer.

J. S. Vrabeck was sales manager of the Sturtevant Mill Company, Chicago, for seven years and prior to that with the sales staff of the Allis-Chalmers Manufacturing Company. H. H. Kessler was formerly with the Atlas-Portland Cement Company and later with the Hardinge Conical Mill Company.

Howell Motors Election

At a recent meeting of the board of directors of the Howell Electric Motors Company, Howell, Mich., the following officers were elected for the ensuing year: W. M. Spencer, president and treasurer; R. B. McPherson, vice-president; C. F. Norton, vice-president and general manager, and H. T. Proctor, secretary and assistant treasurer.

New Company Acquires Electric Steel Box Firm

The Electric Box & Switchboard Company, Inc., 564 West Monroe Street, Chicago, recently organized, has taken over the business of the Electric Steel Box Company and added a switchboard department. The company now manufactures steel boxes for electrical work, switchboards and panelboards. Officers are: H. L. Johnson, president; E. J. Lang, vice-president, and George Meyer, Jr., secretary-treasurer.

Bliss to Sell Old Plant

Following the removal of its plant at the foot of Sands Street, Brooklyn, to its new location for the concentration of production, the E. W. Bliss Company, manufacturer of electrically driven machinery, will discontinue all operations at the previous works and the property will be placed on the market. It consists of a number of buildings, totaling 200,000 sq.ft.

Weeks-Merit System, Inc., Is Successor to S. S. Weeks

The Weeks-Merit-System, Inc., 228 Aborn Street, Providence, R. I., has been incorporated as successor to S. S. Weeks, who for the past four years has represented the Associated Engineering & Supply Company of San Francisco as Eastern distributor of the Merit automatic oil stoking system.

Mr. Weeks will be president of the new corporation. The company is now manufacturing "Merit System" devices of new design only, the standard design being furnished for the present by the Westinghouse Pacific Coast Brake Company.

The new company is enlarging its machine shop and eventually will manufacture all apparatus sold in this territory. The company can furnish automatic fire and draft control for any make or type of oil burner with any type of boiler with either natural or forced draft. It also has an automatic control for pulverized-coal-burning boilers.

Lance Enters Supply Field

The Lance Electrical Supply Company, St. Louis, organized and headed by S. Carl Lance as president, formally announced its recent entrance into the field by a reception held at its office and warehouse at 1016-18 Market Street. Mr. Lance has been identified with the electrical industry for many years, his latest former connection being with Brown & Hall Supply Company, where he served as vice-president and general manager, resigning that office to engage in business on his own account.

Sprague Conduit Products Will Move to Bridgeport, Conn.

The Sprague Conduit Products Section of the General Electric Company will leave the building at 527 West Thirty-fourth Street, New York City, which it has occupied for a quarter century in the manufacture and selling of conduit and other products, and remove to Bridgeport, Conn., on Aug. 1. This move is in keeping with the policies of the merchandise department.

The following men are in charge of the conduit products section: A. J. Young, Jr., J. R. Whittle, L. D. Vanderbleek, O. F. Kypta and H. L. Mulligan.

The Mule Battery Manufacturing Company, care of Albert Setzer, 153 Wendell Street, Providence, R. I., recently organized, will manufacture electric storage batteries and equipment. The company is fully equipped to cope with present requirements, its only need being for raw materials.

The Combination Electric Switch Corporation, New York, has been incorporated with capital stock of $100,000 to manufacture electrical switches and parts. It is not yet permanently located, but the company expects to be in production in the near future. All manufacturing will be done by contract. Address care of P. A. Zizelman, 42 Broadway, New York City.

The American High Frequency Corporation, New York, has been incorporated with capital stock of $500,000 to manufacture electrical machinery. Plans are not yet definitely decided. Incorporators are V. Wirth, A. Weilich and A. J. Armore; address, 128 Broadway, New York City.

The American Electric Company, electric jobber of supplies, fixtures and construction material, St. Joseph, Mo., announces the appointment of C. I. Echols, formerly with the Electric Appliance Company, Dallas, Tex., as sales manager. He succeeds Robert A. Graham.

The H. S. Whiting Company, Inc., manufacturer and distributor of lighting units, Grand Central Terminal Building, New York City, has completed the Joseph Horne Company's department store (Pittsburgh) lighting contract.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Madrid, Spain (No. 7,092), for generators, transformers and electric stoves and fans.

Purchase is desired in Madras, India (No. 7,113), for electrical apparatus for private hydro-electric plant to operate under a 60-ft. head.

An agency is desired in São Paulo, Brazil (No. 7,196), for motors and wiring supplies.

An exclusive agency is desired in Johannesburg, South Africa (No. 7,091), for radio sets, parts and accessories.

ELECTRICAL APPARATUS FOR AUSTRALIA.—Tenders will be received by the State Electricity Commission of Victoria, Melbourne, Australia, until Oct. 6, for 2,000 disk-tensioning insulators and 6,000 pin-type supporting insulators for 22,000-volt circuits.

EQUIPMENT FOR ELECTRIC PLANT FOR DURBAN, SOUTH AFRICA.—Tenders will be received by the Municipal Council of Durban, South Africa, until Aug. 31 for equipment for power plant in connection with the water project at Shongwani, including oil or gas engines, generators, cable ways, electric cranes, motors, etc.

ELECTRIC CAPSTANS FOR CHRISTCHURCH, NEW ZEALAND.—The purchase of twenty-five electric capstans, to cost £18,750, has been decided upon by the Harbor Board of Christchurch, New Zealand.

PROPOSED HYDRO-ELECTRIC DEVELOPMENT IN THE NORTHWEST TERRITORY AUSTRALIA.—Certain water rights have been granted, provisionally, by Sir James Mitchell, Premier of Western Australia, to the Yampi Sound Electrical Power & Smelting Syndicate, which proposes to develop electric power in connection with the development of the iron deposits at Yampi Sound, in the Northwest Territory.

PROPOSED HYDRO-ELECTRIC POWER STATION NEAR DAHLEN, LATVIA.—Plans are under consideration for the erection of a hydro-electric plant near Dahlen, to cost with construction of a canal about one million Latvian rubles. The government and the municipality of Riga have agreed to undertake the work jointly. The work will be finished in about three years.

ELECTRIFICATION OF RAILWAYS IN DUTCH EAST INDIES.—Work will begin on the electrification of one important main line in the Dutch East Indies, according to *Commerce Reports*, as soon as financial conditions are more favorable. Electrification of other lines will depend upon the results achieved in the way of reduction of operating costs and increased returns as compared with the old system.

New Apparatus and Publications

PORCELAIN BUSHINGS. — The Lapp Insulator Company, Inc., Le Roy, N. Y., is distributing bulletin No. 104, covering the "Lapp" porcelain bushings for transformers, etc.

FIXTURE STRAP. — A fixture strap ("Adjustable") for ceiling collars and brackets, which is adjustable from 4 in. to 8 in., has been bought by the Tax-Kerns Company, 591 E. Water Street, Milwaukee.

ELECTRIC WASHER. — An electric clothes washer ("Incomparable Conlon") has been placed on the market by the Conlon Corporation, Chicago.

COMBINATION FAN AND HEATING UNIT. — The Stoughton Manufacturing Company, Stoughton, Wis., has developed a combination fan and heating unit.

ELECTRICAL SIGN.—A new electrical sign, known as the "Color-Volve" sign, has been devised by Fred T. Loftin, 58 When Building, Indianapolis, Ind.

AUTOMATIC MACHINERY, ELECTRIC FURNACES, ETC.—The General Engineering & Supply Company, 160 Fifth Avenue, New York City, is distributing sheets Nos. P-1, F-1, E-1, F-2 and B-1, covering its various products, including automatic punch press, electric furnaces, switchboard for multiple furnace control, etc.

METALLIC PACKING. — The Crane Packing Company, 1800 Cuyler Avenue, Chicago, is distributing a booklet describing the "John Crane" process of metallic packing, its development and correct application to surface condensers, heaters, evaporators and intercoolers.

CONTROL OF LIGHTING IN THEATERS.—The Frank Adams Electric Company, St. Louis, is distributing bulletin No. 28, describing and illustrating the "Major Pre-Selective" system of remote control of lighting in theaters. It also contains general specifications for the electric light and power wiring for theater buildings for the "Major" system.

ELECTRIC HEAT. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued the first number of a miniature publication entitled "Electric Heat." This publication, which will be issued frequently, will be devoted to industrial electric heating problems. This number contains articles on the use of electric heat in the manufacture of batteries, electric motors, etc.

STOKER. — The Sanford Riley Stoker Company, Worcester, Mass., is distributing publication No. 69, describing and illustrating the Jones "Lateral Retort" stoker.

WIRE.—The Copper Clad Steel Company, Braddock P. O., Rankin, Pa., is distributing a leaflet (revised) entitled "Technical Data and Tables on Aristos 'Copperweld' Signal-Line Wire."

MOTOR-GENERATOR.—The Acme Electric & Manufacturing Company, 1444 Hamilton Avenue, Cleveland, has developed a vertical constant-potential motor-generator. This machine is made in 100, 200 and 400-amp. sizes for various phases and voltages.

OIL CIRCUIT BREAKER.—A new oil circuit breaker, type F-33, in capacities of 400, 600 and 800 amp. at 15,000 volts, has been placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

PANELBOARDS.—Bulletin No. 29 issued by the Frank Adam Electric Company, St. Louis, describes and illustrates the "P" type unit-constructed standardized panelboard. Separate bulletins have been issued by the company on the type "T-P" panelboard, which is the tumbler-switch plug-fuse panel of the "Triumph" line and on type "R" panelboard for residences and small stores.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BANGOR, ME.—The trustees of the Eastern Maine General Hospital plan to construct a power house, to cost about $60,000. Haven & Hoyt, 220 Devonshire Street, Boston, are architects.

SPRINGFIELD, MASS.—The Springfield Power Association plans to build a new one-story power house on Lyman Street.

SPRINGFIELD, MASS.—A substation to distribute electricity in the East Springfield district is being erected by the United Electric Light Company on Page Boulevard. The cost is estimated at $36,000.

HARTFORD, CONN. — The Hartford Electric Light Company is planning to erect a one-story substation on Windsor Avenue.

MERIDEN, CONN. — The Connecticut Company has acquired a site on Capitol Avenue on which it will erect new carbarns and shops to replace a building destroyed by fire several months ago. The cost is estimated at about $150,000.

PLAINVILLE, CONN. — The Standard Steel & Bearings Company contemplates the construction of a transformer substation at its local plant.

Middle Atlantic States

ALBANY, N. Y.—Plans are being prepared by the Municipal Gas Company for an electric substation on Partridge Street, to cost about $35,000.

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 24, for one motor-generator set for the local navy yard. (Schedule 1070.)

BROOKLYN, N. Y.—Electric equipment will be installed in the baking plant to be erected at 67-75 Mill Street, by the Larson Baking Company, 732 Henry Street, to cost $90,000. The McCormick Company, 41 Park Row, New York, is engineer.

DANSVILLE, N. Y.—The Hornell (N.Y.) Electric Company contemplates extensions to its local plant.

FLEISCHMANNS, N. Y.—The Fleischmanns Light, Heat & Power Corporation, recently organized, will operate a local power plant for commercial service. S. V. Ryan and G. S. Ortman are interested in the company. Frost, Watson & Sharp, Albany, are representatives.

HORNELL, N. Y.—The Hornell Electric Company contemplates extensions to its electric plants in Hornell and Dansville, N. Y., including the installation of new equipment.

NEW YORK, N. Y.—Power equipment, ovens, conveying machinery, etc., will be installed in the proposed new plant to be erected by the Gottfried Baking Company, 534 East Seventy-second Street, to cost about $100,000.

OLEAN, N. Y.—The Olean Electric Light & Power has applied to the Public Service Commission for authority to erect and operate a transmission line through Humphrey Township. The proposed line will connect the Olean company with the lines of the Niagara, Lockport & Ontario Power Company.

TULLY, N. Y.—The Syracuse (N. Y.) Lighting Company has petitioned the Public Service Commission for permission to operate an electric lighting system in Tully and the towns of Lafayette, Fabius and Tully. The village of Tully has voted to sell the municipal plant to the Syracuse company. If its plans are approved, the company plans to expend about $58,000 in making extensions and installing a distribution system in the new territory, which it will serve from the Syracuse plant.

ASBURY PARK, N. J.—A power plant will be installed in the new ten-story hotel to be erected by a local company, now forming, to cost $1,000,000, for which plans are being prepared by Warren & Wetmore, 16 East Forty-seventh Street, New York, architects.

BRANCHVILLE, N. J.—The property of the Branchville Electric Power, Water & Lighting Company has been acquired by the Culvers Hydro-Electric Company. The latter company has been granted permission to issue $90,000 in capital stock, part of the proceeds to be used for extensions, including the installation of additional equipment.

COLLINSWOOD, N. J. — The General Water Supply Company contemplates the installation of electrically operated pumps, to cost about $45,000.

PATERSON, N. J. — Manual training equipment will be installed in the proposed high school to be erected at Park Avenue and Market Street, at a cost of about $1,250,000. William T. Fanning, 5 Colt Street, is architect.

NEW HAVEN, PA.—The Metropolitan Edison Company has secured control of the York Haven Water & Power Company. Plans are being considered for extensions and improvements. The Metropolitan Edison Company is organizing five subsidiaries, to be known as the Pike, Aisac, District, Rockland and Ruscomb Manor Electric Companies, to purchase existing properties and install transmission lines.

OAKMONT, PA. — The Brady-Warner Coal Company, Brady, W. Va., will construct a substation at its local properties and install additional electrical and mechanical equipment for mining operations.

PITTSBURGH, PA. — The West Penn Power Company is arranging for a fund of $50,000,000 for extensions during the next twelve or more months. Plans are being perfected for transmission lines in Plum and Patton Townships, where rights-of-way have been secured. The following companies have been purchased: Fraser Township, Wayne Township, Karns City Borough, Bruin, Springdale, Queenstown and Cowanshannock Electric Corporations and the Wayne Township Light & Power Company. The properties will be consolidated and additional substations and transmission lines constructed.

YORK, PA.—The Pennsylvania Power & Light Company will build a transmission line from its plant at Holtwood to York and Coatesville.

CONOWINGO, MD. — The Susquehanna Power Company has secured permission from the Federal Power Commission to construct and operate a hydro-electric plant on the Susquehanna River, with ulti-

mate capacity of 360,000 hp., to cost about $20,000,000, with steel-tower transmission system.

ELKTON, MD. — The Eastern Power Company plans extensions to its power plant and transmission system in connection with the consolidation of electric properties at Elkton, Havre de Grace, North East, Aberdeen, Port Deposit and Rising Sun, Md., and Oxford, Pa., recently purchased.

HAMPTON ROADS, VA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C. until July 17, for 1,795 pounds of magnet wire for the local navy yard. (Schedule 1083.)

LYNCHBURG, VA.—The Superior Anthracite Coal Corporation contemplates the installation of electric power equipment at its properties in the Brush Mountain section, Montgomery County.

NORFOLK, VA.—Plans are under way for the installation of an ornamental lighting system on Granby, Main and Church Streets, to cost about $20,000.

NORFOLK, VA.—The Ford Motor Company, Highland Park, Mich., contemplates the construction of a power house at its proposed local assembling plant to be erected on a branch of the Elizabeth River, to cost about $150,000.

PORTSMOUTH, VA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 17, for a miscellaneous quantity of ammeters and voltmeters for the local navy yard. (Schedule 1085.)

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until July 24, for 70,000 ft. of electric cable. (Schedule 1086.)

North Central States

BATTLE CREEK, MICH.—The Consumers' Power Company, Jackson, has acquired the local system of the Citizens' Electric Company. The property will be consolidated and extensions made.

CALUMET, MICH.—The Arcadian Consolidated Mining Company will build a power house at its properties to replace a plant recently destroyed by fire.

IRON MOUNTAIN, MICH.—The Michigan Iron Land & Lumber Company contemplates erecting 2 miles of high-tension transmission line from here to its factory on the Menominee River, to cost about $25,000. Mead & Seastone, Journal Building, Madison, Wis., are engineers.

JACKSON, MICH. — The Consumers' Power Company has issued $3,500,000 in bonds, part of the proceeds to be used for extensions and improvements.

LANSING, MICH. — The Lindell Drop Forge Company plans to construct a power house at its proposed local plant.

CLEVELAND, OHIO—Bids will be received by the commissioner of purchases and supplies until July 20 for lead-covered cable for the division of light and power.

CENTRAL CITY, KY.—The Illinois Central Railroad Company, Chicago, will build a power house in connection with additions to its local car and locomotive shops, to cost about $375,000. F. L. Thompson is chief engineer.

LOUISVILLE, KY. — Electric power equipment will be installed in the proposed local refining plant of the Louisville Petroleum Refining Company, Inter-Southern Building, to cost about $250,000. W. M. Mitchell is in charge.

FRANKLIN, IND.—The Interstate Public Service Company will make extensions and improvements in its local electric distributing system.

HAMMOND, IND.—The Northern Indiana Gas & Electric Company contemplates extensions and improvements to cost about $500,000, one-half of the appropriation to be used this year and the other half during 1924.

INDIANAPOLIS, IND.—The Terre Haute, Indianapolis & Eastern Traction Company is preparing plans for the construction of an addition to its power plant on West Tenth Street.

SHELBYVILLE, IND. — Clarence C. Shipp, head of Shipp & Company, Indianapolis, manufacturers of mechanical apparatus, has acquired a power site and plant at Flatrock Mill, near Shelbyville, which it will utilize for a hydro-electric station. The cost is estimated at $125,000.

CHICAGO, ILL. — Gubinsky Brothers, Inc., 2261 South Union Avenue, will build a power plant in connection with a new paper mill at California Avenue and Thirty-first Street, to cost about $2,500,000. A. Epstein, 2001 Pershing Road, is architect and engineer.

CUBA CITY, WIS. — The Connecting Link Mining Company is asking for bids for the construction and equipment of a new milling and mining plant and power house, to cost about $25,000.

CUMBERLAND, WIS.—The local substation of the Wisconsin Hydro-Electric Company, Amery, was recently destroyed by fire. The station will be rebuilt.

LADYSMITH, WIS.—Plans are under consideration by the Hintz Brothers Company for equipping its new sawmill for electrical operation. Electricity will be supplied by the Lake Superior District Power Company.

MADISON, WIS.—The Chicago & North Western Railroad Company, it is reported, contemplates improvements to its local terminal, to cost about $500,000. The work will include a machine shop, 500 hp. steam generating plant, cinder pit with an electric hoist, new roundhouse, turntable, coal house and water reservoir.

BLUFFTON, MINN. — The village officials have awarded a contract for the construction of an electric transmission line and distributing system.

FOSSTON, MINN.—The Midland Power Company is planning to extend its transmission line to connect with the lines of the Northern States Power Company in Terrebonne.

SUNRISE, MINN.—The Northern States Power Company, St. Paul, has acquired the plant of the Sunrise Milling & Electric Company.

THIEF RIVER FALLS, MINN.—Surveys are being made for a proposed water-power plant for the city, to cost about $200,000.

WINONA, MINN.—The State Board of Control, State House, St. Paul, will take bids at once for the construction of a power plant at the proposed local state institutional buildings, to cost about $575,000. C. H. Johnston, 615 Capitol Bank Building, St. Paul, is architect.

DES MOINES, IOWA.—The Council is considering the installation of an ornamental lighting system on High Street. Karl C. Kastberg is engineer.

OAKDALE, IOWA.—Extensions and improvements will be made to the power plant at the local State Sanitarium. H. F. Liebbe, State House, Des Moines, is state architect.

COLERIDGE, NEB.—At an election to be held July 17 the proposal to issue $24,000 in bonds for extensions and improvements to the municipal electric plant will be submitted to the voters.

Southern States

MARSHVILLE, N. C.—The Union Lumber Company plans to rebuild its mill and power house, recently damaged by fire, causing a loss of about $200,000.

WADESBORO, N. C.—The Wade Manufacturing Company plans to build a hydro-electric plant in connection with its proposed new textile mill, to cost about $1,000,000. A steam-operated power plant will also be installed. Robert & Company, Inc., Atlanta, are engineers.

MACON, GA.—The Clinchfield Portland Cement Company, Kingsport, Tenn., plans to construct a power plant at its proposed cement-manufacturing plant, to be built near Macon, to cost about $1,000,000.

MIAMI, FLA.—The Florida Nu-Tex Brick Company, Tampa, contemplates the construction of a power house in connection with its proposed local concrete-brick plant, to cost about $50,000.

BIRMINGHAM, ALA.—The DeBardeleben Coal Corporation, recently organized to take over and operate a number of interests in the Warrior coal field, contemplates the installation of electric power and mechanical equipment at the mines. A bond issue of $4,000,000 has been sold, part of the proceeds to be used for expansion.

CALERA, ALA. — The O'Neals Lime Works, Inc., Birmingham, will build a power house in connection with its proposed local plant, to cost about $500,000.

GADSDEN, ALA.—The Alabama Power Company will extend its transmission system about 10 miles to serve the Citico mining district.

TOWNLEY, ALA. — The Corona Coal Company contemplates the installation of electric power and mechanical equipment at its properties.

TUSCALOOSA, ALA. — The Alabama Power Company has been denied permission by the Public Service Commission to construct its proposed hydro-electric plant on the Warrior River. The project will be held in abeyance until a new site is selected.

LENOIR, TENN.—The property of the Lenoir Light & Power Company has been acquired by the Tennesee Electric Power Company, Chattanooga. Extensions and improvements, to cost about $25,000, are contemplated.

MARTIN, TENN.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system.

MEMPHIS, TENN. — Plans are under way for the installation of an ornamental lighting system on South Second Street and in the downtown portion of Union Avenue.

TREZAVANT, TENN. — Bonds to the amount of $35,000 have been authorized for the installation of an electric plant and waterworks system.

VICKSBURG, MISS.—The City Council is considering the installation of several electrically operated pumping plants in connection with a land drainage and reclamation project on the water front. The Miller-Butterworth Company, Southern Trust Building, Little Rock, Ark., is engineer.

WAYNESBORO, MISS. — The Simpson County Lumber Company contemplates rebuilding its power house and mill, recently damaged by fire, causing a loss of about $60,000.

COTTER, ARK.—Hugh L. Cooper & Company, 101 Park Avenue, New York, consulting engineers, has taken an option on the property of the Dixie Power Company, and will commence preliminary surveys for a proposed hydro-electric power plant on the White River. The cost of the project is estimated at $10,000,000.

FORREST CITY, ARK. — The Forrest City Special Improvement District will build a one-story power plant, 56 ft. x 80 ft., for commercial service. F. J. Herring is engineer.

OKEMAH, OKLA.—The Okemah Gas & Electric Company, recently organized, plans to install and operate a local commercial system. A transmission line will be built. S. T. Palmer is head.

OKLAHOMA CITY, OKLA.—A two-story power house to cost $65,000 will be erected at the University Hospital. The State Board of Affairs, Capitol Building, is in charge. Layton, Smith & Forsyth, Southwest National Bank Building, are architects.

PANAMA, OKLA.—The Buck Creek Mine Company will electrify its coal mines in the Bedwell section. Electrical service will be furnished by the Oklahoma Gas & Electric Company.

BRYAN, TEX.—Plans to double the capacity of the municipal power plant are under consideration. E. E. McAdams is city manager.

CHILDRESS, TEX.—The Childress Light & Ice Company plans to build an addition to its power plant.

FORT WORTH, TEX.—The Fort Worth Power & Light Company has arranged to increase its capital from $5,189,600 to $6,024,500, part of the proceeds to be used for extensions and improvements.

CORSICANA, TEX. — The Humble Oil Company contemplates building an electrically operated pumping plant at its works in the Beaton section.

DALLAS, TEX. — The Dallas Railway Company contemplates extensions and improvements to its system, including power house, substations, etc., to cost about $1,800,000, during the next eighteen months.

DALLAS, TEX.—Bids, it is understood, will be asked at once by the Brown Cracker & Candy Company, McKinney and Jefferson Streets, for its proposed new plant, to cost about $1,000,000. The equipment will include power equipment, conveying and other machinery, ovens, etc. C. E. Barglebaugh & Company, Medical Art Building, are architects and engineers.

ELGIN, TEX.—The Elgin Ice & Cold Storage Company plans extensions and improvements to the plant of the Elgin Light & Power Company, recently acquired.

FORT WORTH, TEX.—Plans are under consideration for the installation of an ornamental lighting system on the Dallas-Fort Worth highway.

GEORGIANA, TEX.—Tentative plans are under consideration for the installation of a municipal electric light plant.

HUBBARD, TEX.—The City Council is considering the installation of electrically operated pumping machinery at the municipal waterworks, to cost about $55,000.

NEW BRAUNFELS, TEX.—The Landa Milling Company, recently incorporated, has taken over and will operate the local electric light and water plant. Harry Landa, New Braunfels, is interested in the company.

Pacific and Mountain States

ALGER, WASH.—The installation of an electric lighting system in Alger is under consideration. Post office address is Bellingham.

EVERETT, WASH.—Contract has been awarded by the Delta Electric Water Company for the construction of an 80-ft. dam at Pilchuck.

YAKIMA, WASH.—The installation of an ornamental lighting system to cost about $5,000, is under consideration.

PORTLAND, ORE.—The Grand Rapids (Mich.) Show Case Company has acquired property in the Brooklyn district, between Twenty-second and Twenty-sixth Streets, on which it will erect a plant, consisting of a main building, power house, machine shop, etc. The cost is estimated at about $150,000.

LOS ANGELES, CAL.—Ralph Bennett, Central Building, and associates have applied to the State Water Commission for permission to build a hydro-electric plant on Big Rock Creek, Los Angeles County, with initial capacity of 6,100 hp., to cost about $600,000.

OAKLAND, CAL.—The J. W. Murray Manufacturing Company, 1975 Clay Street, Detroit, contemplates the construction of a power house at its proposed local branch plant for the manufacture of automobile equipment, to cost about $250,000.

SACRAMENTO, CAL.—The Great Western Power Company will make extensions in its Brighton substation, including the installation of auto-transformers, etc.

SAN BERNARDINO, CAL.—Plans are being arranged for the installation of ornamental lighting system on several streets, to cost about $100,000. Bids will soon be asked for the proposed installation on Mount Vernon Avenue.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company plans to construct a substation on Minna Street, near Eighth Street, to cost about $40,000.

SAN LUIS OBISPO, CAL.—The Southern Pacific Railroad Company, San Francisco, plans to build a power plant at its local yards to cost about $55,000.

TURLOCK, CAL.—The Turlock Irrigation District is preparing plans for the installation of an electrical distributing system, to cost about $500,000.

BUTTE, MONT.—The Royal Development has filed an application for water rights for a proposed power development on James and Alpine Creeks.

EUREKA, NEV.—The Eureka Smelting Company contemplates the construction of a power house in connection with its proposed local smelting plant, to cost about $1,750,000.

Canada

PORT ALBERNI, B. C.—The installation of a new generator and Diesel oil engine at the municipal electric plant, to cost about $5,000, is under consideration by the Council.

ST. JOHN, N. B.—The New Brunswick Electric Power Commission is planning to make a survey and to prepare an estimate of cost of the proposed electric transmission line from the Aroostook power development, a distance of 39 miles, to serve the towns of Bath, Bristol, Stickney, Florenceville, Centreville and Woodstock.

NORTH BAY, ONT.—The Hydro-Electric Power Commission of Ontario, Toronto, is planning the development of the Bingham Chutes, to include two 450-kva. units; increasing the Nipissing power development by the installation of a 1,200-hp. unit and building a wood-stave pipe line; also to develop 4,000 hp. at Cox's Chutes and 1,000 hp. at Elliott's Chutes, both on South River, and installing a 600-hp. Diesel oil engine in North Bay plant for use during low-water periods. The cost of the work is estimated at $500,000. F. A. Gaby is chief engineer.

SCHUMACHER, ONT.—Extensions are under consideration at the McIntyre-Porcupine Mines, including sinking the main shaft to the depth of 5,000-ft., and building a new mill on another section of the mine. The equipment will include hoisting equipment, crushers, tube and ball mills, pumps, electric motors, etc.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 19, 1923)

1,459,698. DEPOLARIZER; B. H. Teitelbaum, Brooklyn, N. Y. App. filed Dec. 2, 1919. Dry battery provided with depolarizing mixture of manganese dioxide.

1,459,709. MULTIPLEX SIGNALING; B. W. Kendall, New York, N. Y. App. filed Oct. 13, 1916. By means of modulated high-frequency carrier waves.

(Issued June 26, 1923)

15,636 (reissue). TELEPHONE SYSTEM; S. A. Beyland, Long Meadow, N. Y. App. filed June 23, 1915. Means for releasing ringing apparatus.

1,459,726. APPARATUS FOR AUTOMATICALLY STARTING ENGINES OF MOTOR VEHICLES; A. Goodheim, West Hoboken, N. J. App. filed July 15, 1920. Prevents stalling of engine.

1,459,730. OPERATING MECHANISM FOR REGISTERS; F. C. Harris, Chicago, Ill. App. filed Nov. 17, 1919. Notching mechanism.

1,459,756. ELECTRICAL CONTROLLING MECHANISM; H. E. Stahl, Trenton, N. J. App. filed Sept. 23, 1922. Control for automatically reversing motors.

1,459,769. REPEATER CIRCUITS; O. B. Jacobs, East Orange, N. J. App. filed May 17, 1919. Use of repeater for several circuits.

1,459,770. SYSTEM FOR TESTING LINE BALANCE; A. L. Jones, Asbury Park, N. J. App. filed Nov. 15, 1921. Between one telephone line and rest of network.

1,459,786. METHOD OF AND APPARATUS FOR ELECTRICAL COMMUNICATION; D. G. McCaa, Lancaster, Pa. App. filed Jan. 19, 1920. Radio transmission system claimed to eliminate static.

1,459,788. BRAKE FOR TRAMWAY AND RAILWAY ROLLING STOCK; A. W. Maley, West Bromwich, England. App. filed June 21, 1920. Regenerative braking system.

1,459,801. ELECTRIC FURNACE; E. L. Smalley, East Orange, N. J. App. filed Aug. 6, 1920. Supporting means for resistors.

1,459,824. ELECTROMAGNETIC DEVICE; W. H. D. Ford, Chicago, Ill. App. filed Nov. 6, 1920. Increasing time lag for slow-releasing relays.

1,459,829. WATERPROOF ELECTRIC HEATER AND ITS METHOD OF MANUFACTURE; L. P. Hynes, Albany, N. Y. App. filed Oct. 18, 1921. For heating gases or fluid.

1,459,830. LIFTING MAGNET; F. W. Jessop, Cleveland, Ohio. App. filed April 29, 1918. Of very rugged construction.

1,459,859. MECHANICAL SWITCHING SYSTEM; W. T. Powell, Rochester, N. Y. App. filed June 12, 1919. Slow-releasing relays eliminated from automatic telephone exchange.

1,459,860. AUTOMATIC TELEPHONE SYSTEM; W. T. Powell, Rochester, N. Y. App. filed July 15, 1919. Different classes of service for automatic exchange.

1,459,863. MEASURED-SERVICE TELEPHONE SYSTEM; F. M. Slough, Rochester, N. Y. App. filed March 25, 1918. Charging for calls according to time of day.

1,459,868. ELECTRIC STOVE; W. R. Williamson, Thayer, Mo. App. filed Oct. 10, 1921. Electric-steam boilers.

1,459,885. WELDING; C. A. Hadley, Bradford, England. App. filed Sept. 11, 1922. Machine for butt welding.

1,459,902. SEARCHLIGHT FOR THE GUIDANCE OR DETECTION OF AIRCRAFT; E. A. Sperry, Brooklyn, N. Y. App. filed April 19, 1918. Directing beam from distant point.

1,459,932. PROCESS OF HEAT TREATMENT; E. Stansfield, Ottawa, Ontario, Can. App. filed April 3, 1920. Obtaining by-products from coal, liquids, peat, etc.

1,459,967. REGULATING DEVICE; L. Arnold, Lynn, Mass. App. filed Nov. 19, 1917. Constant-current transformer.

1,459,970. METHOD OF AND APPARATUS FOR TESTING MAGNETIZABLE OBJECTS; C. W. Burrows, Washington, D. C. App. filed July 25, 1917. Determining hardness of metal by magnetic analysis.

1,459,988. TRANSFORMER INSTALLATION; W. A. Pressey, Pittsfield, Mass. App. filed Aug. 25, 1919. Special transformer construction for outdoor service.

1,460,000. PROTECTIVE DEVICE FOR POLYPHASE CIRCUITS; L. W. Thompson, Schenectady, N. Y. App. filed April 7, 1920. Relay to open switch when one phase is cut out.

1,460,002. FLASHLIGHT; A. Uran, New York, N. Y. App. filed Feb. 9, 1922. Self-contained generator.

1,460,010. ISOLATOR FOR BATTERY SEPARATORS; C. M. Angell, Chicago, Ill. App. filed May 26, 1922.

1,460,025. INSTANTANEOUS HEATER; C. D. McLean, Berlin, N. H. App. filed May 18, 1922. For house water service.

1,460,031. MOUNTING FOR SLIP RINGS OF DYNAMO-ELECTRIC MACHINES; E. Meyercordt, Locknitz, near Stettin, Germany. App. filed Sept. 9, 1920. Shrinking rings on jacket of micanite upon shaft.

1,460,034. TELEPHONE TRANSMITTER; R. L. Murray, Bushey Heath, England. App. filed Aug. 24, 1921. Type to be held against throat.

1,460,037. ROTATABLE CONNECTOR; I. Pierson, Wellsley, Mass. App. filed April 17, 1919. For telephone cords.

1,460,040. HUSK FOR ELECTRIC LIGHT FIXTURES; J. W. Schulze, Providence, R. I. App. filed Dec. 10, 1920.

1,460,048. ELECTRICAL HEATING ELEMENT; P. A. E. Armstrong, Loudonville, and R. P. DeVries, Newtonville, N. Y. App. filed July 29, 1921. Made of alloy steel.

1,460,060. ELECTRICAL FIXTURE; M. Guett, Hartford, Conn. App. filed Sept. 30, 1920. Plug and receptacle used for fastening.

1,460,062. MOTOR CONTROL SYSTEM; B. W. Jones, Schenectady, N. Y. App. filed Jan. 26, 1920. Control apparatus for hoisting motors.

1,460,072. STORAGE BATTERY; J. D. Mintz, New York, N. Y. App. filed Oct. 11, 1922. Special arrangement for removing sediment.

1,460,083. RECORDING SIGNAL; E. Thomson, Swampscott, Mass. App. filed Dec. 27, 1921. For recording telegraphic or radio signals.

1,460,095. CIGAR LIGHTER; C. H. Cuno, Meriden, Conn. App. filed Sept. 13, 1922. Electric element.

1,460,104. ELECTROLYTIC RECTIFIER; R. W. McClintock and D. McKinnon, Toronto, Ontario, Can. App. filed Aug. 13, 1920. Device for remagnetizing magneto magnets.

1,460,106. ELECTRIC FURNACE MELTING OF MANGANESE SCRAP; W. G. Nichols, Chicago, Ill. App. filed Oct. 27, 1921.

1,460,137. METHOD OF PLATING METALS; H. A. Myers, Toledo, Ohio. App. filed March 6, 1922. Plating bodies by melting and welding coating metal to surface.

1,460,140. ELECTRIC COOKING DEVICE; M. E. Penso, New York, N. Y. App. filed Aug. 9, 1921. Combined electric oven and toaster.

1,460,143. INCANDESCENT LAMP; L. Ryzowicz and J. J. Boiek, Cleveland, Ohio. App. filed Aug. 6, 1920. Two filaments, used one at a time.

1,460,146. DEVICE FOR AIR-COOLING DUST-PROOF FAN MOTORS; M. H. Spielman, Cleveland, Ohio. App. filed Feb. 8, 1918. Auxiliary fan or shaft forces air from main intake through motor.

1,460,149. FLASHLIGHT; E. R. Barany, Brooklyn, N. Y. App. filed July 3, 1922. Three bulbs with switch for each.

1,460,150. FLASHLIGHT-BATTERY THRUST CAP; E. R. Barany, Brooklyn, N. Y. App. filed Aug. 14, 1922. To hold battery against bulb.

1,460,152. BRUSH HOLDER; J. S. Dean, Edgewood Park, Pa. App. filed Sept. 24, 1920. Yieldable holder takes up variable cross-section of brush.

1,460,153. CHOKE COIL; G. C. Dill, Wilkinsburg, Pa. App. filed Nov. 6, 1919. Each coil held rigidly by framework.

1,460,156. AUTOMATIC SUBSTATION; F. C. Hanker, Wilkinsburg, Pa. App. filed April 9, 1918. Automatic control apparatus for convertors.

1,460,157. MOTOR CONTROL SYSTEM; R. E. Hellmund, Swissvale, Pa. App. filed Oct. 8, 1918. Starting motor on low-voltage and switching to full voltage without opening motor circuit.

1,460,158. BRUSH HOLDER; R. E. Hellmund, Swissvale, Pa. App. filed July 30, 1920. Brush holder will flash over barriers for railway motors.

1,460,161. REGULATOR SYSTEM; E. Lehr, Wilkinsburg, Pa. App. filed May 28, 1919. For governing voltages on feeder circuits.

1,460,180. PROCESS FOR CONVERTING THE CARBONATES OR SULPHIDES OF BARIUM OR STRONTIUM INTO THE CORRESPONDING HYDRATES; R. W. Shafor, Denver, Col. App. filed Aug. 27, 1920. Partly by electrolysis.

1,460,190. SYSTEM OF CONTROL; O. Wortman, Audubon, N. J. App. filed Sept. 23, 1921. Control system for railway motors.

1,460,213. SYSTEM OF ELECTRICAL DISTRIBUTION; G. H. Roosevelt, Schenectady, N. Y. App. filed April 8, 1922. Protection of generators against continuous overload.

1,460,239. SLIDER FOR TUNING COILS; W. F. Gehrig, Newark, N. J. App. filed April 4, 1922.

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Superpower—Another Aspect

INTEREST in "superpower" is steadily growing. Springing as it did from the theoretical discussion of a vague dream, "superpower" has come to signify to electrical men the logical development of the electrical power resources of the nation. Even the public is talking about it and is beginning to demand its benefits. Every one knows that superpower development, already under way, will eventually be realized in a comprehensive manner.

But it is well for the electrical industry to study carefully what work must be done to carry out this development, which is before it to accomplish. "Superpower," said M. E. Aylesworth, executive manager N.E.L.A., in his address to the A.I.E.E. at Pittsburgh, "is, to the engineer, an accomplished fact. It is the political, social, business problems that must be adequately solved before superpower is an accomplished fact and before the electrical industry renders its maximum of service." This does not mean that the engineer's work is done, but rather that the industry has developed its engineering talent so that it is capable of handling the engineering problems ahead. Whereas on the business side, if the maximum service is to be rendered, if the engineer is to be given the opportunity to develop the superpower system to its utmost, there is yet much to be done in the development of personnel.

Furthermore, the gradual development of "superpower" through the increasing interconnections of stations of large capacity and the establishing of still further generating stations at great sources of power will make the local company's problem of energy supply considerably simpler. Increasing attention must then be given to the ever-growing problems of distribution and of selling the service. This can but mean that greater and greater emphasis will be placed on the business side of the local light and power company's work.

It is doubtless in recognition of these facts that there is a general demand that central-station commercial men and the commercial section of the N.E.L.A. rise to a higher plane of usefulness. The industry must develop more executives of business inclination and ability if it is to make ready for the superpower era. More engineers are needed who see the greatness of their opportunity in the field of application engineering.

Joseph Henry Brewer

A promoter of electrical development to whom are due the coal-field station on the Wabash and many other enterprises in Indiana and elsewhere

TO RESTORE one's holding company to an income basis after five years of bad times, to bring about a consolidation of utilities covering nearly 150 Indiana cities, to complete the creation of a 26-mile reservoir impounding enough water to level the flow of a great river the year around, and to start a 100,000-hp. electric central station right on top of a coal field which will feed its furnaces for nearly all time to come, may be fairly described as "some jobs." They become more striking when it is known that the climaxes of all of them have come since the first of this year. The man who did these things is Joseph H. Brewer, president of the American Public Utilities Company of Grand Rapids, Mich., which controls the Wisconsin-Minnesota Light & Power Company and the Central Indiana Power Company, besides some other and smaller properties.

Mr. Brewer wasn't born or trained into the utility business. Not yet forty-nine years old, he was originally a court stenographer who saw a chance in gas operation, promoted a company, joined with an associate who had another, bought up some "dead ones" and put life into them, realized substantial profits on one system which he built up and sold, and then plunged actively into the development of hydro-electric possibilities of northwestern Wisconsin. The subsidiary companies controlled by him in that territory furnish gas and electricity to more than seventy cities and villages, operate nearly 100,000 hp. in water and steam power and have another 100,000 hp. in reserve. Having acquired the Merchants' Heat & Light Company of Indianapolis, he has expanded it by consolidations with several groups of properties in Indiana and has made his latest effort in the building of a 100,000-hp. superplant near Terre Haute, set down in the middle of a 4,000-acre coal field, with endless coal deposits under it. This plant will supply a population of 1,500,000 people in Indiana with electrical energy, and not an ounce of the coal which it uses will see a railroad car. The coal will be fed from the mine directly to the crushers.

Mr. Brewer has developed an amazing facility for getting money for public utility enterprises and a splendid quality of patience in developing and maturing the properties. Upward of $50,000,000 is represented in the issues of the American Public Utilities Company and its subsidiaries, all producing dividends and calling for new capital yearly for extensions. Of the income of his properties fully 80 per cent is now based on natural resources of coal supply or water power actually owned by the companies themselves.

Editorial Comment

Electrical World, July 21, 1923

Volume 82 Number 3

Conciliation Wins Over Litigation

THE report of the New York State Water Power Commission on the constitutional rights of the state and federal governments in water-power development is of interest to the whole industry.

The conference with the Federal Power Commission brought out the fact that the primary interest of the federal authorities was navigation, particularly as regards internal waterways. After the interests of navigation are safeguarded the Federal Commission conceded that the state interest is paramount. It grants the state the right to make regulations, fix rates and will grant no licenses to applicants who do not have the state's approval. The Federal Commission reserves the right, however, to refuse licenses to those whose plan of development is not considered "adequate," even though the state approves.

Nationally, the concessions of the Federal Commission may react unfavorably on the industry and introduce handicaps to water-power development. Only time can give the complete answer to all the questions brought forward by the report.

New York Association Recommends Method of Rural-Line Survey

THAT the problem of distribution of electrical energy to the rural districts deserves the same study given to distribution in urban territory is the opinion of the committee of the Empire State Gas and Electric Association which has been dealing with the problem of rural electric service for the past two or three years. Accordingly, it has formulated recommendations, as outlined on page 136 of this issue, covering procedure and the basis on which a study of any territory should be made. Some will say that the study recommended is entirely too elaborate. But a little reflection ought to convince anybody that it is one that every central-station company ought to make of its entire territory if it is to handle its business development intelligently. If such a study were made by each central station there would be fewer mistakes in the building of lines of too low voltage and inadequate capacity. There would be fewer lines built to become a financial liability to both the central station and the consumer. In place of much of the "stalling" that is done when some one wants an impossible extension of service, it would be easy to give the would-be consumer a full understanding of just what stands in the way. Best of all, the sales manager and his executive would have a clear understanding of the problems of the territory that would save many a weary hour of guessing, as well as serious blunders when an immediate answer as to extension possibilities is imperative.

Another useful purpose that would be served is the forcing of adequate standards for the service of the territory. Such a study cannot be made for the purpose of serving farm customers alone. It must inevitably spread out and bring in the small communities and all the possible business. The question of distribution practices as standards for the entire territory would have to be faced and the inadequacy of the too prevalent "just grew like Topsy" policy would be revealed. The central-station business has passed through its childhood days. Careful planning on the lines of the recommendations of the New York association and the elimination of haphazard building must become more and more its settled policy.

The Colleges of the United States and Their Relations to Industry

EVERY one will admit that the method of factory production in mass which came into existence a generation ago has come to stay. It has drawbacks and disadvantages, but it is so much more effective and economical than the older methods of manufacturing which it superseded that it is not likely to be altered radically. Even the Russian communists, in their ruthless destruction of all that was good in the hope of bettering a relatively small amount of ill, were unable to suggest any better method of production and unfortunately, in chasing a shadowy ideal, they destroyed the incentive to work. It is clear that in the present and the near future, if there is to be further progress in economical production, it will be through the additional development of machinery and of quantity manufacture.

Large-scale production is closely associated with engineering; so that, as time goes on, manufacturing comes more nearly to resemble engineering processes. Along with the eternal economic vigilance in administration goes the perpetual scrutiny for the applications of chemistry and physics toward improved methods and tools.

It seems inevitable that the demand on the colleges of the country will be to prepare young men for eventual leadership in large-scale production. Setting aside the professions of law, medicine and theology, the trend is undoubtedly toward increased study of science, of economics and of business principles. In other words, the pressure on the colleges is toward the practical subjects associated with industry and away from the classics or classical forms of instruction. This is not a question as to the most advantageous or desirable kind of education. It is an inevitable consequence of economic pressure. That kind of education becomes sought for which tends to lead to promotion in the business of the country and to bring in a financial return. According to the census returns of 1920, out of thirty-three millions of males gainfully employed, nearly eleven millions, or one-third, were engaged in manufacturing mechanical industries, while nearly eight

millions more, or one-quarter, were engaged in transportation, distribution and public service. If we consider only the manufacturing third and allow the usual army rate of one officer to twenty-five men, there are about four hundred and forty thousand officers needed for this industrial army. A fair proportion of these leaders rise from the ranks by their industry, merit and natural ability; but it is the nominal duty of the colleges to produce men of this type. The task is, however, too much for the colleges, as at present organized, to fulfill. The total number of living male United States college graduates is estimated at about one-third of a million, of whom only one-fifth have graduated from technical schools.

As matters stand today, the leading industries, and particularly the leading electrical industries, seek to obtain college graduates, and preferably technical-college graduates, to recruit their junior ranks. Complaints are heard that they are unable to obtain as many as they desire. Of course, they look for more than a knowledge of principles and facts in the graduates they take in. They naturally lay stress upon other important qualities, such as character, reliability and initiative. In recently published criticisms the complaint is made that the colleges do not select and train sufficiently for these latter qualities. But it is not easy to offer specific directions for selecting and training in these qualities by a college. The qualities in question are the outcome of inheritance rather than inculcation. The colleges do indeed favor and foster these qualities as far as they can, but there are manifest limits to their efforts in these directions. Colleges are nearly all public institutions, open to all who show by examination that they are capable of profiting by the instruction offered. Imagine what would happen if certain youths, after graduating from secondary schools, applied for entrance to a college and were informed that they were judged to be deficient in character, reliability or initiative!

Moreover, while it is reasonable and necessary that the colleges should tend to modify their courses of instruction in conformity with the main business needs of the country, it is also very important that the colleges should likewise maintain a suitable range of instruction in subjects that are aside from the immediate utilitarian needs of the public. It would be a world calamity, for instance, if the study of the classics, ancient history, art, religion and of many other non-commercial subjects were to cease. The economic and industrial needs of a community are paramount and must first be met, but after they are satisfied come the artistic, intellectual and spiritual needs, which, if less clamorous, are greater and more precious to the world.

There are now more than one hundred and twenty-five American technical schools or colleges with an average of about four hundred students each; but the demand for good graduates is greater than the supply. The whole question occupies the special attention of the Society for the Promotion of Engineering Education, which met recently in Ithaca, N. Y., and which is just about to launch out on an aggressive and comprehensive effort to find some adequate solution of this educational problem. That this society should have the sympathetic and active support of the industries that require the graduates goes without saying. And of all those industries that can profit most by, and that most need, recruits with good technical training, the electrical industry stands well to the fore.

How Is Commercial Activity to Be Measured?

A LEADING electrical man recently made the accusation that the commercial men of the industry are, as a whole, "hiding behind a smoke screen of naturally growing business" and claiming credit for an increase for which they are not at all responsible. Whether the statement be actually true or not is beside the question. But there is food for thought here for the commercial man which should help him analyze and measure his own efforts.

The commercial man must recognize that the central-station business will grow even if he sits still. The engineer or the technical man is paying the price of going at the facts and studying what he is doing—there is a definite measure of technical progress. The commercial man should likewise devise some practical way of knowing what he is accomplishing, and any measure of what he does must be based on the estimated normal growth and show what increment over normal he has caused.

The Interest of the Electrical Industry in the Trend of South American Trade

THE electrical industry has goods to sell and to provide the necessary diversity of market that will protect itself against dull periods at home would like to establish a more substantial foreign trade. Electrical engineers are ever seeking new fields for service. Operating syndicates are beginning to reach out into strange lands for new opportunities to build up power systems. In South America there is great need for electrical skill, experience and materials, and already North Americans are, in fact, extensively engaged in electrical projects in process there. The development of that great continent will be accelerated by the electrification of railways and the construction of transmission lines. These projects are proceeding as fast as they can, but there is lack of money with which to go forward. There is more than passing interest, therefore, in a study of the customs records of the United States for the past few months as regards its trade balance with the southern continent.

Imports from Latin America of late have been increasing more rapidly than exports to those countries. As compared with 1922, the excess of imports over exports is more than double up to the present time and increasing every month. These imports consist principally of raw materials vitally necessary to the continuance of industrial activity. And the influence of this condition is shown not alone in the advance in exchange rates but also in increased purchasing in many countries and a general improvement in the tone of many markets. Trade balances are being established in the United States that greatly facilitate purchases in this country, and United States exports of a great variety are rapidly increasing. This remarkable growth in importation of Latin-American products will ultimately be reflected in the increased value of South American securities and additional investments of North American capital in South America.

The well-known shortage of coal in all settled regions of Latin America and the abundance of available hydro-electric energy in its mountains make the idea of American investment in the hydro-electric industry of Central and South America especially appealing. It has not only the basic soundness of such industry in

most parts of the world; in addition, it secures an increasing market for manufactured products of the investing nation. A further interesting possibility of increasing imports is the possible dislodgment of a portion of the excessive gold reserve in the United States, causing it to move to other centers by direct gold exportation or the establishing of dollar credits in Europe, which in turn would be used to make payments on European obligations due the United States.

This trend in trade marks a very distinct upward tendency in the prosperity of the southern continent—and, of course, of Cuba and Mexico, and perhaps of parts of Europe. It brightens the outlook for foreign trade in electrical products in this undeveloped market. It should be observed and considered as a very present factor in our industry's plan for the expansion of expert selling.

How to Revive a "Mattress"

IN SOME of our largest cities the old original 220-volt three-wire direct-current Edison distributing network is not sectionalized at all. The cables are solidly spliced together, forming many square miles of interconnected "mattress," supplied with power at numerous points through feeders from various substations themselves interconnected with two or more power stations. The whole arrangement is a result of a continuous growth and constitutes a system of almost unbelievable dependability of service. Suppose, however, that through some entirely unforeseen combination of circumstances the entire power supply of one of those systems should be interrupted. Or, more likely, that through internal or external disturbances a sufficient number of substations drop their load to put the rest out of commission through overload. There would then be an immense dead mattress with a connected load far in excess of the rating of any individual substation. Before a single live feeder could be again connected to this network, it now appears that either the entire load would have to be cut off, or else the mattress would have to be sectionalized. The first alternative is almost impossible of accomplishment and the second would require considerable time and expense. Of course, remote-controlled manhole type sectionalizing switches such as some companies are installing would simplify the problem, but they would still necessitate a large investment. Isn't there a better solution?

Don't Give Up the Ship

MANY companies have become discouraged in their attempts to embody a power-factor clause in their rate schedules so as to bring about an improvement in their system power factor. It has proved difficult to explain the complications of the invisible electrical actions concerned in power-factor theory to the general public. Only those with intuitive intelligence can get the faintest inkling of the meaning of the explanation, and most customers are left like Pascal's man "suspended between two infinities." Moreover, trouble in operation, inaccuracy, high first cost and unsuitable equipment have added to the disagreeable features of the game of trying to work power factor clauses and have proved to many that hypotheses cannot be permitted in dealing with the doctrine of good power factor. Thus much discouragement and a lagging of interest in power-factor problems are generally evident in the light and power industry.

But the idea is fundamentally sound that a good system power factor reacts to the benefit of the central station and the customers and that a bad power factor penalizes every producer and user of electricity, and it is only in the commercial application of power-factor improvement schemes that failure has arisen. The theory of power-factor correction is so beautifully simple and precise to the technical man that its commercial difficulties were discounted too readily. However, undigested rates, ill-judged engineering advice, offended customers and other vexatious outcomes soon brought about the realization that power-factor correction was a real commercial job to accomplish which required brains and a combination of technical knowledge and commercial sense.

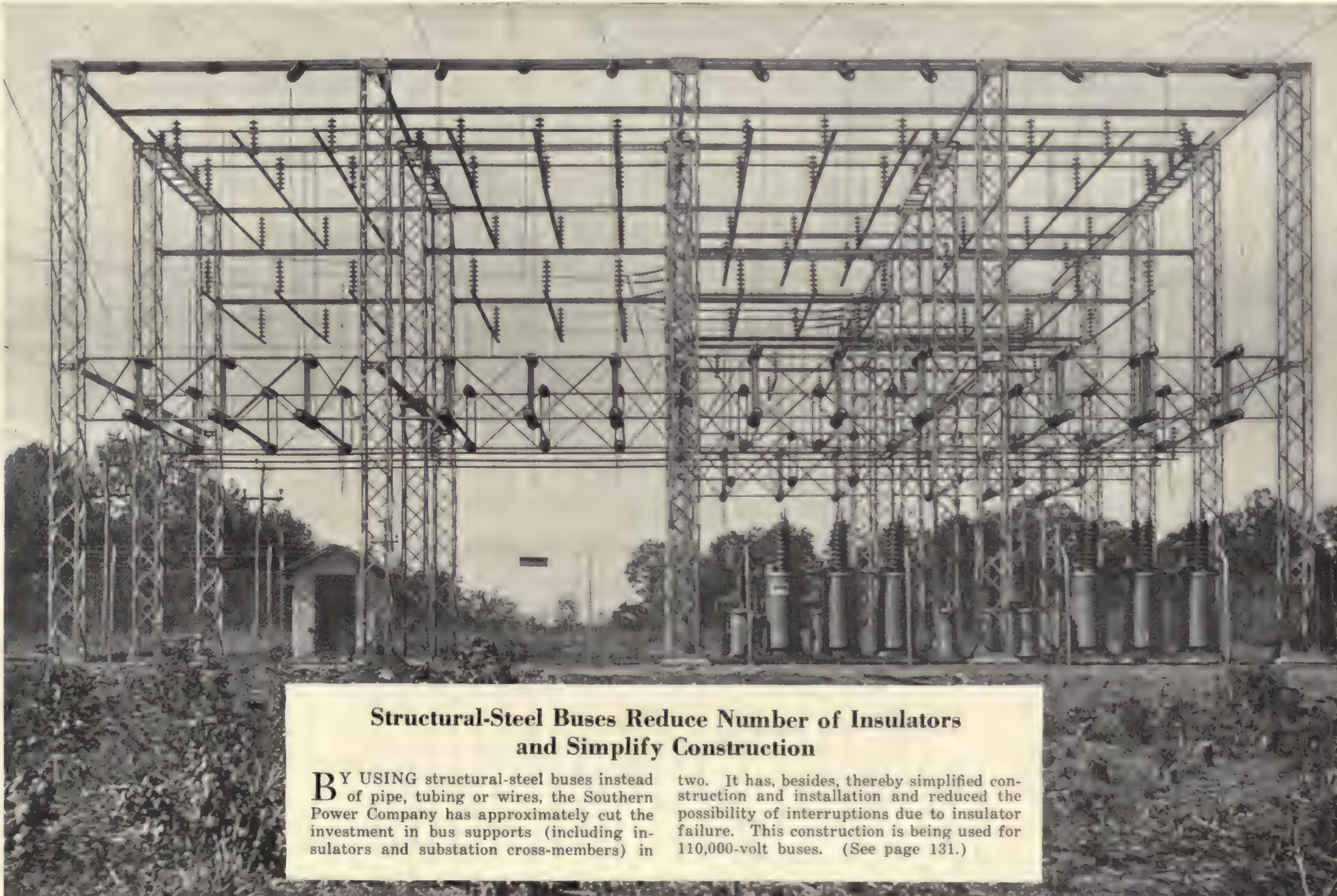
Thus the way is now paved for the inauguration of well-considered power-factor-improvement plans. In isolated instances light and power companies have achieved notable results by attacking the power-factor commercial problem with intelligence and knowledge. It is to be hoped that the results of these endeavors may be made available to the industry so that other companies may be encouraged to revive or continue their efforts to improve conditions.

Out of the Speculative Realm Into Facts

EXPERIENCE in the field with underground cables shows that the performance of the insulation is largely dependent upon the temperature to which it is subjected. Not only will continued high temperature bring about deterioration that will eventually cause electrical breakdown, but temperature changes will cause expansion and contraction of the entire cable structure. Some engineers go so far as to predict that mechanical breakage of the insulation may result from unequal expansion of the conductor, insulation and lead sheath. Others attribute migration of joint compound largely to temperature changes.

Rather than leave these and other contentions in the speculative field some manufacturers and operating engineers have been and are conducting tests to ascertain facts. The more such investigations are extended, the more prompt will be the relief from some of the troubles which are being experienced. Data of an illuminating kind should come from tests in which experimental lengths of cable are installed as they would be for regular service and then observed under known operating conditions. It is gratifying to hear that at least two operating companies are employing this method to ascertain the feasibility of high-voltage cables.

If all the ideas on subjecting cables to tests which would simulate operating duty could be brought to the attention of operating companies which are willing to conduct field experimentation, and if the contemplation, undertaking or completing of such research could be made equally available, such work could be both enlarged and co-ordinated and the results would form a valuable supplement to the more exact information obtained in the laboratory. The Research Section of the ELECTRICAL WORLD in the third issue of each month affords a practical monthly clearing house for suggestions, research contemplated, under way and completed.



Structural-Steel Buses Reduce Number of Insulators and Simplify Construction

BY USING structural-steel buses instead of pipe, tubing or wires, the Southern Power Company has approximately cut the investment in bus supports (including insulators and substation cross-members) in two. It has, besides, thereby simplified construction and installation and reduced the possibility of interruptions due to insulator failure. This construction is being used for 110,000-volt buses. (See page 131.)

Power-Factor Correction by the Use of Synchronous Condensers

An Analysis of the Operation of Unloaded Synchronous Motors for the Correction of Power Factor Considering Both Constant-Load Conditions and Constant-Current Conditions

By CLIFFORD W. BATES
Research Engineer Philadelphia Electric Company

SYNCHRONOUS motors without mechanical loading may be used to improve the power factor of a system in two ways: (1) Operation of the motor with the system having a constant (kw.) power load. The kva. output of the generator and the line current are then reduced by the power-factor improvement. (2) Operation with the system having a constant (kva.) load, i.e., at constant current. This case involves increasing the power delivered to the load.

An analysis of these two methods of operation is best presented in the form of curves which furnish a ready means of estimating the improvement of power factor due to the installation of a synchronous condenser, together with the reduction in line current. The curves also afford a comparison of the relative improvement of power factor arising from the use of various sizes of condensers.

In studying the first method of operation, which assumes conditions particularly applicable to the needs of a customer's installation, the analysis was made by assuming synchronous condensers of various kva. rating C in proportion to the constant power P (in kw.) of the load whose power factor is to be corrected. The size of condenser is expressed as C/P, the values ranging from 0.2 to 2.4. The values of the resultant or line power factors were then calculated for various values of the load power factor, no allowance for condenser losses being made. The percentage decrease of line current and the ratio between the size of condenser necessary to correct to any power factor and that required to correct to 100 per cent were also calculated.

In Fig. 1 each curve shows the relation between the load power factor and the line power factor for a given size of condenser (expressed as the ratio of condenser kva. to load kw.). To illustrate the application of these curves assume that a synchronous condenser is to be installed to improve the power factor of a load which is

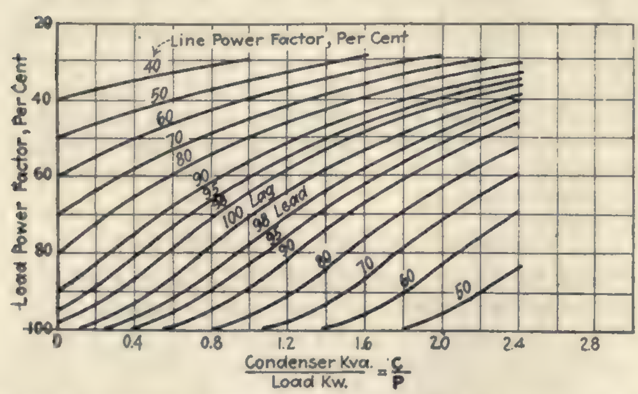


Fig. 1—Relation between load power factor and condenser size for various values of line power factor at constant load power.

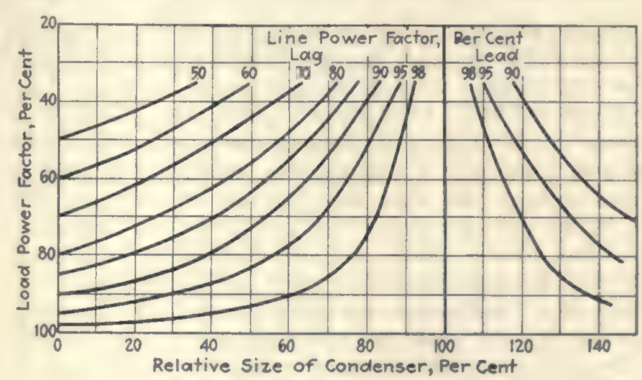


Fig. 3—Size of condenser required to correct to any particular line power factor compared to that required to correct to 100 per cent power factor for constant load power.

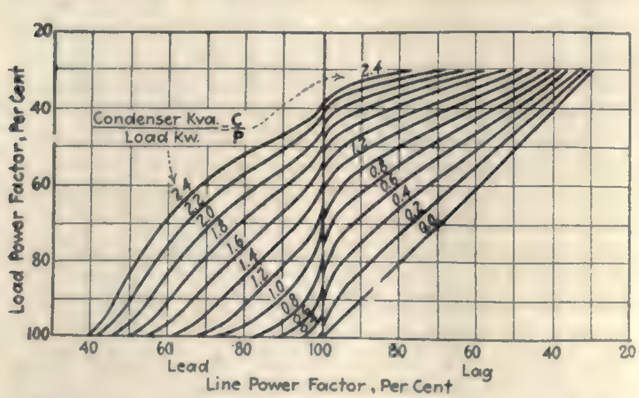


Fig. 2—Relation between load and line power factors for various sizes of synchronous condensers applied to loads of constant power.

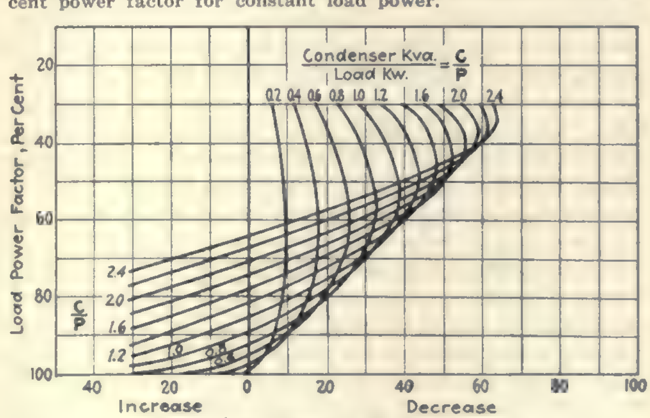


Fig. 4—Percentage change of line current due to the use of condensers of various sizes at constant (kw.) load.

OPERATION AT CONSTANT POWER

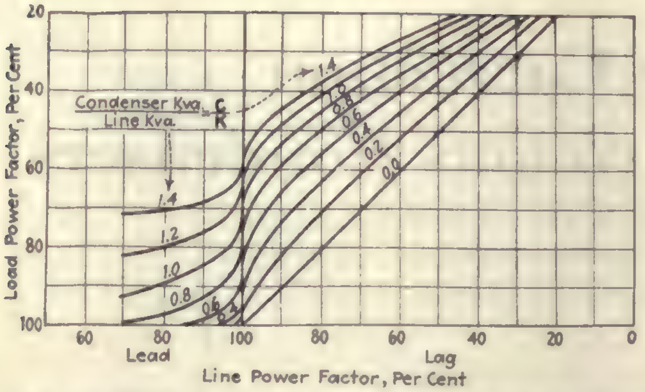


Fig. 5—Relation between load and line power factors for various sizes of synchronous condensers at constant line current.

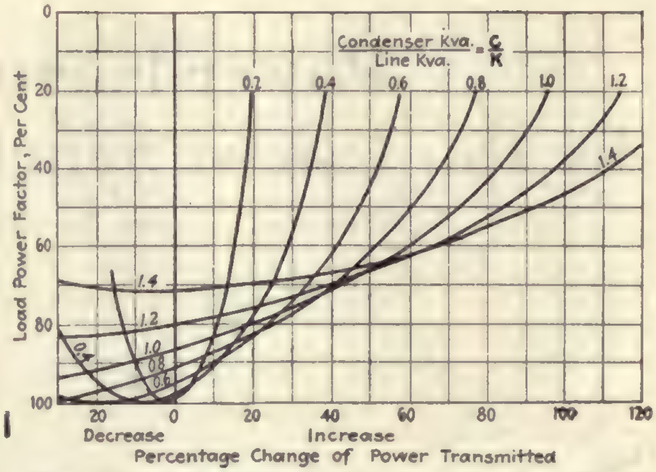


Fig. 7—Percentage change of power transmitted due to the use of synchronous condensers of various sizes at constant line current.

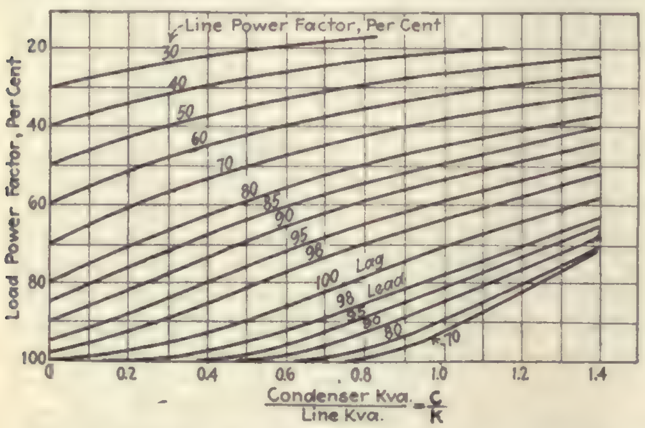


Fig. 6—Relation between load power factor and condenser size for various values of line power factor at constant line current.

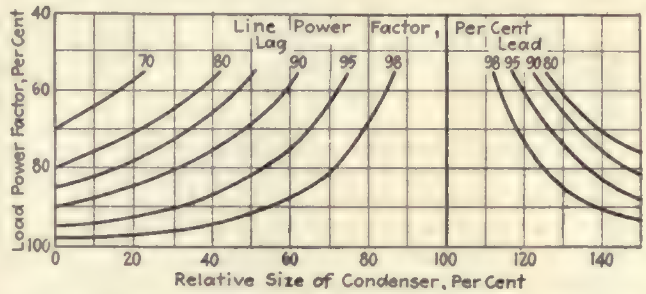


Fig. 8—Size of condenser required to correct to any particular line power factor compared to that required to correct to 100 per cent power factor, the line current being constant.

OPERATION AT CONSTANT LINE CURRENT

normally 400 kw. at 60 per cent lagging power factor. To neutralize exactly the reactive component of the load will require a condenser for which $C/P = 1.35$, or about 540 kva. If, however, a 400-kva. condenser is chosen ($C/P = 1.0$) the line power factor will be 95 per cent lagging. If this 400-kva. condenser is used at times of light load when the power required is, say, 200 kw. at 50 per cent power factor, $C/P = 400/200 = 2$, the line power factor will be 95 per cent leading, provided the excitation of the synchronous condenser is unchanged. A change of condenser excitation is equivalent electrically to the use of a condenser of another size.

The same facts as shown in Fig. 1 are expressed in a different way in Fig. 2, where each curve shows the size of condenser required to produce a fixed value of line power factor. The advantage of this form of presentation lies in the mental picture obtained of the relative sizes of condensers required to produce different line power factors. For example, at 60 per cent load power factor it is readily seen that condensers of approximately 0.6, 0.85, 1.35 and 1.8 times the kw. load will be required to produce line power factors of 80 per cent lag, 90 per cent lag, 100 per cent and 90 per cent lead respectively.

The curves of Fig. 3 show the size of condenser necessary to correct to any specified power factor as a percentage of the size required to correct to 100 per cent line power factor. For example, with a load power factor of 60 per cent, the condenser size required to correct to 95 per cent lag is only 75 per cent of that required to correct to 100 per cent. In Fig. 4 is shown the relative saving in line current which will be produced by various condensers. Continuing the application already used, in which with load power factor of 60 per cent the line power factors of 80, 90, 100 and 90 per cent lead resulted from the use of condensers of 0.6, 0.85, 1.35 and 1.8 times the kw. load, this figure shows that the relative decrease in line current will be approximately 25, 33, 39 and 34 per cent respectively for these condensers.

Operation at Constant System Kva.

Under the second condition of operation the analysis was made by assuming synchronous condensers of various kva. rating (C) in proportion to the constant kva. (K) of the system whose power factor is to be corrected. The size of condenser is expressed as C/K and ranges from 0.2 to 1.4. The value of the resultant or line power factors were calculated for various values of the load power factor, no allowance for condenser losses being made. The assumption was made that any additional load permitted by the action of the condenser has the same power factor as the original load. The percentage increase of power transmitted and the relative size of condensers necessary to correct to any power factor compared to that required to correct to 100 per cent were also calculated.

The relation between the load power factor and the line power factor for a given size of condenser (expressed as the ratio of condenser kva. to line kva.) is shown by each curve of Fig. 5. To illustrate the application of the curves suppose a condenser is to be installed to improve the power factor of a load which is originally 400 kw. at 60 per cent power factor lagging, or 667 kva. The curves show that a condenser whose rating is equal to 1.35 times the kva. load must

be used to correct to 100 per cent power factor in the line; i.e., a 900-kva. synchronous condenser would be required. At the same time the original load is increased to 667 kw. at 60 per cent power factor, thus maintaining constant line current.

The same facts are expressed in a different way in Fig. 6. Each curve shows the size of condenser required to produce a fixed value of line power factor for various values of the load power factor. For example, suppose that a load of 1,000 kva. at 60 per cent power factor lag is to be corrected at constant current so as to allow the transmission of more power. In order to correct to 80, 90 and 100 per cent power factor, condensers of 0.48, 0.76 and 1.35 times the line kva. would be required; i.e., 480, 760 and 1,350 kva. condensers. Since the power transmitted is changed from 600 kw. to 800, 900 or 1,000 kw., the increase of power transmitted is 200, 300 or 400 kw. according to the extent of the correction.

The size of condenser necessary to correct to any specified power factor as a percentage of the size required to correct to 100 per cent is shown in Fig. 7. For example, with a load power factor of 60 per cent lag the size necessary to obtain 95 per cent line power factor is 72 per cent of that required to obtain 100 per cent power factor.

The relative increase in power which can be transmitted at constant line current due to the compensating effect of condensers of different sizes on loads of various power factors is shown in Fig. 8. Continuing the application used previously for illustration, in which a load of 60 per cent lagging power factor was compensated to 80, 90 and 100 per cent lagging power factor by condensers of 0.48, 0.76 and 1.35 times line kva., the curves show that the power which can be transmitted at no increase of line current will be increased by 34, 50 and 67 per cent respectively.

Operation at constant (kw.) load is illustrated by a set of curves which are particularly applicable to a customer's installation where the problem is to reduce the reactive component without considering the possibility of increasing the power component. On the other hand, the set of curves produced by considering operation at constant system kva. or current are of great interest to the central station, since they indicate the possibility of increasing the power transmitted over a line of limited load capacity or of increasing the power supplied from a generator which is fully loaded by an excessive amount of reactive component. The first analysis will also help the central station to analyze the resultant savings due to compensating the lagging power factor at times of light load or when the additional power cannot be utilized. In considering either set of curves it should be borne in mind that the improvements affect only the part of the system which carries both the load and the condenser current.

Graphic Analysis of Economy of Developing Water Powers

Aids Study of Sites Which May Become Economically Feasible Through Increased Demand for Power, Greater Interconnection and Use of Automatic or Semi-Automatic Generating Stations

By G. R. KENNY* and PAGE GOLSAN†

THE recent emphasis placed on future power needs and the necessity for developing all feasible hydro-electric sites, together with the advances in the field of automatic or semi-automatic power-house operation, may be expected to lead sooner or later to an examination of the power possibilities of all streams which show any promise whatsoever of development.

Attention has recently been focused on certain very large hydro-electric projects outside the present prospective transmission range of developed markets. In such cases the market can perhaps be brought to the power if other conditions are not unfavorable. The principal considerations then become:

First—Developing a load with seasonal and daily characteristics such that the proposed development can be operated at its highest efficiency.

Second—Bringing in only such industries as will not be handicapped by fuel, material, transportation and labor costs under the conditions to be expected.

Third—Building up such transportation, commercial and other activities as will enable the district to compete in desirability with other similar districts.

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Gradual changes in industrial and economic conditions which will enhance the value and desirability of water power are taking place. Therefore every investigation should be so reported that the data may be useful in after years under conditions of:

First—Lower construction and equipment costs.

Second—Greater interconnection of systems, plants and markets with improved load factors.

Third—Increase in fuel costs due to diminishing supply.

Fourth—Greater value of power to industry due to improvements in factory machinery and methods.

It is seldom that sufficient reliable data are available for a really satisfactory study of the possible useful power to be derived from any stream. Discharge records are often so meager and inaccurate and cover such short periods as to require much care and judgment and make necessary resorting to all possible checks on their use. This is particularly true of many Western streams which have not only great variation in monthly flow but markedly diverse seasonal discharge.

An accurate determination of the quantity of water flowing in a stream large enough to be useful for power development is practically impossible, and allowance must be made for this fact in all consideration of run-off

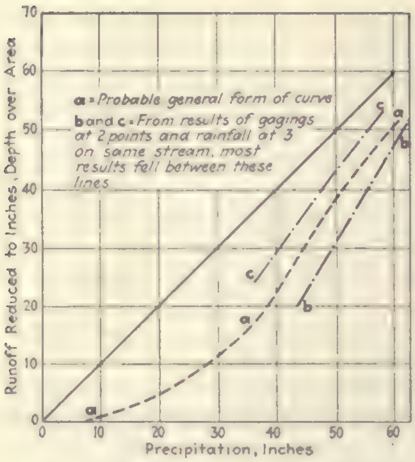


FIG. 1—RAINFALL-RUN-OFF CURVES USEFUL FOR COMPARISON AND CHECKING PURPOSES

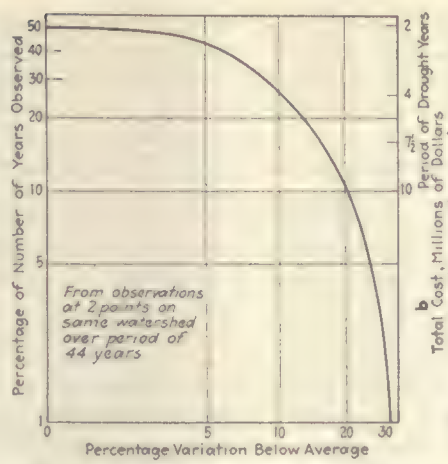


FIG. 2—PROBABILITY OF DEPARTURE FROM AVERAGE RAINFALL. FROM OBSERVATIONS OF FORTY-FOUR YEARS

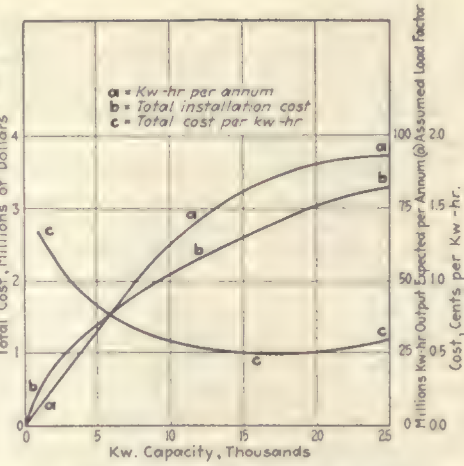


FIG. 3—PERMITS STUDY OF COST OF PLANTS OF DIFFERENT CAPACITY FOR SAME SITE

records. Government gaging stations are established with the greatest care, and much time and effort is expended on their calibration, but the best results that can be hoped for under the constantly varying conditions is a fair approximation.

Rainfall-run-off curves from adjacent similar watersheds are useful for comparison and checking purposes. These (Fig. 1) may be constructed by reducing the seasonal run-offs to inches of depth over the drainage area and plotting these results against rainfall for the same seasons. Rainfall records are usually available for considerable periods at several points on most watersheds. In such records the element of uncertainty is less than that encountered in run-off records.

Before an effort is made to determine the economic feasibility of any proposed development the element of "expectancy" of a sufficient water supply should be considered. As an example of what is meant, assume the case of a stream normally varying less than 10 per cent from the mean flow, but having a deficiency of 50 per cent once in thirty years. Assume also that we have run-off records for five years, and that this record includes one of these droughts, while rainfall records at points on the watershed are available for a forty-year period. This is an extreme case, but it illustrates the point. If the run-off records only were considered, cyclic storage would be necessary to carry over such a season, or the project might be considered impracticable.

A much more comprehensive method in such cases is to plot the probability of drought in percentage against

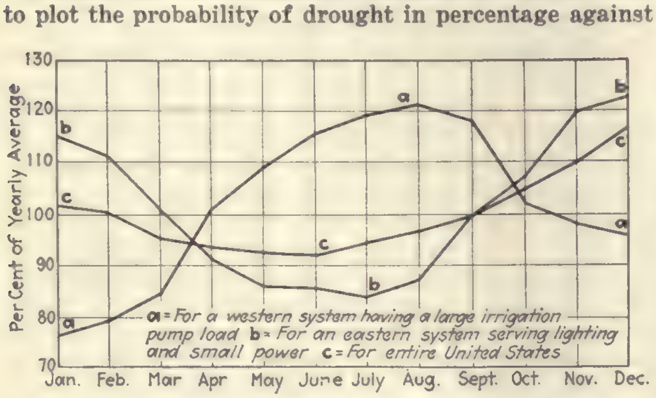


FIG. 4—SEASONAL FLUCTUATIONS IN LOAD VARY WIDELY WITH NATURE OF LOAD

Average monthly load in percentage of yearly average for three cases.

deficiency in rainfall in percentage of the average, and to determine the flow for which to develop the stream by the use of the probability curve which results.

The probability of departure from average rainfall and run-off can be determined by plotting percentage deficiencies and percentage of occurrences. We cannot say what the rainfall at New York City for next year will be, but the probability that it will be more than 100 in. or less than 10 in. is very remote.

Inspection of such a curve simplifies the determination of the percentage of normal flow for which to develop any stream. If the curve shows that deficiencies of 15 per cent or more of average rainfall occur not oftener than once in ten years, of 20 per cent not oftener than once in twenty-five years, and of 25 per cent not oftener than once in fifty years, it apparently would be good economy to develop for any run-off of less than that represented by 15 per cent below the average rainfall from the rainfall-run-off curve. Variations both above and below the average rainfall may be used to obtain more points except in cases where the totals for individual years are in excess of twice the average.

The storage necessary to maintain constant flow can be determined by setting up a monthly run-off regimen, showing percentage of the total occurring in each month for each year for which run-off records are available and for the average of these.

If the investigation so far outlined indicates that the project may be economically desirable, a study that will allow a reasonably accurate estimate of the cost will be the next step. This should include (1) the rate of fall in the stream or the possibility of securing head at a reasonable cost by constructing dams; (2) how much capacity can be provided for annual or cyclic storage to take care of seasonal variations in flow and fluctuating storage to handle fluctuating load, and (3) the nature and cost of the construction necessary. After this study calculation of the economic installation to make an application of methods of fitting the plant to the load can be undertaken.

Having a rainfall-run-off curve, a probability of drought diagram, the percentage of storage required and that available, the head and efficiencies expected, and a basis for estimating investment, annual costs and value of output, theoretical calculations of the economic capacity for which to install may be made. In Fig. 3 the useful kilowatt-hours per annum expected for different installations in kilowatts, the total installation

costs at such values and the total cost per kilowatt-hour expected are plotted for a theoretical case. The point at which the total cost C is a minimum is the economic capacity unless a definite value per kilowatt-hour higher than such minimum is determined. In this case the point at which C crosses this value after passing the minimum should be taken as the economic capacity. The total cost $C = [(b \times r) + o]/a$, where

b = installation cost,
r = rate for fixed charges applying,
o = estimated annual operating costs,
a = kilowatt-hours per annum.

Equations involving supplemental and alternative steam plants have also been developed in certain cases but involve too many assumptions and complications.

It will usually be found that the peculiar conditions of seasonal fluctuations in flow, lack of storage sites, the nature of the load, necessity for fitting the project into an existing production system and other factors will make the theoretically determined proper installation impracticable; study of all conditions is necessary.

Generally the proposed development is to be added to an existing growing system which may be entirely served by steam or by hydro-electric plants or by a combination of the two. It is here that the engineer finds the greatest opportunity for the exercise of judgment and must make the most complete and exhaustive investigations if the proposed development is to prove economically advisable and its greatest possible usefulness is to be attained. An intimate knowledge of the kind of business served and class of service necessary, of daily and seasonal fluctuations in load, of fluctuation in flow of streams already developed and storage capacities already provided, of the capacities and efficiencies of existing steam plants, of the comparative cost and efficiency of new steam equipment at the date of investigation, and of all possible means of predicting the growth and characteristics of the future load, is essential.

Electric service with its instantaneous demands is always more exacting than any other service for which water power is developed and always brings into the problem the elements of competition with other power and of auxiliary and reserve capacity.

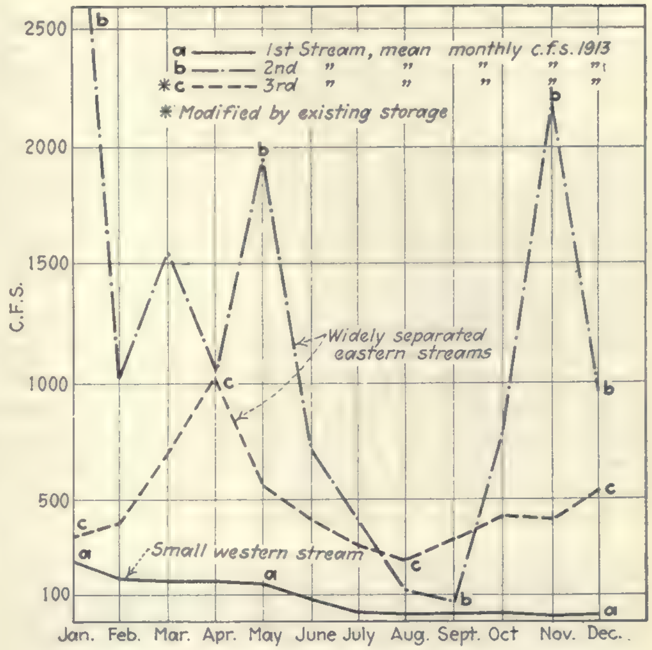
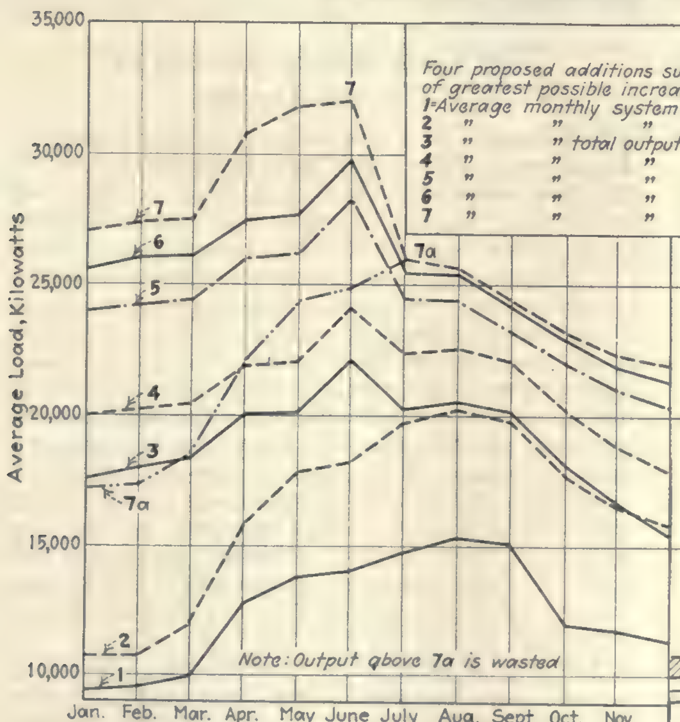
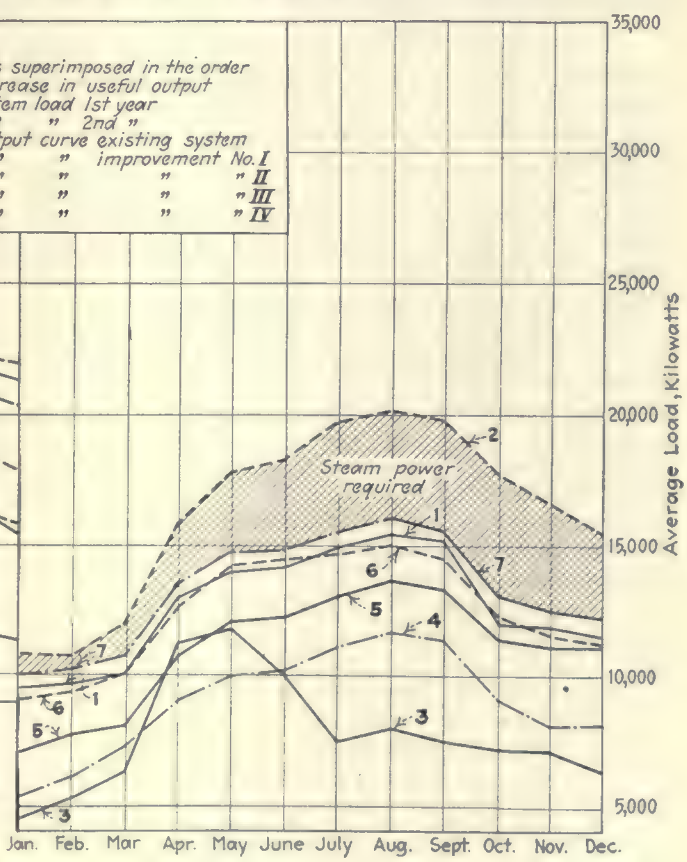


FIG. 5—MONTHLY VARIATION IN FLOW OF THREE STREAMS

FIGS. 6 AND 7—AVERAGE MONTHLY LOAD THAT COULD BE CARRIED BY FOUR DIFFERENT DEVELOPMENTS OF SAME SITE DURING AVERAGE AND EXTREME LOW-WATER CONDITIONS





The developments under consideration were as follows: (1) Installation of one unit in a new plant. (2) Installation of a second unit in the same plant. (3) Bringing an additional stream into an existing plant. (4) Changing the method of supplying water to an existing string of plants.

A hydro-electric plant may be considered in place of adding steam capacity and expected to operate under the same conditions as would a modern high-efficiency steam plant. It may be designed to operate in conjunction with existing low-efficiency steam units, which will supply the deficiencies in times of low water, as an addition to an existing hydro-electric system, or to shut down existing steam plants, either wholly or in part. Business sufficient to load it immediately may be available or it may require some years for full load to build up.

The seasonal fluctuations in output required to supply most systems are very uniform from year to year, and those of stream flow for most streams are quite uniform except in occasional years. Consequently it has been found that curves of monthly average output in kilowatts, monthly peak loads in kilowatts and average monthly stream flow reduced to kilowatts for the developments under consideration can be used in the study of the proper size of installation. Its usefulness as a part of the entire system and the storage required under any of the conditions is outlined above. Such curves furnish a comprehensive, easily grasped and rapid means of considering the results of changes in general design or proposed operation, and the results obtained by their use are sufficiently accurate for the purpose. Seasonal fluctuations in load vary widely with the nature of the load, as indicated by Fig. 4.

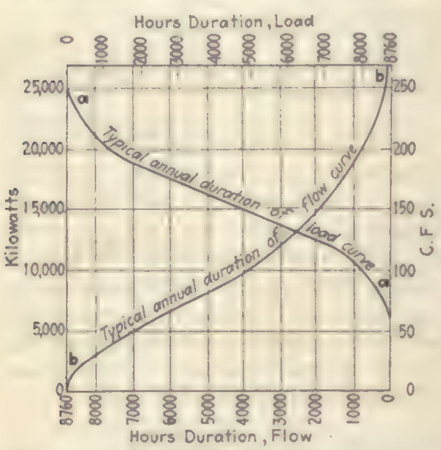


FIG. 8—DURATION-OF-LOAD AND WATER-FLOW DATA PERMIT INTERESTING COMPARISONS

Hydrographs of the stream under consideration for as many seasons as possible are essential. "Point" curves connecting the values of average monthly flow reduced to average kilowatt output are usually most useful. Such hydrographs are shown in Fig. 5.

The weekly and daily fluctuation in flow will be much greater than those from month to month. This can be at least partly taken care of if storage is provided, otherwise hydrographs of monthly flow should be made up by taking the average below certain readings. As an illustration, if the average flow in a certain stream is 500 second-feet, the average of all readings of 500 or less, 400 or less and 300 or less will give the average effective flow for a development without storage designed for each of these values.

The use of curves of average monthly load in kilowatts and average output in kilowatts in studying the effect of adding certain proposed developments to an existing system is illustrated in Figs. 6 and 7.

The system load for two years in succession is shown, and the additions are considered on the basis of controlling the stored water to get the greatest possible output during the critical late summer and autumn months. It was assumed that the general form of the annual load curve would not change greatly for future years, and this assumption was borne out by experience. The developments are shown added in the order of their importance from the standpoint of increase in useful output when the load in August and September absorbed the full capacity. It was apparent that development No. 1 would give the best results, but it was necessary to make trial calculation to determine the best order for the other three.

Curves made up on the same basis and for the same proposed additions as Fig. 6 are presented in Fig. 7, but the records of a year of extremely low water were used in order to show the deficiency to be made up from steam or purchase in each month. Conditions nearly as severe as those assumed were encountered just after development No. 1 had been made, and the resulting output was very similar to that predicated by the curves.

Sufficient capacity to carry peak loads must be provided for any system. Whether it is economical to provide hydro-electric or steam capacity for this purpose must depend upon the daily fluctuations in load and upon the relative costs per kilowatt of the various installations possible. In considering this phase a curve of duration of load will be found useful. Fig. 8 illustrates this in hours per annum (curve *a*). The hourly readings of system load in kilowatts are summarized, and the number of times each value or any greater value occurs is plotted against that value in kilowatts.

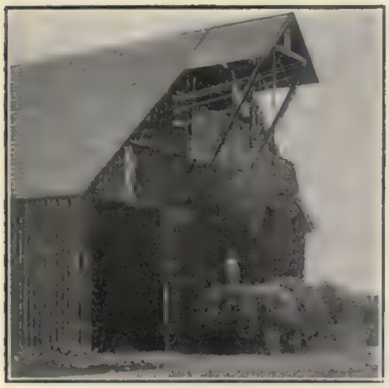
Steam installation costs per kilowatt are generally considerably less than hydro-electric, and at low load factors the total costs per kilowatt-year, including fuel, are less. By the use of the duration of load curve, balancing steam fixed costs plus operation and fuel costs against hydro-electric fixed and operating costs is simplified, and the percentage of each to the total required capacity in order to provide the lowest total cost of output is easily determined.

Life Tests and Inspection of Electric Lamps

THE quality of lamps ordered by government departments during the fiscal year ended June 30, 1923, was considerably smaller than for several years preceding. The total number was about 1,355,000 lamps, valued at $353,000, the average cost per lamp being about 26 cents, as compared with 30.4 cents in 1922. This difference in unit cost is largely accounted for by two reductions in the price of tungsten lamps made during the year. Of the total number of lamps purchased 86 per cent were large tungsten lamps as distinguished from miniature and carbon lamps. The corresponding percentage in 1922 was 79. The increase in tungsten lamps was largely in the vacuum type and was due to the adoption of mill-type tungsten lamps instead of the carbon lamps formerly used extensively by the Navy Department. The quantity of carbon lamps was thus reduced to about 3½ per cent of the total. Of the large tungsten lamps 15.4 per cent in number and 33.3 per cent in cost were of the gas-filled type.

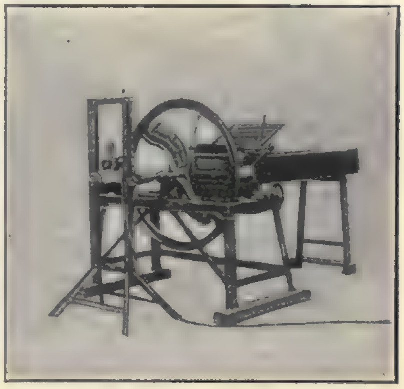
Since several large orders placed late in the fiscal year 1922 were inspected during the current year, more lamps were inspected than were actually ordered during the year, the total being about 1,660,000. As samples representing these inspected lamps, there were subjected to life tests at the bureau during the year 1,418 tungsten, 214 gas-filled tungsten and seventy-four carbon lamps, a total of 1,706.

Electricity in German Agriculture



By AUGUST PETRI
Consulting Engineer, Belgard, Germany

The Economic Situation in Germany Has Forced the Development of Electricity for Rural Use—Machines Have Been Developed and Processes Invented to Aid in Carrying Out This Purpose—Data on Installations Are Given



UPPER LEFT, ELECTRIC HAY HOIST—SIX TO EIGHT GRIPS WILL UNLOAD A FULL WAGON. UPPER RIGHT, MOTOR-DRIVEN STRAW CUTTER. LOWER LEFT, ELECTRICALLY DRIVEN PEAT HARVESTER. LOWER RIGHT, ELECTRIC STRAW CUTTER WITH BLOWER

GREAT efforts are now being made in Germany against extraordinary difficulties to connect to transmission systems all the rural districts of the country in the interest of the general economic situation. Electrical energy on the farms counteracts effectively the lack of labor and creates favorable conditions for the use of machinery, which, in turn, betters the economy of the farms. This movement is noticed in many other European countries. Italy, for example, provides regular and fixed subsidies for rural use of electric power.

To give an idea of the magnitude of the rural electrical supply problem of Germany, a tabulation is given of agricultural enterprises based on data collected in 1907 and corrected for losses of territory due to the war. Small estates are the rule in central, west and south Germany, and the large farms chiefly elsewhere.

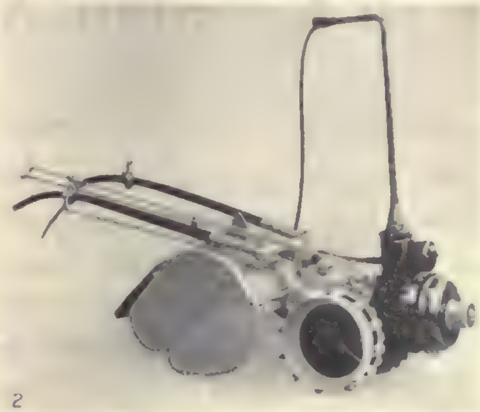
RURAL TERRITORY OF POST-WAR GERMANY

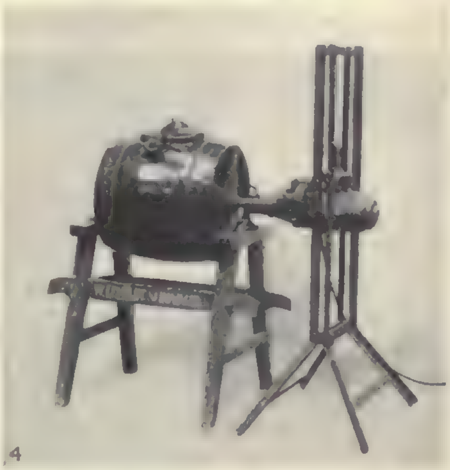
Size of Farm, Acres	Number Farms	Total Area of Tracts, Acres			
		Agriculture	Forests	Pastures, Steppes	Houses, Yards, Rivers, Roads
Under 5	3,011,000	4,100,000	996,000	205,000	245,000
5 to 12½	956,000	7,520,000	1,309,000	487,000	230,000
12½ to 50	912,000	21,270,000	4,350,000	1,803,000	397,000
50 to 250	258,000	21,760,000	5,130,000	2,149,000	667,000
Over 250	21,000	15,390,000	5,780,000	679,500	667,000
Total	5,168,000	70,040,000	17,565,000	5,323,500	1,936,000

To supply Germany's need of electrical energy a tremendous development has occurred since 1908, when thirty-two long-distance-transmission power stations supplied 1,291 cities, villages and farms. This number grew to 208 stations in 1921, with 25,403 connected cities, villages and farms. Only those large city stations which supply surrounding territory are included in the estimate, and it is probable that 40,000 of the 64,208 rural districts are now supplied with electricity.

Before the war electrical illumination on the farm was of subordinate importance and was used chiefly in the living quarters and the stables. At the time of the carbon-filament lamp the specific consumption was 5 kw.-hr. to 10 kw.-hr. per acre, which fell to 5 kw.-hr. and less with the introduction of the tungsten lamp. The difficulty of obtaining oil during the war forced a much more general use of electric light not only in the farmhouse but also in the storerooms, the granary and other buildings, bringing the consumption above the previous figure and as high as 15 kw.-hr. per acre. These data apply to farms of 20 acres or more. For smaller farms, particularly those less than 12 acres, the acre unit no longer gives a reliable representation of the kilowatt-hour consumption.

The use of electric power may be divided into small-power, threshing, plowing and miscellaneous agricultural drives. In the small-power machines the electric

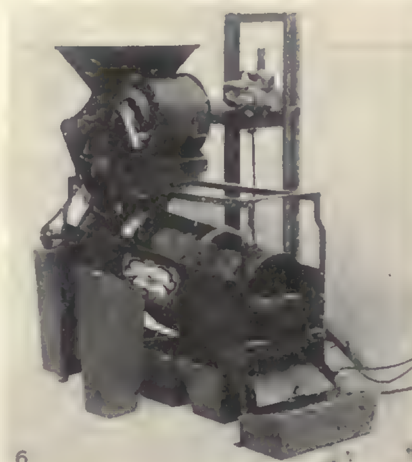


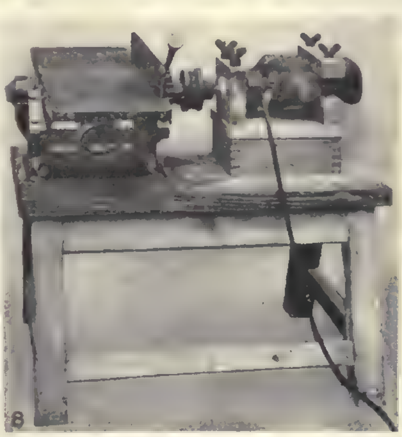


Readily Adaptable Motors Have Facilitated Electrification of Farms

SOME European countries—Italy, for example—offer regular and fixed subsidies for using electric power on farms. This motive power is favored because of the scarcity of fuel and the fact that the utilization of electricity helps to compensate for lack of labor. One thing that has greatly facilitated the electrification of farm operations has been the development of motors which are readily adaptable to a variety of applications.

The illustration marked 1 shows an electric cultivator in operation, and 2 is a more detailed view; 3, a grain grinder; 4, a butter churn with one of the readily adaptable motors; 5, a milk separator; 6, a grain cleaner; 7, a milling table; 8, a combined planer and saw, 9, a small buzz saw; 10, a slot miller.





motor replaces chiefly animal drive or manual operation, and its superiority is due largely to the flexibility of the drive for all conditions, its simplicity and ease of operation and its vastly higher efficiency. Naturally, the motor was first used for the machines of greatest importance to the farmer, such as pumps for water for drinking and utility purposes, irrigation pumps and fodder machines. In larger establishments grinding mills and potato mashers were added. Electric drive for these machines can always be arranged for the best operating conditions requiring the minimum of time, and as soon as electric service was obtainable on a farm these machines were the first to be power-driven. But the full advantage can only be realized when all the power-consuming machinery is electrified. This may be accomplished easily with the new portable electric motor, one motor being used to drive a number of different machines.

Further possibilities for electric drive are offered by wheat cleaners, sack elevators, conveyors, manure pumps, winches, hoists, hay unloaders, grinders, buzz saws, band saws, car builders' machines, blacksmith machinery and general repair-shop machines, such as lathes, drills, grinding wheels, blowers, peat presses, sheep shears, etc. Washing machines, dairy and milking machines may be added to these.

Drive Must Be Perfect

To insure the best performance from all these varied machines, their drive has to be made technically perfect, which can be achieved only by a close co-operation between farmer, machine designer and installation firm. The designer should be governed by the experience of well-established farmers and should consider the particular properties of the electric drive. The firm which makes the installation should know when to use individual drive and when a group drive would be better. Faulty choice may cause unnecessary power consumption. The power demand of all these machines may amount to 10 kw.-hr. to 20 kw.-hr. per acre. The upper limit has not yet been reached in Germany.

A few data will show the unexcelled advantages of electric drive for such small farm machinery. To chop 50 kg. of straw takes one man one hour; an electric motor will do it in not quite fifteen minutes at a consumption of 0.15 kw.-hr. to 0.3 kw.-hr. The same amount of energy will be required to pump 1 cu.m. of water (depending on the height to which it is pumped); one man would require forty-five minutes to do it. The cutting of 50 kg. of beets takes about 0.02 kw.-hr.

Aids in Threshing Operations

Disregarding staged exhibition performances and taking into account actual figures of a complete threshing campaign, compiled by the owners themselves, a well-made superheated steam locomotive consumes 1.2 kg. of coal per 50 kg. of ready marketable wheat, and, using saturated steam, 2½ kg. of good coal will be required. An electric motor will consume under similar conditions 0.4 kw.-hr. to 0.5 kw.-hr. The elimination of all auxiliary work, the instant readiness of its service —a feature beyond estimation in a wet year—the simple attendance and the insignificant cost of maintenance are among the outstanding features which have introduced electric drive for threshing. The rational economy of the motor is beyond dispute, because coal is burned much more efficiently in large power stations than in thousands of small engines. The saving in this respect is about 50 per cent. Several factors determine the energy requirements for threshing per acre unit: for example, the amount of grain planted, the intensity of cultivation, the condition of the harvested wheat as regards dryness or wetness, the length of the straw and the productiveness of the harvest. The energy necessary will vary between 25 kw.-hr. and 45 kw.-hr. per acre.

The threshing motor is generally portable and has to be designed with enough margin to take care of difficult starting and heavy momentary overloads.

The total consumption of the drives already mentioned will be on the average 50 kw.-hr. per acre, but may go as high as and higher than 60 kw.-hr. According to figures compiled by Dr. Windel from thirty-four German agricultural transmission systems during the year 1920-21, the energy consumption per acre was: For lighting, from 12.5 kw.-hr. to 22.5 kw.-hr.; for power, from 27.5 kw.-hr. to 42 kw.-hr.; total, 40 kw.-hr. to 65.5 kw.-hr.

How important a rôle the fertility of the soil and the intensity of cultivation play is shown by records from farms near Dantzig, where up to 100 kw.-hr. per acre has been consumed.

Electrically driven plows, both of the single-machine and the two-machine type, came into use in the eastern provinces of Germany during the seasons of 1908 to 1912, but their number has not increased since the era of the gasoline-tractor plow. Wherever cable plows are necessary the electrically driven plow will maintain its economy. Its disadvantage is its dependence upon the line which feeds it. This makes itself felt particularly when changing the position of the engine. But with skilled and experienced labor it is not a serious handicap. The energy consumption is on the average 120 kw.-hr. to 130 kw.-hr. per acre and may go as high as 200 kw.-hr. when very deep plowing in a heavy soil has to be done. Electric motor plows are at present only in an experimental stage.

Auxiliary Operations

For auxiliary agricultural operations electric drive has been introduced with success in flour mills, dairies, starch plants, distilleries, drying plants, rural repair shops, brick yards, field railways, irrigation and artificial-rain plants, etc. These may be found everywhere and in varied combinations. Their total consumption may be taken as about 25 to 30 per cent of the purely agricultural consumption.

It appears on its face paradoxical that in dairies, where exhaust steam may be used, electric drive should be economical. But it is nevertheless the case, because the heat energy needed for power is only a small percentage of the required energy for heating. A test was made in a newly equipped dairy with a one-fire-tube boiler of 14-sq.m. heating surface with 7 atmospheres pressure, supplying steam to a 10-hp. to 12-hp. steam engine with Rider valves, and obtained the following data for a daily output of 3,600 liters of milk:

With steam drive 219 kg. of good egg-size coal and ½ liter of oil were needed daily. Electric drive consumed 144 kg. of coal and 23 kw.-hr. The coal in the latter case was used merely for heating the milk. The 23 kw.-hr. required 38 kg. of coal in the supplying steam-power house, which includes line and transformer losses. There is shown, therefore, a total coal consumption of 182 kg. for electric drive and 219 kg. for steam drive, or a saving of 37 kg. of coal per day.

Such comparisons are of acute economical importance under present German conditions. A still higher coal saving could be realized if in a new dairy a low-pressure steam boiler were installed in the first place and all mechanical drives were electrified. Such tests have been made by unbiased investigators with similar results.

In starch plants with a clearing basin 0.4 kw.-hr. is required per 50 kg. of potatoes; twice as much in plants using centrifuges. Drying plants for potato fodder using daily 5 tons of tubers require 60 kw.-hr. Except in the case of a few large beet farms, electric field railways could not be introduced as yet.

Artificial Irrigation

Artificial-irrigation plants are still in the development stage and are used to a very small extent. As proved by experiments, their beneficial influence will be gigantic, but a final estimate cannot as yet be made. The damage due to dry spells may be averted and the harvests considerably increased. Irrigation plants are a safe means to obtain maximum harvests, permitting the use of the largest amount of artificial fertilizers.

Of what importance electroculture will be to the harvest cannot be fully stated as yet. Here, too, tests have shown very promising results.

Electrical energy is being used sparingly for cooking and for heating incubators, mostly in southern provinces where cheap water power is available, the erection under pressure of necessity of large water-power stations in the north and south and of steam plants in soft-coal mines will soon create new and extensive demands for electrical energy.

Preserving Fodder

The scarcity of fodder may be lessened if success in conserving it at the time when its albumen content is at the highest is achieved. The American silo method cannot be used in Germany. The German "Herba" method is likewise unsuitable because the necessary quick rise of temperature is impossible. The use of electricity gives the simplest means to produce heat. Green fodder does not conduct electricity to any extent. Cut up, it has a large resistance, but it heats relatively quickly between electrodes, thus avoiding the otherwise unescapable loss of albumen. The heating must be carried to about 50 deg. C., at which temperature all life in the plants stops and the milk-acid fermentation begins. The acetic-acid and butter-acid fermentation will have already stopped at a lower temperature. The products of the milk-acid fermentation are responsible for the preservation of the fodder.

This method was first introduced by Schweizer and is being exploited by a concern in Dresden. Three silos with electrodes are star-connected to a three-phase current supply and the process begins simultaneously in the three. Toward the end of the charging period the current amounts to 50 amp. at 220 volts. For 50 kg. of preserved fodder 1.2 kw.-hr. to 1.5 kw.-hr. is required, which includes the power needed for cutting. There are today 120 such plants in operation, and fifty are being built.

A second method, known as the one-silo method, was suggested by Vietze in Halle. Its main advantages are that only one silo is required and that the necessary current for 50 deg. C. heating is much smaller. About 13 amp. at 220 volts is sufficient. In this method all three electrodes are placed in the same silo (three-phase) and a heating unit is used in addition. For 50 kg. of preserved fodder about 1.25 kw.-hr. is needed.

The author believes that both of these methods will be of greatest importance. The one first mentioned will be more used on large farms, the latter on smaller ones. The central stations too will welcome this new demand, because it will come during the summer months, or the season of otherwise lowest demand, and will not require additional generating equipment. The preservation may even be done during the night hours. The magnitude of the demand cannot yet be foreseen, but it is not at all impossible that it should be doubled if these methods of preserving fodder should come into general use.

At this point the work that is being done on electrically heated steam boilers for dairies, on potato-steaming equipments and on welding transformers for farm blacksmiths deserves mention. All of these things, however, will find use only in districts with cheap hydro-electric power. Of great value would be the introduction of the potato steamer, which is needed on all farms. It can be operated at night and may be equipped in such a way as to be automatically disconnected as soon as all the water has boiled away.

German Farm Construction Methods

The rules followed in German farm installations are formulated by the Verband Deutscher Elektrotechniker, a co-operative society embracing central-station companies, engineers, industrial-plant operators, consumers, manufacturers and jobbers. Three-phase energy is the most usual supply. The low voltages are as a rule of 210/120 and 380/220; that is between 210 volts and 380 volts for power and 120 volts or 220 volts from each phase to grounded neutral for lighting. The grounding is carried by some plants throughout the entire system to the last branch lines, requiring only single-pole fusing. It is essential that the grounding of the neutral be perfect. Every village and farm has its main ground, made as a plate or better surface ground, and each connected building has a pipe ground. Motors and plugs are connected to the neutral and grounded besides. Structural steelwork and metallic fodder troughs are separately grounded and must not be connected to the neutral. The neutral wire must be plainly marked as such and must not be connected to the grounding system or the high-voltage apparatus. Other plants are grounded only in the network and install phase as well as neutral insulation on the premises, employing double-pole fusing.

In dwellings and in all dry rooms the wires are installed as in cities. As a rule conduits are used, or conduit wire, and frequently the outer metallic armor forms the neutral.

In temporarily wet rooms like kitchens the conduits must either have a protective coat of paint or must be kept at a distance from the wall. All switches must be waterproof and porcelain sockets must be installed.

In stables, fodder kitchens and similar rooms, where acid fumes must be expected, special care has to be exercised. If possible, all wiring should be on the outside of the building except a short connection to the outlet. If the height of the rooms prevents touching the wires, bare wires on porcelain cleats are the best method. Otherwise steel-armored conduit, well laid out and grounded, should be chosen. "Long-handle switches" should be used, or inclosed switches in steel-armored installations. Ceiling penetrations to hay or

straw lofts are to be avoided. Usually a ⅝-in. steel pipe, through which the insulated conductors run, is carried less than a foot above the ceiling and ends there in a steel junction box.

Circuits for stables and other outbuildings must be separated from circuits in dwellings. The installation of wires in structures containing inflammable materials, such as hay and straw barns, should be avoided. The entrance of wires into such places through roof stands or the installation of fuses therein is prohibited. Fixtures must be of insulated material, must have a protective glass bowl and, if necessary, a wire basket.

Flexible connections to portable energy-consuming devices must be equipped with a durable non-metallic protection. Junction boxes and power or light plugs are permitted in barns only in exceptional cases and must be waterproof and fireproof.

It is impressed upon the users that all installations should be kept clean and neat, that switches and motors should be easily accessible, that the touching of unprotected parts should be avoided, that fuses should never be bridged with wire or metallic objects and that any attemps to repair fuses by inexperienced users must be avoided. An inspection of the wiring at intervals by an expert is recommended.

Development of Austrian Water Powers Under Way

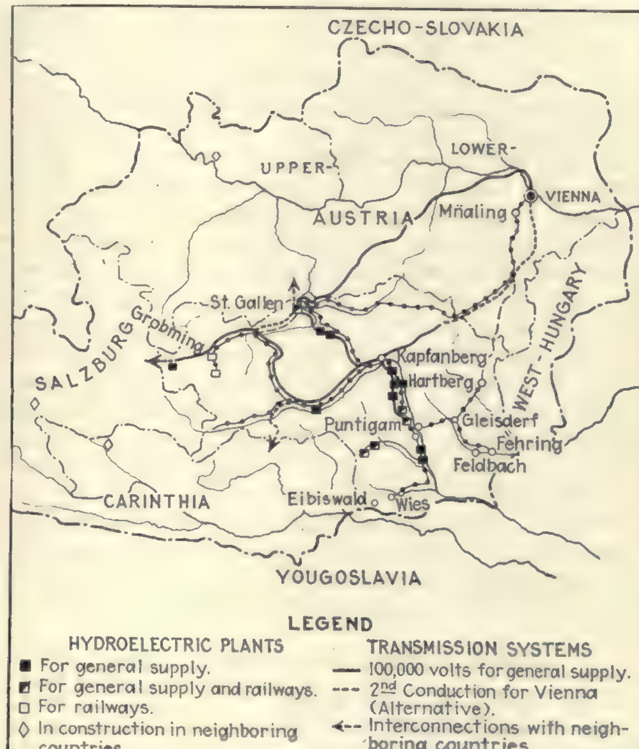
Concessions Granted for the Production of Hydro-Electricity as Part of National Project—To Extend Over Period of Thirty years

ONE of the paramount questions under consideration by the commercial and industrial interests of the young Republic of Austria is the development of the water powers of that country. Whereas in the Austria of old the motor power required by the industries was produced almost exclusively from coal, cheap coal then being at the disposal of the country to a sufficient degree, Austria is now forced to economize its insignificant coal resources to the utmost extent. The production of power for the future will have to be done on a hydroelectric basis, and it is therefore an absolute necessity that the country exploit in the most intensive way one of its greatest natural resources, that is, its water power. The utilization of this power has already commenced, but lack of capital has caused wholly inadequate progress to be made.

Austria has about 3,000,000 hp. of workable water powers. The complete electrification of all industries and of the railways would require the installation altogether of about 1,500,000 hp. The cost of this development, including the long-distance network and substations, would total about 2,000,000,000 gold crowns and the development would be extended over a period of twenty or thirty years.

As pointed out in a report by Richard Hofbauer, chief engineer of the Styrian Water Power & Electricity Company, Ltd., the foundation for organizing energy production in Austria is to be found in the electrical companies already existing. These companies at the present time are small, the energy generated being utilized largely for local supply. These units form only an insignificant part of what is actually required by the nation as a whole. The nation-wide scheme of development advocated by the Styrian company is the first attempt at a development of the water-power resources of Austria on a large scale. A careful plan of development has been drawn up, showing the locations selected for the power plants and describing the long-distance and distributing networks necessary to meet the existing load requirements. The program is to extend over fifteen years, in which period all the power plants required for the actual energy supply, inclusive of long-distance and transformer stations, will be constructed. The accompanying map shows the proposed locations of the generating plants and transformer distribution systems.

The maximum load of the future Styrian long-distance network, inclusive of overload, is estimated at about



EXISTING AND CONTEMPLATED GENERATING AND TRANSMISSION SYSTEMS IN AUSTRIA

265,000 kw. In laying out the general scheme, however, consideration has been taken of the probable development of the iron industry, which is one of the most prominent industries of Austria.

The scheme of development as proposed by this company has been considerably accelerated by the course of the government in granting concessions for water powers. In order that the electrical energy produced may be distributed to consumers uniformly in accordance with their requirements, the country has been divided into five centers of supply. The organization of the whole enterprise, comprising all the power stations, long-distance-line and transformer stations, is intended to be carried through by the Styrian Water Power & Electricity Company interests. This parent company will control the generating plants and transmission systems, but the distribution of electrical energy from the main transformer stations will be confided to subcompanies to be formed in the different centers of supply. Already a syndicate has been formed to carry the financial management of the Styrian enterprise, all the large Austrian banks forming a part of it.

Regular Maintenance Schedules for Diesel Engines

A Maintenance Outline, Maintenance Calendar and Reports Suggested—How Such Schedules Should Be Developed

BY J. L. SCHNEITTER*
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THE great number of new and important installations of oil engines during the past few years, and especially in the Southwest, has caused many to recognize the field which justly belongs to these prime movers. The oil engine of today promises to become in increasing degree a competitor with steam equipment of many kinds. However, the successful operation of an oil engine, like that of any power plant equipment, includes maintenance, and maintenance involves careful and systematic mechanical work. Past records showing high maintenance costs and failures of Diesel engines have been facts, but in many cases these represent avoidable accidents and lax maintenance methods.

As oil-engine users we find the care required by any Diesel engine installation dependent upon two factors—the kind and reliability of the engine itself and the attention given it at all times. Close co-operation between engine builders and engine users has already resulted in redesign and improvement in engine parts which have been shown to require close attention and periodic renewals. Extensive studies made by many makers of Diesel engines of cylinder head, cylinder liner and piston failures have resulted in many improvements. Knowledge of facts regarding failures has resulted in simplification of cylinder-head structure, improved cooling regulation and extensive research in the field of better materials of construction.

DIESEL ENGINE WORTH MAINTAINING

If the engine is worth the cost of installing, it should be worth maintaining in condition to produce reliable operation and good records. For this reason maintenance routine is important and time and labor for the proper care of oil engines must be allowed.

Maintenance, to satisfy the elementary requirements of all-around efficiency, maximum capacity and minimum "idle" expense with the greatest dispatch and least discomfort, is best accomplished by systematic inspections. Proper maintenance does not consist of making repairs after something has happened, but rather at some convenient time before the defect has had an opportunity to cause an unexpected shutdown. A minor defect in the governor or fuel pump on a Diesel engine, if discovered and repaired in time, may cost a small amount. A failure to correct the defect may result in a disastrous wreck.

SYSTEMATIC INSPECTION ESSENTIAL

It would be difficult to overemphasize the importance of a systematic routine of inspection for Diesel engines. There is danger in involving the operating organization in a maze of red tape which will not only discourage the initiative of those who have to keep the wheels turning but also create a tendency to be antagonistic toward anything that looks like system. Any system of inspection should be made as simple and easily applied as possible and yet produce the desired results.

There is no standard system to follow. What may be suitable to one installation with set conditions may not be suitable to another. Careful study must be given to what it is desired to accomplish before introducing such a system, as well as careful consideration to its working after it has been put into effect. Not infrequently it has been found that what looked well on paper failed in practice. These weaknesses must be detected and remedied if the confidence and co-operation of the operating force is to be had.

The preparation of a maintenance schedule requires that the length of intervals between inspection of every part requiring attention be carefully studied. Such information should be gathered from plant engineers or engine maintenance men of long experience in the field. After these data and records on the wear of parts have been formulated the time intervals for inspections can be safely decided on.

FACTORS IN A MAINTENANCE SCHEDULE

An analysis of any maintenance schedule scheme will usually show that it should consist of:

1. A maintenance outline with suggested inspections for each part of the engine and suggestions for procedure.

2. A maintenance calendar listing the time and frequency of inspections given in the maintenance outline.

3. A report sheet suitable for keeping records and noting the progress made during inspections.

A maintenance schedule based on this outline has been put in operation by the chief operating engineers at a number of Diesel stations. The maintenance instructions were prepared in pamphlet form. They consist of an outline of the procedure in making inspection. This material refers to all parts of the engine requiring attention, and each major inspection, of which there are twenty-five, is designated by a number for simplicity and easy reference. "Inspection No. 3" in the outline is "fuel pumps" and an inspection is required every six months. The parts to be examined are valves, check, valve seats, springs, eccentrics, eccentric straps, cross-head, pump plungers, fuel-pump piping, strainers and oil heater.

Similarly under "Inspection No. 7," "exhaust valves," the inspection should include the following every two months: Valves, cages, springs, valve guides, valve thimble and key, water jacket, and gaskets. Details to be followed when making these inspections are also given in the body of the schedule and for the "fuel pump," as an example, are as follows:

(a) Disconnect the fuel lines and clean. Remove all valves and checks from fuel pumps (remove pump body if necessary).

(b) Wash out pump with kerosene. Examine valves for wear and springs for tension and grind valves or renew parts as required.

(c) Examine check valves and reseat by tapping with brass rod if necessary. Examine connecting link (which drives one pump) for wear and lost motion.

(d) Examine cross-heads and pins. Examine fuel-pump plungers for wear; if necessary renew. The plunger stroke for all pumps should be the same. Repack pump as required.

(e) Assemble pumps for operation and check each valve lift. Be sure that discharge valve is seated when hand lifter is in stopped position and that suction valve is open. Check valve lift every time valves are ground. Check clearance of hand lifter.

(f) Examine and clean fuel oil strainer and heater when same are used.

*Abstract of paper presented before the Southwest Geographic Division, N. E. L. A., convention at Oklahoma City, Okla.

Each inspection is outlined in a similar manner, and every part of the engine can be properly covered by inspections at regular intervals.

General instructions for conducting all the various inspections and remarks on maintenance should be included in the preface of every schedule. Some instructions referring to maintenance in any station are as follows:

1. The major inspections must be planned and organized so that the least possible operating time will be lost.
2. When parts are removed for inspection they should be marked plainly to facilitate reassembly. As soon as a spare part is put into use a new one should be ordered to replace it and the old part properly disposed of.
3. Whenever inspection work has been done on an engine care should be taken to bar the engine over by hand to make sure that everything clears properly and that the engine is ready for operation before starting.
4. Maintenance reports should be filled out promptly and care should be taken by the chief inspector to note and report in detail conditions of parts inspected.

Frequency of Inspection Should Be Specified

An important part of any maintenance material consists of a calendar giving the time and outlining the frequency for each inspection. Such a calendar can best be prepared on a cardboard sheet measuring approximately 12 in. x 20 in. This is ruled off horizontally into fifty-two weekly spaces so that the inspections due can be listed by weeks for one year. Three vertical columns are ruled and headed "Cylinders," "Air Compressor" and "Miscellaneous." Under each of these respective columns and opposite the week numbers are listed the inspections due by numbers for the whole year, giving proper consideration to the arrangement of the inspections, which depends on the frequency of their occurrence. The various inspections should be so distributed through the year that no great amount of work is accumulated for any one week. Such a calendar might be enlarged as necessary to provide space for remarks or data not elsewhere included. In plants where more than one engine is used it can be made of such size to include more than one outline, and thus all units might be included. The calendar should be posted in a convenient place for easy reference and the inspections should be properly checked off for each week as they are completed. In this way it is possible to note inspections which have been incomplete and also those which are in the immediate future, so that proper arrangement can be made for their completion. In every case the necessary repairs or other troubles must have first attention, regardless of a conflict with the maintenance work.

Another important part of the maintenance material is the reports and records. The best type of report sheet is one which provides space for listing all the inspections made during a certain period and yet is of suitable size for filing. These reports are usually made out to cover a full month's inspection work. After each inspection reported, the date should be given as well as the date when the inspection was due as recorded on the maintenance calendar. These dates will provide for an active check on the progress of maintenance work. Sufficient space should always be provided for comments and remarks regarding the parts inspected, giving all details observed with reference to wear and condition. A separate sheet is filled out for each engine and a careful check made of each inspection. Such reports are filed and prove invaluable for future reference.

Included with the above monthly maintenance report should be a brief statement regarding weekly inspections. For this inspection it is suggested that each engine should be stopped at a convenient time at least once a week and the main bearings, crank boxes and piston pins examined. It should be observed that all nuts and set screws are tight. The air compressor should be examined in a similar manner. Parts of the valve mechanism, fuel pump and governor should also be checked over to make sure everything is operating properly. Report should also be made on the running characteristics of the engine, the way it pulls load and the sound of the exhaust.

Record of Wear Should Be Kept

The final and an important part of all data to be collected is the record of wear of parts. Such information is best collected at the time of an annual inspection or overhaul of an engine. The Diesel-engine maintenance schedule should be arranged for a complete inspection at the end of every twelve to eighteen months for best operation. At this time the engine is dismantled, the crank shaft raised and tested, and main bearing shells examined and adjusted as required. The crankshaft is then rebedded, which is a rather important piece of work. This is best done under direction of experienced maintenance men. Many of the maintenance inspections which fall due annually can be done at this time, thus saving unnecessary loss of engine-hours. Records of crankshaft tests, alignment of bearings, cylinder liner wear and main piston deformation are of much importance, and every measurement should be taken with exacting care. Such records afford an excellent opportunity to study results of engine operation and often reveal some necessary condition which can be corrected. They also serve as the only means of reference and for comparison between different sizes and types of engines. Along with the information on wear and replacement of parts it is well to retain data on crank-shaft alignment and, when possible, graphs showing liner wear.

Personnel Is Highly Important

The success of any maintenance program depends on the men directing it and the way in which the system is applied. Since the condition of any power-plant equipment is no better than that of its least reliable part, it is worth while to have some systematic check on the condition of equipment. Neglect does more harm than spasmodic effort can repair, but a moderate amount of care will keep any unit in good repair if exercised regularly and at the opportune time.

Every Diesel-engine user should recognize the advantages of some simple system of maintenance which will also be comprehensive for the needs of his station. There are no standards for engine wear. However, experience has shown that there are certain tendencies which manifest themselves in the life of any Diesel engine. A well-planned system of maintenance and rules for inspections have already reduced the cost of repairs and prevented costly shutdowns in many stations. This makes it possible to reduce the amount of reserve capacity necessary to insure continuity of service. Maintenance material to prove valuable need only offer the right suggestion as regards responsibility and duty of the operating engineer. When the time comes and these suggestions are more fully applied, greater reliability and an increased service factor for the Diesel engine can rightly be expected.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

An Underlying Cause of Customer Ownership

To the Editors of the ELECTRICAL WORLD:

Scarcely an issue of the ELECTRICAL WORLD is published which does not contain some favorable or even enthusiastic comment on the growth of customer ownership of public utilities. Little is said, however, regarding an underlying cause which has probably done more to advance this movement than all the enthusiasm and arguments of its proponents combined. I refer to the decision of the Supreme Court of the United States which left state and municipal bonds free from federal income taxation. This decision, together with the income tax law which led up to it, has caused the withdrawal of huge sums from the utility field and their investment in tax-exempt bonds. The consequent scarcity of funds and increased interest rate has been instrumental in making it pay the public utility executive to go after the little investor, and may have been the deciding factor that put the official "O.K." on many a customer-ownership campaign. The fact that, in customer ownership, Canada has lagged behind the United States is easily explainable by the difference in tax laws.

Now, the tax-exempt bond is doomed; the public mind is made up on that score, and whether it requires an amendment to the Constitution or a simple act of Congress, means will be found to abolish the exemption. The central-station industry may well consider in advance the effects on its relation to the public that may flow from this change.

In the first place, customer ownership will doubtless receive a severe setback regardless of such efforts as may be made to maintain it. It always appears more desirable and less costly to sell securities in large blocks than in small parcels, and when the present tax differential in favor of state or local bonds is removed, it will be much easier than at present to sell utility bonds in large amounts. Economic pressure which has favored the one policy will be reversed and favor the other.

However undesirable the loss of the tempering influence of the customer owner on the public attitude toward the industry may be, it is not, as I see it, the danger to be feared as a result of the expected change in tax laws. The present hue and cry for economy in government will probably not be of great duration, and the removal of the haven of refuge that tax-exempt securities have furnished for the wealthy will leave everything favorable for a renewed "tax the rich" campaign which will run the rates on the larger incomes up to confiscatory figures. Such heavy taxes on income, however, leave existing fortunes intact as to principal, and the danger is that the owner, prevented from obtaining a satisfactory income from his principal, will turn it to other uses and attempt to control some industry for purposes of political aggrandizement or personal advertisement.

Now, the central-station industry is particularly suitable for such purposes. It is essentially monopolistic within the community served. Moreover, it is a community industry which draws all its employees from the local population and has a maximum of contact with the people in its territory. It is thus an ideal tool for the local politician who can control it. Should such perversion occur on any considerable scale, the industry will be started straight down the road to more stringent regulation or government ownership.

The central-station electrical industry less than any other can safely neglect the vital questions of its relation to the public or of the effects of political change or legislative action.

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Electrical Engineer and Machine Designer Should Co-operate

To the Editors of the ELECTRICAL WORLD:

It is interesting and important to note the attitude which some manufacturers of machinery assume toward applications of electrical energy. Apparently they fail to realize in many instances that, although applied electricity is not a panacea, nevertheless it offers a ready means of devising improved machinery and processes which the world is clamoring for.

Some of the stock arguments in opposition to electrifying which the writer has heard used are thus expressed: "We will only be making business for the electric companies," or "It will complicate the machine and make it more costly," or "Electrification will not make the machine produce more, neither will it improve the quality of work which it produces, therefore, there is nothing in it for us; but if the man who buys our machine desires to have it motor-driven, we will accommodate him."

Now, the foregoing arguments and others frequently used also are generally based upon false premises, but the fault lies just as much with the electrical manufacturers as it does with the machine builders, the latter, however, in many instances being supplied with insufficient facts upon which to base their opinions.

This condition can be largely eliminated, however, with great benefit to industry in general, by the electrical engineer co-operating with the machine designer in applying electric heat and power to the production unit. The old way of the salesman selling the motor to the purchasing agent will no longer suffice, for modern industry demands the knowledge and experience of the trained specialist to bring maximum results. Riding on the waves is fine sport while it lasts, but it is much better to possess a power boat with good steering gear which will take one to port in a storm.

The cry of the machine manufacturers today is, "Improve the tool which comes in contact with the work!" and in a large majority of cases simply attaching an electric motor to a machine, regardless of the characteristics which the motor may possess, will fail, in large measure, to accomplish results desired. When the motor elements are built integral with the machine, however, another story can be told, and it is along these lines that the engineer and the designer should work together. The same thing is fundamentally true of applied electric heat, with its many advantages.

The great factors in industry today are "electricity," "mechanics" and "chemistry," properly applied, and behind these must stand "research," with supporting funds sufficient to attract and hold the interest of the best minds that modern society can produce.

JOHN J. BROPHY,
Electrical Engineer.

The Turner Tanning Machinery Company, Salem, Mass.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Reducing Substation Cost and Insulator Hazard by Steel Buses

When copper wire or even tube buses are supported by suspension or post-type insulators the cost of insulators and steel work to support them may mount into a considerable sum, especially in installations at the higher voltages, because the buses must be supported about every 6 ft. Thus in 22-ft. bays each three-phase bus will require twelve insulators and four horizontal steel pieces to support the insulators. Furthermore, each insulator affords one more opportunity for breakdown and interruption of service. To avoid these objections the Southern Power Company is converting many of its outdoor substation buses to structural steel (not pipe) and expects to adopt this construction as standard in the future.

For most cases 2½ in. x 2½ in. heavily galvanized angle irons fastened back to back with ½-in. spacers are supported on insulators 22 ft. apart. At the joints in the buses heavily galvanized steel-plate spacers are used to obtain the necessary bonding, and this joint may be further reinforced as to current-carrying capacity by the use of standard rail bonds such as are in use by traction companies.

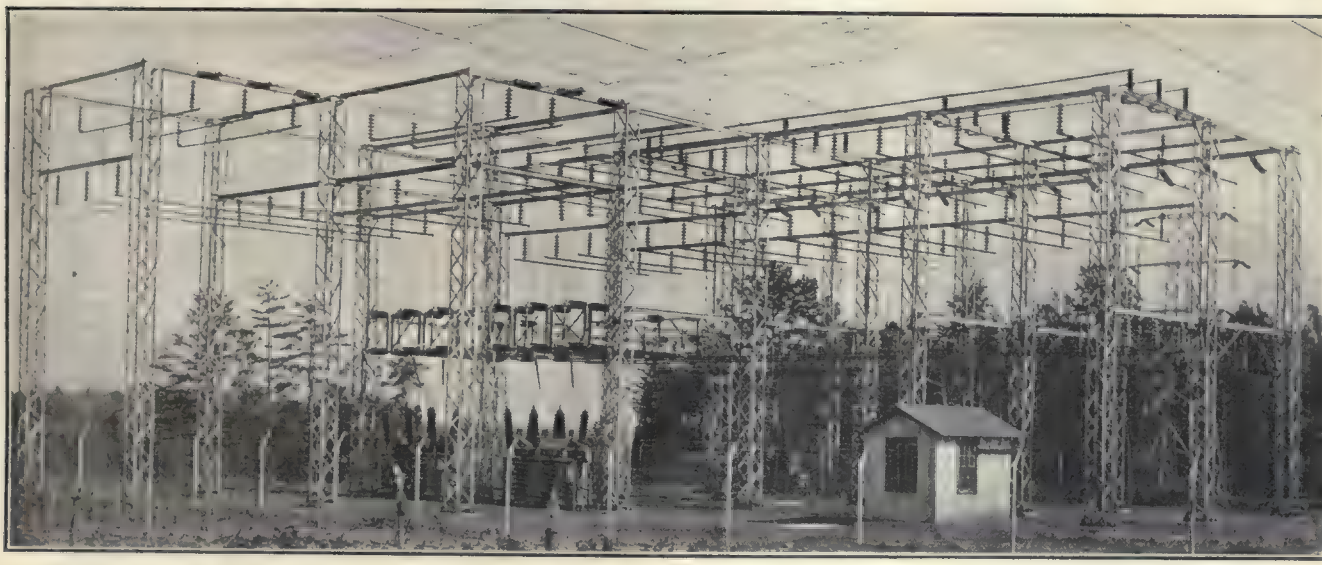
Several types of fitting are used to attach the buses to the insulators. To make vertical connections between the buses and other buses, circuit breakers and the like, cast-copper spacers with lugs that will take pipe fittings or Dossert connectors are employed.

With this construction it is possible to get along with one-half the usual number of insulators and insulator supports and reduce the likelihood of insulator breakdown accordingly. Furthermore, this construction obviates the necessity of working to such close fits as are necessary with pipe or tubing since the fittings and joints with steel buses can be adjusted to allow for the lack of alignment usually encountered.

According to tests made on these busbars, they are capable of carrying 400 amp. without noticeable heating, the observed temperature rise at the contacts being only 10 deg. If larger carrying capacity is desired, a copper bar may be clamped between the backs of the angle irons.

Referring to the left-hand part of Fig. 2, connection was made to the line wire as shown, going from the strain insulator to the line-disconnecting switch, from the line-disconnecting switch to the oil switch, and from the oil switch to the heel of switch X_1, using flexible copper wire. From the top of the switch X_1 to the top steel bus pipe is used, the connection of the pipe to the steel bus being marked H. This steel bus is supported at four points by detail marked B or C. Connection from this steel bus, B_1, to main top buses is made by means of copper pipe. The top main buses are supported on top of pillar insulators, detail marked E. On the other side. the connection from B_1 to switch X_2 through oil switch and line switch to line is similar to the method just given.

Angle steel buses are connected to the heel of the switch X_1 according to detail F. This steel bus connects also to the heel of switch Y_1. From the top of switch Y_1 pipe extends to steel bus B_2, connection between steel bus and copper pipe being according



SOUTHERN COMPANY ADVOCATES STEEL BUS SUBSTATION AS MUCH MORE ECONOMICAL AND LESS HAZARDOUS THAN COPPER BUS CONSTRUCTION

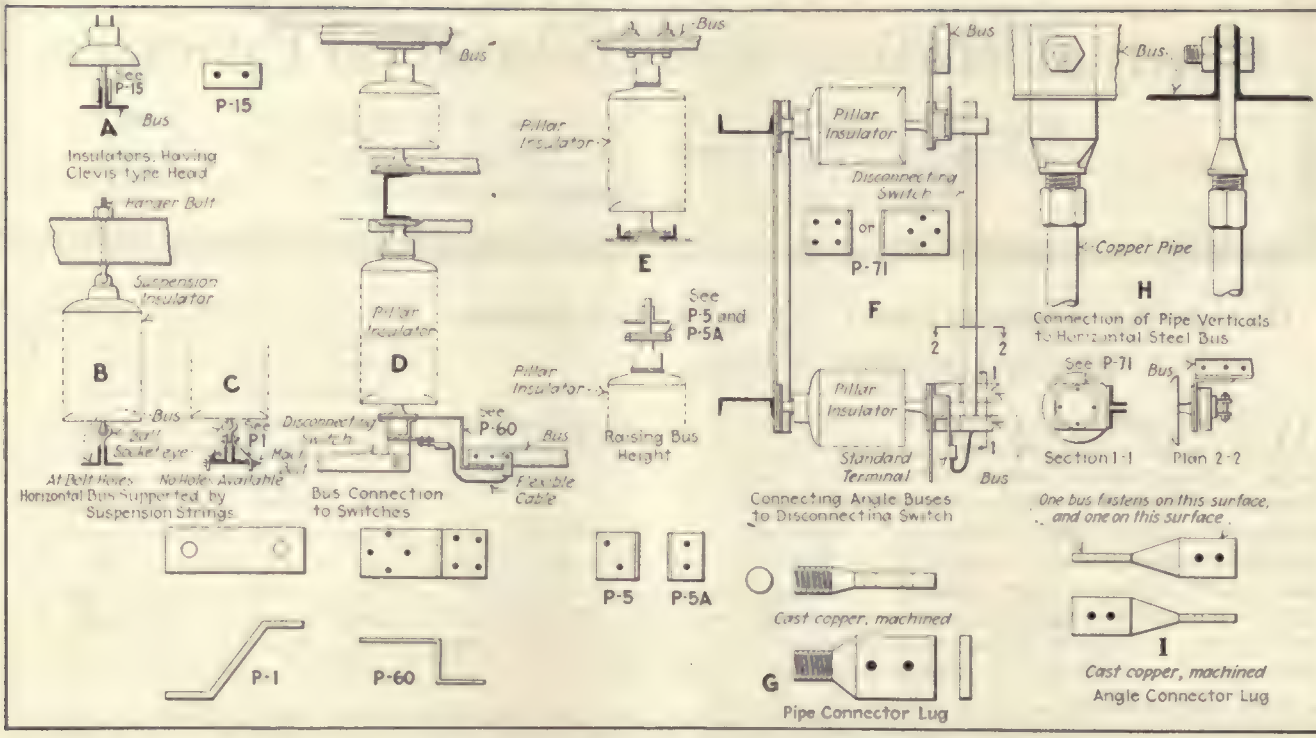


FIG. 1—DETAILS OF JOINTS AND CONNECTIONS USED IN STEEL BUS SUBSTATION

to detail *H*. Steel bus *B* is supported at two places, connections between B_2 and bottom main buses being made by means of copper pipe. The top main buses and bottom main buses shown are steel angles.

The various details as given below refer to Fig. 1:

Connection to Insulators.—A.—Normally these busbars are laid out so that connecting holes occur at the points where insulators are supported by suspension strings. This detail is marked *B* and consists of a connection to the insulator with a flat piece, ½ in. x 1½ in., which is fastened between the two angles forming the bus by a machine bolt ½ in. x 1¾ in.

B.—At points where busbars are supported by suspension strings but with no connection holes in the busbar angles two plates, P_1, are placed on the outside of the angles and held according to detail marked *C*.

C.—For insulators having clevis-type head and stud bolt at bottom busbars are supported by two plates, *P*15, placed on the outside of the busbar angles, as shown in detail *A*.

End to End Connections.—A flat plate is used as a splice plate in making a butt connection between busbars.

Connection to Disconnecting Switch.—A.—Details of connection at the heel of the switches marked X_1, Y_1, X_2 and Y_2 are shown by detail *F*. This consists of a bent plate, *P*71, which is placed between the insulator and the disconnecting switch. For light current no other connection between the busbars and the switch is necessary, but for heavy current it is necessary to make connection from the regular terminal of the switch, as shown by means of flexible copper wire, to another standard terminal which is fastened to one of the bolt holes shown on detail *F*.

B.—For the ordinary underhung disconnecting switch the detail is self-evident and is shown as *D*. The connection between switch and busbar is made by flexible cable as shown.

Taps Between Buses.—Copper pipe is connected to the steel buses according to detail *H*. The detail shown is for points at which bolt holes occur; in case no bolt hole is available at this point the machine bolt, as shown on *H*, is omitted, and instead two pieces (*P*1) are assembled similar to method shown on detail *C*, with the exception that no connection to insulator is made and the pipe connector lug is dropped down a fraction of an inch so that the ½-in. x 7-in. machine bolt shown on detail *C* passes through the bolt hole of the pipe connector lug.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

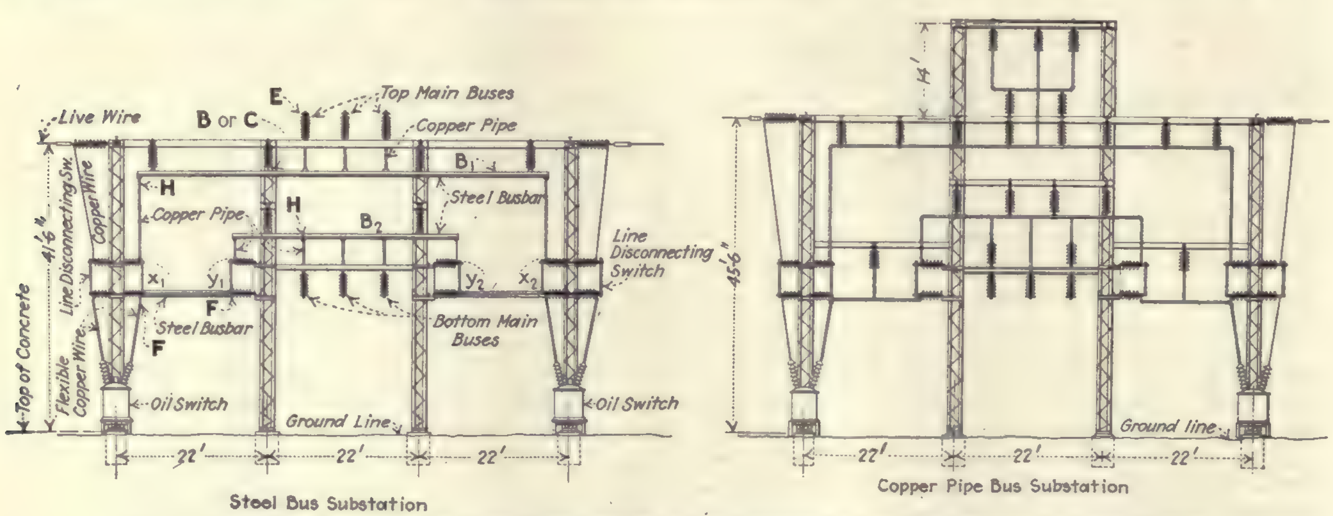


FIG. 2—INCREASED STRENGTH OF STEEL OVER COPPER BUSES REDUCES NUMBER OF SUPPORTING INSULATORS USED IN SUBSTATION BY ONE-HALF

Means of Repairing Pitted Waterwheel Runners

NOT having been able to ascertain definitely the real cause of the pitting of waterwheel runners on their back surface and thus being unable to prevent it, the Georgia Railway & Power Company has tackled the problem by repairing the wheels when the pitting becomes serious. This is being done by oxyacetylene brazing at a cost of $325 to $350 for eighteen-blade wheels costing from $3,000 to $4,000.

From records which have been kept for some time it has been found that the penetration of the pitting increases most rapidly the first two years of service, reaching in some cases to a depth of $\frac{3}{8}$ in. to $\frac{3}{4}$ in. After that the depth stays virtually constant but the extent of the holes increases. With the conditions existing in the Georgia system it appears that a runner can be operated seven years before the pitting becomes serious enough to necessitate its removal.

In making these repairs a very important feature of this process is to have absolute control of the rate and extent of pre-heating the piece to be welded, to make certain of a gradual increase or decrease as required.

To repair pitted wheels they are removed from their shaft and placed on a mandrel supported horizontally by brick piers. Perforated pipes connected with a gas and air supply are then bent into circles conforming with the hub and the circumference and placed on both sides of the waterwheel. A firebrick furnace is then built up around the entire wheel except for a small opening giving access to the back of one of the blades. The wheel is then raised to a cherry-red heat by the perforated gas-pipe burners. While the wheel is in this condition an oxyacetylene welding set is used to fill the holes with bronze, a bronze rod being used. This rod is similar to the material of which the runner is made. As each blade is repaired the wheel is turned on the mandrel until the next blade comes into position for brazing. After this is completed the bronze fillings are smoothed off and the wheel is balanced.

Experience with the repaired wheels indicates that the bronze retains its place and wears better than the original blade. The work is being done by the department of tests and repair, of which A. L. Smith is superintendent, under the direct supervision of W. B. Payne, foreman of repairs.

FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

Protect Aluminum Solders Against Moisture

SOLDERED joints of aluminum which are to be exposed to moisture should be protected against corrosion by paint or varnish. Various compositions of zinc-tin and zinc-tin-aluminum solders give best results.

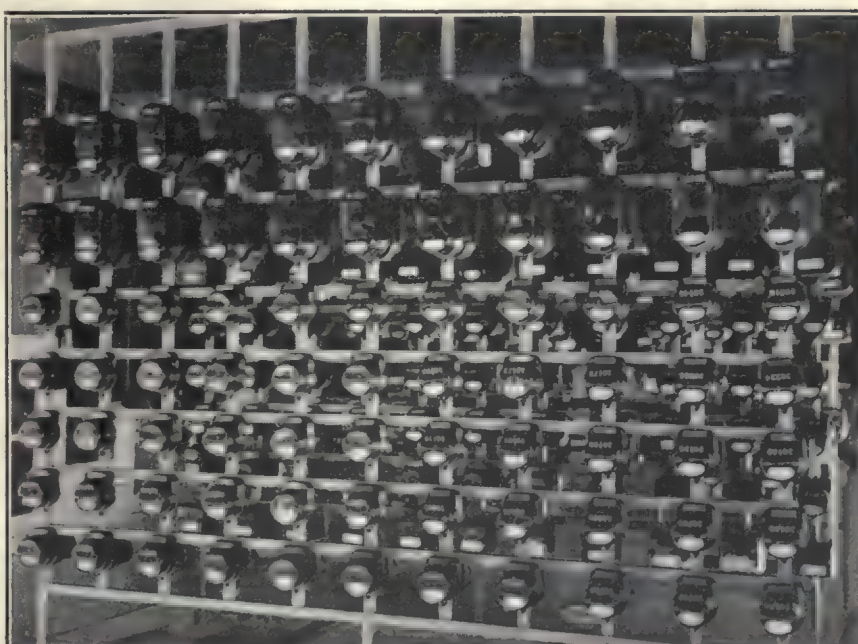
Most of the metals commonly used in solders, except magnesium, are electropositive to aluminum, so that any metals used in making a soldered joint of aluminum act electrolytically in the presence of moisture as positive galvanic poles accelerating the corrosion of the aluminum. Magnesium cannot be utilized advantageously for this because the metal disintegrates rapidly in the presence of moisture. The tensile strength of a good aluminum solder is about 7,000 lb. per square inch, because those with either tensile strength usually have such a high temperature of complete liquidation that they are unsuited for soldering purposes. As a rule, the strength of an aluminum-soldered joint depends upon the type and workmanship. The Bureau of Standards has recently revised circular No. 78, entitled "Solders for Aluminum," and this will soon be available.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Welded Strap Iron Rack for Storing Meters

ONE of the many problems of a meter department is the proper kind of racks for storage of electric meters. After the meters have been tested and calibrated, there should be a rack for them so designed and placed that meters will be protected from mechanical injury and at the same time be in a convenient place when wanted.

A set of racks in use by the San Diego Consolidated Gas & Electric Company is shown in the accompanying illustration. This was constructed by welding two strips of channel iron together. A small weld was made every foot on both sides where the channel iron joins. When completed these were used as uprights and also for the meter supports. Strap iron, 2 in. x $\frac{1}{4}$ in., was used for cross supports. These were riveted to the channel iron and hooks were run through and extended on both sides of the supports. These hooks were welded in place and serve as hangers for the meters. There are four racks, and on each there is space available for 44 power and 110 lighting meters. The spacing was made so that any type of power or lighting meter can be taken care of. The advantage of having a rack so designed is the ease with which the numbers can be read and the meters cleaned.



STEEL RACKS HOLD 440 LIGHTING AND 176 POWER METERS

W. H. TALBOT.

Superintendent Electric Meter Dept.
San Diego Consolidated Gas & Electric Company,
San Diego, Cal.

Gang Operation of Reclosing Equipment

Self-Starting Motor Generator, Step Regulation of Rotaries, Barnacles on Penstocks and 35,000-Volt Duct Lines Also Discussed at Pacific Coast Electrical Association

OPERATING reclosing equipment in automatic substations by gang operation as against individual reclosing equipment for each feeder switch, step method of regulation for rotary converters, trouble encountered with the growth of barnacles on the inside of concrete tunnels and a 35,000-volt undergound cable installation were among the important subjects discussed by the Technical Section of the Pacific Coast Electrical Association at its annual convention in San Francisco, June 19 to 22.

In speaking of reclosing equipment, H. A. Laidlaw of the Pacific Gas & Electric Company suggested that large savings can be made by the gang operation of reclosing equipment in automatic substations as against individual reclosing equipment for each individual circuit. In one particular station on that company's system, with four outgoing feeders, a study indicated that gang reclosing equipment could be installed for $800, whereas individual reclosing switches would have cost $3,500. He said that the only objection to the equipment developed was that it did not have capacity to close more than one feeder at a time, an objection which could be easily overcome.

Gang Operation of Switches

C. E. Schnell of the San Joaquin Light & Power Corporation stated that his company had developed equipment for gang operation of switches. It now has one substation installed with this type and another one under construction. The principal feature of this reclosing equipment is a small motor driving an operating rod so that when the switch is tripped out the motor is automatically started and at the end of two minutes the switch is closed. The switch is automatically closed three times and then locks out in case of continued trouble. Four feeder switches are operated in this manner, and the equipment is so arranged that only one switch will close at a time should serious trouble trip all of the switches at once. A recording instrument has been in use, the chart of which gives a complete log of the operation of the substation, showing the time at which switches trip, etc. This station is 6 miles from the nearest town with no telephone or alarm system, and out of twenty or thirty times that feeder switches have operated automatically it is only in one or two cases that a line has been out of service for any length of time. Standard relays are used in all of this equipment, and a relay has been developed by the company which combines in one instrument all of the features that manufacturers employ in several relays. This relay has been developed for alternating-current operation on a new job, and one will be built for direct-current operation on another job which will have twelve feeders. In connection with the reclosing of the four feeder switches in the automatic station mentioned above, Mr. Schnell stated that if all of these switches were out they would close within six seconds of each other.

A direct-current self-starting motor-generator set was described by S. J. Lisberger of the Pacific Gas & Electric Company. This set can be started either by push-button control or manually. He pointed out that if automatic closing switches are made to operate too soon, difficulty may be expected on outgoing feeders, mentioning one case where men working in a manhole would have been seriously injured if a feeder which had tripped out had been reclosed without a certain lapse of time. Mr. Kellogg of the same company stated that at one of its stations there are automatic starting motor-generating sets which are of unusual design and with which various combinations of relays are used.

Step Regulation

The step method of regulation used on rotary converters by the Market Street Railway Company was described by J. E. Woodbridge, consulting engineer of the company. In commenting on this method, H. A. Laidlaw said that for some time past the Pacific Gas & Electric Company has been using tap-changing leads on its regulators on outlying feeders similar to the system described by Mr. Woodbridge. Other companies have also used this system and manufacturers are adopting it.

The secret of success of operation in step regulation, J. P. Jollyman of the same company asserted, is to bridge the steps on the regulator with resistance instead of reactance. He said that if reactance is used much trouble will be encountered. In diametrical opposition to this statement, an engineer stated that reactance is used in the Westinghouse equipment of this type and has worked out very successfully.

H. L. Doolittle, presiding at the session of the hydraulic power committee, said that the Southern California Edison Company was having considerable trouble because of the growth of barnacles on the inside of concrete tunnels at its Kern River No. 3 plant. This growth is so rapid that within a few weeks the flow is cut down by 25 sec.-ft. or 30 sec.-ft. from the normal of 625 sec.-ft., thereby reducing the capacity of the plant approximately 5 per cent. This is a very serious matter, Mr. Doolittle said, and information on some means of preventing this growth is badly needed. The growth is from 1 in. to 2 in. thick and must be cleaned off every two or three months.

Duct-Line Practice

An interesting installation of a 35,000-volt cable in Los Angeles was described. About 36,000 ft. of this cable is to be installed, and a 6-in. water main will be laid between the two four-way duct lines to dissipate the heat liberated by the cable. It is estimated that 50 per cent of the heat liberated will be taken up by the water main. In the discussion S. J. Lisberger said that, in his opinion, heating is the limiting factor in the design of duct lines and that in this case a great deal of trouble would be encountered. However, he said that engineers will watch this experiment to carry 100,000 kw. in two duct lines with a great deal of interest. His company, the Pacific Gas & Electric, has not attempted to carry more than 43,000 kw. in one subway system.

In speaking of transmission systems to transmit energy over long distances, J. P. Jollyman said that this must be done at nearly unity power factor if it is to be done economically. He pointed out that the extensive use of synchronous condensers to correct poor power factor might involve heavy expense because 1 kva. of synchronous condenser capacity is necessary for every 2 kw. of energy delivered to raise the power factor from 90 per cent to 100 per cent. It is his opinion that electrical men should make careful study of this question before trying to raise the power factor to unity.

FIELD EDITOR ELECTRICAL WORLD.
San Francisco, Cal.

Drying Out High-Tension Transformers

WHEN a transformer is dried out before the oil is placed in the tank, either by supplying a hot blast of air or by heating the coils electrically, it is very difficult, and in the latter case practically impossible, to bring the whole assembly to a high temperature without subjecting some parts to excessive temperatures. When the core does not become sufficiently heated moisture may readily be retained in the laminations and later be given out to the oil with consequent loss of dielectric strength.

It is probably the best practice to apply heat to the transformer completely assembled and under oil. The whole unit may then be heated, the moisture being driven into the oil, which is dehydrated continuously during the process. Heating is usually accomplished by blanketing the tank, short-circuiting the low-voltage winding and supplying sufficient potential to the full high-voltage winding to give from two-thirds to full-load current. This will require 3 or 4 per cent of rated voltage, depending on the impedance of the particular transformer, and such a value of voltage with suitable control is rarely ever available. Several days will be required to raise the temperature to a suitable value, and as the coils will be very much hotter than the oil, extreme care is necessary unless the temperature is brought up very slowly.

These methods require skilled attendance during the entire run as resistance checks must be made frequently and a little negligence may result in permanent injury.

The writer is proceeding as follows with excellent results on medium-size transformers. The last method described above is used except that the heat is applied directly to the oil by means of the centrifugal dehydrating machine and the windings are not excited. These machines are provided with an electric heater in their intake, which in from twenty-four to thirty-six hours will raise the temperature of the entire mass of the transformer to a high value with absolute safety. Continuous dehydration is accomplished with the same operation. After once arriving at the desired temperature the feed may be easily regulated to maintain constant temperature. The drying out is continued until the insulation resistance reaches a nearly constant value in the usual way. As the coils are not excited, tests may be made at any time without interfering with the heating process. There are several sizes of these machines available, and on very large transformers auxiliary heaters would probably be necessary.

This method results in an extremely good job, and, owing to dehydration at high temperatures, the oil becomes much clarified. The whole operation requires very little attention and may be left over night for any substation attendant to take care of without any dangers being encountered.

C. A. MULLEN,
Electrical Engineer.
Ohio Service Company,
Coshocton, Ohio.

Extracts from an Operating Code*

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

Storage Batteries in Central Station Use

REGULATING the rate of charge, interpretation of specific gravity readings, importance of pilot cells and the prevention of excessive gassing are important factors to be taken into consideration when operating storage batteries. To give batteries the proper care the following rules should be observed:

1. Never allow a battery to stand for any length of time in a discharged condition.

2. Too high a rate of charge must be avoided to prevent excessive gassing and shedding of active material by the plates.

3. An equalizing charge should be made weekly in case of power batteries and of control batteries as often as the condition of each battery may require it.

4. Add water from time to time to replace the evaporation by filling the cells $\frac{3}{8}$ in. to $\frac{1}{2}$ in. above the level of the plates.

The best time to add water is just before a charge to insure thorough mixing. Distilled water is preferable for this, but raw water may be used if periodic chemical analyses show that it contains no dangerous impurities, such as iron. Care must be taken that the height of the electrolyte is no greater than that specified, as otherwise overflowing may result when the cells gas excessively.

5. Where specific gravity readings are taken they must be corrected for temperature as follows:

For each 3 deg. F. above 70 deg. add one point to the hydrometer reading, and for each 3 deg. below 70 deg. subtract one point. Examples:
Hydrometer reading 1.213 at 61 deg. F.
Specific gravity (corrected) = 1.210.
Hydrometer reading 1.207 at 79 deg. F.
Specific gravity (corrected) = 1.210.

6. Keep the hydrometer clean, as dirt or oil on its surface will cause incorrect readings.

7. In taking voltmeter readings see that good contact is obtained between the cell terminals and the voltmeter leads and that the voltmeter binding posts are tight, as poor contact may introduce a large error in reading low voltages.

8. See that the automatic filler maintains the proper level of the electrolyte in the pilot cell.

9. On control batteries take specific-gravity readings of the pilot cell every six hours when the battery is discharging, daily when the battery is floating, and hourly or oftener when the battery is being charged; also of all cells just before and just after the equalizing charge.

10. On power batteries take specific-gravity readings of the pilot cell daily if the battery is stand-by or floating, hourly if the battery is regularly worked, and hourly or oftener when the battery is being charged; also of all cells just after each equalizing charge.

11. Take voltage readings of all cells just before the conclusion of the equalizing charge, after all cells are gassing freely.

12. Never charge a battery at a higher rate than that given by the manufacturer for the particular type of cell.

Even the normal rate may produce excessive gassing as the battery approaches the fully charged condition; if so, the rate should be reduced.

*Abstracted from the operating code of the Philadelphia Electric Company.

The Meaning of Flue-Gas Temperature Readings

FLUE-GAS temperature in conjunction with CO_2 readings constitute one of the most effective indications of the efficiency of heat transference in the boiler, the completeness of combustion and the conditions of the boiler settings. The significance of certain combinations of temperature and CO_2 readings are given in the accompanying table.

CONDITIONS INDICATED BY COMBINATIONS OF TEMPERATURE AND CO_2 READINGS

Condition	Indicates
Low temperature, high CO_2	Good settings, good heat transfer and good combustion.
Low temperature, low CO_2	Poor combustion or good combustion with excessive air leakage through the settings.
High temperature, high CO_2	Good settings, good combustion and poor heat transfer.
High temperature, low CO_2	Good settings and poor combustion, with poor heat transfer, or leaky settings and good combustion with poor heat transfer.

A Plan for Studying Rural Territory*

Empire State Gas and Electric Association Recommends Procedure and Suggests Bases for Distribution Layouts

By Bert H. Shepard

Consulting Engineer, Syracuse, N. Y., Chairman Rural Lines Committee, Empire State Gas and Electric Association

IN ORDER to provide adequate means for serving the rural sections electrically in a manner which will assure satisfactory service at rates consistent with investment and other costs, it is advisable to make a study of the entire section to be treated as a unit for averaging purposes.

The first step in making such a study is to determine the extent of the territory to be included in a uniform rural charge area. Some utilities may find it advantageous to consider their rural territory as a whole and have a uniform rural charge throughout all rural sections; others may find it desirable to consider the rural territory surrounding each large center by itself or to subdivide such territory into segments. Determining factors include the general scope of the utility's operations, the extent and character of its territory, the rate at which it desires to effect the rural development and the relative advantages and disadvantages of uniform or varying rural charges for different sections. In the case of a complete rural development this resolves itself into consideration of the advisability of averaging the rural charge throughout the entire rural territory, a question which can best be answered by each utility after a careful consideration of its case.

Method of Procedure

Following the determination of the extent of the territory to be included in the uniform rural charge area, a topographical survey map (scale 1 mile to the inch) or its equivalent should be procured and upon it should be shown the boundaries of the urban rate areas, the proposed rural charge area and the location of all wire-carrying lines regardless of ownership, proper symbols being used to indicate the character of the different lines and service and their availability for carrying rural distribution circuits. On this map should then be indicated the location of all present and prospective customers. Appropriate symbols should be used to distinguish the different classes of service which may be as follows:

1. Lighting only.
2. Lighting and small power (i.e., milking machine, pumping or utility motor).
3. Lighting and large power (i.e., over 5 hp.).

These should be marked so as to denote present customers, the first year's growth, the combined second and third years' growth, and possible future growth beyond the third year. Such symbols might consist of a small dot to represent lighting only, a small dot surrounded by a small circle to represent lighting and small power and a large dot to represent lighting and large power, black being used to denote present customers, red to denote first-year "prospects," green to denote second and third-year "prospects," and yellow to denote "prospects" beyond the third year.

In congested sections, where the scale of the map will be found too small to show clearly the information desired, the section in question may be surrounded by a closed line and the information tabulated separately with a proper reference to the section. In the case of a very large area a saving in time and expense may be effected by first making a general survey of the territory with respect to possible customers and construction costs and then taking for detailed study a section large enough to be fairly representative of all conditions.

After such a map has been prepared, showing the location of the rate area boundaries, present wire-carrying lines and present and future customers, the rural territory should tentatively be divided into sectors, each sector to include that portion of the territory which should be served by a main feed circuit and the territory tributary thereto. In general, the boundaries of each segment will be such that the distance from the location of all customers within the segment to the point of the supply for that segment, via the tributary and main feed circuits, will be shorter than the distance to such point by any other route. The side boundaries of such segments will, therefore, be so located that points along them will be equidistant from the point of supply via the alternate routes. These boundary lines will extend from the boundary of the urban rate area at one end to the outer boundary of the rural charge area at the other end.

Value of Dividing Area

The object of dividing the rural territory into segments is to obtain a more comprehensive circuit layout than would otherwise be possible. In order to effect economy the territory in each segment should be developed in a certain fixed way, i.e., along the main and tributary highways, each segment being considered a complete unit, its development in no way affecting the development of the other segments except in so far as the rural development as a whole affects the further development of the territory. There are, of course, cases where it will be advisable temporarily to serve customers in one segment by means of circuits extending from an adjoining segment, but care should be taken to see that the minimum amount of plant will be cut dead when the particular customers in the adjoining segment are served in the proper way, i.e., by circuits along the main highway in the segment where they reside. If this latter point is not

*From a report presented at the Commercial Section meeting of the Empire State Gas and Electric Association at Briarcliff Manor, N. Y., June 28 and 29.

observed closely, it will be impossible to guard against errors in the design and construction of plant, and the work undertaken now probably would not fit in with future work.

Following the completion of the map a preliminary estimate should be made of the cost of connecting all of the prospective customers (not including motors and meter installations). In making this estimate it will, in general, probably be found satisfactory, on account of the scattered location of customers, to assume a 1½-kva. transformer installation for each customer and to neglect secondary distribution entirely. From this estimate the average number of customers per mile of line and the average cost of a mile of line may readily be determined.

SUGGESTED BASIS OF PLANS

Some utilities may not find it necessary to make an estimate for more than a single segment in order to arrive at the average cost of a mile of line, and it is, of course, apparent that the average number of customers per mile may be determined after the circuits have been laid out and without any estimate of cost. The idea is that only sufficient territory be covered to permit the determination of a true average cost. In the making of such estimates and the extension of rural service the following points are suggested for consideration by the utility companies concerned:

1. Plan the development along the line of single-phase service for lighting and power not to exceed 5 hp. per customer, where small power will eventually be used as in the case of a dairy farm. Where a greater demand than 5 hp. is required by any one customer, consider him alone or in combination with others desiring similar service, but do not include such in the general average.

2. To make a proper development the route selected for the circuits must always be the least expensive, i.e., of minimum length. Exceptions may, however, arise where it will be cheaper to serve customers by means of an existing route slightly longer than the theoretical route.

3. All pole-line extensions must be adequate to care for the final development, i.e., the construction must be heavy enough to carry the number and type of circuits which the final development involves.

4. The cost of all spur pole-line construction on private property should be borne by the customer or customers affected, and all maintenance, taxes and renewal expense of such lines should also be borne by the customer.

5. Signed rights-of-way should be secured for all pole-line construction on private property, whether for main routes or spurs to serve individual customers, so as to facilitate the use of such construction to serve other customers if desired.

6. Along improved highways or highways likely to be improved, consideration should be given the future use of pole lines for carrying highway lighting circuits.

7. Wherever economically possible, pole lines should be jointly used with other companies. Where such lines are used upon an attachment basis or the utility's transmission pole lines are used to carry rural distribution circuits, cognizance should be taken of the proper proportionate investment value of lines devoted to this purpose.

8. In starting the actual development of any one segment it is advisable to canvass the entire segment and develop it as completely as possible at the outset in order to overcome the disadvantages resulting from piecemeal construction and to make as much use of the facilities as possible from the beginning. Besides, it frequently happens that certain prospective customers will at the outset interest themselves in obtaining additional customers and rights-of-way in order to make certain of getting their own service, while after they once obtain service their interest in large degree ceases.

Salt Lake's Fourth Annual Electric Cooking School

THE annual electric cooking school conducted by the Salt Lake *Telegram* was held in Salt Lake City in the week of June 11. Miss Edith Clift, domestic science expert and demonstrator, gave lectures each day and by practical demonstrations impressed the hundreds of housewives who attended with the advantages of cooking electrically.

In addition to exhibits and advertising features displayed by electrical firms, several merchants entered exhibits and booths at the school. To tie in with this advertising there were many items in the news columns of the paper covering the advantages of more extensive use of electricity in the home.

The attendance at each daily session was large, and it was noted that a keener interest than ever was shown by the spectators. The school was conducted in the ballroom of the Hotel Utah and was the fourth annual event of this kind which had been held.

ONE OF THE WELL-ATTENDED SESSIONS OF SALT LAKE'S ELECTRIC COOKING SCHOOL

Electric Trucks Indispensable to Railway Express

PERHAPS the best evidence that the electric truck is a well-proved economic unit in application, design and operation is the fact that 86 per cent of all electric truck business during the past year represents "repeat orders." The recent order of the American Railway Express Company for twenty-seven "electrics" to be used in Oklahoma City brings the total country-wide fleet of the largest user to approximately 1,400 trucks in daily operation. This company, whose business is entirely that of transportation, has proved that for short-haul, frequent-stop service the electric truck has no real competitor. A realization of this truth prompted President Robert E. M. Cowie to declare: "The electric truck in the service of the American Railway Express is indispensable."

The trucks to be used in Oklahoma City will replace approximately a hundred horses and wagons and four trucks of another type. They include two 1-ton, twenty 2-ton and five 3½-ton trucks.

A few months ago the same company placed twenty-five trucks in San Antonio to replace a hundred horses. In New York City twenty 3½-ton trucks were ordered the latter part of June. This brings the total in the metropolitan district to 564. Each truck included in this latest purchase is equipped with the Stone cradle, permitting an exchange of batteries in less time than the chauffeurs can change from street clothes to uniforms. These trucks will be in operation from eighteen to twenty-two hours per day, the

batteries being exchanged between 11 a.m. and 3 p.m.

As an indication of the amount of electricity which will be used by this fleet of twenty trucks with forty batteries it is estimated that the consumption will be equivalent to that of a thousand residence customers.

Thirty-Day Campaign Sells 300 Electric Waffle Irons

RECENTLY the Washington Water Power Company of Spokane conducted a one-month sale of electric waffle irons which resulted in the sale of 300 pieces. Prior to the campaign the waffle irons had been on display in the company's electric shop, but no special effort had been made to stimulate sales and only a few had been sold as the public was rather indifferent in regard to this appliance.

No preliminary advertising was done, but beginning the first of the month small advertisements were run in the Spokane papers offering the waffle irons at a price of $10.85, somewhat below the regular price. A recipe for waffles was printed in these advertisements, and waffles were served daily from 2 p.m. to 4 p.m. in the electric shop. Other goods were mentioned in the same advertising, although the waffle iron was played up during the whole month.

NEWSPAPER PUBLICITY USED TO BUILD RANGE LOAD

A return post card was distributed to residential customers with all bills issued during the month. This made it very easy for the customers to order the appliance, and this fact was considered to be directly responsible for the success of the campaign.

Advertising Campaign to Build Range Load

TO STIMULATE interest in the electric range and build up its range load the California Oregon Power Company is putting on an advertising and educational campaign dealing with the advantages of electric cooking. The advertisements consist of a series of eight insertions, two of which are shown here, and appear in eighteen daily and weekly papers in the territory served by the company. The company does not engage in the retail appliance business, but pays for all the advertising and it enjoys the fullest co-operation of the local electrical dealers, who benefit as much by the campaign as does the central station.

The newspaper advertising, however, is subsidiary to personal letters to consumers in which the special advantages in each individual case are pointed out. Responses to these letters are turned over to the electrical dealers to follow up. These letters, which are signed by the district manager, tell a particular customer just what his average lighting bill amounted to for the past year and call his attention to the fact that for the additional sum of $3.06 per month he can enjoy the comforts of an electric range.

Many customers of the company are the people in small towns and rural communities where timber is plentiful and firewood cheap. Accordingly the point of the argument in each advertisement is that the customer enjoys all the advantages of electric cooking at an operating cost no greater than that for other fuels. It is pointed out that the average monthly bill for the past year in a certain district for both lighting and cooking was only $5.53.

Information Bureaus Effect Better Public Relations

CONVINCING testimony as to the good effect of information bureau work upon public relations and the sale of utility securities throughout the country is presented in the second annual report of the New England Bureau of Public Utility Information. Commenting upon this, Director Joseph B. Groce says in part:

The business of all the public utilities has been excellent during the past year. New financing has been accomplished with little difficulty, and the securities of the public utilities have appreciated in value all over the country. Every reputable banking house is today recommending public utility securities as among the safest and best in the country. The daily newspapers are full of investment bankers' advertisements telling of the worth of public utility bonds and stocks.

Here is perhaps an indication of the intangible results of the work of these public utility information bureaus; and, after all, the intangible results are probably as important as the tangible ones. The bankers of the country are unquestionably convinced that the public utilities are being wisely managed and are recommending the securities of these public utilities to the public. Were not these bankers assured that this great industry was being conducted safely and sanely, they would not offer these securities to the public, and had not the thinking public been educated to a realization of the absolute necessity of these public utilities in the development of the state and the country, and to a knowledge of the true worth of these securities, the public would not be buying the securities by the thousands.

If the public utility information bureaus now established in the United States, serving states, had done nothing else than distribute their news bulletins, in which the facts in regard to the public utility industry are told, among the reputable banking houses of the country, the information bureaus would have well repaid their sponsors for the money expanded.

The nation-wide publicity movement of these state bureaus means that at the present time there is a combined circulation of considerably more than 50,000 bulletins going out each week, all over the country, to the newspapers, state public utility commissioners, banking houses, public and college libraries, chambers of commerce and boards of trade, Kiwanis and Rotary Clubs and similar organizations, and dealers in appliances, giving accurate information in regard to the public utility industry. Such a distribution as this, of the kind of information these bulletins are publishing, is bound in itself to bring results, and when it is realized that hundreds of columns of material clipped from the bulletins are being published in the newspapers each week, the influence of this work is seen to be indeed far-reaching.

The effect of this work on the editorial columns of the daily newspapers of the country is an interesting development. There has always been a group of newspapers with vision, which have realized the tremendous influence of this great public utility industry in the development of the country and the essential character of the services this industry renders in making for prosperity; that the public utilities, regulated as they are by state commissioners, are doing a good job and are entitled to fair treatment both by the public and by the press. If criticism of the public utilities is made in their editorial columns, it is constructive criticism and is tolerant.

On the other hand, there has been a radical group of newspapers, an intolerant group, which has seemed to take delight in "knocking" the public utilities at every opportunity and has persistently advocated public and municipal ownership of these utilities, the continuous failures of such ownership having had little influence on these papers.

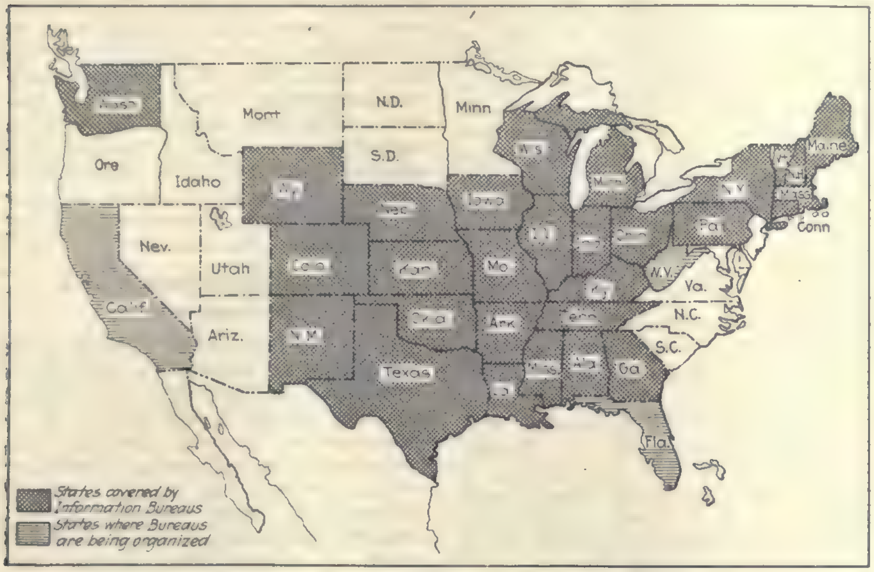
It is with this last-named group of papers that we believe the public utility information bureaus are having considerable influence. So long as yellow continues a color of the spectrum there will always be in the world a certain type of newspaper; but newspapers are somewhat like politicians in that they are both influenced by public opinion, and the people today are not generally "knocking" the public utility. Gradually it is being brought home to the United States citizen that every time a public utility is attacked unjustly it is an attack on something in which he is personally interested, that his national and savings bank funds are being jeopardized by such attack, that his insurance policies are involved because of the large amount of money invested by insurance companies in public utility securities. Then, too, the public, the customers of the public utilities, have directly and personally invested thousands of dollars of their savings in these same public utilities. These investors are decidedly interested today in seeing that the company in which they have invested their savings gets fair treatment—a decent rate of return on the money invested. This customer ownership is the genuine public ownership of the public utilities.

One result of the work of the public utility information bureaus lies not so much in what the newspapers do not say today in the editorial columns as in what they do say. The information supplied to the newspapers answers many questions in regard to the public utility industry which were perhaps never before understood. The result is that the newspaper editor himself has a different slant on the industry from what he had before. It was a frequent occurrence not so long ago for editorials to appear in the newspapers with a questioning title:

"Why does the gas or electric light, or telephone, or street railway company do so and so?"

We do not see so many editorials of that type these days.

This publicity work on the part of the public utilities, through the information bureaus, has now become a nation-wide movement in the interests of the public utility industry as a whole. Last year at this time the New England Bureau was the only one in the East. A most successful bureau is now in operation in New York State, and one in Pennsylvania has just been established. Eight Eastern states therefore are at the present time carrying on this work.



FIVE-EIGHTHS OF THE UNITED STATES IS NOW COVERED BY PUBLIC UTILITY INFORMATION BUREAUS

What Other Companies Are Doing

Reading, Mass. — Fifty electric ranges were sold in eight weeks as a result of popular interest created by good demonstration methods at an electric show held here recently by the Municipal Light Department with the co-operation of local contractor-dealers. A. G. Sias is manager of the Municipal Light Department, which serves the towns of Reading, North Reading, Wilmington and Lynnfield Center.

Scranton, Pa. — The Electrical Association of Scranton is planning to conduct an electrical show this fall at which exhibits will be confined to electrically operated appliances, fixtures, radio sets and so forth. Scranton is the metropolis of the anthracite coal region and is known locally as "the Electric City." F. L. Smith is chairman of the show committee.

Providence, R. I. — Every executive of the Narragansett Electric Lighting Company is now using an electric range, and a few have electric water heaters, with many miscellaneous appliances in employee service. Appliances for domestic use are frequently loaned to salespeople employed by the company.

Denver, Col. — Complete charge of the washing-machine department of the Denver Gas & Electric Light Company has been assumed by George Williams of the 1900 Washer Company, and a special sales force of representatives to work in the residence section of the city has been organized. It is understood that financing and servicing will be assumed by the central station as formerly.

Chicago, Ill.—Announcement has been made that the Commonwealth Edison Company, the People's Gas & Coke Company and the Public Service Company of Northern Illinois have purchased a tract of about 150 acres of land with beach frontage on Lake Geneva, in Wisconsin, at a price of $150,000, for use as a summer resort and recreation ground for the employees of these companies. The place is already partly equipped for use, and a further extensive development for the benefit of the employees of the companies is contemplated.

Salt Lake City, Utah — A very effective method of interesting merchants in the value of correct window lighting and of displaying the various color effects was adopted by the Utah Power & Light Company for a period of several weeks. The goods of various dry-goods merchants, florists and others which responded to color effects were displayed in the power company's window with the full benefit of the proper lighting methods. These displays attracted considerable attention from the public and proved of value to the merchants in advertising their goods, clearly demonstrating to them the favorable results which could be obtained by proper lighting.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Hydro-Electric Development and Steam Equipment

High-Pressure Reinforced-Concrete Penstocks.—NICOLA KELEN.—The reinforced-concrete penstock has not been used to a great extent and when used it has been for comparatively low pressure only. On account of the high cost of steel, the author suggests the use of reinforced-concrete penstocks for high pressure and gives a theory for their design. To withstand high pressure the penstock is coated inside with a sheet of steel which absorbs part of the internal pressure, the concrete taking care of the rest. Not only is the strength of the assembly thus greatly increased but the cost is diminished. The article contains charts and examples.—*Ingegneria*, Vol. II, No. 3.

Automatic Control of Combustion.—E. M. ELIOT.—Three factors that enter into the automatic control of combustion boilers in using forced draft are the air supply under the fire, methods of heating the fuel and the draft over the fire. The author analyzes each of these elements with special reference to the simplicity and directness with which the machinery in each case is controlled.—*Power Plant Engineering*, May 15, 1923.

Various Systems of Burning Pulverized Coal.—C. F. HERINGTON.—A comparison is made between the bin, air-distribution and unit systems, with an estimated cost for each of these types of installation.—*Blast Furnace and Steel Plant*, June, 1923.

Steam Plans in Tuscany.—E. HAHN.—On account of the scarcity of coal, oil and wood in Italy, use has been made of three unusual fuels, namely, peat, lignite and natural steam. The author describes how lignite fuel is used in boilers and gas producers at San Giovanni Valdarno. In another plant at Lardarello power and boric acid are derived from natural steam.—*Power*, June 5, 1923.

Generation, Control, Switching and Protection

Reactive Power in Three-Phase Circuits.—G. W. STUBBINGS.—Methods of charging for electric power supplies designed to induce consumers to install power-factor-correcting devices call for the determination of the wattless kilovolt-amperes in the supply. Although the exact method of determining this quantity is quite simple, indirect and approximate methods have been devised and are in use. This paper considers such approximate methods with a view to determining the errors likely to occur.—*Electrical Review (England)*, June 1, 1923.

Steam-Turbine Governors and Valve Gears.—E. H. THOMPSON.—The author discusses the causes of hunting in auxiliary driven valve gears, such as hydraulic, mechanical and steam-cylinder types, including those encountered in connection with direct-acting gears, with the addition of minor causes of pulsation peculiar to individual constructional features. Special adjustment is usually necessary in each type for smooth operation. Information of this type is found in the first section of this article. In the second section dashpots, synchronizing springs and pilot valves are considered.—*Power*, June 19 and 26, 1923.

Desirable Duplication and Safeguarding in the Electrical Equipment of a Generating Station.—W. F. SIMS.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. summer convention, July 7, 1923, page 21.—*Journal of the A. I. E. E.*, July, 1923.

Transmission, Substations and Distribution

Care and Operation of Power Transformers.—A booklet giving recommendations of the Electric Power Club for the proper care and operation of power transformers. It is written from the standpoint of those responsible for inspection and maintenance of power transformers and tells how this equipment should be handled, installed, treated and kept in proper condition. The instructions apply particularly to power transformers (sizes over 200 kva.), but will also apply to high-voltage distribution transformers.—*Electric Power Club Bulletin*, May, 1923.

Use of Bronze Wire for Transmission Lines.—R. EDLER.—Little attention has been paid so far to the possibility of using bronze wires and cables for high-voltage transmission lines. The following mechanical, electrical and cost data have to be considered:

	Copper	Bronze
Electric conductivity	57	40
Permissible stress, kg. mm.:		
Solid wire	12	18
Cable	16	24
Elastic limit, per cent of break load	40	85
Cost	100	110

Data are compiled on a large number of assumed line conditions, which show that a bronze line is mechanically superior to a copper line. Owing to longer possible spans bronze wire, it is claimed, is frequently cheaper also. To produce reliable bronze with electric furnaces is as simple and uniform as the manufacture of bimetallic conductors, like copper-steel. The author claims that it is not justifiable to discard the possibility of using bronze as a conductor solely on account of its higher electric resistance. He develops formulas for comparing bronze and copper wire.—*Elektrotechnische Zeitschrift*, May 27, 1923.

Standards for Electric Service.—A full discussion of engineering and technical features underlying standards for light and power services. Twenty-two states, through their public service commissions, have adopted electric service rules, many of which are based upon suggestions contained in this bulletin. The new edition presents a suggested set of rules suitable for adoption in any state with such changes as may be necessary because of local conditions.—*Circular No. 56 of the Bureau of Standards.*

Units, Measurements and Instruments

Measuring Peak Value of Very High Potentials.—A. HUND.—The method is based upon the fact that any voltage variation in the anode branch of a three-electrode electron tube may be compensated by a certain auxiliary voltage between the heated cathode and the grid. With two variable air-dielectric condensers, arranged and connected in potentiometer fashion, the high potential is reduced to a suitable small value, and this is compensated by the grid potentiometer until the anode current disappears (null method). The results are independent of the frequency.—*Jahrbuch des Drahtlosen Telegraphie und Telephonie*, May, 1923.

Standardized Entrance Switches.—The article tells how the standardization of meter switches is being promoted by Western utilities. The many advantages obtained by standardized meter switches are discussed.—*Journal of Electricity and Western Industry*, June 15, 1923.

Bridge Method for Determining Dielectric Losses at Wireless Frequencies.—M. D. HART.—The method described was devised with a view to the investigation of the losses which occur in soil. It was found possible to measure at various frequencies. the capacity and equivalent resistance of the condensers employed, and the latter was found to be unexpectedly large.—*Journal of the Institution of Electrical Engineers (England)*, June, 1923.

Effect of Transient Voltages on Dielectrics.—F. W. PEEK, JR.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. summer convention, July 7, 1923, on page 16.—*Journal of the A. I. E. E.*, June, 1923.

Illumination

Manufacture of Lamp Bulbs.—G. GEHLHOFF.—Germany produces today about 250,000,000 glass bulbs for incandescent lamps per year, of which 20 per cent are for export, the industry employing about four thousand men. All bulbs are blown individually by hand, because it has been found that

the Westlake automatic machine turns out a poorer average and costs more to operate than manual labor. A skilled workman can make 600 bulbs in an eight-hour day. In one melting furnace there are usually eight to ten individual crucibles, each containing 250 kg. of molten glass. About fifty men work on one furnace, which is fired by soft coal. The necessary high heat resistivity of the glass requires a large percentage of lead. The melting temperature of the mixture is about 1,400 deg. C. Carefully packed in corrugated paper or straw, the breakage in transportation can be reduced to an average of 2½ per cent.—*Zeitschrift des Vereines Deutscher Ingenieure*, May 26, 1923.

Better Lighting for Drug Stores.—W. STURROCK.—As drug stores usually operate longer hours each day than other classes of stores, the value of light is much greater for the drug store. Quality of light, intensity, reflectors and diffusing units and location of fixtures are among the subjects discussed in this article.—*Central Station*, June, 1923.

Motors and Control

"Mother Ship" for Submarines.—W. F. POT.—A complete description with diagrams is given of an electrically propelled submarine "mother ship" and airplane carrier using the Ward Leonard system of control.—*Ingenieur*, May 26, 1923.

Pulling an Induction-Type Synchronous Motor Into Step.—L. H. A. CARR.—The author gives a mathematical determination of the limiting conditions under which an induction-type synchronous motor will pull into step.—*Journal of the Institution of Electrical Engineers (England)*, June, 1923.

Flexible Couplings for Steel Mills and Other Drives.—A symposium that covers all of the most important flexible couplings now manufactured and used in this country. It consists of seven papers discussing the relative advantages and disadvantages of various types of couplings, followed by a general discussion.—*Bulletin of Association of Iron and Steel Electrical Engineers*, June, 1923.

Electrical Equipment in Mines.—FREDERICK KRUG.—The practice at the isolated plant of the New York & Honduras Rosario Mining Company is described. Motors, transformers and other machines used are discussed with the reasons for their selection. Tables give the electrical power distribution for typical months and the connected motor load in horsepower for this mine.—*Engineering and Mining Journal-Press*, June 30, 1923.

Heat Applications and Material Handling

Comparative Costs of Electric, Coal and Combined Cooking.—J. RUTISHAUSER.—In a Swiss sanitarium caring for 180 patients extensive cooking tests were carried on during the last year to arrive at reliable cost data for different cooking methods. The kitchen was equipped with up-to-date electric heating devices and with a large coal range. Every test was carried on for a week, so that at the end of the year seventeen results for each method were available. During the coal-range tests all necessary hot water was obtained from a heating coil in the oven. During the winter months the kitchen had to be heated by coal when cooking was done electrically. The cost, including wages and expense of heating water, is given in the accompanying table. It is claimed that electric cooking saves 1,584 francs per year as compared with coal cooking. It was found that 1.35 kw.-hr. is required to replace 1 kg. of coal. The electric kitchen had a capacity of 75 kw. All costs are based on a current rate of 0.10 franc per kilowatt-hour for cooking and 0.04 franc per kilowatt-hour during night hours for water heating.—*Bulletin de l'Association Suisse des Electriciens*, May, 1923.

COST OF COOKING BY COAL AND BY ELECTRICITY

	Francs per Day for 180 Persons
Cooking by coal	19.30
Cooking by coal and electricity	18.46
Cooking by electricity:	
In winter, with coal-heating of kitchen	15.41
In summer	14.51

Development of the Large Electric Melting Furnace.—F. HODSON.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. spring convention, May 5, 1923, on page 1025.—*Journal of the A. I. E. E.*, June, 1923.

Electrophysics, Electrochemistry and Batteries

Magnet Steels.—J. F. KAYSER.—At present four types of steel are available, the tungsten-steel and chromium-steel types, giving coercive forces of from 60 to 70 and remanence of from 10,000 to 12,000, and the cobaltcrom and cobalt magnet steels, giving coercive forces of from 180 to 300 and remanence of from 8,000 to 10,000 according to composition. The various characteristics of each type of magnet steel, magnetic standards and alloys with greater coercive force are among the subjects considered.—*Electrician (England)*, May 25, 1923.

Magnetic Losses in Solid Iron.—E. ROSENBERG.—If the thickness of a solid steel plate or steel bolt which is placed parallel to the laminated part of the iron core so that the magnetic flux is parallel with its long dimension exceeds a certain minimum, the magnetic loss in this plate or bolt will no longer depend upon the volume but upon the surface of the plate in the direction of the flux. Only a comparatively thin outer layer of the solid iron carries flux and causes losses, while the inner part remains practically free from induction and carries no current. Simple formulas are given for calculating the depth of magnetic penetration and the losses per unit of surface. The penetration is inversely proportional to the square root of the frequency. Heavy end plates of cast iron will cause larger losses than those made of steel or cast steel. Increasing the thickness of an end plate will not cause larger losses, but two ½-in. end plates will give more loss than one 1-in. plate, on account of the larger surface in the former case. The losses in a solid steel bolt will be increased about 50 per cent if the bolt is cut in half lengthwise. All these results, theoretically arrived at, were checked very closely by actual tests and measurements in the laboratory.—*Elektrotechnische Zeitschrift*, May 31, 1923.

Traction

Electrification of Swedish Railroads.—AXEL F. ENSTRÖM.—This paper gives a short review of the present situation in the electrification of railroads in Sweden. Up to this time the controversy has concerned the different electrical systems. Single-phase and direct current now receive equal consideration except for long distances where the single-phase system receives preference. The author adds to the discussion by a comparison between steam power and electric power for the Stockholm-Gothenburg railroad (about 300 miles). The analysis indicates that the electrification of this road may be undertaken with assurance of economical success.—*Teknisk Tidskrift (Swedish)*, April 7, 1923.

Details of European Electric Locomotives.—H. A. KJELSBERG.—Clearances and other physical limitations greatly affect the design of foreign motive power, and consequently complicated designs are much more in evidence in Europe than in America, where locomotive designs are featured by simplicity and easy maintenance. General comparisons of frames, brakes, drive, equalization, etc., are made.—*Railway Age*, June 16, 1923.

Telegraphy, Telephony, Radio and Signals

Recording of Signals in High-Speed Radio Telegraphy.—N. W. MCLACHLAN.—The author gives a general outline of the various recording systems now in use for the transmission and reception of high-speed signals in radio telegraphy. The technique of radio recording has improved until it is possible to work at much higher speeds than formerly. After comparing standard simplex and duplex systems of radio signal transmission with the ordinary line telegraph, he considers the propagation of electromagnetic radiation through space. The method in which the various types of antenna are utilized in signaling and the various circuits employed are discussed in some detail. Several typical valve-recording circuits for single-current working and the methods of double-current working are described with diagrams of the layout of the apparatus.—*Beama (England)*, June, 1923.

Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

Conducted by PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N.Y.*

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Current Transformer for Calibration Purposes

Current transformers for laboratory and portable use of the through type, permitting the threading of one or more primary turns, have been available for some time. During the past year, however, one of the instrument makers has developed a current transformer of this type with additional self-contained primary connections which can be varied through a certain number of combinations, giving an extremely wide primary range of current from 10 amp. to 800 amp. This transformer should give a better degree of accuracy than can be obtained from preceding types of portable current transformers.—*Instruments and Measurements Committee of the A. I. E. E.*

Foundry Pattern Plates, Electrically Heated

The production of clean, smooth castings from molds made with metal patterns is possible only when the molding sand does not stick to the pattern while it is being removed from the mold. There is a tendency for a cold metal pattern to "sweat" or collect moisture from the sand. A method has been developed for heating the patterns electrically. The heaters consist of a ribbon heating unit inclosed in a steel casing. It is made in two widths and various lengths so that any kind of molding table or molding machine can be equipped with very little work.—*Westinghouse Electric & Manufacturing Company, East Pittsburgh.*

Furnace, Induction, Circulating Type of

In the usual induction furnace the power factor is low, making it difficult to deliver large amounts of power. The magnetic leakage around the charge makes it almost impossible to use such a furnace for high-conductivity metals, such as copper and brass, because the magnetic field causes periodic interruptions in current (pinch effect). These drawbacks have been eliminated in a new furnace in which the iron core and the primary winding are placed at the bottom of the molten-metal bath and only the lower part of the charge serves as the secondary turn. The primary winding being placed to one side, the repulsion between it and the molten metal causes a unidirectional circulation of the latter, thus communicating the heat to the rest of the bath. A sketch of this furnace will be found in the *General Electric Review*, 1923, Vol. 26, page 24. [This furnace is not only a notable practical achievement, but is also of interest as an application of electromagnetic forces discussed by Dr. Carl Hering in the *A. I. E. E. Journal*, 1923, Vol. 42, page 139. Since these forces can be made to produce continuous motion, it should be possible to design an electric motor based on this principle. The phenomenon being reversible, such a machine should also operate as a generator.—EDITOR.]

Fuses for Potential Transformers, Expulsion Type

Tests have been made on expulsion-type 13,200-volt fuses for the protection of potential transformers, and their use in this particular application is not recommended. On a dead short circuit recoil forces sometimes tear the fuse off, and the flame may start an arc to the ground followed by a short-circuit between the adjacent phases. A wire resistor in series with such a fuse makes it safer, but even then the use of expulsion fuses is not advised with station potential transformers.—*A. F. Bang, Pennsylvania Water & Power Company, Baltimore.*

Lamps, Comparison of, at 1,000-Hour and 1,500-Hour Efficiencies

Tests were made by several observers to determine whether or not the slight decrease in candlepower due to the adoption of 1,500 hours as the standard life in preference to 1,000 hours could be detected. Under conditions purposely arranged to favor the comparison it was found that the smallest differences in candlepower that could be detected by visual observation were considerably larger than the differences in candlepower between lamps of 1,000-hour and 1,500-hour efficiencies. From the data obtained a new set of specifications for the purchase of vacuum and gas-filled multiple lamps was drafted. A revision of the specifications for series lamps was also made.—*Hydro-Electric Power Commission of Ontario, Toronto.*

Magnetic Alloys (Permalloy)

A new iron-nickel alloy has been developed whose permeability is very much greater than that of the best magnet iron. It is being tried in a new submarine cable and is expected to increase the speed of sending with the cable about four times. It also has valuable uses in telephone and radio transformers and induction coils. In addition to its high permeability, it has a very small hysteresis loss. The electrical resistance is found to vary with the strength of the magnetic field in which the alloy is placed, so that a difference amounting to three-tenths of 1 per cent is caused by the earth's magnetic field. Its electric and magnetic properties are also changed by the application of a load.—*H. D. Arnold and G. W. Elman, Western Electric Company, New York City.*

Welding, Suitability of Various Materials for

A sound weld can be obtained only when the metal fuses evenly and quietly and without excessive sputtering and boiling. This means a material thoroughly degasified and low in gas-forming elements. Freedom from slag or slag forming constituents is also essential. Strips under test were heated by an electric current, which was gradually increased until the strip was brought slowly to the melting point. The iron samples melted quietly and threw out very few sparks, while other grades of material threw out a shower of sparks and left a very rough surface after fusion. —*J. H. Nead and R. L. Kenyon, American Bureau of Welding.*

In Progress or Purposed

Agriculture, Electricity in

The action of artificial light on plant growth is receiving considerable attention. New investigators have started experiments in this field, and it is anticipated that in the near future elaborate equipment for experimental purposes will be available. A systematic and thorough study, with the various elements carefully controlled, is planned.—*General Electric Company, Schenectady, N. Y.*

Cables, Paper for, Endurance Tests on

A folding endurance tester has been developed by means of which a sample of impregnated paper can be subjected to repeated folding until it breaks. The tests now under way will cover only the question of depreciation of the paper due to heat alone and not when subjected to dielectric stresses. Later it is the intention to make similar tests to discover the rate of depreciation of impregnated paper insulation when subjected to various high dielectric stresses, and also the rate of depreciation when the insulation is subjected to both dielectric stresses and heat at the same time.—*V. Bush, Massachusetts Institute of Technology, Cambridge, Mass.*

Cast Iron, Electric Arc Welding of

Determination of the proper current to get the best adhesion between filler and base metals, determination of the proper electrode to get the best adhesion, prevention of the hard zone at the junction of the filler and base metals, prevention of free carbon and slag in the weld metal, study of straight versus reversed polarity, high versus low temperature welding, prevention of the closing of the "V's" opening between plates while welding, multiple interlocking layers versus a single spirally deposited layer, single versus double-V groove and a method of determining the grade of the cast iron constitute a "proposed program of research."—*American Bureau of Welding.*

Furnace, Electric, for Brass

A study of brass-furnace practice in the United States indicates that the complete substitution of electric furnaces for the crucible and oil-fired types should result in savings in the brass-melting industry amounting to two or three million dollars a year. If all brass made in the country could have been melted electrically in 1917 and 1918, the war expenses of the country would have been reduced about twenty million dollars.—*H. W. Gillett, Bureau of Mines, Washington, D. C.*

Monochromatic Light, Lamp Producing

Experiments have been made by the Bureau of Standards in connection with the production of light sources from which pure monochromatic light of various wave lengths and great intensity may be obtained. An inclosed quartz vacuum lamp using an alloy of gallium and zinc, similar in many respects to the cadmium-gallium lamp previously designed, has been perfected. The lamp operates quite satisfactorily with very little flickering, giving several intense lines, one red, and several blue and green. The results with a thallium lamp so far have not been entirely satisfactory owing to the high temperature at which it is necessary to run the lamp to prevent the thallium from depositing on the walls of the light space, thus covering up the arc.—*Bureau of Standards, Washington, D. C.*

Suggestions for Research

Gap, Dielectric, Cylindrical, for High-Tension Work

Let two identical circular cylindrical surfaces, made of metal, be placed near each other with their axes parallel. The electrostatic field between such surfaces is nearly uniform, and therefore such an arrangement may be useful both for measurement of high voltages and as a protective gap. It may have certain advantages over the sphere gap, because cylindrical surfaces are easier to make. Moreover, a larger spacing may be used without corona formation, thus increasing the range of voltages for a given set of cylinders. A theoretical and experimental investigation of the properties of such a gap is desired. The possibilities of a gap consisting of two concentric or eccentric cylinders should also be studied.

Grounding of Transmission Systems

The industry is sadly lacking in definite information as to why transmission systems are grounded or not grounded and what factors determine the method of grounding. —*A. I. E. E. Sub-committee on Grounding.*

Ionization Theory, Data

With the advancement of the theory of ionization by collision and its application to the design of electrical apparatus it becomes increasingly necessary to consult the numerical data on which computations of this theory and conclusions from it are based. At the present time such data are scattered in numerous books and magazines, mostly dealing with physics, and some of the data are contradictory. The numerical values should be given for air and for some other gases and should include the charge and the mass of an electron, ionizing rates, ionizing potentials, size, mass and the number of molecules per cubic centimeter, velocities and mobilities of ions, mean free path of molecules, coefficient of diffusion, number of collisions, etc. A few fundamental formulas and laws should also be included.

Welding, Electric

Various suggestions for research and a discussion of some incomplete developments in the arc-welding field by O. H. Eschholz will be found in the *Journal* of the American Welding Society, January, 1923; also *ibid*, April, 1923, page 28.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Big Merger Announced

Purchase of Control of the Wisconsin-Minnesota Company by the Byllesby Interests

ANNOUNCEMENT has been made of the purchase of control of the Wisconsin-Minnesota Light & Power Company by the Byllesby interests. The Wisconsin-Minnesota company has been controlled by the Kelsey-Brewer interests of Grand Rapids, Mich., and is the last of the large property groups in Wisconsin that these interests controlled, the eastern Wisconsin group having been sold to the Insull interests last year. The group acquired by the Byllesby interests centers at Eau Claire and serves seventy-three cities and towns, including La Crosse, Eau Claire, Chippewa Falls, Menominee, Wis., and Red Wing, Minn. Power has also been supplied to the Byllesby properties at St. Paul and Minneapolis over a 110-kv. line which ties the Byllesby and Kelsey-Brewer properties together. There are a number of water-power plants on the system, the two largest being those at Wissota, with approximately 40,000 kva., and Cedar Falls, with 7,500 kva. capacity. There is some 700 miles of transmission line operating at 110, 66 and 22 kv. in the system, which is one of the largest transmission systems in that part of the country. It is announced that the properties will be consolidated with the Northern States Power Company group. The following officers have been elected for the Wisconsin-Minnesota Light & Power Company: H. M. Byllesby, president; R. F. Pack, vice-president; Halford Erickson, vice-president; R. J. Graf, A. S. Huey, J. J. O'Brien, F. W. Stehr, F. C. Shenehon, J. H. Briggs, H. W. Fuller and John H. Roemer, directors.

New Type of Overhead Construction Tested at Erie

A new type of overhead trolley construction has been developed by the General Electric Company for use on heavy traction electric railways. A public test was given on the tracks of the General Electric Company at Erie, Pa., on July 16, 17 and 18, before a distinguished group of railway executives, engineers and operating men.

These public trials were for the purpose of showing that the new type of overhead construction can be used successfully for collecting current, either direct or alternating, for handling the heaviest railway traffic that can be anticipated in the future. A new record for current collection of more than 5,000 amp. was set up, which is considerably more than twice the amount of current now collected for normal requirements. This was done at speeds up to nearly 60 miles per hour, the current and speed apparently being limited only by the ability of the equipment.

The special feature is the method by which the trolley wire is suspended from the feeder messengers. This is accomplished by means of a lacing of copper cable, along the direction of the line, fastened with clips alternately to the feeder and to one or the other trolley wire. The spacings between clips on one wire vary from 15 to 20 ft., making the clips on the feeder messenger 7½ to 10 ft. apart. By this means great flexibility is obtained.

Water Power Future in State's Hand

Report of New York State Water Power Commission Says No Conflict Exists with Federal Commission—State Legislation for Water-power Development Is Recommended

NEW YORK STATE is in a position today to own and control all its water-power development upon its inland border streams and it should not adopt a dog-in-the-manger policy toward Federal encroachment on its water power by refusing to develop its own, or refusing to allow any one else to do it, is the opinion of Attorney-General Carl Sherman, State Engineer Dwight B. La Du, Deputy Attorney-General Edward G. Griffin, Charles A. Collins and John Godfrey Saxe, expressed in their report on the status of the state's action against the Federal government to test the constitutionality of the Federal water-power act.

The Federal government asserted its right to control or lease the use of water for power purposes on navigable streams within the state, and the state's suit was begun under the administration of former Governor Miller.

It is stated by the committee that the action has accomplished its purpose in the Federal government's disavowal of any intention to interfere with power developments in connection with the barge canal and its willingness to co-operate with the state and international joint commission in state development of power possibilities of the Niagara and St. Lawrence Rivers without claiming a right to share in profits therefrom.

State legislation is recommended to carry out this policy, which would mean the immediate development by the state of the undeveloped water power available on the Niagara and St. Lawrence Rivers. The absence of such a statute jeopardizes, it is believed, the rights of the state in its relations with the Federal government. Opposition to such legislation within the state would, it is said, be more dangerous than a positive refusal by the Federal government to execute a formal consent to the state's plan after such legislation is obtained.

Conferences in Washington by this committee and Hubert Work, Secretary of the Interior; Henry C. Wallace, Secretary of Agriculture, and O. C. Merrill, William Kelly, Major Lewis W. Call and J. F. Lawson of the Federal Power Commission resulted in the following recommendations to Governor Smith by the New York State Water Power Commission:

"1. That we do not commence the taking of testimony in the present suit at the present time, but, with the permission of the United States Supreme Court, permit the suit to stand along for the present, unless and until the Federal Power Commission should change its present conciliatory position.

"2. That the state of New York, at the earliest possible moment, enact the statute for state development recommended in your message of March 5, 1923 (the Rabenold-Hackenburg bill), so that the rights of New York may not be jeopardized and the development of its water power delayed because of the absence of such a statute.

"3. That the State Water Power Commission continue in close touch with the Federal Power Commission and endeavor to harmonize from time to time any conflicting claims which may arise, to the end that the development of the water-power resources of the state may be accelerated.

"4. That during the coming session of Congress Federal bills relating to water power be carefully scrutinized and that the state be represented at any and all committee hearings in respect to any measures which may affect the rights of New York."

In part, the report says:

"For all practical purposes in the im-

mediate future the pending suit against the Federal officials has accomplished the objects for which it was brought. The acceptance by the defendants, in their answer to the leading propositions constituting the basis of the complaint, and the full and frank confirmation thereof at this conference between the representatives of the Federal and State commissions, have apparently settled the principal propositions for which the State of New York has contended, and which the Federal Power Commission had previously seemed unwilling to accept.

"The disavowal by the Federal Power Commission of any intention to interfere with power developments in connection with the barge canal, and the expressing of willingness to co-operate with the state and the international joint commission in state development of the power possibilities of the Niagara and St. Lawrence Rivers, without claiming a proprietary right on the part of the Federal government to share in profits therefrom, has now cleared the way, so far as the Federal government is concerned, for power developments on these boundary streams by virtue of the concerted action of the state, the Federal Power Commission and the international joint commission.

SUGGESTS LEGISLATION

"We fully concur in your Excellency's message to the Legislature, dated March 5, 1923, that New York's water power 'must be developed in accordance with the enlightened thought of today, by the state itself, under state ownership and state control, to the end that all of the people may be able to realize the individual benefit which should flow to them from their resources and their own property,' which would mean the immediate development by the state of the undeveloped water power available on the Niagara and St. Lawrence. We believe that the absence of such a statute jeopardizes the rights of the state in its relations with the Federal government.

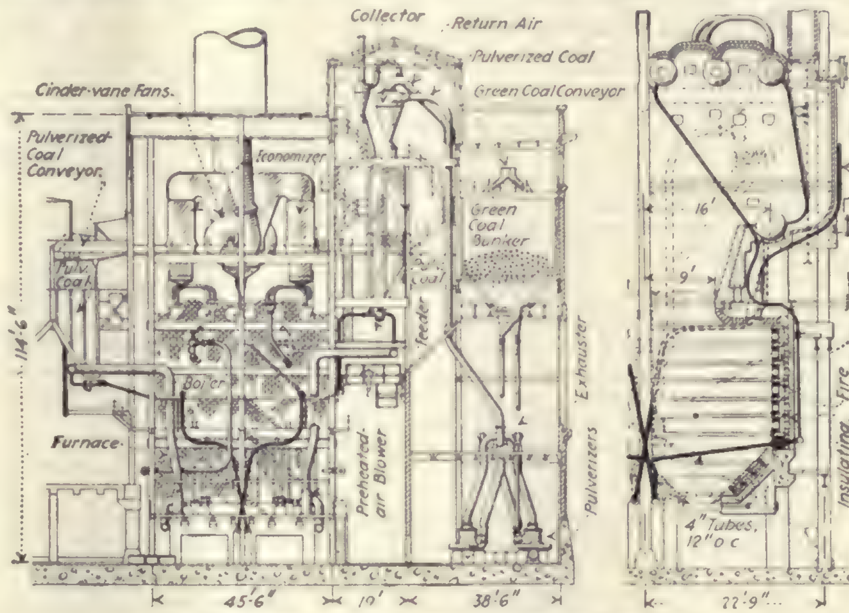
"New York is in a position today to own and control all its water-power development upon its inland and border streams. How long she can maintain that position depends wholly upon her own disposition, by appropriate enabling legislation, to make use of them. If the state is not able to obtain from its own Legislature a grant of favorable legislation, it makes little difference whether it is the federal commission or the state commission which licenses the state's power to private interests. In either case, the water power of the state will be out of the hands of the people of New York, who really own it.

"The people who are deeply interested in the development of New York's water power have reasons to be more apprehensive of opposition within the state to needed legislation authorizing state development of water power than they have of a possible refusal by the Federal government."

Pulverized Fuel in Ohio

Cleveland Electric Illuminating Company to Use It in Extension to Lake Shore Plant

AN EXTENSION is being made to the Lake Shore plant of the Cleveland Electric Illuminating Company, which will contain two 35,000-kva. units and four twin-boiler units, each consisting of two class P-13 Stirling boilers fifty-five tubes wide with a heating surface of 30,600 sq.ft. Work was started on the extension about Jan. 1,



CROSS-SECTION OF LAKE SHORE PULVERIZED FUEL PLANT

and sheet steel piling and columns are now ready for pouring the concrete foundations. Upon the installation of these new units in the fall of this year the plant will contain 310,000 kva. and will be the largest steam station in this country in one building.

The installation is notable in that pulverized fuel will be burned under the new boilers, which will operate at 250 lb. gage with 250 deg. superheat, yielding a total temperature of 656 deg. F. B. & W. superheaters will be used in the new boilers and twin Foster economizers will be employed on each unit. A Lopulco pulverized-fuel system will be installed. Existing crushers driven by constant-speed motors reduce the coal to about three-quarter-inch size, and it then goes to a green-coal bunker and thence to a pulverizer in the basement. From the pulverizer the fuel is conveyed to the top of the boiler room, where fans and separators are installed, and from the separators it is moved by screw conveyors to the two bins which supply each boiler unit. These bins have capacity for about twenty hours of operation. The boilers are fired from each side into a common combustion chamber, which is 32 ft. wide at the base, contracts to a throat 18 ft. wide and is about 52 ft. in height from the bottom of the furnace to the top of the boiler. This gives a flame-path of 65 ft.

Gases from each boiler unit after passing through the economizers are exhausted by the fans into a common flue and thence go to brick stacks about 250 ft. high.

Dayton and Cincinnati Interconnection

Two 66,000-volt 25,000-kva. high lines will soon tie in the Millers Ford plant of the Dayton Power & Light Company, Dayton, Ohio, and the Elmwood substation of the Union Gas & Electric Company, Cincinnati. The Dayton utility will build to Trenton, south of Middletown, where the lines of the Cincinnati utility will be joined. One line will be completed by November. The line details, including right-of-way, survey and material, have been all worked out and actual construction started about July 1. The conductors will be 477,000 circ.mil aluminum cable, steel reinforced, suspended by a five-string insulator. Western Red cedar poles, 50 ft. long with 9-in. tops, will be set at 300-ft. spans.

Proposed Municipal Control of Milwaukee Company

Middle West news reports last week indicated an agreement between the Milwaukee Electric Railway & Light Company and the city of Milwaukee whereby the municipal government would control the electric light and railway facilities in the city so far as rates, character and quality of service are concerned though the properties would remain under the management and operation of the company. According to these reports, the rates would be fixed on a cost-of-service basis plus a stipulated fixed return on the investment that the company has in utility property in the city. The reports arose out of the work being done by a committee appointed by the City Council several years ago to deal with the acquisition of the electric railway and light properties. The ideas of the committee as announced in the Mil-

waukee press are along the lines just indicated.

It is expected that an ordinance embodying the proposals will be introduced into the Council at a later date and then submitted to popular vote. The proposals contemplate the ultimate purchase of both the urban and suburban properties of the company if the people decide in favor of such purchase. Officials of the Milwaukee Electric Railway & Light Company deny that the proposals have reached the stage of agreement and say that they represent merely the ideas of the Council committee.

Engineers Meet at Schenectady

Operating engineers from seventeen New England power companies met at the plant of the General Electric Company on July 12-13. Papers were read by H. H. Dewey, R. M. Spurk, H. E. Starbuck and C. O. Traver on various operating problems.

This was one of the regular meetings of the system operators and proved interesting and profitable to those attending.

Among those present and the companies represented were: Fall River Electric Light Company, D. S. Owler, C. Gay; New England Power Company, W. R. Bell, A. S. Walker, H. S. Soper, W. S. Cavanaugh, I. L. Moore, H. K. Patterson; Turners Falls Power & Electric Company, C. F. Mosher, L. A. Fitts; Blackstone Valley Gas & Electric Company, A. K. MacNaughton, S. C. Jacoby; Malden Electric Company, H. K. Brown, C. A. Mayo; Suburban Gas & Electric Company, W. C. Lewis, A. F. Gardella; Cumberland County Power & Light Company, H. W. Yeaton, F. R. Fowles; Eastern Connecticut Power Company, E. T. Phillips; Rockingham County Light & Power Company, J. J. Gaffey; Salem Electric Lighting Company, Messrs. Aulin and Ryno; Charles H. Tenney & Co., L. R. Hicks; New Bedford Gas & Edison Light Company, E. H. Steele; Edison Electric Illuminating Company, R. S. Hale, W. H. Wellington, J. P. Kent, T. H. Haines; Manchester Traction, Light & Power Company, F. S. Piper; Narragansett Electric Lighting Company, J. R. Lyons, F. I. Saggitt; Eastern Massachusetts Electric Company, H. G. Jenks.

Ohio Operators Discuss Future Regulation

Merchandising Wiring and Illumination, Metering and Coal Combustion Problems Featured at Cedar Point Convention—Association Now Has a Second Vice-President

THAT public utilities, because of their far-reaching expansions, would soon see the day when Federal control would replace the present state commissions was the prediction of Prof. C. O. Ruggles, Ohio State University, when he dealt with the subject of future emphasis in public utility regulation before the twenty-ninth annual convention of the Ohio Electric Light Association at Cedar Point, July 10-13. Whether such a control was to be patterned after the form adopted for the Interstate Commerce Commission time alone would tell, but he hoped that the utilities would take to heart the troublesome problems encountered by the railroads while passing through that stage of economic development. With the utility industry expanding at such a rate that the mere designation of a state border as the boundary of the economic transmission of energy became mere foolishness, he contended that such nonsense would be necessarily over-ridden by rigid economic laws. This tide of Federal control was coming, and the sooner all the cards were on the table the better, he felt, could the utilities face their problems.

Professor Ruggles also laid special emphasis on four other important factors having particular bearing on utility problems, namely, monopoly, rates, fair return on investment and the relation between management and regulation.

Under monopoly he insisted that the fault in the past had been where commissions, wittingly and unwittingly, had tried to read into utility regulations certain economic fundamentals that had no bearing at all upon the economics of such a monopolistic type of business. It was pure nonsense for the public to think that duplication was necessary for protection. And it was these broad, fundamental principles of economics that Professor Ruggles lamented some commissioners were decidedly lacking in. However, all future programs of development will be controlled solely by these basic fundamentals if success is expected to follow.

As to rates, Professor Ruggles mentioned the recent Supreme Court decision of Wisconsin which ruled against the so-called loop system of rate making. In developing the fallacy and unjustness of this decision, he quoted from Professor Marshall, an English economist, who declared that while during one decade a certain size of a business unit may be best suited for its development, the next decade might so alter conditions as to dictate an entirely different business size. The solution to many rate difficulties lay in the differentiation of internal versus external economics of operation.

A fair rate of return was viewed by Professor Ruggles as one which should be considered not upon a yearly basis, but upon the span of time during a business cycle, for otherwise no utility could balance the lean against the good years and still act as a buffer state against industrial changes. He very clearly portrayed the effect on the utility of the war-time act restricting the coal supply to industries. When these industrial companies learned that the utilities were afforded priority rights on coal, they immediately called for electric service, thereupon loading up the central station lines and closing their own inefficient generating plants. And so this meant that these utilities were required to render a service using high-priced coal which other industries could not get. In acting as an intermediary agent in such cases, Professor Ruggles felt that fundamental economics should determine the necessary regulation of protection.

During the Wednesday session A. Bliss McCrum, secretary of the Utilities Association, Charleston, West Virginia, drew an excellent picture of his state from a utility development standpoint. He traced the rise of the power companies up to their 500,000-kva. present capacity. West Virginia has the largest potential hydro-power resources of any state east of the Rockies, excluding the state of New York, since only 20,000 hp. is utilized of the 1,400,000 hp. available.

NEW ENGLAND SYSTEM OPERATORS VISIT SCHENECTADY

Regarding the state's future power growth, he declared that by 1928 the available capacity, from present rate of growth, would have risen to 1,600,000 kva. and by 1933 it would be around 2,375,000 kva. The reason for this was because of the state's wealth in coal and oil.

On Thursday G. E. Miller, Cleveland, opened the discussion on E. G. Eichelberger's report on the new business co-operations committee by pointing out the necessity of educating electrical contractors and architects toward calling for more complete wiring jobs and not cutting the installation to the bone merely to lower prices. He painted an effective picture of price cutting by comparing the salesmanship of an electrical contractor and an automobile salesman while trying to make a sale. Whereas the former would deliberately cut out wiring essentials just to get the contract, the automobile salesman would try to sell his prospect a higher priced car. What merchandisers of wiring needed to employ in their sales talks was more of this type of salesmanship. Mr. Miller also argued that constancy in telling the public the value of utility service was absolutely essential, since every minute there "arises a new King who knows not Joseph." This was a Biblical quotation which Mr. Miller amplified upon most cleverly.

Merchandising Illumination

A. S. Turner, Jr., Edison Lamp Works, Harrison, N. J., explained an excellent series of charts which illustrated the value of obtaining more illumination business. Since the average family in the United States spends about $95 a year on tobacco and cigars, most surely it shouldn't require much effort to increase their lighting bills from $18 to $25 a year by the use of improved and more units of illumination. Mr. Turner pointed out seven ways in which a central station could increase its illumination business, namely, high grade lighting in its own main office to serve as an example for the rest of the community, newspaper advertising, high caliber window displays, mail stuffers showing new advances in the art of illumination, personal calls—most effective; close co-operation with civic leagues and, finally, improving the illumination in the consumer's home. C. S. Beardsley, Cleveland, asked that central stations direct as much hard-headed business sense toward their appliance departments as they did toward the solution of engineering problems. And as for the size of this merchandising field, he couldn't imagine any one failing to sell appliances, such as vacuum cleaners, washing machines and ironers which, by their use, have been calculated to give the housewife sixty days a year of economic wealth.

The report of the meter committee was presented on Thursday afternoon directly following Hon. Newton D. Baker's address on the "League of Nations or a World Court." It was read by J. L. Wright of Toledo, who briefly enumerated the year's work. The discussion was opened with a prepared paper by Frank G. Vaughn, Schenectady, which was read by W. S. Culver of Cincinnati, due to Mr. Vaughn's absence. Mr. Vaughn's paper dealt with the proper selection of meters and considered the small cost of meters compared to the money spent for generating and distribution equipment. J. C. Langell, Jackson, Mich., mentioned the need of meter standardization because of the numerous special features which were now being manufactured. The work of reaching the meter departments of small central stations he felt was an exceptionally good move of the meter committee during the year.

R. C. Fryer, Cincinnati, developed two important thoughts, namely, that the meter superintendent should always consider himself an executive and that the value of meter accuracy was meaningless unless it was properly employed. He also urged that the money wasted through a 1 per cent meter inaccuracy should always be kept in the minds of the central station executives. Mr. Fryer also made a prediction that the meter development within the next five years would be just as radical as those which will occur in the equipment for the distribution of super power.

W. J. Canada, New York, opened the discussion of the report of the transmission and distribution committee on Tuesday morning. He dealt with the Ohio Administrative Order No. 65 and declared that the utility industry must not rest on its oars once good work had been done, but that it must strive onward in supporting and developing further standards. Mediators for regulation were needed to offset failures created by not looking ahead to see where the next steps of interruptive practices were to turn. He thought the map of Ohio's transmission circuits would greatly assist in solving problems of "parallels" with signal circuits.

Interconnection Discussed

That problems of transmission interconnection fell into two classes was the assertion made by H. P. Sleeper, Duquesne Light Company, Pittsburgh. The first is one of combining the physical conditions of two systems to a basic standard; the other class is one entirely devoted to operation, such as the problems of protection and metering. He also spoke of the contemplated plans of the interconnection between this company and the West Penn Power Company, using a 132,000-volt circuit rated at 30,000 kw.

A special feature of the step-up transformers will be that the tertiary winding will receive a voltage of 11,000 direct from the generators. Prof. A. M. Wilson, Cincinnati, called attention to several problems which the incoming committee on distribution would materially assist in solving, the first of which was the compilation of the ground resistance values in various localities in Ohio for different seasons of the year. The other was the determination of the electrical neutral in Ohio or the value of the electrical ground plane.

When J. G. Worker gave his address on the generation of steam by powdered fuel, he insisted that not enough stress was laid upon the 5 or 10 per cent loss in efficiency lying idle in every plant due to poor operation. Too often would designers worry over procuring the last 1 per cent, whereas by maintaining a higher standard of boiler room operation present day plants could be boosted to a much higher value of efficiency. The fault of such operation he directed toward both the designers and operators, since not enough consideration was given to the human element in operation. And since this element could be entirely submerged in the operation of powdered fuel plants, due to its continuity, Mr. Worker argued that much still higher boiler room efficiency could be obtained. He also urged that more men consider this subject of combustion as a career and not as a blind alley job. The present rate of power development, he said, may be taken from the sales of stokers during the past two years; in 1921 fifteen stoker manufacturers sold 871 stokers totaling a capacity of 327,000 hp., while in 1922 this figure had risen to 1,563, rated at 725,000 hp. And for the first two months of 1923 561 stokers were ordered with a rating of 305,000 hp.

Powdered Fuel Ash Precipitation

H. D. Savage of the Combustion Engineering Corporation felt that the boiler room personnel had been neglected too long with respect toward developing them to become efficient operators. But since the combustion efficiency of stokers depended upon high grade operation instead of a high efficiency built into powdered fuel installations, this factor alone would determine the economic question of deciding between the various methods of coal burning. Mr. Savage also spoke on the size of powdered fuel ash precipitation which becomes so small that particles are invisible to the naked eye. With a spread over a very wide area, he thought that these dust particles do not settle to the earth until precipitated by rain.

Along with the high caliber of papers presented, twenty-five exhibitors displayed their recently developed equipment, ranging from new metering devices, outdoor switching apparatus and electrical appliances. The total registration went over 600.

New Officers

Frank Espy of Canton will head the association as president for the coming year. First and second vice-presidents (the latter a new office this year), T. O. Kennedy, Cleveland, and C. I. Weaver, Springfield. O. L. Gaskill was again appointed secretary and treasurer. The new executive committee will consist of C. L. Franklin, Robert Lindsay, O. H. Hutchings, R. S. Graves and S. D.

Heed. For the advisory committee the three following men were chosen: J. C. Martin, Columbus; D. J. Hard, Cleveland, and W. W. Freeman, Cincinnati. The finance committee will include L. E. Marshall, Middletown; W. B. Wilkinson, Newark, and C. L. Allis, Wooster.

The following were chosen as chairmen of their respective committees: J. J. Dolan, Coshocton, station and operating; K. C. Long, Dayton, new business co-operation; J. W. Wright, Toledo, meter, and R. R. Krammes, transmission and distribution.

Two constitutional amendments were added during the convention. One provided for a second vice-president occasioned by the growth of the association, and the other amendment related to the men appointed for the nominating committee, which will hereafter comprise five men, two of whom were to be chosen by the executive committee, two by the convention at large and the other appointed by the president.

Public Service Company to Make Extensions

New Jersey has rapidly forged to the front as an industrial center and continues to make increases in its power demands on the Public Service Electric Company. The company has recently applied for permission to dispose of $12,750,000 of capital stock for use in making improvements and extensions exclusive of the new generating plant to be erected on the Hackensack River near Kearny.

The new work will cover that now under way and to be made in the coming months, including an addition to the generating department, switching plant and coal bunkers at the Essex power station, Point-No-Point, estimated to cost $1,000,000; new switching station at the Marion power plant, Jersey City, to cost about $750,000, with machinery; extensions and betterments in existing power plants at Newark, Paterson, Perth Amboy, Hoboken, Burlington, Trenton and Camden, estimated to involve, collectively, $800,000, with additional machinery. Proposed extensions to distributing lines, additions to meter service, transformers and auxiliary apparatus are estimated to cost $3,000,000. Transmission lines to be constructed in different parts of the state, and principally in the Camden and Trenton districts, are expected to cost $1,750,000. The remainder of the appropriation will be used for new substations, distributing lines and miscellaneous work.

New Dam Will Increase Storage of Stave Plant

Work on the new million dollar dam of the British Columbia Electric Railway at Stave Falls to increase the storage of Stave Lake is being rushed to completion and will be ready to receive the waters of the early fall rains. This is a sluice dam 60 ft. in height and will increase the storage of Stave Lake from 168,000 acre-ft. to 465,000 acre-ft. Anticipating this additional water supply, a fourth unit of 9,000 kva. was installed in the Stave Falls plant in 1922, bringing the capacity up to 36,000 kva. Owing to the higher elevation of the lake due to this dam the Blind Slough dam immediately above the plant is being raised 22 ft.

Providing permission is granted by the provincial government, the company proposes to divert the waters of Lake Alouette, lying above and nearly parallel to Stave Lake, through a 10,000 hp. plant under a head of 140 ft. Following this development, as the demand for power increases, a fifth unit of 25,000 hp. capacity will be installed at the Stave Falls plant and later a third plant will be built near the junction of the outlet to Stave Lake and the Fraser River which will develop 80,000 hp. This program contemplates the expenditure of $10,000,000 over a period of from five to ten years. The company now operates two hydro-electric plants on Lake Buntzen which have a combined capacity of 84,000 hp., in addition to its Stave Falls plant and a stand-by steam station in Vancouver of 17,000 hp. capacity.

70,000 HP. WILL BE DEVELOPED AT THE GORGE PLANT ON THE SKAGIT RIVER

Skagit River Plant to Be in Operation by End of Year

Work to cost approximately $10,000,000 on the first unit of the Skagit River hydro-electric project of the city of Seattle is well along and it is planned to place the plant in operation late this year. The Gorge plant, which is located on the Skagit River 100 miles north of Seattle, is now under construction. Two units of 20,000 kva. each will be installed at present and as the demand for power increases a third unit of 30,000 kva. will be added. Work will start soon on a rock fill diversion dam 2 miles above the power house. An 11,000-ft. pressure tunnel for conveying the water to the power house is nearing completion. This tunnel is of horseshoe shape, concrete lined with an inside diameter of 20 ft. 6 in. and a capacity of 3,500 sec.-ft. The diversion dam to be constructed at present will give the turbines in the power plant a head of 250 ft. As the Gorge plant will depend entirely at present upon stream flow, full capacity can only be developed under favorable water conditions. It is later planned to build a 240-ft. concrete arch dam below the rock fill dam which will have a storage of 13,000 acre-ft. and increase the head on the plant to 375 ft. At this time the runners in the turbines will be changed to operate efficiently under the greater head. A unique feature of the plant is that due to the grade of the tunnel only short, nearly horizontal penstocks will be required instead of long penstocks down the side of the mountain operating under the full head of the plant.

LINES NOW BUILDING

A 165,000-volt transmission line and receiving substation are now under construction. The transmission line will have a single circuit on double wooden pole towers of the H type. The conductors will be 300.000 circ.mil copper equivalent, steel core aluminum, and the line will have a capacity of 90,000 kva. The normal span will be 600 ft. with a minimum ground clearance of 30 ft.

The next step in the Skagit River development after the construction of the 240-ft. concrete dam below the present diversion dam will be the construction of the Ruby dam about 10 miles up the river from the Gorge power house. The proposed dam at this point will be 480 ft. with a storage of 1,300,000 acre-ft. This contemplates a 3-mile tunnel of 6,000 sec.-ft. capacity and a power house with six 45,000-kva. units operating under a head of 720 ft. The estimated cost of the completed development is $57,000,000.

Federal Commission Busy

No Cessation in Water-Power Development Activities—Scramble on for Control of Upper Tennessee

THAT a veritable scramble is on for the control of the water-power resources of the Upper Tennessee is evidenced further by the filing with the Federal Power Commission of an application for a preliminary permit by the Tennessee Electric Power Company covering three large projects on the Clinch and Powell Rivers. The application is in conflict with two applications previously filed. One is that of the Knoxville Power & Light Company, a subsidiary of the Electric Bond & Share Company; the other was filed by the Tennessee Hydro-Electric Company, which was backed by Pittsburgh interests.

The project of the Tennessee Electric Company is practically identical with that contemplated by the Knoxville Power & Light Company. One of the three developments proposed is on the Clinch below its junction with the Powell. The plan is to erect a dam 175 ft. high at that point so as to create a pool 42 miles long with a 40-ft. drawdown to create 1,000,000 acre-ft. of live storage. This is sufficient to equalize the flow of the river at that point. The power capacity at that point would be 100,000 hp. The second development is planned for the head of the pool created by the first dam and will be near the railroad station of Cheat River. This dam is to be 160 ft. high. It is expected to develop 50,000 hp. at that point. The third development is to be on the Powell at the head of the pool in that stream. That dam, which would be near the town of Combs, is to be 180 ft. high. The development there would provide an additional 27,000 hp., making a total of 177,000 hp. at the three sites.

The Tennessee Electric Power Company, which has its domicile in Chattanooga, serves a large territory. Its lines serve most of the territory between Chattanooga and Bristol and between Chattanooga and Nashville. It has an existing development at Hales Bar on the Tennessee, another on the Ococee and another at Great Falls on Caney Fork. This gives the company a total capacity of 108,000 hp. at its water-power plants. In addition it operates three steam plants with a total capacity of 59,000 hp.

LOAD GROWING RAPIDLY

The Tennessee company reports that its load is growing at such a rate that it will require 40,000 hp. more within the next four years. If these requirements cannot be met from water power, the company has announced its intention to install further steam plants. The Federal Power Commission is anxious to prevent a situation which will result in the construction of steam plants in a region of abundant water power. Owing to the magnitude of the power involved and the determination of the interests concerned the commission's handling of this matter will be watched with more than ordinary interest. Incidentally it may be stated that the Federal Power Commission is much concerned in securing maximum utilization. Since this can be accomplished best by confining operations on a single stream to one company, it is anticipated that there will be no effort to divide the sites among the contending applicants.

OTHER SECTIONS SHOW ACTIVITY

The California-Oregon Power Company of Medford, Ore., which operates in southern Oregon and northern California and which recently acquired a property in Roseberg, Ore., has applied to the Federal Power Commission for a preliminary permit covering four power projects on the Umpquah River.

An extension of one year has been asked by the Pacific Power & Light Company of Portland, Ore., for its preliminary permit covering the reclamation site on the Deschutes River. This extension has been made necessary because the preliminary investigation indicates that the cost of power production at this site is much higher than had been estimated. Additional time is asked to determine whether or not a plan can be evolved for a smaller initial investment which will eliminate a part of the costs of carrying a larger development through the period during which the whole is being built up.

The proposed development of the Pennsylvania Power & Light Company on the Wallenpaupack River affects navigation on the Delaware River, and for that reason the district engineer of the Corps of Engineers at Philadelphia has recommended that the project be found to come within the jurisdiction of the Federal Power Commission. The Pennsylvania Power & Light Company project would store 200,000 acre-ft. and develop 60,000 hp.

A preliminary permit has been issued to the Susquehanna Power Company covering an extensive power project on the Susquehanna River, in Cecil and Hartford Counties, Maryland, and in Lancaster and York Counties, Pennsylvania. This development is of special interest since it will probably be the largest single power development on the Atlantic seaboard. It is proposed to construct a dam near Conowingo, Md., between 103 and 110 ft. above mean sea level, creating a pool 10½ miles in length extending to the tailrace of the Holtwood Power Dam at McCalls Ferry. An installation of 360,000 hp., or more than the total present development on the American side of Niagara Falls, is contemplated, at an ultimate cost likely to exceed $30,000,000. When this project is completed the Susquehanna Power Company will be in position to supply electrical energy to New York City, Philadelphia, Chester, Wilmington, Baltimore, Washington and all intervening communities within a radius of 150 miles from Conowingo.

New 410,000-Kva. Station

Public Service Electric Company Plans a Large Steam Station at Kearny—Use Stokers and 325 Lb. Steam

THE largest initial generating capacity so far incorporated in any station will be installed in the new Kearny station of the Public Service Electric Power Company of New Jersey, construction of which will be started shortly and is expected to be completed early in 1925. This station will have an initial installed generator rating of 205,000 kva. at 80 per cent power factor, and will probably have an ultimate rating of 410,000 kva.

Five turbo-generators will be installed initially, three of which will be 39,200-kva. General Electric units and two will be 43,750-kva. Westinghouse units. These will be designed for a throttle pressure of 325 lb. and 271 deg. superheat, making a total steam temperature of 700 deg. F. New features will be incorporated in the General Electric units which cannot be announced at this time. The chief feature in the Westinghouse units will be the multiple exhaust.

Electric auxiliaries will be used almost without exception. No house turbines will be installed, the power for the auxiliaries to come directly from the main generators. The only steam units will be just enough turbine-driven boiler-feed pumps to keep the boilers on the line without load in case all service to the electric auxiliaries is interrupted.

Powdered fuel will not be used; instead superstokers about 17 ft. long and consisting of sixteen retorts will be employed, with extra large furnaces approaching the volume used for powdered fuel. They will have unusually high settings and ventilated side walls. The arches over the fire belt as well as the furnace wall in this vicinity will be constructed so that the fire brick can be easily replaced without taking down the rest of the fire brick.

Babcock & Wilcox boilers rated at 2,360 hp. (based on the heating surface) will be used, with the superheaters between two banks of the tubes. No economizers will be used.

Boiler feed water will be heated entirely by bleeding from the three or four stages of the turbines previously mentioned. For this purpose deaerating heaters will be used to raise the boiler feed water to 212 deg. F.

The arrangement of the circulating water intakes and discharge tunnels is another feature of this plant. The circulating water intakes will be perpendicular to the water front, each intake serving two units.

Parallel to the water front and connected with tidewater at each end of the station is the discharge tunnel. To prevent the warm water discharged from the condensers flowing past the intakes and into the condensers again some arrangement will be made in the discharge tunnel to force it to discharge in the direction in which the tide is flowing.

O'Shaughnessy Dam and Hetch-Hetchy Reservoir Dedicated

Debate Sale of Power to Private Corporation or Arrangement for Municipal Distribution System—Power Ready for Delivery in Fall of 1924

O'SHAUGHNESSY DAM, the city of San Francisco's new dam for impounding water for the city supply, and the Hetch-Hetchy Reservoir were dedicated on July 7. A group of San Francisco citizens, guests of the Board of Public Works, were present at the dedication.

W. H. Wattis, president of the Utah Construction Company, formally delivered the completed structure to the city officials and T. A. Reardon, president of the Board of Public Works, accepted the dam for the board. Mayor James Rolph, Jr., dedicated the dam on behalf of the people of San Francisco and M. M. O'Shaughnessy, city engineer of San Francisco, for whom the dam was named, briefly outlined the less technical features of the structure. Mr. O'Shaughnessy has been in direct charge of the erection of the dam, which was started in 1914.

The new concrete structure is built in the shape of an arc with a 700-ft. radius. The cost of the dam and reservoir was $6,647,356. The storage capacity of the reservoir behind the dam is 66,000,000,000 gal. and water is supplied the reservoir from a drainage area of 294,000 acres.

The dam is one of the largest masonry dams in the world. It is 298 ft. thick at the bottom and the foundation is 114 ft. below the stream bed. The top of the dam is 341 ft. above the stream bed, with a crest 600 ft. long. Tunnels and aqueducts will be used to transport the water to San Francisco.

The board of governors of the Civic League of Improvement Clubs and Associations of San Francisco has gone on record as favoring the sale of power generated at Hetch-Hetchy in a block to a private corporation at the power house. The board ignored the majority report of a special committee formed to investigate the matter and voted to accept the minority report.

CITY MONEY LACKING

The supporters of the minority report stated that it would be difficult for the city to raise enough money to either purchase or erect a distributing system and that in addition some provision for stand-by service would have to be made if the city were to distribute power.

Mr. O'Shaughnessy has stated that the city's power plant at Moccasin Creek, as the structure below the Hetch-Hetchy reservoir is known, will be ready to deliver power in the fall of 1924. The minority report also states that the city could not possibly be ready to distribute power by that time. The new project will develop approximately 52,000 hp. when the first unit is installed.

No action has been taken by the Board of Supervisors of San Francisco up to the present time. Three proposals have been offered. The first is to sell the power in a block to a private corporation at the power house, the second provides for the city to have a private corporation act as its agent in distributing the power and the third calls for the city to distribute the power direct.

Tenney Organization Acquires Large Plant Site at Salem

A power plant site on the harbor front at Salem, Mass., has been purchased by Charles H. Tenney & Company of Boston. Sufficient space is available for the construction of a steam generating station of several hundred thousand kilowatts rating in case future load and interconnection requirements warrant its erection.

Brief News Notes

New Nebraska Plant Making Rapid Progress.—Work on the Central Power Company's new power plant on the banks of the Platte 6 miles east of Grand Island, Neb., is progressing rapidly. This six-hundred-thousand dollar oil-burning investment will give to Central Nebraska a plant which will rank among the most efficient in the state. It will generate 3,750 kw. This plant will eventually be connected with the Boelus and Kearney units of the company's system.

Radio to Prevent Forest Fires.—Radio talks on the prevention of forest fires are being broadcast every two weeks from the Portland, Ore., office of the Forest Service, United States Department of Agriculture, through an arrangement with the Portland *Oregonian*. Definite dates have been fixed for these talks, which, according to estimates, reach from 10,000 to 15,000 people. A radio release on some phase of the work of the Forest Service is also broadcast once a month from Washington.

Hydro Plant Proposed for Colima.—A proposal to erect a large hydroelectric plant in the mountains near Colima, Mexico, has been announced by Lawrence C. Morley and associates. Mr. Morley has applied to the Mexican government for a concession to construct the proposed plant. It is stated that the group of men intend to develop about 100,000 hp. and that they plan to erect transmission lines leading to Colima, Manzanillo and other towns and mining districts.

Muscatine May Purchase Lighting Company's Plant.—Abandonment of the municipal electric plant now under construction and the purchase by the city of Muscatine, Iowa, of the plant of the Muscatine Lighting Company has been proposed by the company just named as a settlement of legal controversies extending over five years. It is suggested that the purchase value of the company's property be determined by a disinterested board of supervisors, one to be appointed by the city, one by the company and the third by those two.

Pennsylvania Power and Light Now Controls Schuylkill Electric Company.—The Pennsylvania Power & Light Company of Sunbury, with headquarters at Allentown, has taken over the control of the Schuylkill Electric Company, the last of the independent power companies in that section of the anthracite regions. The Schuylkill company has been supplying power and light to Ashland, Girardville and all other small towns and villages within a radius of 50 miles. The management of the company was under the control of J. H. B. Yeaton, which position he has held for the last thirteen years.

Extending Rural Service in Michigan.—The Lake Superior District Power Company, which has been steadily electrifying the iron mines of the Gogebic district, is now turning its attention to furnishing electricity to the agricultural districts surrounding Ironwood, Mich., and is negotiating with representatives of the farmers to that end. The company proposes to supply the farmers with electricity at the same rate charged townspeople provided it can get a guarantee of $6,150 from forty-one farmers to help defray the expense of installing the lines. This means an assessment of $150 on each farmer, after which his service will cost him 9 cents per kilowatt-hour.

More Waterpower for Oregon.—A permit has been issued by the State Engineer of Oregon to A. D. Gardner to appropriate 1,000 sec.-ft. of water for power development from the North Santiam River. Mr. Gardner, according to present plans, will develop a total of 13,636 hp. at four points between Mehama and the present development at Stayton, at an estimated cost of $250,000. It is proposed to use the power for general commercial purposes and to supply additional power to the industries of Stayton, which are now using 1,500 hp. Any surplus power that may be developed will be sold at wholesale. The accessibility to Salem, Jefferson, Albany and other towns in the central Williamette Valley make this new development of the utmost importance.

Reading-Easton Transmission Line Completed.—The steel-tower high-tension transmission line connecting the system of the Metropolitan Edison Company of Reading, Pa., with that of the Pennsylvania Edison Company of

Easton has been completed. The interconnected system which has been thus formed has four main generating stations, and two base-load stations are now under construction at Middletown, on the Susquehanna River, and at Holland, on the Delaware. The initial capacity of these two stations will be 30,000 kw., which, as previously told in these columns, will be increased as the demands for electrical energy increase until a maximum capacity of approximately 200,000 kw. is reached. At the present time this system is furnishing light and power in the territory extending from York to York Haven, north to Harrisburg, across Pennsylvania by way of Lebanon, Reading and Easton to Dover, N. J., then beyond this place to within 30 miles of New York City.

More Work in Indiana Extensions.—New extensions and improvements costing in excess of $1,000,000 are to be made at the Marion, Ind., plant of the Indiana General Service Company. Work on the extensions has already started. The improvements include a 10,000-kw. turbine, a new substation in West Marion for the benefit of the factories in that district, a high-tension line to Converse connecting with the light and power plant at Kokomo, three new transformers at the outdoor switchboard and new pipes for the hot-water heating system. The substation is to be in Henderson Avenue and poles are being placed which will carry high-tension wires to Converse. This will give a connection with Converse in the event of local trouble. The Indiana General Service Company will be able to get power from Kokomo in addition to Muncie and Elwood, these connections providing 1,000 additional kilowatt capacity.

Southern Italy's Big Water-Power Project. — The financing of the important hydro-electric project in the Sila Mountains of Cambria, southern Italy, has been recently arranged through the help of the government, the Bank of Naples, the Bank of Sicily and other institutions, according to a report to the Department of Commerce from Commercial Attaché H. C. McLean at Rome. The total cost is estimated at 400,000,000 lire, and the government will pay a subsidy of approximately 100,000,000 lire. One of the problems to be faced will be finding a market for the large amount of power that will be made available, since the surrounding districts are little developed. It is probable that a part of the power may be carried across the Straits of Messina into Sicily and northward into Campania.

Moffat Tunnel Planned for Aug. 1. Start.—The Moffat Tunnel Commission is endeavoring to start work on the driving of the Moffat tunnel, which will connect the two halves of the state of Colorado, by Aug. 1. It is the intention of the commission to have some sort of dedication ceremonies on that day as it is known as Colorado Day. As yet no chief engineer has been selected for the work and the commission is not willing to let any contracts until this position has been filled. Denver reports indicate that as soon as contracts for work are let transmission lines will be built from the Boulder Canyon plant of the Northern Colorado Power Company to the eastern portal of the tunnel and then over the mountains to the western portal. Members of the tunnel improvement district voted on July 10 for the members of the tunnel commission. The wording of the bonds has been approved by the commission and as soon as accepted by the purchasers of the issue printing will be started.

New Tie Line Started in Oregon.—Survey work on the transmission line of the California Oregon Power Company between Roseburg, Ore., and Dixonville has been started. As soon as the route is mapped out rights of way will be secured and actual construction will be started as soon as possible. The line will connect with the 66,000-volt transmission line between Prospect and Eugene. It is probable that a substation will be erected at Dixonville and another at Roseburg. It is expected that construction on the line will be complete by Sept. 1. Six miles of line will be necessary to tie in the system of the Douglas County Light & Water Company with the California Oregon Power Company system. The former company was recently purchased by the large concern and the new line is being built to connect the two parts of the power company's system. When this line is completed the utility will be prepared to supply Roseburg and the Umpquah Valley with all of the power that is needed.

Associations and Societies

American Electrochemical Society.—The next meeting of this society will be held in Dayton, Ohio, on Sept. 27-29. The plans include a symposium on electrochemistry of gaseous conduction, in charge of Dr. Duncan MacRae, Westinghouse Lamp Company; a symposium on recent progress in electrolytic refining, and round-table discussions on electric furnace brass-foundry practice, organic electrochemistry, chlorine and electroplating.

Iron and Steel Technical Sessions.—Preliminary announcement of the technical program to be given by the Association of Iron and Steel Electrical Engineers in connection with its annual exposition, to be held at Buffalo on Sept. 24-28, includes a paper on blast-furnace skip hoists by A. C. Cummins, one on slip regulators by D. W. Petty, one on combustion by E. C. Seibert, one on motor-driven centrifugal pumps by B. A. Cornwell and one on electric furnaces by E. T. Moore. A specification covering the construction and operation of automatic engine stops will be presented for the recommendation of the association by Walter Greenwood, chairman of the safety committee.

Detroit Engineering Society to Have New Home.—The Detroit Engineering Society has purchased property at 478 Alexandrine Avenue, West, for conversion into a clubhouse and is financing the purchase by the sale of second mortgage bonds to its members, who are increasing in number. Member societies of the Associated Technical Societies of Detroit can obtain space in the new home. The alterations will be completed in time for occupancy this fall.

I. E. S. Prepares List of Topics for Coming Season.—At a recent meeting of the New York Section of the Illuminating Engineering Society Prof. S. K. Barrett submitted a list of eight topics as suggestions for the meetings of the section for the coming season. This list was discussed by the members of the board and extended eight additional subjects, the entire list including: "The Lighting of the Leviathan," "Lighting Effects as Viewed from an Aëroplane," "Lighting Progress as Exemplified in Recent Large Office Buildings," "Color Pictures and Color Motion Pictures," "Latest Tendencies in School Lighting," "Lighting in the Dental, Surgical and Ophthalmological Professions," "Effects of Better Lighting upon Office Work and School Work and Upon Manufacturing and Selling," "Recent Progress in Street Lighting," "Bus Lighting," "Hospital Lighting," "Modern Gas Lighting in the Home," "Effect of Artificial Lighting on Plant Growth," "Industrial Lighting," "How to Plan the Lighting System," "Daylight Illumination" and "Store and Window Display Illumination."

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

National Electrical Credit Association—Boston, Aug. 9-10. F. P. Vose, 1347 Marquette Bldg., Chicago.

New England Division, N. E. L. A.—Swampscott, Mass., Sept. 6-8. Miss O. A. Bursiel, 149 Tremont St., Boston.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 17-19. O. A. Weller, 900 15th St., Denver.

Association of Edison Illuminating Companies—Dixville Notch, N. H., Sept. 17-21. P. S. Millar, 84th St. and East End Ave., New York.

Michigan Electric Light Association—Grand Rapids, Sept. 18-20. Herbert Silvester, Detroit Edison Co., Ann Arbor.

Illuminating Engineering Society—Lake George, N. Y., Sept. 24-28. S. G. Hibben, 29 West 39th St., New York.

Association of Iron and Steel Electrical Engineers — Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

Indiana Electric Light Association—French Lick Springs, Sept. 26-29. T. Donahue, Northern Indiana Gas & Electric Co., Lafayette, Ind.

American Electrochemical Society—Dayton, Ohio, Sept. 27-29. Colin G. Fink, Columbia University, New York.

American Institute of Electrical Engineers—Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

Association of Electragists International—Washington, Oct. 8-13. Farquson Johnson, 15 West 37th St., New York.

Commission Rulings

Failure to File Surcharge Leads to Discrimination.—Finding that the failure of the Elkhorn Light and Water Commission to file with the Wisconsin Railroad Commission an agreed-upon surcharge had led to the eventual refusal of a customer (the Wisconsin Butter & Cheese Company) longer to pay it, and that this company was therefore being illegally supplied at a rate less than the municipality had to pay for the energy purchased from the Wisconsin Gas & Electric Company for distribution, the Railroad Commission authorized the addition of a surcharge as an emergency rate to apply uniformly to all the municipality's customers on future bills, thus ending the discriminatory charges that had arisen because of the neglect to file rates.

Burden of Cost of Change of Frequency.—The Illinois Commerce Commission in authorizing the Illinois Traction System to make a change of frequency from 25 cycles to 60 cycles on a transmission line between Danville and Champaign said that, although the proposed change should improve the continuity of service in the territory and eliminate the fluctuation in lighting noticeable in 25-cycle service, its object appeared primarily to be for the benefit of properties of the Illinois Traction System. This company was therefore required to bear the expense of making such changes in meters, fans and street-lighting equipment as might be necessary and to bear a portion of the expense of changing motors equivalent to the present value of all motors which would not properly operate on 60-cycle alternating-current service.

Unprofitable Extensions of Service.—In refusing, on the petition of one Deeg, to require the Edison Electric Illuminating Company of Boston to make an unprofitable extension wholly at its own expense, the Massachusetts Department of Public Utilities said: "This is a case where the petitioners have asked the company to extend its lines some 1,500 ft. to supply them with electricity. There are six houses that would be supplied by this extension. Two of these are occupied throughout the year and the others for various periods of time. By the extension of another hundred feet another house would be served. The neighborhood is what might be termed an outlying section of the town. To supply the petitioners with electricity would require an extension of over 2,250 ft. at an estimated cost of $2,200. The petitioners were unable to state approximately what their electric bills would be for the year, but the company made an estimate, based on the number of lights that would be required, that it would amount to about $60 a year. . . . Assuming that the bills for electricity would amount to $100 a year, then the gross income to the company would be less than 5 per cent on the investment, with no allowance for the cost of energy or the maintenance and depreciation of the line. There, of course, must be a limit to which the company can afford to extend its lines into the country."

Equitable Division of Charges.—"The fixing of rates and the equitable division of charges on a system as extensive as that of applicant," said the California Railroad Commission in fixing rates for the Pacific Gas & Electric Company, "is a problem in the solution of which no exact rule or formula can be used. The approximate cost of rendering the several classes of service, the economic value of the service to the individuals and groups of consumers, the rates heretofore in effect and their results upon the operations of the consumers, the elimination of discriminatory conditions among classes and districts and the general effect on future development of business of new rates must be considered in the division among the various classes and groups of consumers of the total revenue which the company is entitled to receive. Forms of rates must be relatively simple, yet must meet the widely varying conditions of retail and wholesale service. It is impossible and uneconomical to attempt to fix rates such that each district or each class of consumer will return to the company an equal rate of compensation for the average proportion of the plant necessary for their service. The system is so extensive and receives power from so many points that the service to the different classes of consumers is largely interdependent as to costs. It is the conclusion of practically all witnesses and of the various representatives before the commission that service to certain basic industries may reasonably be rendered at a less net profit on the average investment than must be obtained from the average of all classes; also that within reasonable limits developing business and service in developing territory should not be expected to return to the utility as great a net as business in the more congested districts. Evidence in this proceeding indicates, as has been many times stated, that the profit or return upon capital invested in the congested incorporated territories is greater than in the developing rural territories served. If this is not to be continued, the extension and development of the rural and unincorporated territory will be stifled and such policy must ultimately work to the detriment of the more congested districts. In the rates fixed herein consideration is given both to justification, on the one hand, for a lower lighting rate in the incorporated territory than in the unincorporated territory, and also to the justification and fairness of fixing a reduced rate for power sold for redistribution in unincorporated territory still in the development stage."

Recent Court Decisions

Company Forbidden to Plead that Old Contract Was Beyond Village's Powers.—Asserting that the rates paid it by the village of Davenport under a twenty-five-year contract entered into in 1915 were no longer adequate, the Meyer Hydro-Electric Power Company sued the village, claiming that the contract at the time of its acceptance was beyond the village's powers, though it would have been legal under a law of 1919. The Supreme Court of Nebraska sustained the contract, holding that, since the parties to it had continued to operate under it subsequent to 1919 and that to discontinue service would have worked an irreparable injury to the inhabitants of the village, the company could not claim that the agreement was *ultra vires*. (193 N. W. 719.)*

Allegation of Knowledge of Fallen Electric Wire Imputes Specific Act of Negligence. — In Edmanson vs. Wilmington & Philadelphia Traction Company the plaintiff was injured by electricity alleged to have been conveyed along a wire fence with which a fallen transmission line of the defendant had come in contact. The Supreme Court of Delaware has overruled a demurrer filed by defendant on the ground that no specific act of negligence or of dereliction of duty had been alleged. According to the court, any allegation of knowledge of defendant of its broken or fallen wire and the failure to repair the defect after knowledge imputed a specific act of negligence to defendant, and a declaration reciting the alleged facts put forth imputed a duty from defendant to plaintiff without necessity specifically to allege such duty. (120 At. 923.)

Iowa Courts Have No Authority to Require Municipality to Pay Higher Rate than Required by Contract.—In Wapsie Power & Light Company vs. City of Tipton, the Supreme Court of Iowa, reversing the lower court, held that where a city exercised its right under a franchise ordinance to purchase a light and heating plant, the owners of which were procuring under a ten-year contract electrical energy from another company at a very low rate, the fact that the company furnishing such electrical energy was also supplying other municipalities which would have to make up the deficit if it was compelled to serve appellant at a loss was no reason for the court to require the city to pay a greater rate than that provided by the contract, there being no statutory provision for a public utility commission to regulate rates and the courts being without power to assume such function. (193 N. W. 643.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Hutchings and Rutledge Among New Vice-Presidents of U. G. I.

James T. Hutchings, general manager of the United Gas Improvement Company, Philadelphia, and F. J. Rutledge, manager of the new-business department, have been elected vice-presidents of the company by the board of directors, the former in charge of operation and of plants and the latter in charge of sales of gas, electricity and appliances for using same. The other two new vice-presidents are G. W. Curran, who retains the title of secretary, vice-president in charge of accounting, and J. A. Pearson, promoted from purchasing agent to be in charge of purchases. Randal Morgan, who has been associated with the company for forty years, retires as vice-president and becomes chairman of the executive and finance committee. Walton Clark, who has served the company for thirty-five years, retires as vice-president and becomes consulting engineer. Lewis Lillie, vice-president, will in addition assume the duties of general manager. The other vice-presidents are Paul Thompson and Philip H. Gadsden.

William W. Bodine becomes assistant secretary and assistant treasurer. In addition to his duties as assistant to Vice-President Lillie, Mr. Bodine was also appointed secretary of the executive and finance committee. The positions of general superintendent and assistant general superintendent were abolished. Rollin Norris was appointed gas engineer, Paul Spencer electrical engineer and John B. Klumpp inspecting and valuation engineer.

W. A. Carter of the research department of the Detroit Edison Company, who recently visited the East, spending some time in New York and Ithaca, has returned to Detroit.

Dr. L. H. Baekeland of Yonkers, N. Y., honorary professor of chemical engineering in Columbia University, has been made "Officier de la Legion d'Honneur" by the French Republic. Dr. Baekeland is president of the Bakelite Corporation and of the General Bakelite Company and past-president of the American Institute of Chemical Engineers and of the American Electrochemical Society.

J. P. Dick, purchasing agent for the Georgia Railway & Power Company, Atlanta, and H. L. Wills, operating engineer, have just been appointed assistants to W. H. Taylor, vice-president and general manager of the company. Mr. Dick, who is a graduate of the University of Georgia, has been with the Georgia Railway & Power Company for the past three years. Mr. Wills, who will operate as a special engineer under Mr. Taylor, is nationally known as an electrical engineer. F. A. Jordan, who has been with the power company for the past eight years, has been appointed purchasing agent to fill the position left vacant by Mr. Dick's promotion.

Frank A. Leach Made General Manager of P. G. & E.

Frank A. Leach, Jr., formerly manager of the East Bay division of the Pacific Gas & Electric Company, and more recently vice-president in charge of public relations and service, has

F. A. LEACH, JR.

been named vice-president and general manager of the company to fill the vacancy caused by the death of John A. Britton. The appointment was made at a meeting of the board of directors of the company held July 12.

The new general manager is an Oakland man, having resided there since his early youth. He began his early business training on the Oakland *Enquirer*, a newspaper owned by his father, Frank A. Leach, Sr., formerly superintendent of the San Francisco Mint and later Director of the Mint at Washington, D. C. He entered the public utility service twenty-five years ago in the employ of the Oakland Gas, Light & Heat Company, of which the late John A. Britton was president and manager. Upon Mr. Britton's acceptance of the presidency of the California Gas & Electric Corporation, of which the Oakland Gas, Light & Heat Company was a subsidiary, Mr. Leach was appointed to succeed him as manager of that utility and also of the Berkeley Electric Lighting Company. Upon the organization of the Pacific Gas & Electric in 1905 Mr. Leach was made manager of the East Bay division. Three years ago he was called to the head office in San Francisco as vice-president in charge of public relations and service, the position he occupied until his present appointment. Mr. Leach is a member of the N. E. L. A., the I. E. S., the San Francisco Engineers' Club and at the last convention of the Pacific Coast Electrical Association he was elected second vice-president.

Charles W. McKay Directs Valuation Work

Charles W. McKay, well known appraisal and valuation engineer, has been appointed manager of the division of valuation and appraisement of the Roberts - Pettijohn - Wood Corporation, consulting engineers, Chicago, to whom he has been consultant for some time past. Mr. McKay was formerly president and general manager of McKay & Sherman, valuation engineers, and when Mr. Sherman retired from the firm, the name was changed to Charles W. McKay & Associates. Recently the interests of the latter have been merged with those of the Roberts-Pettijohn-Wood Corporation and Mr. McKay received his present appointment. Since his graduation from Sibley College of Mechanical Engineering, Cornell University, in 1906 he has been engaged in engineering and appraisal work.

H. H. Henley has been elected president of the Tri-State Utilities Company, Eldora, Iowa, and of the Iowa River Light & Power Company of the same city, to succeed F. J. Cross, who recently resigned.

G. J. Newton, formerly associated with the George Construction Company, Philadelphia, has resigned and will devote his time to the design of underground distribution systems with offices in Philadelphia.

A. J. Wiley, hydraulic engineer of Boise, Idaho, has been retained in a consulting capacity by the city of Logan, Utah, in connection with its new hydro-electric plant.

George D. Martin was elected secretary and treasurer of the William Cramp & Sons Ship & Engine Building Company, Philadelphia, to succeed the late Charles T. Taylor.

F. H. Rood has rejoined the Pittsburgh Testing Laboratory as engineer of tests with headquarters at Pittsburgh, Pa. Mr. Rood, who is a graduate of Syracuse University, was a member of the organization once before when he served as assistant engineer of tests for a period of three years.

G. R. Fulton, assistant engineer at the power station of the Baton Rouge (La.) Electric Company, a Stone & Webster property, has been transferred to the Webster station of the Galveston-Houston Electric Railway. Mr. Fulton

has been associated with the Baton Rouge company for the past three years.

Joseph J. Thomason is engaged as chief engineer of the city of Corinth, Miss., in the construction and operation of a new municipal light and water plant. Mr. Thomason was previously connected with the W. A. Fuller Company of St. Louis.

H. M. Van Gelder has been made a partner of Stovel & Brinkerhoff, engineers and constructors of New York. Mr. Van Gelder was formerly electrical engineer and managing engineer of Westinghouse, Church & Kerr and recently project engineer on railroad electrification work with Gibbs & Hill, consulting engineers, New York.

J. E. Goodwin of Beloit, Wis., has been named head of the investment department of the Janesville Electric Company, succeeding Victor Rauer, who has been assigned to the operating department. Mr. Goodwin will have complete charge of the sale of stock and bond securities in the Janesville Electric Company, Wisconsin Power, Light & Heat Company, and kindred plants in the Janesville area.

W. A. Thompson, formerly controller of Allis-Chalmers Manufacturing Company, has been elected secretary and controller of the company. Other changes in the official staff on account of the death of Henry Woodland, who was secretary and treasurer, include the election of R. Dill, formerly assistant secretary and assistant treasurer, to the office of treasurer and the appointment of D. A. Stewart as assistant treasurer and of J. A. Keogh as assistant secretary.

A. S. Moody, until recently assistant Northwest manager of the General Electric Company at Portland, has been appointed manager of the Los Angeles office of the company. He assumed his new duties about June 15. After spending two years as salesman in the Seattle office of the company Mr. Moody was transferred to the Portland office and soon afterward received the appointment of supply manager. After 1911 a larger portion of his time was given to the directing of others until he assumed the office of assistant Northwest manager.

C. A. Garrett of Indianapolis recently joined the commercial department of the Oklahoma Gas & Electric Company in Oklahoma City. Mr. Garrett was graduated from the electrical engineering school of Purdue University in 1906 and then joined the engineering works of the International Harvester Company at Plano, Ill. Subsequently he allied himself with the Merchants' Light & Heat Company of Indianapolis in the commercial and engineering departments and was promoted to the position of company engineer. In 1913 he was placed in charge of the light and power department of the Union Traction Company at Anderson, Ind., leaving this position to become instructor in the mechanical shops of Purdue University. Mr. Garrett later taught sales classes and trained appliance salesmen for the Commonwealth Edison Company at Chicago.

G. L. Myers Heads Northwest E. L. and P. Association

George L. Myers, assistant to the president of the Pacific Power & Light Company of Portland, Ore., was elected president of the Northwest Electric Light & Power Association (geographic division N. E. L. A.) at the recent convention of that organization in Seattle. Mr. Myers has been active in the work of the association for the past six years, having served as secretary-treasurer in 1917 and as vice-president for Oregon and a member of the executive committee since 1919. He entered the electric utility field in 1910, when he became associated with the Pacific Power & Light Company in the office of the president. Two years later he was made assistant to the president, which position he still occupies.

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G. L. MYERS

He spent several years in journalistic work before becoming identified with the public utility field, and at the present time, in addition to his other duties, he finds time to edit the house organs of the Pacific Power & Light Company and the Portland Gas & Coke Company.

John W. Reed, formerly connected with the Holtzer-Cabot Electric Company, is now associated with the Peerless Electric Company of Warren, Ohio, as district manager.

Frank B. Carpenter, formerly electrical engineer in the design and construction department of the West Virginia Engineering Company, has resigned to ally himself with the J. C. Sullivan mining interests of West Virginia.

George H. Weatherbee, sales manager of the Middletown division of the Connecticut Power Company, has resigned and allied himself with the United Light & Power Company of New Haven.

Obituary

Frank L. Henry, formerly electrical engineer of the St. Joseph (Mo.) Railway, Light, Heat and Power Company, was killed recently in a coal mine accident in New Mexico. Mr. Henry left St. Joseph about a year ago to engage in electrical engineering work in New Mexico.

Frank E. Chase, for the past eighteen months manager of the electrical department of the Lynn (Mass.) Gas & Electric Company, died on July 2 after a protracted illness. Mr. Chase was born in 1862 at Medford, Mass., and became associated with the Thomson-Houston Electric Company in 1890. Subsequently he spent a short time in the service of the Malden (Mass.) Electric Company, and in 1892 joined the Lynn company as stockkeeper, rising from post to post until 1908, when he became electrical superintendent.

Francis W. Little, for many years identified with public utility interests in Springfield, Mo., died recently at his home in Minneapolis. He was the first man to bring the matter of water-power development to a definite head in the Springfield region by having a survey made of the entire region and exhaustive investigation conducted on every source of supply. Mr. Little headed the company that bought the local lighting plant at Springfield from E. Henning in 1903. Many improvements were made, and in 1906 the street railway system was combined with the lighting plant. Mr. Little sold out his interests in Springfield in 1911 to the Federal Light & Traction Company.

Chester Hicks Pennoyer, Pacific Coast representative for the National Conduit & Cable Company for the past seventeen years and one of the pioneers in the electrical industry in California, died during the recent Pacific Coast Electrical Association convention in San Francisco. From 1892, when he entered the employ of the California Electric Light Company in San Francisco, until 1906 Mr. Pennoyer was association with the central-station field. When the California Electric Light Company became the Edison Light & Power Company in 1894 Mr. Pennoyer was made purchasing agent, which position he held until 1898, when the utility was consolidated with the San Francisco Gas Light Company, forming the San Francisco Gas & Electric Light Company. In 1902 with several others he took over the Electric Improvement Company and the San José Light & Power Company, forming the United Gas & Electric Company. Mr. Pennoyer was vice-president and general manager. The company also operated the Standard Electric Company of San Francisco. With the formation of the California Gas & Electric Corporation in 1906 Mr. Pennoyer left the central station field and became Pacific Coast representative for National Conduit & Cable Company.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Electrical Conditions in Germany

Work in Progress at Germany's Great Electrical Plant—Steel-Mill and Railroad Electrification—Changes Caused by the War—Future Outlook

BY CAPT. GODFREY L. CARDEN

THE German electrical works of Siemens and Halske - Siemens - Schuckertwerke are employing to-day approximately one hundred thousand people. This includes all plants in and out of Germany. The headquarters are at Siemensstadt, near Berlin. In this locality are the Wernerwerk.

In 1908 I visited the Nonnendamm shops of the firm and made a report in my capacity as a special agent of the Department of Commerce at Washington. At that time the Siemens and Halske-Siemens-Schuckertwerke were employing approximately forty-two thousand people, and of this number five thousand were carried on the rolls of the Wernerwerk. The total number of employees in the Nonnendamm shops, inclusive of the Wernerwerk, was approximately ten thousand.

I revisited the Wernerwerk and the Nonnendamm shops late in February this year. I wanted to see what changes had occurred since my last visit and what developments, if any, had taken place since the war. Every facility was accorded me by Director Maleyka and his associates. The tremendous expansion of the works was at once apparent. All shops were busily engaged. A forty-eight-hour week was in effect, but this did not prevent the utilization of additional shifts of workmen. Enough work was in sight to keep the Wernerwerk busy for six months, and in the other branches there was work in hand sufficient to keep going for periods varying from three to five months.

POLITICAL HANDICAPS

The entire electrical situation for these and other German shops has been very much complicated by recent political events. The directorate of the Siemens and Halske-Siemens-Schuckertwerke view the outlook with no little pessimism. In a written statement handed me the directorate says:

"We are unable to say anything about the immediate future outlook for German electrical business on the Continent and beyond Europe as the present political situation has brought economic life, not only in Germany but in all Europe, to a state of complete incertitude. The unjust settlement of the peace treaty and the new violation of this treaty by the French are oppressing the market for electrical products more and more, not only in Germany but also abroad. German buyers are becoming more rare and other countries are fencing themselves behind a high tariff wall. The result seems to be inevitable.

"We have no future to face. The political crisis has upset all our plans, and the only possible issue would be for the Allied Powers, and especially the United States of America, in their own interests, to bring about a right consideration of present-day German economic life and a real peace."

Leaving political questions out of consideration, I took up with the various directors those matters which related more particularly to work in hand. Director Maleyka is in charge of the industrial power department, which is primarily devoted to the installation of electrical equipment in iron and steel mills. I had just come from the Witkowitz Works in Czechoslovakia, where there were approximately two thousand electric motors of the Siemens-Schuckertwerke in use.

To-day in Germany practically all rolling mills and iron and steel plants are electrically driven. This is due to the ease of application and also to the use of blast-furnace gas engines as prime movers. For iron and steel works requiring only a small amount of power the Siemens-Schuckertwerke practice is to install 500-volt direct current. Three-phase, 50-cycle alternating current is normally employed in large installations, the generators being wound for 2,000, 3,000 and 6,000 volts.

TENSION OF 10,000 VOLTS

The highest tension now in use in iron and steel plants is declared to be 10,000 volts, motors for this tension being quite common in rolling mills. The output of energy from blast-furnace gas plants is limited by the capacity of the engines, the maxmium size of which is 3,000 hp. per cylinder. In twin-tandem installation, therefore, 12,000 hp. can be obtained from one engine set.

Direct current is supplied from three-phase power stations through converter sets. These comprise single-armature rotary converters in sizes up to 3,000 kw., cascade converters rated at about 2,000 kw., motor-generators and mercury rectifiers. The latter can be had in sizes up to 1,000 amp. at a tension of 1,200 volts. Apparatus for improving power factor, such as compensators or over-excited synchronous motors, are to be seen in many mills.

Rolling-mill motors with a single armature are now furnished by the Siemens-Schuckertwerke, and for still larger outputs motors are supplied of the double armature machine type. The latter are equipped for Ilgner-Leonard control.

UNDERGROUND CABLES AND OVERHEAD TRANSMISSION

The Siemens-Schuckertwerke are now manufacturing and have already delivered a number of 35,000-volt three-phase cables. These works say that the results have proved satisfactory and that the cables are working well. For high-tension work non-armored, lead - covered single-phase cables are provided. Many cables of this kind were delivered for tensions of 60,000 volts prior to 1915.

The Siemens-Schuckertwerke have installed a number of overhead transmission systems for 110,000 volts and report that they are quite satisfied with the results.

RAILROAD ELECTRIFICATION

While the three-phase system is still used on railways of early construction as, for instance, in northern Italy and in the Simplon Tunnel, the Siemens and Halske-Siemens-Schuckertwerke report that today electric railways in Switzerland, Austria, Sweden and Norway have, like Germany, adopted the single-phase system. In this connection it is interesting to note that the heavy ore trains running into Norvick, in upper Norway, are pulled by electric locomotives from the Siemens and Halske-Siemens-Schuckertwerke.

The blockade of Germany had a direct bearing on electrical construction work and affected seriously the receipt of essential materials entering into the manufacture of electrical equipment. Copper, rubber and other essentials were taken by the government for military uses. As a consequence substitutes had to be found, but after the war many of these substitutes had to be abandoned. For overseas business the firm reports that none of these war substitutes could be used, importers insisting on peace-time standards.

PERSONNEL AND PRODUCTIVITY

The personnel at the Siemens and Halske-Siemens-Schuckertwerke, in common with that at many another industrial plant, has undergone a change. War did not make such heavy inroads into the ranks of electrical workers as in the case of machine-tool men, but nevertheless Germany lost many of her skilled electric workmen. At the present time all revolutionary ideas have apparently vanished, and there is reason to believe that the French advance into the Ruhr has had the effect of wiping out the last vestige of local opposition to the German government.

Just now it is difficult to fix any average rate of wage for electric workers because of the changing value of the mark. Not only are conditions changing, but all prices are rising, so that no average payment per hour can be given.

In answer to a question concerning the post-war productivity of the workmen, the Siemens and Halske-Siemens-Schuckertwerke state that it is difficult under present conditions to arrive at an accurate proportion as between real production and productive capacity. The productivity of individual workmen, they say, has suffered a great deal in consequence of the many years of war. The war, as they characterize it, has continued subsequent to the armistice. To this they add as disturbing causes the blockade, the reparation burden and the continued economic pressure. While emphasis was laid on the fact that the German people are working hard and straining every effort, the present output in comparison with pre-war days is estimated by the Siemens and Halske-Siemens-Schuckertwerke to be from 60 to 70 per cent normal.

MACHINE TOOLS

There have been practically no machine tools of American make purchased since the war. Throughout Germany I have repeatedly heard it said that the German market was a thing of the past for American machines. The installation of machine tools in the Wernerwerk is large. There are many American automatic machines in service there, and those in evidence are representative of the best American makes. But the present price of American machines, it was pointed out to me, makes prohibitive any purchases by the Siemens firms, and in consequence recourse is had to the cheaper German machines. When one considers that the Krupp works, employing 100,000 people approximately, last year worked for a reported net profit of $20,000, some idea can be gained of how close the Germans are figuring and to what extent they are straining efforts to maintain shops in operation. There have been a few American machines imported into Germany during the past year, but in every case, so far as I can learn, these machines were of a highly specialized type.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

TWO aspects of the market situation seem to stand out as of particular interest to electrical men this week—one the influence of building conditions upon the market for wiring materials, the other the record sales in appliances which are being reported in all quarters.

Construction of residences and commercial buildings is proceeding, but labor conditions in the steel and building trades are causing much anxiety and hold back much work. August and September are expected to bring a great many buildings to a state of completion that will require a large volume of electrical equipment. Large contractors in New York City report ample labor but a distinct setback in business owing to the stoppage of large building operations on account of high costs.

There is an outlook for a large volume of retail trade in household appliances for the fall. Electric range sales during April and May, it is estimated, show about 70 per cent increase over those of the corresponding months of 1922, when the range market was just recovering. It is believed that August, September and October sales will exceed those of the spring months. The general market for appliances is enjoying the largest year in its history. Very large sales of flatirons and heaters of the reflector type are reported as the result of special campaign promotion.

Central-station construction continues strong and the pole and cross-arm people in both Chicago and New York report increasing business, less impeded by delivery troubles.

Price reductions have been announced in wire and flexible armored conductor throughout the Eastern and Middle Western districts. Stocks of conduit are reported abundant with expected price increases within a month. Porcelain is selling best in the South and Southwest, where it is said to be entering principally into the finished house-wiring field, little of the volume being used for telephone construction.

Radio sales to jobbers during the week are reported larger, one manufacturer stating that retailers have started inquiries for fall stocks. Stocks on the shelves during the summer have been very low, it is to be remembered, and any activity on the part of the dealers is now regarded with keen interest by both manufacturers and jobbers.

Long Deliveries Persist for Turbo-Generators

NO SIGNS of decreasing demand for turbo-generator sets for central-station service appear on the horizon of leading manufacturers. On both large and smaller units the 1923 output is fully sold, and quotations on new machines are for 1924 deliveries.

Demand for prime movers of this

type parallels the expansion of the central station and is influenced by load-building campaigns throughout the country, embracing every phase of industrial power service, advances in electric heating, the electrification of mercantile establishments and the growing purchase of energy by traction companies, to say nothing of the progress of illumination. Turbine makers are keeping the supply of raw material well in hand, prices are firm and labor none too plentiful.

Orders by Two Companies Show Business Trend of 1923

AN INDEX to the business of the entire electrical industry in America is afforded by studying the reports of the leading companies. Orders by the two largest companies show gains ranging from 25 to 44 per cent over the corresponding period of 1922. Reports from the General Electric and Westinghouse companies are as follows:

General Electric Company in the six months ended June 30 booked orders totaling $164,263,755, against $114,219,-248 for the corresponding period of 1922. This is an increase of 44 per cent. In the three months ending June 30 bookings totaled $84,249,719, as compared with $62,883,948 in the second quarter of 1922, increase of 34 per cent.

The accompanying tabulation compares General Electric's new orders for the past three quarters and year 1922 with previous corresponding periods.

	1923	1922	Percentage Increase
Six months ended June 30	$164,263,755	$114,219,248	44
Three months ended June 30	84,249,710	62,883,948	34
Three months ended March 31	80,014,045	51,335,300	56
	1922	1921	Percentage Increase
Year ended December 31	$242,739,527	$179,721,680	35
Three months ended December 31	66,568,333	44,465,218	50

In the six months of the current year General Electric took on new business at the monthly rate of $27,377,000, or about $6,317,000 a week. The monthly average for the quarter ended June 30 was somewhat above that for the six months, or about $28,083,000 a month. While the half year indicates annual bookings of approximately $328,000,000, officials would consider the year satisfactory if the year's total should range between $300,000,000 and $320,000,000. Billings for the year, allowing for gradual increase in shipments booked over a year ago, will likely exceed $270,000,000. It should not be overlooked that General Electric entered the year 1923 with approximately $76,000,000 unfilled orders.

Incoming orders of the Westinghouse Electric & Manufacturing Company for the first quarter of the fiscal year beginning April 1 totaled over $47,500,-000, compared with $32,119,000 in the corresponding period of last year. There was a decrease in June compared with the two preceding months, but that it was seasonal is indicated by the fact that bookings so far in July are ahead of the same period in June. Officials of the company expect July business will be better than June, the company having booked up to July 9 $8,000,000, compared with $3,000,000 for the corresponding period of June. Included in the July figures are several large turbine contracts, but the general run of business has also improved substantially over last month. Sales billed for the first quarter amounted to $36,-564,000, compared with $26,713,000 in the first quarter last year. Billings are also expected to improve in the second quarter since output is being constantly increased. Unfilled orders have increased approximately $11,000,-000 since the first of the year, when they amounted to $61,914,237.

Makers of Fine Fixtures Striving to Offset Rising Costs

WITH the values of both raw materials and labor rising much effort is being made in the present residential and commercial fixture manufacturing field to reduce other production expenses in an effort to keep prices at the normal level of last year. It is to be remembered that this market is on a highly competitive basis, and that the only method by which its manufacturers are allowed to keep within prices agreeable to the consumer is by simplified factory methods which allow no waste in materials by unskilled craftsmen.

Increased costs during the past three months include most every material entering into a fixture. Best silk has advanced approximately 75 cents a yard over the corresponding period of a year ago, copper, brass and bronze castings have increased approximately 10 per cent during the last four months, vellum and parchment values have gained slightly, the increased use of decorative glass has brought higher prices, steel wire is harder to obtain and skilled labor is now at $10, having advanced $1 a day a few weeks ago.

Although there has been a distinct trend to standardize on design in commercial fixtures and in some styles of the residential type, to develop large volume sales, several conservative manufacturers of the more expensive, artistically designed standards, brackets and shades which are sold on special orders to larger hotels, public buildings and residences have little chance to engage in national business with even a partly standardized line. In order to prevent losses through dead and depreciated stocks, however, they try the experiment of making up quantities of silk shades in only neutral colors, such as, gold, champagne and yellow. Pink, blue and other shades are provided only on special orders at slightly higher prices.

Although there has been some serious discussion among this conservative trade toward following the more simplified practices of manufacturing employed by the French, there is little possibility that American producers will attempt it, for the reason of the changing demand. In France it is a practice of one company to make the body parts, another shades, and still another to assemble and distribute.

Because of the lasting qualities of parchment and vellum, there is an increasing volume of orders in this material going to hotels and high class retail establishments. Simplified lines in champagne and deep yellows are selling best. A few styles to be brought out in the fall when Tutankhamen's tomb will be reopened show finely blocked squares, circles and triangles in various colors in order to satisfy the craving for Egyptian styles which it is expected will be greatly revived. The Byzantine period is also in much favor. Silk shades are selling best in the residential field.

Large Increase of Electrical Brass and Copper Products

CENSUS reports of the brass, bronze, copper and allied industries for the year 1921, just issued, contain considerable information of value for electrical manufacturers. Of the finished products covered by the Department of Commerce, those made of brass constitute by far the greater part and are 84.6 per cent of the total value in 1921, which amounted to $39,139,373. According to the report, 157,114 lb. of brass was used in the manufacture of lamps in 1921, compared with 1,504,406 lb. in 1919 and 561,746 lb. in 1914. Other metals and alloys entering into lamps in 1921 amounted to 71,064 lb. No comparisons with 1914 and 1919 are given.

Electrical supplies in 1921 consumed 2,787,460 lb. of brass, 10,000 lb. of bronze, 557,277 lb. of copper, 3,333 lb. of other metals and alloys, all of which were valued at $3,358,070.

Plain wire in 1921 took 18,748,700 lb. of brass, 8,526,123 lb. of bronze, 94,-249,187 lb. of copper, 750,884 lb. of other metals and alloys, all of which were valued at $20,709,474. Insulated wire in 1921 took 14,527,036 lb. of copper valued at $3,694,152. In 1914 there were 5,384,175 lb. of copper, valued at $846,439, used by insulated-wire companies, according to the census report.

New York Business Is Termed "Uneven"

NEW YORK'S electrical business continues in an uneven condition, with prices advancing up and down in the materials entering into new construction. During the past week prices on armored cable slumped considerably owing to the light demand by finished house-wiring contractors during the past few months. No. 14, two wire, double strip, in lots of 5,000 ft., selling by the jobbers at $46 per 1,000 ft. at the beginning of last week, is now quoted in same quantities at $43.

Conduit stocks are very heavy in the Manhattan warehouses, contrary to reports by manufacturers that there is little left in the hands of the jobber. Several houses expect a noticeable price decline in this commodity to come within a week. Wire stocks are heavy with continuing weakening in quotations to the contractors.

Sales in the appliance market are astounding. The volume of washers and cleaners is going to the outlying districts. Iron sales are said to be 50 per cent heavier than last year. Manufacturers report heavy orders of headlight heaters for September delivery.

Transportation of porcelain, electrical machinery and wire from the factory is said to be most easy. Collections are running at normal.

Porcelain sales in New York are few and far between and there are few heavy stocks of this material reported by the wholesale trade.

Lamp sales are said to be unusually heavy for this time of the year, the largest orders being taken for signs and new apartment houses.

Spotty Trade Conditions Prevail in Boston Jobbing Circles

SPOTTY trade conditions prevail in Boston jobbing circles, although underlying sentiment is wholesome and stocks are meeting requirements without undue accumulation of inventories, at least in many establishments. The general volume of trade this spring and early summer has been excellent. Collections are fair, the credit situation being satisfactory and money easy.

Central-station expansion continues rapid. Industrial buying of electrical supplies from jobbers shows some improvement. Flexible armored conductor dropped about 12½ per cent Monday on jobbers' cost quotations and wire prices continue weak. Deliveries in New England on porcelain insulators are reported slow, but in general wiring supplies are ample. Home building has been somewhat impeded in this section by high prices of labor during the past few months, although a large volume of construction is still under way.

Apparatus manufacturers are doing an immense business; the sale of lamps is exceptionally good for this time of year and appliances are moving well, interest in irons, washers, cleaners and ranges being marked. Prices of rigid conduit continue firm, with intimations of further advances to come. Telephone service in New England is improving week by week, the strike of operators apparently being headed for total failure after several weeks' duration.

California Trade Experiencing Cautious Buying This Month

CALIFORNIA building showed a June 1923 increase of about 10 per cent over May 1923 and of about 25 per cent over June 1922. The great natural products, such as fruit, lumber, oil and mining, also show increased production with a gradual curtailment, however, of lumber and oil. Competent judges predict a big mining boom this fall.

Credit conditions are better, collections now averaging nearer fifty than sixty days, and recent failures have been few and small. Power sales have been running 20 per cent over last year and railroad traffic will undoubtedly jump in response to steamer freight raises.

Purchases by power and railroad companies have been very large. It is evident that a spirit of caution has succeeded the spring optimism and is reflected in markedly decreased July buying. Electrical jobbers and dealers report universally lighter buying.

The Metal Market

COPPER is more firm at 14.75 cents, despite the downward movement in prices abroad. The export market is weaker, however, and is quotable at from 14.62½ to 14.75 cents.

Sales of copper in June ranged between 195,000,000 and 200,000,000 lb., according to estimates made in the trade last week. This compares with sales of 190,000,000 lb. in May and 195,000,000 lb. in April. For the first six months of the year refinery shipments approximated 1,175,000,000 lb., while output was estimated at 1,053,000,000 lb., thus causing a reduction of 122,000,000 lb. in surplus stocks between Jan. 1 and June 1, 1923.

Almost daily reductions in price of lead have been made by the American Smelting & Refining Company during the last week.

The price of zinc has hardened perceptibly since a week ago. At first the increased price was largely occasioned by a reluctance by producers to sell at levels which gave them no profit, considering the price of ore. Then, in the last week, consumers have become somewhat alarmed at the increasing prices, and more active buying has shoved prices up further. Dealers, galvanizers and brass manufacturers have all entered the market.

NEW YORK METAL MARKET PRICES

	July 10, 1923 Cents per Pound	July 17, 1923 Cents per Pound
Copper, electrolytic.	14.37½	14.75
Lead, Am.S.& R.price	6.85	6.00
Antimony	6.90	6.75
Nickel, ingot	27.00 to 32.00	27.00 to 32.00
Zinc, spot	5.76	5.90
Tin, Straits	38.40	38.08
Aluminum, 98 to 99 per cent	26.00	26.00 to 27.00

Chicago Business Continues at Normal with Firm Prices

CHICAGO electrical business continues on a normal plane for jobbers and dealers and prices are firm with the exception of a lower price on flexible armored cable in some instances. The reduction of wire prices of two weeks ago did not have much effect on buying, as most jobbers were pretty well stocked up months ago. The present price, it is assumed, will be in effect for several months and then indications are that a price advance can be expected again. Cedar poles are still in demand and stocks have not been replenished to any great extent. Pole-line hardware, transformer and meter demand good and supply normal.

Conduit prices are firm with no reductions in sight. Producers claim that no lower prices can be quoted until there is a reduction in labor costs. The steel companies appear to be sold to the full capacity of their plants on pipe orders for the balance of the year.

Meter Demand Well Sustained, with Excellent Deliveries

DEMAND for watt-hour meters as reported by representative factories in the East and Middle West continues to reflect great activity in the building industry and in central-station house-wiring campaigns. While the total volume of meter sales is somewhat below that of early spring, there is little indication that the summer's business will not hold close to present or even larger totals.

At the factories raw materials are in good supply; the use of standardized methods and of automatic machinery is stabilizing costs, and prices are steady. There is an upward wage pressure in common with other branches of electrical production, but there is sufficient reserve manufacturing capacity today in the meter plants of the country to maintain labor costs around present levels, at least for the time being.

Deliveries are excellent, both from factory stocks and on new orders for massed units. The industrial expansion of the country is absorbing an increasing number of meters for power service; curve-drawing meters for electric furnace and other heating applications are moving well, and there is wide interest among central stations in the development of reactive meters, due to increased concern over power-factor problems in consumers' installations.

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.034	$0.034	$0.0252
Cold finished shafting, per lb.	0.042	0.042	0.0335
Brass rods, per lb.	0.1825	0.1850	0.1566
Solder (half and half), per lb.	0.2862	0.2812	0.21
Cotton waste, per lb.	0.1231	0.1231	0.101
Washers, cast iron (½-in.), per 100 lb.	4.66	4.66	3.83
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.08	3.08	3.11
Machine oil, per gal.	0.349	0.349	0.36
Belting, leather, medium, off list	37%	42½%	46½%
Machine bolts, up to 1-in. x 30-in., off list	44½%	44½%	56½%

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Cramps' Contracts for Hydro Equipment Total 180,000 Hp.

New contracts for hydro-electric machinery aggregating 180,000 hp. have been announced by the William Cramp & Sons Ship & Engine Building Company. This additional equipment is to be placed in service throughout the United States and Canada.

The largest single contract calls for the construction by the Dominion Engineering Works, Ltd., Canadian licensees of Cramp's, of two 58,000-hp. turbines for the Queenston development of the Hydro-Electric Power Commission of Ontario. The same plant has also received a contract from the commission for two Johnson penstock valves and two sets of I. P. Morris governors.

Other contracts reported include two 10,000-hp. turbines for the Northern Canadian Power Company, one 14,000-hp. impulse wheel for the Southern Sierras Company, two 7,500-hp. turbines for the Montana Power Company and an additional turbine for the Washington Water Power Company, all from the Pelton Water Wheel Company of San Francisco, besides a 7,500-hp. turbine for the Amoskeag Manufacturing Company, to be built in the I. P. Morris shops in Philadelphia.

Akron, Ohio, Jobber Moves

The Hardware & Supply Company, Akron, Ohio, electrical jobber, announces its recent removal to its new building at 535 South High Street. Since 1911 the business has been conducted at 21 West Market Street, in the Hower Building, which was erected especially for the company's use. The company's present officers are J. E. Good, president; W. W. Wohlwend, vice-president; E. W. Hartzel, secretary, and W. T. Flower, treasurer.

Electrical Toy Manufacturers to Hold Show Feb. 4

The National Toy Show, which since 1916 has been held annually at the Hotel Imperial, New York City, will be held in the future at the Bush Terminal Sales Building, 132 West Forty-second Street, according to reports from electrical toy manufacturers who during the last four years have controlled the largest exhibits at these shows.

It is stated that George T. Keen, manager of the Imperial, has taken over for a term of ten years three full floors and parts of three others in the Bush Terminal Building. The fifth floor will be put into exhibition use first, with the fourth and third following. The other floors will be utilized later. The first show to be held in the new quarters will be on Feb. 4.

Automatic Electric Schedule Is Filled for Remainder of Year

The manufacturing schedule of the Automatic Electric Company, Chicago, manufacturer of telephones for private use and telephone receivers, is entirely filled for the remainder of the year, it was revealed by H. S. Harris, vice-president of the company, last week. Inquiries and orders already booked for the next year indicate that the 1924 manufacturing program will be the largest in the history of the company.

George H. Wahn Organizes Central Station Department

The George H. Wahn Company, Boston, Mass., has organized a central station department at its headquarters, 69 High Street, in charge of H. E. Stockwell. For the past four years Mr. Stockwell has been in the general supply sales work of the company, traveling in northern New England and also being attached to the Boston office.

In connection with the establishment of the new department the company has taken the New England representation of the "Semco" line of meters manufactured by the Sewickley Electric Manufacturing Company, Sewickley, Pa., and of the Kuhlman Electric Company's transformer line, produced at Bay City, Mich. Another recent line that has been taken over is the "Buss" fuse, produced by the Bussman Manufacturing Company, St. Louis. The company was recently appointed distributor for fixture material of Crescent Brass Products Company, Cleveland.

Thirty Years of the G. E. Company

Book Issued Last Week in Tribute to Charles A. Coffin Indicates the Company's Wonderful Growth, Accomplishments and Contributions to the Industry

THE General Electric Company last week issued a review of its activities since its beginning in 1892, which indicated the company's growth, accomplishments and contributions in the field of scientific research, engineering, development and manufacture, and future opportunities of the electrical industry. In this book tribute is paid to the leadership of Charles A. Coffin, recently retired chairman, and to accomplishments of E. W. Rice, Sr., former president.

From the relatively small successor of the Edison General Electric Company and the Thomson-Houston Electric Company, the company has grown to a tremendous organization, with plants in forty cities and field offices in every important city. In the short span of thirty years General Electric stock has been increased from $35,000,000 to $184,000,000, while annual sales have jumped from $12,000,000 to $243,000,000. The stockholders now number 29,461, as against 4,000 in 1893. The value of its manufacturing plants has increased from about $4,000,000 to $167,000,000 and factory floor space from 400,000 sq.ft. to more than 25,000,000 sq.ft. The number of employees has grown from 4,000 to 74,000. Up to the present time products aggregating $300,000,000,000 have been carried to all parts of the civilized world, outside of the United States, justifying creation of the International General Electric Company to handle foreign business.

The General Electric Company has been a powerful and progressive force in every field of the electrical industry, and its contribution in the form of inventions has been noteworthy. In large scale power generation the company has been a leader, the most powerful single-unit turbine in the world being constructed in the General Electric's shops. The latest machine has 80,000 hp. capacity, or more than eleven times that of the first machine. Through turbine installations in power plants 90 per cent more energy was obtainable from a pound of coal in 1922 than in 1913.

The General Electric Company installed its first motor for ship propulsion in the year 1908. Since 1914 the company has manufactured or is now building propulsion machinery for 400 ships, including 322 merchant cargo carriers, forty-eight torpedo boat destroyers and thirty ships equipped with electric drive, an unequaled record in this field.

The present company and its predecessors were pioneers in the introduction of electricity for street railway transportation. They were the first to supply apparatus for electrification of elevated and steam railroads, especially through tunnels entering large cities. Included among the roads are the New York Central Terminal, the Michigan Central tunnels and the St. Paul.

In the past thirty years motors ranging in size from 1,200 hp. to those rated at 30,000 hp. or more have been installed and are now performing work equivalent to manual labor of 175,000,000 men.

The booklet points out that in the field of illumination the General Electric Mazda lamp is now the most widely used. Electric lighting is one of the few commodities that have steadily de-

creased in cost from the beginning. The aggregate of its improvements, together with reductions in cost of producing electricity, have reduced the cost of a given amount of light 95 per cent since 1880. Purchasers of incandescent lamps in this country paid $90,000,000 last year for lamps with which to light homes, stores, factories, streets, etc. This is equivalent to 85 cents per capita annually, or less than 2 cents per capita a week.

Generation and transmission of electricity in excess of 1,000,000 volts was first accomplished at the Pittsfield works, on Sept. 13, 1921. Practicable transmission of energy at such voltages is a thing of the future, but 220,000 volts, now utilized commercially, was anticipated by the company twenty years before its application. Other contributions made by the General Electric Company include trackless trolley cars, the first elevator motor, the development of radio, household conveniences and the X-ray tubes.

Despite increased labor and material costs and with all improvements in manufacture, the average selling price of General Electric products has not increased as rapidly as the average selling price of commodities in general, as shown by reports published by the Bureau of Statistics. The United States Bureau Index reached the peak of 231 in 1920, and General Electric reached the peak in the same year, but the latter's peak was only 155. The average for last year of the Labor Bureau's figures was 152, compared to only 125 for the electric company. The price index for incandescent lamps, taken as 100 in 1914, has not been over 4 per cent higher since, and in 1922 was about 95 per cent of pre-war prices.

Distribution of each dollar of income of the General Electric Company from 1918 to 1920, inclusive, is clearly set forth in a chart prepared by the company. Wages and salaries paid to the average of 76,000 employees took 41.7 cents; materials, supplies, depreciation, operating charges and losses required 40.6; 4.7 cents represented surplus reinvested for enlargement of business, and 5.3 cents for taxes and public utility services, but of these two amounts, the greater part was eventually paid out as wages and salaries. Stockholders received 4 cents; 2.5 cents represented transportation, telephone and telegraph, and 1.2 cents interest on borrowed capital.

Purchase Electric Furnace Company of Salem, Ohio

The Electric Furnace Company, Salem, Ohio, of which T. F. Baily was formerly president, and which went into the hands of receivers a few months ago, has been purchased by F. A. Hoiles and R. F. Benzinger, Alliance, Ohio, and F. T. Cope of Salem.

The new company expects to manufacture Baily electric melting furnaces for non-ferrous metals, high-temperature heating furnaces and heat treating and annealing furnaces. The officers of the new company are: F. A. Hoiles, president; R. F. Benzinger, vice-president, secretary and sales manager, and F. T. Cope, treasurer and general manager. The officers state that the organization is entirely a new company, adequately financed.

Refractory Companies Merge Into Stowe-Fuller

The Stowe-Fuller, the National Fire Brick Company and the Minor Fire Brick Company, all of the Cleveland district, manufacturers of fire brick and refractory materials, have been consolidated into the Stowe-Fuller Refractories Company. The Stowe-Fuller Refractories Company has also acquired a controlling interest in the Federal Refractories Company, manufacturer of silica, magnesite and chrome brick, and will handle the output of the Open Hearth Fire Brick Company, the Zoar Fire Clay Company, the Lock Haven Fire Brick Company and the Hite Coal & Clay Company.

This consolidation makes this company self-contained and in a position to mine, manufacture and supply every class of refractory material required by a steel or electrical plant.

Connecticut Blower Corporation Expects to Finish Plant in Fall

The Connecticut Blower Corporation, Hartford, Conn., recently formed under Delaware laws, with a capital of $250,000, is perfecting plans for the establishment of a plant to manufacture exhaust fans, blower systems, etc., and expects to have the works ready for service in the fall. In the meantime, production will be carried out at the plant of the International Blower Company, which has been succeeded by the new company. M. E. Keeney is president and C. H. Keeney treasurer.

The American Electric Company, St. Louis, announces the appointment of C. I. Echols, formerly with the Electric Appliance Company, Dallas, Tex., as sales manager. He succeeds Robert A. Graham.

The Otis Elevator Company, Eleventh Avenue and Twenty-sixth Street, New York, has awarded a contract to the Turner Construction Company for a five-story addition to its plant at Yonkers, N. Y.

The Century Electric Company, 1827 Pine Street, St. Louis, manufacturer of fans, motors, etc., is planning the construction of an addition and improvements in the present plant, to cost $400,000, with equipment.

The Apex Electrical Distributing Company is now manufacturing and selling the "Kool-Rite," which is a lamp socket electric stove formerly made by Electric Appliances, Inc., of Muncie, Ind. This device will be known as the "Rotarex Electric Kook-Rite" and will continue to be made at Muncie.

The Republic Lamp & Fixture Works, Inc., 732 Daly Street, Philadelphia, manufacturer of lighting fixtures, etc., has leased two floors in the building at 610 Arch Street for expansion.

The Fibre Conduit Company, Orangeburg, N. Y., manufacturer of insulating conduit, has acquired a tract of land of about 30 acres at West Richmond, Ind., and has tentative plans for a new Western branch plant to cost close to $200,000.

The Horne Manufacturing Company, Mercer and Colgate Streets, Jersey City, has been bought out by the Horne Electric & Manufacturing Company, which is continuing the manufacture of radio apparatus and supplies, marine apparatus and railway supplies.

The Heyer Products Company, 3 Valley Road, Montclair, N. J., has been incorporated with capital of 2,004 shares of stock, no par value, to manufacture battery charging and testing equipment and automotive electric testing equipment. Most of the equipment has already been placed. These machines have been made for the past two years in small quantities and the company expects to enlarge its capacity considerably. B. F. W. Heyer heads the company.

The Bonmor Blower Corporation, New York City, recently incorporated with stocks of $10,000, will manufacture brass and bronze lighting fixtures. The corporation is now functioning with a plant at 117 East One Hundred and Twenty-ninth Street and show rooms at 139 Fifth Avenue. L. H. Fischer, 33 Union Square, is president.

The Rome Wire Company, Rome, N. Y., has secured a building permit for the erection of the proposed addition to its branch plant at 180 Clyde Street, Buffalo, N. Y., to be 100 ft. x 225 ft., estimated to cost $70,000.

The Spaulding Electric Company, 1344 Michigan Avenue, Detroit, Mich., manufacturer of electrical equipment, has filed plans for the erection of a one-story plant addition, to cost about $13,000, exclusive of equipment.

The Detroit Insulated Wire Company, 4651 Wesson Street, Detroit, Mich., has taken out a permit for the erection of a new one-story plant at 6000 Vigo Street, to cost about $45,000.

The Vaughn Electric Company, Seattle, Wash., has acquired the stock and business of the M. & M. Electric Company, Seattle, which has been in financial difficulites. The company has also purchased the plant and equipment of the Sterling Electric Company, Tacoma, Wash., manufacturer of electrical specialties. Plans are being perfected for the establishment of a plant in the building at 4200 University Way, Seattle, for the manufacture of electric fixtures and equipment. It is proposed to remove some of the equipment from the Tacoma works of the Sterling company to the new location.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Zagreb, Yugoslavia (No. 7,137), for electrical appliances.

An agency is desired in Porto Alegre, Brazil (No. 7,190), for electrical goods.

Purchase is desired in Montevideo, Uruguay (No. 7,133), for insulated wire.

Purchase is desired in Port Arthur, Canada (No. 7,134), for two 10-ton ice-making plants.

Purchase is desired in Fort William, Canada (No. 7,142), for one 20-ton ice-making plant.

Purchase is desired in Pedricena, Mexico (No. 7,204), for ice-making or refrigerating machinery.

PROPOSED NEW PLANTS IN ARGENTINA.—Consul Wilbert L. Bonney, Rosario, Argentina, reports under the date of May 22 that six new lighting plants are under consideration. They are all private enterprises based on the needs and gradual growth of the Province of Cordoba.

ELECTRIC RAILWAY MATERIAL REQUIRED IN SPAIN.—A Spanish firm, *Commerce Reports* states, is interested in getting in touch with American manufacturers and dealers of equipment and material required for electric railways. Further information may be obtained from the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, by referring to No. 96,777.

APPLICATIONS FOR CONCESSIONS TO DISTRIBUTE ELECTRICITY IN FRANCE.—Application has been made by the Société l'Energie Industrielle for a concession to supply electricity in twelve towns in the Departments of the Basses-Pyrénées and Landes. The Société des Entreprises Electriques du Centre has petitioned for a concession to furnish electricity to a syndicate formed of thirty-three communes in the Department of Saone-et-Loire and two communes in that of the Ain. Application has been made by the Société Agricole d'Electricité de la Region d'Hattencourt for a concession to erect a distributing system to serve electricity to twenty-six communes in the Department of the Somme.

PROPOSED EXTENSION TO THE HIGH-TENSION SYSTEM IN GOTHENBURG, SWEDEN.—Extensions to the high-tension cable of the city of Gothenburg, Sweden, according to *Commerce Reports*, are under consideration. The city, it is stated, buys this material direct from manufacturers and the municipal electrical department sends out formal calls for bids from firms which are either known personally or whose reputation invites trade. Full address and a list of electrical dealers can be secured from the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., or the district offices of the bureau, by referring to file No. 95,471.

New Apparatus and Publications

PREVENTION OF CORROSION.—Bulletin N-4, entitled "Conquering Corrosion," issued by the Elliott Company, Jeannette, Pa., discusses the problem of corrosion in power plants and pipings in buildings and tells how to protect boilers, economizers and piping by removing the dissolved oxygen in the water by the "Elliott deaëration" process.

OUTLET BOXES, UNILETS, ETC.—The Appleton Electric Company, 1701 Wellington Avenue, Chicago, is distributing catalog No. 9 (in two sizes, desk and pocket), in which is listed a complete line of all the "Appleton" electric products, including unilets, outlet boxes and covers.

METER SEAL.—The Decorated Metal Manufacturing Company, 198 Degraw Street, Brooklyn, N. Y., is manufacturing studlocking type of seal for sealing meters, recording devices, appliances, etc.

ELECTRICAL SUPPLIES.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing its catalog of electrical supplies for 1923 and 1924. This issue replaces and supersedes all catalogs issued heretofore on electrical supplies. The book is cloth-bound, contains 1,300 pages and is thumb-indexed. A new feature, classified index, has been added to the introductory section under the title "How This Catalogue Serves," in which is listed apparatus of particular interest to central stations, electric railways, industrial plants, mines, contractor-dealers and architects. More than 175 pages are devoted to the street-lighting section.

BATTERY CHARGING MOTOR-GENERATORS.—The Electric Products Company, Clarkstone Road, Cleveland, is distributing bulletin No. 51 covering its "Wotton" battery charging motor-generators for storage battery trucks, tractors and locomotives.

STANDARD CODE FOR TESTING CENTRIFUGAL AND DISK FANS.—The Green Fuel Economizer Company, Beacon, N. Y., is distributing a bulletin containing the "Standard Test Code for Disk and Propeller Fans, Centrifugal Fans and Blowers" prepared by a joint committee selected by the National Association of Fan Manufacturers and the American Society of Heating and Ventilating Engineers.

TACHOSCOPE.—A direct-reading tachoscope, "O-Z," which is a combined antimagnetic chronometer and revolution counter, is being placed on the market by O. Zernickow, 15 Park Row, New York City.

ELECTRIC MOTOR TRUCK.—The Ward Motor Vehicle Company, South Fulton Avenue, Mount Vernon, N. Y., has brought out a new electric milk delivery truck, known as "WM-2" model, specially designed for house-to-house milk delivery.

TAPS AND PLUGS.—Harvey Hubbell, Inc., Bridgeport, Conn., is distributing a folder describing the "Hubbell Te-Tap" No. 1 for use with any standard socket, and its general service plug with double "Te-Slots." It is also distributing bulletin No. 17-12C, entitled "Elexits, 'Places for Lights'," which supersedes bulletins Nos. 17-12A and 17-12B.

ELECTRIC FURNACE.—The Booth Electric Furnace Company, 411 North Wells Street, Chicago, has developed a small 1-lb. furnace in which it is possible to reach a temperature of over 4,200 deg. F.

AIR PREHEATER.—James Howden & Company of America, Inc., engineers, Wellsville, N. Y., are distributing bulletin No. A-5, describing the "Howden-Ljunstrom" patent air preheater.

STOKER.—The Combustion Engineering Corporation, Broad Street, New York City, is distributing a pamphlet covering its "Type K" stoker for operating boilers ranging up to 200 hp. at high capacity and efficiency.

TRANSFORMER FUSES AND FUSE BLOCKS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has placed on the market a line of inclosed cartridge-type potential transformer fuses and fuse blocks in voltages of 2,500 to 25,000 for the protection of indoor potential transformers.

ELECTRIC CLEANER.—The United Electric Company, Canton, Ohio, is distributing three new folders on the new model "Ohio" electric cleaner and attachments.

VARNISH.—The E. I. du Pont de Nemours, Wilmington, Del., has developed a new finish for wood and metal, known as "Viscolac."

PRECISION BALANCING MACHINE.—The Gisholt Machine Company, Madison, Wis., has placed on the market a precision balancing machine, which is the commercial application of new principles of static and dynamic balance discovered by Dr. B. L. Newkirk of the research department of the General Electric Company. It is a rapid, mathematically absolute machine or instrument which accurately measures and locates unbalance in rotative parts.

New Incorporations

THE KILMARNOCK (VA.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $10,000 to distribute electricity in Lancaster and Northumberland Counties. The officers are: W. L. Mason, president, and W. B. Lee, secretary.

THE BREVARD COUNTY POWER COMPANY, 1422 Munsey Building, Baltimore, has been incorporated with a capital stock of $200,000 by Herman A. Lang and Joseph A. Slattery.

THE OKEMAH (OKLA.) GAS & ELECTRIC COMPANY has been organized to take over and operate the municipal electric power plant. The incorporators are: S. J. Palmer, T. E. Stanley and Merle F. Henry.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BATH, ME.—The Central Maine Power Company plans to rebuild its local plant, recently damaged by fire causing a loss of about $20,000.

BETHLEHEM, N. H.—The Bethlehem Electric Company has contracted with the Twin State Gas & Electric Company, Brattleboro, Vt., for power supply from its Gorham-St. Johnsbury transmission line.

BOSTON, MASS.—The Edison Electric Illuminating Company has completed plans for the construction of a substation at 70-74 Sarner Street, to cost about $300,000.

DEDHAM, MASS.—The Dedham & Hyde Park Gas & Electric Light Company is planning to issue $50,000 in capital stock, to be used for extensions and improvements.

HOLYOKE, MASS.—The Holyoke Water Power Company plans to increase the output of its plant by the installation of two additional generating units of 2,000 hp. each.

SALEM, MASS.—The Charles H. Tenney Company, 200 Devonshire Street, Boston, has acquired the Phillips Wharf property and other adjacent properties, about nine acres, on which it proposes eventually to erect a super-power plant.

HARTFORD, CONN.—The Hartford Electric Light Company is planning to lay a cable across the Connecticut River, to carry electricity to East Hartford and Manchester.

Middle Atlantic States

ALBANY, N. Y.—The Adirondack Power & Light Company, Amsterdam, contemplates building a new substation at North Albany, to cost about $40,000.

ALTNAR, N. Y.—The Niagara, Lockport & Ontario Power Company, Buffalo, contemplates the construction of a hydro-electric plant on the Salmon River in this section, with steel tower transmission system, to cost about $1,200,000.

BUFFALO, N. Y.—The Council has approved an ordinance for the installation of a luminous-arc lighting system on East Ferry Street, from Main Street to Bailey Avenue. An appropriation of $34,000 has been granted by the City Council for the installation of electric power equipment in the Broadway Auditorium.

EAST CREEK, N. Y.—The Adirondack Power & Light Company, Amsterdam, contemplates the construction of a hydro-electric plant at East Creek, to cost about $1,500,000.

LITTLE FALLS, N. Y.—Bids will be received by the city of Little Falls until July 27 for the installation of a lighting system on Main Street. Proposals and specifications may be secured from the city engineer at Little Falls, or from the Charles M. Kelso Company, Inc., engineers, City National Bank Building, Utica.

NEW YORK, N. Y.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 24 for one motor-generator set, etc., at the navy yard, New York.

OSWEGO, N. Y.—Electric power equipment will be installed at the proposed grain elevator to be constructed by the State Canal Board, Albany, at the local barge canal terminal, to cost about $1,200,000. Dwight B. Ladu is state engineer.

DOVER, N. J.—The New Jersey Power & Light Company will build a substation at its local power plant, to be used for service in conjunction with a new 200,000-kw. steam-operated generating plant on the Delaware River, near Holland, N. J., on which preliminary work has been started.

NEWARK, N. J.—The Public Service Electric Company has arranged to increase its capital stock to $200,000,000, part of the proceeds to be used for extensions and improvements, including the construction of the proposed generating plant on the Kearney meadows, to cost about $25,000,000.

WOODBURY, N. J.—Bids will be received by the City Council until July 24, for a switchboard, with switches, fixtures, etc., for use at the Sewell pumping plant. F. F. Kauffman, 13 North Thirteenth Street, Philadelphia, is consulting engineer.

ALLENTOWN, PA.—The Pennsylvania Power & Light Company plans to construct a hydro-electric plant in Wilsonville, to cost about $5,000,000, including steel tower transmission line.

ALLENTOWN, PA.—The Greene, Salem, Paupack and Palmyra Township Power & Light companies, recently organized, will erect and operate distribution systems in the respective territories indicated by the names. L. K. Bingaman is treasurer.

GIRARDVILLE, PA.—The Pennsylvania Power & Light Company, Allentown, has purchased the property of the Schuylkill Electric Company. Extensions and improvements are contemplated, including a steel tower transmission line.

ORRTANNA, PA.—The Orrtanna Electric Light & Power Company will rebuild its power plant recently damaged by fire, causing a loss of about $27,000.

PENNSBURG, PA. — The Pennsylvania Power & Light Company has acquired the municipal light and power plants and systems at Pennsburg, Red Hill and Green Lane. A transmission line will be erected from Allentown and a substation installed at Pennsburg. The local plant will be discontinued. Extensions will be made in distributing systems.

PHILADELPHIA, PA.—The W. J. McCahan Sugar Refining Company, Tasker Street Wharf, Delaware River, will build a new power house at its plant to cost about $90,000.

PHILADELPHIA, PA.—The Largman-Gray Company will build a power plant at its new textile mills at Torresdale Avenue and M Street, to cost $100,000. The entire project will cost about $450,000.

PHILADELPHIA, PA.—C. A. McClure, F. W. Woodcock and others are organizing a number of utility companies to install and operate transmission lines, to be known as the West Bradford Township, Upper Uchlan Township, East Brandywine Township, West Brandywine Township, Highland Township, West Sadsbury Township, West Marlboro Township and the Wallace Township Power companies. Application for state charters will be made on August 6. James C. Jones, Bullitt Building, is representative.

QUAKERTOWN, PA.—A call for bids has been authorized for the installation of a new power unit at the municipal electric lighting plant.

WEST CHESTER, PA.—A power plant will be erected at the Villa Maria Convent, to cost about $40,000. Emile G. Perrot, Boyertown Building, Philadelphia, is architect.

WILLIAMSPORT, PA.—The Lycoming Edison Company will install an ornamental lighting system in different parts of the city, replacing present arc and gas lamps.

HAGERSTOWN, MD.—Application has been made to the Public Service Commission for permission to issue $300,000 in bonds for extensions and improvements in the municipal electric system. A. B. Grubmeyer is manager.

CLARKSBURG, W. VA.—The American Sheet Glass Company, recently organized with a capital of $250,000, plans for the construction of a power house at its proposed local plant. P. M. Robinson is head.

CLIFTON FORGE, VA.—The Virginia-Western Power Company has acquired the Staunton (Va.) Lighting Company, and smaller properties in this section, and will make extensions, including the construction of a transmission line from Staunton to Charleston. Bonds have been issued for $3,500,000, part of the proceeds to be used for extensions and improvements, including the completion of a steam-operated generating plant, now in course of construction.

FORT HUNT, VA. — The constructing quartermaster, United States Army, has been authorized to erect a pole transmission line and system from Fort Hunt to Fort Humphreys.

MARION, VA.—The Amalgamated Mining & Development Corporation, recently formed, plans to install electric power and mechanical equipment at its properties.

WASHINGTON, D. C.—Bids will be received at the office of the general purchasing officer, of the Panama Canal, Washington, D. C., until July 31 for steel, steel rope, deck and power cable, brass and copper tubing, rectifiers, electric drill and grinder, electric fans, vacuum cleaners, centrifugal pumps, gasoline engine, etc., under circular No. 1,543.

North Central States

DETROIT, MICH.—The Detroit Edison Company has purchased the lighting and power business of the villages of Dundee and Milford, and will erect a high-tension transmission line from Milan and later from Monroe to connect with the distributing systems of the two towns. The local dams and generating plants will not be taken over by the Edison company.

MAYVILLE, MICH. — Extensions and improvements to the municipal electric light plant, to cost $7,000, are under consideration.

KENMORE, OHIO—The city officials are considering entering into a new franchise with the Northern Ohio Traction & Light Company which will provide for extension of the electrical service to the outlying districts of Kenmore. The plans also include the installation of an ornamental lighting system on Kenmore Boulevard, to cost about $35,000.

TOLEDO, OHIO—Bids will be received at the office of the clerk of the board of education of the city school district of the city of Toledo until Aug. 6, for furnishing and installing electric light fixtures in the Edward D. Libbey High School. Edwin M. Gee is architect, board of education.

WARRENSVILLE, OHIO—Bids will be received at the commissioner of purchases and supplies, City Hall, Cleveland, until July 27 for erecting an elevator in the Administration Building of the children's tuberculosis unit and the main tuberculosis sanatorium, Warrensville, Ohio, Department of Public Welfare. Bids will also be received at the same time and place for the installation of a refrigeration system and refrigeration boxes in the administration building of the children's tuberculosis unit.

DANVILLE, KY.—Plans are under consideration by the Dix River Power Company, a subsidiary of the Middle West Utilities Company, 72 West Adams Street, Chicago, for the construction of a hydro-electric plant on Dix River, in Garrard County, to cost between $2,000,000 and $3,000,000. The plans provide for a 250 ft. dam and a 30,000-kw. generating plant. L. E. Herza is engineer.

LOUISVILLE, KY.—The Louisville Gas & Electric Company plan to construct a substation at Third and Magazine Streets.

COLUMBUS, IND.—The Interstate Public Service Company plans extensions to its local power plant, including the installation of additional equipment.

INDIANAPOLIS, IND. — Electric and steam power equipment, etc, will be installed in the proposed addition to be erected by the Progress Laundry Company, 420 East Market Street, to cost about $110,000.

INDIANAPOLIS, IND.—The Merchants' Heat & Light Company has filed notice of increase in capital stock from $2,500,000 to $3,000,000, part of the proceeds to be used for extensions and improvements.

MARION, IND. — The Indiana General Service Company plans extensions and improvements to its generating plant, including the installation of a 10,000-kw. turbo-generator and auxiliary machinery. A substation will be erected at West Marion and extensions made in the transmission system. The cost is estimated at $1,000,000.

SOUTH BEND, IND. — Electric power equipment will be installed in the proposed addition to be erected at the local plant of the La Salle Paper Company, to cost $300,000.

AVA, ILL.—The Southern Illinois Light & Power Company has acquired the municipal electric plant, and will extend its transmission line to Ava. The local plant will be remodeled for a substation.

CHICAGO, ILL.—The erection of safety islands, equipped with electric lamps, at every dangerous street intersection in the city has been recommended to the City Council by the local transportation committee. The plan if adopted will involve an expenditure of $80,000.

LA CROSSE, WIS.—The La Crosse Rubber Mills Company contemplates building a new power plant, 60 ft. by 90 ft., this year. Holm-Page Company, Rockford, Ill., is engineer.

FENWOOD, WIS.—Plans are under consideration to secure an adequate electric service here. It is proposed to have the Wisconsin Valley Electric Company extend its high-tension transmission line from Edgar to Fenwood and to rebuild and operate the local distribution system. The cost is estimated at $4,000.

HANCOCK, WIS.—Preliminary plans are under way for the erection of a high-tension transmission line to furnish electricity to the towns and villages along the Portage-Stevens Point branch of the Soo railroad from Plover, via Bancroft, Almond, Plainfield, Hancock and possibly Colma. It is proposed to organize a company principally by residents along the line, taking over the local electric plants now being operated in the towns. Electricity will be obtained from the Wisconsin Valley Electric Company, Wausau.

MENOMONIE, WIS. — An appropriation of $75,000 has been granted for the construction of a new steam generating plant and the purchase of boilers, engines, etc., for the Stout Institute, a school for vocational instructors, owned by the State. Bids, it is understood, will be asked about July 30. Burton E. Nelson is president.

ONTARIO, WIS.—The Middle Wisconsin Power Company has acquired the plant of the Electric Light & Milling Company. Extensions and improvements to the system are under consideration.

PORT WING, WIS.—The Northern Wisconsin Hydro-Electric Company contemplates extending its transmission lines to Iron River and to Washburn next season.

ST. PAUL, MINN.—Plans are being prepared for an addition to the power house at the State mechanical laundry, to cost about $35,000. C. H. Johnson, Capitol Bank Building, is architect.

DECORAH, IOWA. — The Interstate Power Company expects to begin work soon on the rehabilitation of the Calmar-Decorah transmission line, to provide for carrying 33,000 volts.

ST. LOUIS, MO.—Plans are being considered by the State Highway Commission for the construction of a power house at the proposed cement-manufacturing plant to be owned by the state, to cost about $300,000.

WARRENTON, MO.—The Missouri Utilities Company, Mexico, is negotiating for the purchase of the local power plant and system. Extensions will be made, including the erection of a new transmission line. The company has tentative plans for additions in its electric plant at Mexico, and improvements in transmission system in this district, to cost about $100,000.

BOWMAN, N. D.—The power station of the Bowman Electric Company was recently destroyed by fire.

ALLEN, NEB.—The Minnesota Electric Distributing Company, Minneapolis, has secured a contract to install and operate an electric distributing system here. Energy will be secured from the Sioux City (Iowa) Gas & Electric Company, which will erect a transmission line to a point east of Coburn, where the Minnesota Company will connect and build a line to Coburn, Waterbury, Allen, Martinsburg, Ponca and Newcastle, and on the west to connect with already existing lines in Cedar County and in South Dakota.

BEATRICE, NEB. — Surveys are being made for the proposed hydro-electric plant to be built on the site of the old paper mill south of Beatrice by the Black Brothers Flour Mills Company, Beatrice. The company is building a hydro-electric plant at Blue Springs, which it expects to have in operation about Sept. 1. When completed it will supply energy to the city for street-lighting purposes.

MARQUETTE, KAN. — Bonds to the amount of $15,000 have been voted for improvements to the light and water systems.

TOPEKA, KAN.—Bids will be received by A. A. Doerr, business manager, Topeka, until July 24-27, inclusive, for electrical supplies, hardware, etc., for twenty-seven state institutions.

Southern States

JEFFERSON, N. C.—A company is being organized by Walter B. Bauguess, Jefferson, to construct and operate a hydro-electric power plant on the New River, with local transmission and distributing systems.

RALEIGH, N. C.—Contracts will soon be awarded for central heating plant, connecting mains, heating apparatus for heating in buildings for Colony Group at the State Hospital for Insane, and also for a new underground electric distributing system. Wiley & Wilson, National Bank Building, Lynchburg, Va., are engineers.

MEMPHIS, TENN.—The new Hotel Peabody to be erected by the Southern Hotel Company, Inc., at Union and South Second and South Third Streets will have an electric plant, electric elevators, etc. The cost of the building and site is estimated at

$4,000,000. **Walter Ahlschlager, Inc.**, Chicago, is architect.

TULSA, OKLA.—Bids will be received by the Water Commissioners of the city of Tulsa until July 30 for furnishing pumps and boilers for the Mohawk pumping stations as follows: Plan A—For two 12,000,000-gal. steam turbine-driven centrifugal pumps, and a separate bid for two 300-hp. water tube boilers. Plan B calls for two 12,000,000-gal. motor-driven centrifugal pumps. J. D. Trammell and W. R. Holway are the engineers, Wright Building, Tulsa.

FORT WORTH, TEX.—The City Commission, it is understood, will call for bids about Sept. 25 for the installation of an ornamental lighting system in Mistletoe Heights, to cost about $50,000. D. L. Lewis is city engineer.

GALVESTON, TEX. — Bids are being asked by the City Commission for equipment for the Alto Loma waterworks, including two oil-engine-driven generating units, motor-driven air compressor, three 3,000,000-gal. motor-driven pumps and one 6,000,000-gal. steam-driven pump at the plant in Galveston. C. A. Holt, Jr., is city engineer.

PAMPA, TEX.—The local electric plant has been acquired by F. W. Grogan, Spur. Extensions and improvements will be made, including the installation of additional equipment.

SWEETWATER, TEX. — The United States Gypsum Company, 205 West Monroe Street, Chicago, plans to install a power house at its proposed local plant, to cost about $1,000,000. G. W. Rathgens is assistant engineer in charge of construction.

Pacific and Mountain States

LILLAWAUP, WASH.—Plans are under consideration by A. W. Layne, Los Angeles, and others to establish a summer resort here, to cost about $1,000,000. The plans include a 4,000-hp. hydro-electric plant.

SEATTLE, WASH.—The City Council has passed a resolution authorizing the installation of a street-lighting system on Rainer Avenue from Alaska Street to Thirty-ninth Avenue South.

SEATTLE, WASH. — The Puget Sound Power & Light Company will build a substation at 4314 Pasadena Place, to cost about $15,000.

SEATTLE, WASH. — Petitions for new lamps on East and North Forty-fifth Street from the east side of Stone Way to the west side of University Way are being circulated by property owners on that thoroughfare.

BISHOPS MEADOW, ORE.—The Bowman-Hicks Lumber Company, Wallowa, is planning to establish a townsite, 16 miles north of Wallowa, which will involve an expenditure of $500,000 during the coming year. The project will include a saw and planing mill, electric light and power plant, railroad yards and station, water and sewer systems, over 100 dwellings, etc. C. B. Miller, La Grande, is architect.

RIDDLE, ORE.—The installation of a municipal electric system is under consideration by the City Council. The plans call for a 300-kw. plant.

SALEM, ORE. — The City Council has decided to file application for a power site on the Santiam River in the Cascade Mountain, about 40 miles from Salem, with a view of utilizing the power for city purposes.

STAYTON, ORE.—A. D. Gardner, Stayton, and associates have received permission from the state engineer, to construct a hydro-electric plant on the North Santiam River, with initial output of 13,600 hp. The cost is estimated at $250,000.

LOS ANGELES, CAL.—An ordinance is being arranged for the installation of an ornamental lighting system on Canal Avenue, between D and Anaheim Streets, Wilmington.

LOS ANGELES, CAL.—The Pacific Electric Railway Company plans to extend its Alhambra-San Gabriel line, a distance of 2 miles. The cost is estimated at about $250,000 and will include a new substation and a joint passenger and freight station, etc.

RIVERSIDE, CAL. — Tentative plans have been prepared by the Nevada-California Power Company for a hydro-electric plant on the North Fork of Rush Creek, Mono County, to cost about $160,000.

SACRAMENTO, CAL.—At a special election held July 2 the proposal to establish a municipal utility district, and to construct a hydro-electric plant and system was approved. The cost is estimated at about $7,000,000.

SAN ANSELMO, CAL.—Bids will be received by Arthur W. Studley, town clerk, until Aug. 6 for the installation of ornamental lamps on different bridges in this section, with underground conduits and connections.

SAN FRANCISCO, CAL.—Plans are being prepared by the Pacific Telephone & Telegraph Company for the erection of a telephone exchange at Bush and Larks Streets, to cost about $800,000. The company is also preparing preliminary plans for the erection of a twenty-story building on New Montgomery Street, to cost about $2,000,000.

SAN JOSE, CAL.—Bids will be received by Henry A. Pfister, county clerk, until Aug. 6 for an electric distributing system for the Santa Clara County Hospital.

TURLOCK, CAL.—Plans are being considered by the City Council and the Chamber of Commerce for the installation of an ornamental lighting system throughout the city. The plans call for 694 electroliers maintained by underground conduits, the initial installation to cost about $140,000.

VISALIA, CAL. — The California Hot Springs Company contemplates the construction of a hydro-electric power plant for service at its resort buildings, to cost about $100,000.

DENVER, COL. — The Colorado Power Company has been awarded a contract to furnish power in connection with the building of the Moffat Tunnel. Under the terms of the contract the company will erect about 21 miles of transmission line to connect with its hydro-electric stations at Boulder, Shoshone and Idaho Falls. The cost is estimated at $60,000.

Canada

OTTAWA, ONT. — The Ottawa & Hull Power Company has engaged William Kennedy & Sons, 232 St. James Street, Montreal, to prepare plans for a power plant and dam to be erected at Cat Calumet Island Falls, on the Ottawa River, near Bryson, Que.

TILSONBURG, ONT.—The erection of a transmission line from Tilsonburg to Courtland, to cost about $40,000, is under consideration by the Hydro-Electric Power Commission of Ontario, Toronto.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 26, 1923)

1,460,246. LOCKING LAMP; H. Hubbell, Bridgeport, Conn. App. filed June 18, 1921. Removing lamp breaks filament circuit permanently.

1,460,259. ELECTRIC HEATING DEVICE; W. C. Lindemann, Milwaukee, Wis. App. filed March 28, 1922. Cooking grids and plates.

1,460,283. ATTACHING CLAMP; S. J. Shutsa, Uniontown, Pa. App. filed April 18, 1922. Hangers for trolley-wire clamps.

1,460,288. TROLLEY-WIRE CUT-OUT SWITCH; T. A. Thomas, Amherstdale, W. Va. App. filed July 15, 1921. For mine use particularly.

1,460,349. ELECTRIC INCUBATOR; L. R. Oakes, Tipton, Ind. App. filed Nov. 3, 1920. Thermostatically operated.

1,460,357. TRANSMITTER FOR PRINTING TELEGRAPHS; E. E. Kleinschmidt, Brooklyn, N. Y. App. filed May 1, 1919. Transmitter for synchronous multiplex systems.

(Issued July 3, 1923)

15,642 (reissue). ELECTRIC CONDENSER; C. F. Smith and W. H. Smith, Brooklyn, N. Y. App. filed May 17, 1920. Made of tinfoil and waxed paper.

1,460,368. ELECTRIC SIGNALING SYSTEM; L. H. Darrow, New York, N. Y. App. filed Jan. 30, 1920. Busy-test arrangement for telephone lines.

1,460,394. ELECTRIC INCANDESCENT-LAMP HOLDER; E. F. Tweedy, Glenbrook, Conn. App. filed Jan. 3, 1919. Lamp guard.

1,460,408. RHEOSTAT; E. G. Danielson, San Francisco, Cal. App. filed July 18, 1921. Electron-tube filament rheostat.

1,460,438. SECRET COMMUNICATION SYSTEM; R. D. Parker, Brooklyn, N. Y. App. filed Dec. 26, 1919. By superimposing varying voltage on transmission system.

1,460,439. INTERFERENCE PREVENTER; G. W. Pickard, Newton Center, Mass. App. filed April 22, 1922. Means for segregating desired electric waves from interfering disturbances.

1,460,444. MECHANICAL RECTIFYING SYSTEM; J. W. Robinson, Macon, Ga. App. filed Oct. 8, 1920. Set for charging storage batteries.

1,460,500. PLANT FOR THE SUPERVISION OF THE CIRCULATION LUBRICATION ON POWER CARS; M. Rall, Stuttgart, Germany. App. filed May 26, 1922. Electrical indicator.

1,460,517. ELECTROMAGNET; W. C. Stevens, Milwaukee, Wis. App. filed April 22, 1918. Plunger type for operating apparatus.

1,460,530. METHOD OF AND APPARATUS FOR MEASURING ELECTRICAL RESISTANCES; R. P. Brown and C. P. Frey, Philadelphia, Pa. App. filed Aug. 31, 1920. Wheatstone bridge method applied.

1,460,546. DRUM CONTROLLER; R. B. Hunter, Milwaukee, Wis. App. filed July 19, 1920. For joint control of several motors.

1,460,556. OVERLOAD PROTECTIVE DEVICE FOR ELECTRIC MOTORS; E. Newnham, St. Louis, Mo. App. filed April 10, 1922. Overload relay.

1,460,562. MOTOR CONTROLLER; C. W. Yerger, Milwaukee, Wis. App. filed June 28, 1919. Drum type.

1,460,569. SYSTEM OF CONTROL FOR ELECTRIC ELEVATORS; P. H. Brodesser, Milwaukee, Wis. App. filed Aug. 26, 1920. Automatic alignment of elevator at each floor.

1,460,604. BATTERY CONNECTOR; C. E. Potter, Baltimore, Md. App. filed Feb. 17, 1921. For connecting the terminals of battery cells.

1,460,624. INSULATING CAP FOR ELECTRICAL CABLE JOINTS; F. M. van Gelderen, Enschede, Netherlands. App. filed March 3, 1923. For several sizes of cables.

1,460,636. WAVE METER; P. J. Armagnat, Paris, France. App. filed Aug. 9, 1920. Comparison method.

1,460,698. DISTRIBUTING-BOX CONNECTION FOR ELECTRICAL CONDUCTORS; H. H. Berry, Springfield, Mass. App. filed Sept. 28, 1922. For use in manholes of underground cable systems.

1,460,701. DIRECTION INDICATOR; A. Butter, Clifton, N. Y. App. filed July 20, 1922. For automobiles.

1,460,726. MEASURED-SERVICE TELEPHONE SYSTEM; T. G. Martin, Chicago, Ill. App. filed June 14, 1919. Controlling coil-collecting device in automatic telephone system.

1,460,734. WIRELESS DETECTOR; W. H. Ruf, Roselle Park, N J. App. filed April 27, 1922. Crystal detector holder.

1,460,790. WELDING ROD; J. H. Critchett, Niagara Falls, N. Y. App. filed June 24, 1921. Iron alloy containing carbon and chromium.

1,460,793. FEEDING AND ROTATING MEANS FOR ELECTRODES; A. P. Davis, Brooklyn, N. Y. App. filed March 27, 1917. For arc lights.

1,460,801. DIRECTIONAL RADIO RECEIVING SYSTEM; R. H. Marriott, Bremerton, Wash. App. filed June 20, 1921.

1,460,814. VOICE-CURRENT TELEPHONE REPEATER; J. H. Homrighous, Oak Park, Ill. App. filed March 27, 1919. Amplification and transmission of voice currents in both directions.

1,460,815. ELECTRIC HEATER; L. P. Hynes, Albany, N. Y. App. filed Feb. 10, 1922. For heating gas or liquid.

1,460,895. BATTERY TERMINAL; L. A. Doughty, Glenside, and F. S. Carlisle, Philadelphia, Pa. App. filed Nov. 12, 1921. Leakage of acid prevented.

1,460,913. SWITCHING APPARATUS FOR TELEPHONE SYSTEMS; D. L. Lienzen and K. Larsson, Stockholm, Sweden. App. filed Oct. 21, 1920. Apparatus arranged to perform both rotation and radial movement.

1,460,926. COMPENSATOR FOR INDUCTION MOTORS; H. F. Stratton, Cleveland Heights, Ohio. App. filed July 26, 1922. Circuit cut-out for electric heater.

1,460,943. ELECTRIC CUT-OUT; S. M. Carmean and J. H. Carmean, Kansas City, Mo. App. filed Feb. 20, 1922. Circuit cut-out for electric heater.

1,460,969. TERMINAL FOR DRY BATTERIES; H. M. Koretzky, New York, N. Y. App. filed June 30, 1920. Improved carbon post terminal.

1,460,992. ORNAMENTAL LAMP STAND; C. Vehling, Indianapolis, Ind. App. filed March 28, 1922.

1,461,001. MOTOR AND MEANS FOR CONTROLLING THE SAME; E. V. Hartford, Deal, N. J. App. filed July 24, 1918. Means for maintaining constant speed with varying loads.

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Kinds of Leadership

INSTINCTIVELY mankind seeks leadership. In the days of youth "the gang" always had a leader, and as life progressed a series of leaders swayed the actions. And recently there has been renewed interest in leadership at the conventions of engineers and engineering educators. Many seem to feel that the engineer is responsible for the present mechanistic civilization and should shoulder the burden of guiding its political and social destiny. And often the comment is heard that engineers should be trained in the colleges to become leaders.

Leadership in a social sense denotes the power to decide, the power to think, the power to act and the power to influence others to carry out decisions. Such leadership is of the highest type and cannot well be produced by any system of training. Executives can be trained, but leaders fill no general specification and remain distinct personalities, in the same category as geniuses.

The engineer, merely as an engineer, is not particularly apt to assume a place as this type of leader. In fact, the inherent traits of his personality and type of mind as an engineer would hardly lead to an expectation that he would. The ability to think logically, critically and with constructive imagination is his, but the warmth, color, feeling and intuitive understanding of human nature essential to the highest type of national leader are frequently missing in his make-up. Fortunate will be this country, however, if some engineers who do have the proper characteristics awaken to the possibilities of higher leadership and strive for its attainment.

But in another type of leadership the engineer can and should assume a more important position. Scientific leadership is one of the most effective and permanent contributions that can be given to civilization, and in this field the engineer stands alone. The achievements in applied science during the past few years have had a tremendous influence on national, political and social well-being in addition to their more materialistic accomplishments.

In the light of developments of the past it may well be that the greatest contributions to civilization would be new inventions, new agencies, new machines and new energy applications because of their indirect influence on civilization and standards of living. And thus, a greater recognition of the merits of engineering research and invention might prove a more logical procedure than the introduction of too many so-called humanitarian courses in the engineering colleges in an attempt to develop social leadership.

Albert Lyndon Marsh

Noted for the development of alloys of nickel and chromium, which have contributed so greatly to the industrial supremacy of electricity.

THE advent of the nickel chromium alloy made possible a wide range of new applications of electricity for industrial purposes and made feasible the development of household heating appliances which add greatly to the comfort and convenience of life.

In large measure the new alloy was the contribution of Albert Lyndon Marsh, who worked and experimented many years before he developed a successful product. His optimism, industry and persistency at last permitted him to contribute to the electrical field an alloy which has been used in a multitude of ways and has been far reaching in making possible a greater use of electrical energy in the factory and in the home.

Mr. Marsh was born in Pontiac, Ill., Aug. 6, 1877, and attended the Pontiac schools up to the second year in high school. His family moved to Pana, Ill., in 1894 and Mr. Marsh was graduated from the high school there. He attended the University of Illinois from 1897 to 1901, receiving the degree of B. S. in chemical engineering. For the next two years he was assistant chemist for the Illinois State Water Survey. The following year he worked with an electric storage battery company and then for the next year he devoted his time to technical writing.

During his spare time Mr. Marsh had been experimenting with alloys of nickel and chromium and in 1904 he had developed them to a point where he needed improved facilities and more capital. These he obtained by making a business arrangement with William Hoskins at Chicago to further the commercial development of alloys. Finally in 1908 the Hoskins Manufacturing Company of Detroit was organized. Mr. Marsh at that time served as chief engineer and superintendent, and in 1913 he was made director and general manager.

The Marsh patents controlled the development of many heating applications for several years as the nickel chromium alloys proved very suitable for use as heating elements in baking ovens, irons, ranges, household electric heaters and other devices requiring an incandescent non-oxidizing heating element.

The career of Mr. Marsh furnishes another example of the wonderful contributions to the advancement of the electrical art that are possible through the vision and efforts of an individual research.

Editorial Comment

Electrical World, July 28, 1923

Volume 82 Number 4

The Question of Equitable Rates on an Extensive System

THE Supreme Court of the United States has consistently emphasized the fact that a constructive interpretation of law can be had only with due regard to conditions as they exist at the time of the interpretation. There has always been full recognition by this court that no law can be successfully administered in the public interest without a sympathetic realization of the development of society and of the arts. The California Railroad Commission has recently emulated this policy in a decision on the question of rates for an extended electric power system (the Pacific Gas & Electric Company, reviewed in last week's issue of ELECTRICAL WORLD, page 151) and the Supreme Court of Wisconsin could study with profit this particular case, keeping in mind the United States Supreme Court's policy mentioned above. The Wisconsin court's famous condemnation of the so-called "loop system" of rate making is still fresh in mind.

As Professor Marshall, an English economist, has pointed out, while during one decade a certain size of business unit may be best suited for its development, the next decade might so alter conditions as to dictate an entirely different business size. The California commission shows that it has due regard for the present condition in electric system development when it says:

"The fixing of rates and the equitable division of charges on a system as extensive as that of applicant is a problem in the solution of which no exact rule or formula can be used. * * * It is impossible and uneconomical to attempt to fix rates such that each district or each class of consumer will return to the company an equal rate of compensation for the average proportion of the plant necessary for their service. The system is so extensive and receives power from so many points that the service to the different classes of consumers is largely interdependent as to costs."

This opinion from California should serve to help promote sound and equitable rate policies which, in turn, will prove a potent influence in the extension of electric service for the good of the greatest number.

Forecasting Water Supply

NO OPERATING engineer with a hydro-electric company needs to be told that if he were provided with some accurate method of forecasting water supply he would be able to use the water more economically, he could utilize his plant equipment most efficiently and he could forestall some of the interruptions to service which now seem occasionally inevitable. Three methods are discussed in the N. E. L. A. hydraulic power committee's report this year, namely, by means of precipitation records, by snow surveys and by study of the relation between ocean temperatures and run-off. The last is a new method which deserves the consideration of many companies, as does also the effect of ice coverings on stream flow.

Virtually every one will contend that no cut-and-dried rule can ever be followed for forecasting water supply, but if there shall be a more extensive dissemination of information on how each company is tackling the problem, it will surely serve as a better guide to operation than the haphazard guesses now employed by some organizations.

Rural Electric Service Not to Be Judged Solely by Money Saved

A PLEA against trying to sell the farmer electric service purely on the basis of its power to save him dollars in his farm-operating costs was made before the North Central Electric Association by Prof. A. E. Stewart of the agricultural department of Minnesota State University. As Professor Stewart pointed out, the biggest single influence in improving living conditions in the city home has been the use of electrical energy for lighting and to do the drudging tasks that sap the energy and vitality of the home worker and the value of the saving thus made is one that cannot be expressed in dollars and cents, nor does any one attempt such a valuation. Professor Stewart claimed for the farmer a right to the same advantages and to the same disregard of what the cost in dollars may be. Incidentally he protested against the idea that the use of electrical energy on the farm must be justified wholly on an economic basis.

This protest reveals anew the confusion that can be created by a loose use of terms. Less than twenty years ago many a banker declared that the farmer or the ordinary citizen could not afford to own an automobile. Its possession meant economic ruin for any one with a personal income less than $10,000 annually. The same solemn warnings have been issued by pessimistic financial geniuses in the past two or three years. Yet the farmer and middle-class American generally are purchasing motor cars at a rate that is astounding, and the ruin that was predicted twenty years ago is still ahead and apparently more remote than ever. There are, no doubt, many people driving motor cars who should not own them, but the fact is that the motor car has so contributed to health, recreational opportunities and all the things that go to make up a more enjoyable life that, in spite of its inevitable misuse, the balance is on the credit side of the ledger. The whole error lies in assuming that the story can be told entirely in the figures on an accountant's balance sheet and that economics is solely a matter of mathematics.

Electricity, the automobile and thousands of other things are adding to the enjoyment of human existence and therefore to the economic advance of the world. It is possible to sit down and prove by figures

that any one of them is a luxury that the world cannot afford. Thus in dollars and cents the use of electric lighting is an economic waste because it costs more than some other forms of light, but the absurdity of the argument is so apparent that it needs no demonstration. Yet there are many electrical men who, while recognizing the intangible benefits of these things and instantly resenting any effort to prove that the use of electric lighting in the city home is a fallacy because it costs more than some other forms of lighting, are consistently applying the same argument to the use of electrical energy on the farm. Electricity in a broad economic sense has advanced the economic status of the world more than any other single agency. Its justification is in intangibles plus dollars saved rather than dollars saved plus intangibles, even though many if not most of its uses are fully justified on the latter basis. The farmer is as much entitled to the benefits that cannot be measured in dollars and cents as any other class in the community, although, like the other classes, he must pay dollars and cents for the benefits. Whatever justification can be shown in dollars and cents makes the total economic showing just that much better. It is like any other business proposition, and, as Professor Stewart pointed out, the value of the intangibles can be made manifest to the farmer just as soon as the seller can convince himself they exist. Since the central-station man is selling these intangibles to other classes every day, he must learn to sell them to the farmer as well.

The Accountant Must Be Human

IN DISCUSSING "The Value of the Accountant to the Industry" at the recent convention of the N. E. L. A., A. Monro Grier, president of the Canadian Niagara Power Company, assigned a high place to the accountant in the scheme of company organization. He also set a high standard for the accountant to live up to in performing his duties. The engineer has been justly charged with limiting his viewpoint to purely engineering or technical questions and with forgetting the economic and human elements in the solution of his problems, with a result that is often disastrous to himself as well as to the organization to which he belongs. The same type of error can be charged against the accountant in that he has been prone to center his attention upon the technical features of accounting and to ignore the more important human elements. A little of the narrow viewpoint, as previous comment in these columns has pointed out, crept into the discussion of budgeting which followed in the same session that Mr. Grier addressed, when several accountants tried to support the budget as a rigid measure for the control of expenditures, failing to recognize that budget estimates months ahead of detailed study of projects are fallible instruments that need frequent readjustment to be of the greatest value, and that their use as a club eventually makes them valueless because the co-operation of the human element is not obtained.

Louis F. Mussel of the Cities Service Company, in the same session, pointed the way for the accountant when he pleaded for the introduction of this human element and an effort to formulate budgets in terms of the human as well as the dollar assets of the business organization. Dollars, at best, are only a representation of the value of human brain and brawn and are valuable because they put the results of the application and brain and brawn into a fluid state for the most convenient use. To make his work successful the accountant must enlarge his horizon and consider his work and its results in the light of its effect on the human element, the real asset on which the business is built. Cold-blooded recommendations and decisions based on the balance-sheet figures alone make the accountant hated and not loved. He must be human. Accounting, engineering or any of the professions is only the means to an end and not the end itself.

Mica-Folium Resistant to Internal Ionization

UP TO a certain value of potential gradient most gases are good insulators—air is the commonest and most widely used of all insulating substances. Beyond the critical gradient, however, not only will air not insulate, but in breaking down it spreads destruction and does its best to carry down with it all neighboring insulating structures. The arc in air is the extreme case, the local spark is next, and the ionization of thin layers apparently the least harmful. All of these instances of the breakdown of air are accompanied in varying degrees by elevation of temperature and the liberation of chemically active oxygen and nitrous oxides, highly detrimental to all types of insulation, especially those of fibrous and combustible composition.

Flexible insulation, such as that used in high-voltage cables and turbo-alternator armatures, must from its nature be applied in layers. This means that even under the most careful conditions of manufacture a certain amount of air is introduced between the successive layers. These thin layers of air will break down under a sufficient voltage gradient, and the voltage tends to concentrate on them because of their relatively low specific inductive capacity. The resulting ionization thus tends in various ways to attack the adjacent insulation.

The degree of damage caused by this attack of gaseous ionization has never been exactly known. That it is a real danger is suggested by the evidence in dismantled insulation, of gas pockets with discolored surfaces and other evidences of chemical action. In a paper before the recent A. I. E. E. convention, Dr. J. B. Whitehead described an extensive study of the magnitude and effects of internal ionization in the mica-folium insulation of high-voltage armature conductors. The mechanical properties of mica are especially favorable for the formation of air layers throughout the built-up wall of insulation. The results show the presence of internal ionization, the voltage at which it sets in and other interesting properties. Most important, however, is the fact that the ionization loss is a relatively small part of the total dielectric losses, of which the principal part is due to straight conductivity, and that the resulting deterioration of the body of the insulation is very slow. It is suggested that the great value of mica is in the breaking up of the conductivity inherent in the impregnated fibrous parts of the insulation and in its immunity from attack by the active products of the ionization of the entrapped air layers.

It is a relief to find that by careful manufacture there is one danger the less to armature insulation, but it

must be remembered that the question is still open as regards cables and all other fibrous insulation in which mica cannot be used. Dr. Whitehead's results suggest indirectly that insulation of this type would be subject to attack and depreciate much more rapidly. This is an important question for further experimental study.

Behavior of Standard Current Transformers Is Assuring

WITH the ever-increasing tendency toward centralization of power generation and expansion of transmission systems the requirements for satisfactory and reliable operation have become more and more rigid and exacting. It follows that the characteristics and properties of the different elements which go to make up the modern high-power systems must be accurately known for normal and abnormal system conditions. This knowledge can be obtained only through the use of measuring devices.

One of the most important of the devices utilized is the current transformer; the accurate metering of the system output is in a large measure dependent on the constancy of its characteristics, while the effective protection of equipment and lines rests upon the ability of the transformer to withstand the abnormal currents to which it may be subjected under system short-circuit conditions.

The behavior of the current transformer under these abnormal conditions is thus of paramount importance. On page 169 are presented some results obtained by actual tests on standard type transformers by the Pennsylvania Water & Power Company. The value of the tests described lies in their being carried out at current values far in excess of the normal rating of the apparatus. A reliable basis is therefore provided for determining the performance of similar equipment wherever installed. These tests are also of value in that they indicate the degree of conservatism of the manufacturer's rating. In general the ratings appear to be well within safe limits.

Need of Distinguishing Between Polarized and Identified Wiring

JUST now a good deal is heard about "polarized" wiring. But is this exactly the right wording to use, since, as a matter of fact, the present discussion appears to be merely on identifying the grounded conductor and on connecting it to the proper side of the fuse blocks, switches and sockets, rather than on polarizing? It is argued that the grounded or cold conductor is one pole of the circuit and that the "hot" wire is at a different polarity; but polarity, as usually understood, refers not only to a difference of potential but also to the direction or relative value, as positive or negative.

Now, a two-wire system on direct current can be polarized without being grounded at all. To be polarized all that is necessary is that one wire shall always be at the higher potential in relation to the other. On the other hand, there can also be a system which has the grounded conductor identified without the system being polarized, in that the "hot" wire may sometimes be positive and sometimes be negative. This would make a great difference when connecting in order to charge storage batteries, but so long as the same conductor was always connected to ground the fact that the "hot" wire was sometimes positive and sometimes negative would make no difference in the safety factor.

In the case of alternating current the circuits can only be identified as to phases and grounded wire and not for polarity in its usual sense, because the latter is changing continuously. Polarity enters into alternating-current circuits only when it comes to such questions as whether a transformer connection is additive or subtractive. If the polarity of a two-wire direct-current circuit is reversed, any electrolytic effect is, of course, also reversed, even if the same wire is at all times the grounded wire.

It is suggested that the term "polarized" be reserved for the cases where real polarity is meant and that some other expression be found for the cases where all that is meant is that the grounded wire shall be identified throughout and properly connected. "Polarized" should, of course, mean that one identified wire is always positive or always negative to the other, no matter which is grounded and no matter whether either is grounded. Would not "identified" wiring serve as an expression to indicate that one wire or pole of the circuit is always identified and grounded, irrespective of whether the other pole may either be positive or negative to the grounded pole? If not, will some one suggest a better term?

Value of Explosion Pots in Oil Circuit Breakers

VERY valuable and interesting data on the operation in actual service of oil circuit breakers are given in Bernard Price's report in this issue relating the experience of South African mining companies with oil circuit breakers equipped and not equipped with explosion chambers. Mr. Price's report is of particular interest to American engineers because it confirms the claims of American switchgear manufacturers. Standard oil circuit breakers utilizing explosion chambers have been marketed for some time in this country. Operating reports that have been made available indicate a performance on such apparatus comparable with the results observed by Mr. Price.

Moreover, a number of operating companies in this country which have found it necessary to increase the interrupting capacity of oil circuit breakers already installed have equipped those breakers with explosion chambers supplied by the original manufacturer of the breaker. Rebuilt breakers so equipped are now in successful operation on 22,000-volt and 110,000-volt circuits. The results obtained in each case warranted the expense of rebuilding.

Mr. Price has indicated that there are a number of design factors involved in the application of explosion chambers to breakers. The determination of the proper oil height, diameter of contact rod, clearance between contact rod and bushing, length of break and other features require considerable experimentation and testing. Inasmuch as such experimentation is generally difficult and expensive to accomplish on a system in commercial service, it would seem that the best practice for operating companies is to refer their problems to the breaker manufacturers, who from their experience in the design of this class of apparatus are able to make definite recommendations for the rebuilding and give definite ratings to the rebuilt equipment.

Time and Labor Saving Methods

IF THE practices of all companies could be compiled it would be found that they are directing more and more attention to methods of saving time and reducing labor expense in all branches of their activities. Just three applications of mechanical equipment to handling overhead construction work are shown. Many others could be cited. For example, there are truck cranes for loading and hoisting equipment, truck winches for similar purposes, as well as pulling cable, compressed-air drills for installing house-service conduits, compressed-air pavement breakers, trenching machines for laying park cable, etc.

Tests for Rating Current Transformers

Effect of High Current on Mechanical Strength—Thermal Capacity Studied—Details of Tests and Conclusions for Specific Types Used on Two Large Atlantic Coast Systems

WHEN current transformers used in connection with relays and meters on power systems undergo short-circuit conditions they are subjected to mechanical forces of considerable magnitude and thermal stresses of great severity. Furthermore, the accuracy of the current transformers for measurement purposes may be questionable under these conditions. To obtain definite information on these points tests were devised and conducted by the Pennsylvania Water & Power Company and the Consolidated Gas, Electric Light & Power Company to determine the thermal or mechanical breakdown limits as well as the accuracy of the devices during the short-circuit period.

In these tests an oscillograph was connected so as automatically to close the oil breaker, thereby imposing a short-circuit current of practically sustained value, and then to open it after a predetermined number of cycles (Fig. 8). The high currents desired were obtained by means of a 5,500-kva., 13,200/169-volt, single-phase furnace transformer at Baltimore energized from either one or two generators at Holtwood through one transmission line and transformers at both ends, or from a generator at Westport through an underground cable. Tests were accordingly made at low voltage, and the currents obtained evidenced very little dying down on account of the high impedance from the generator to the short circuit. The frequency was 25 cycles.

Tests for thermal and mechanical failure were made on the following transformers:

General Electric Company	Westinghouse Electric & Manufacturing Company
K48-100/5	KB-100 5
K28-300/5	KB-200 5
D21-300 5	KB-600 5 5
....	Special-100/5

Tests for ratio error were made on a Westinghouse FB-2,000/5 and a General Electric D21-300/5 and will be reported in a later issue.

To afford a basis for comparison, calculations were made from test data to establish a two-second rating for each transformer on the following basis:

The quantity of heat H is proportional to the square of the current I (effective), the time t, and a constant K. Therefore, $H = KI^2t$. Since it is the quantity of heat which destroys the transformer, $H = KI_1^2t_1 = KI_2^2t_2$, or $I_1^2t_1 = I_2^2t_2$, where

I_1 = test current in r.m.s. amperes,
t_1 = time I_1 is present in cycles,
I_2 = any other value of current in r.m.s. value,
t_2 = time corresponding to I_2, in this case 50 cycles, and
K = a constant for a given transformer.

Applying these relations to a specific example, assume the test current as 15,000 r.m.s. amperes and the period before failure 17.5 cycles; then

$15{,}000^2 \times 17.5 = I_2^2 \times 50$, $I = 8{,}880$ r.m.s. amperes, and the transformer would fail for thermal reasons in 50 cycles at 8,880 amp.

Results of the tests to determine the thermal and mechanical limitations of the current transformers are presented below classified as to type:

K48-100/5.—This late type of transformer is rated by the maker to withstand momentarily 120 times normal rated full-load current. This was taken to mean that it would withstand this symmetrical effective current plus whatever displacement of the initial wave which may occur on high-voltage short circuit. Assuming a possible displacement of 1.8, the initial peak current will be $120 \times 100 \times 1.8 \times \sqrt{2} = 30{,}600$ amp. The primary is made of a number of turns of square stranded copper wire, and the heavy stranded copper wire secondary is wound on one leg of the core under the primary.

TABLE I—TEST OF TRANSFORMER K48-100/5

Conservative (2-sec.) rating is 8,220 s.e. amp. with old terminals and 10,000 s.e. amp. with new.

Test No.	Time	Initial Peak Amperes	Symmetrical Peak Amperes	Symmetrical Effective Amperes	Cycle
98	11:05 a.m.	11,700	8,750	6,180	12
99	11:28 a.m.	15,400	11,100	7,850	17
100	11:31 a.m.	16,700	11,900	8,400	19
101	11:53 a.m.	15,600	13,600	9,600	19
102	11:57 a.m.	17,400	16,600	11,700	19.5
103	11:18 a.m.	16,300	15,800	11,100	19
104	11:35 a.m.	20,400	18,600	13,150	19.5
105	11:42 a.m.	23,300	21,200	15,000	17.5
106*	12:02 p.m.	33,900	26,300	18,600	13.5
183†	12:55 p.m.	30,700	24,900	17,600	19.5†
184‡	1:10 p.m.	31,900	59,000	......	4

* New transformer.
† Estimated time.
‡ Transformer of test 106 equipped with extra heavy lugs.

No apparent damage occurred to the transformer up to test No. 105, when one primary terminal burned off and the insulation burst open accompanied by quantities of smoke. Upon opening the transformer the windings were found intact. On the basis of the rating outlined the transformer would fail thermally in 50 cycles at 8,880 amp. Since it withstood a current of 13,150 symmetrical effective amperes for 19.5 cycles, calculations indicate that it would be safe for two seconds at a current of 8,220 symmetrical effective amperes, and if equipped with extra heavy lugs (test No. 183) it should withstand 10,000 symmetrical effective amperes for two seconds. Since (test No. 106) the transformer withstood 33,900 peak amperes, it comes well within the rating claimed, although the lugs burned off after 13.5 cycles. The current value of 59,000 peak amperes on test No. 184 occurred at the fifth half-cycle, and the increase was probably due to the short-circuiting of some of the primary turns when the transformer failed at 31,900 peak amperes. The previous tests probably affected this result, since in test No. 106 it safely withstood 33,900 peak amperes.

K28-300/5.—Although no longer cataloged by the maker, this type was tested because several were in use on the system. The first test at 25,600 symmetrical effective amperes for 19.5 cycles is equivalent to 16,000 symmetrical effective amperes for two seconds. No change could be noted in the transformer after this test. It was then tested at an estimated current of 50,000 peak amperes. This test practically destroyed the transformer. The oval-shaped primary attempted to assume a circular form (Figs. 2 and 3). It will be noted that the pieces of angle iron that held the primary in place cut through the primary as it was forced outward. The block of wood that these angle irons supported was thrown a distance of 25 ft. It is believed that this transformer would have caused an arc to form had it been used on high voltage.

A current of 25,600 amp. for 19.5 cycles is equivalent in heat production to 16,000 symmetrical effective amperes for two seconds. The manufacturer rates the instrument at seventy times normal full-load current, which means $70 \times 300 \times \sqrt{2} \times 1.8 = 53{,}400$ peak amperes. It is

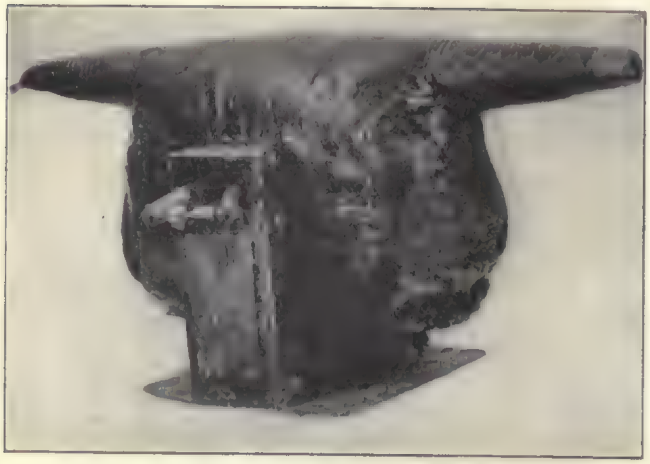
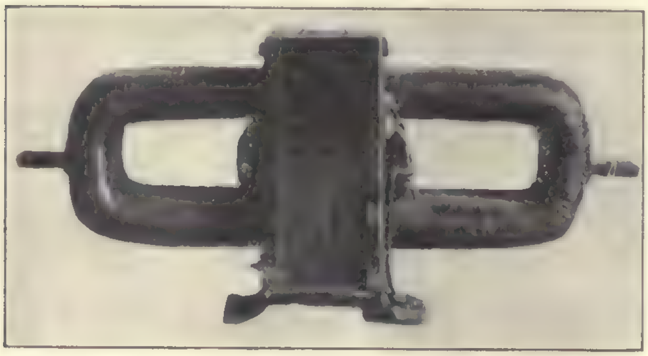
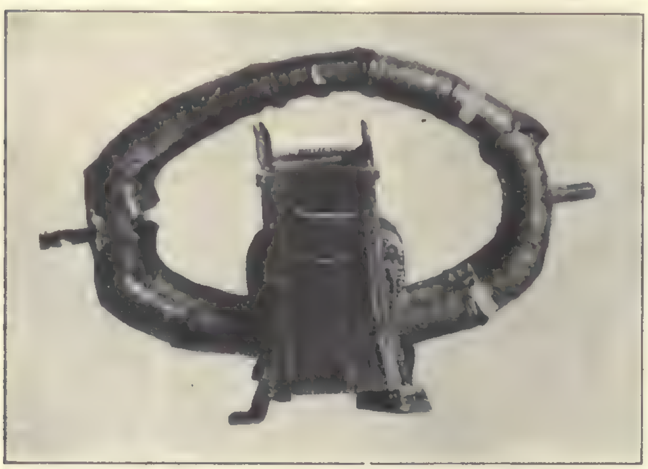


FIG. 1—K48-100/5 AFTER TESTS





FIGS. 2 AND 3—K28-300/5 BEFORE AND AFTER TESTS

believed that this transformer will fail before such a current is reached.

KB-100/5.—This transformer is rated by the manufacturer at forty times full load current, or $40 \times 100 \times 1.8 \times \sqrt{2} = 10{,}200$ initial peak amperes.

The first three tests did not injure the transformer as far as could be determined, but the heating was perceptible. The last test, at 20,400 peak amperes (12,600 symmetrical effective amperes), caused the insulation to burst open at the top (Fig. 4). Smoke was emitted from this opening and from the ends of the transformer at the lugs. The oscillogram showed no disturbance to the windings. It is believed that if the three previous tests had not been made, the transformer would have withstood this test successfully. The two-second rating on this assumption would be 7,870 symmetrical effective amperes, and it will be noted that it comes well within the manufacturers' claim of 10,200 initial peak amperes.

KB-200/5.—This transformer is the same as the previous one tested except that its ratio is different, and hence its physical dimensions are different.

TABLE II—TEST OF TRANSFORMER K28-300/5

Withstood 25,600 s.e. amp. for 19.5 cycles, but failed mechanically at 50,000 peak amp.

Test No.	Time	Initial Peak Amperes	Symmetrical Peak Amperes	Symmetrical Effective Amperes	Cycles
179	3:18 a.m.	36,200	36,200	25,600	19.5*
180	3:37 a.m.	50,000†	......	......	

* Estimated time. † Estimated current.

TABLE III—TEST OF TRANSFORMER KB-100/5

Conservative (2-sec.) rating is 7,870 s.e. amp.; insulation burst open at 12,600 s.e. amp.

Test No.	Time	Initial Peak Amperes	Symmetrical Peak Amperes	Symmetrical Effective Amperes	Cycles
107	10:28 a.m.	13,300	10,800	7,560	19.5*
108	11:13 a.m.	15,300	11,600	8,200	19.5*
109	11:18 a.m.	21,500	14,700	10,400	19.5*
110	11:25 a.m.	20,400	17,900	12,600	19.5*

* Estimated time.

The manufacturers' momentary rating would be $40 \times 200 \times 2 \times 1.8 = 20{,}400$ initial peak amperes.

On the first test the only effect noted was the heating of the transformer accompanied by the emission of quantities of smoke. After an interval of several days, giving the transformer time to cool, it was tested at an initial current of 66,000 peak amperes. It soon dropped to a sustained value of 43,300 effective amperes, and, after 11 cycles, it blew open and caught fire (Fig. 5). Considerable noise accompanied the opening and the primary winding was ruptured.

The two-second rating based on test No. 182 is 17,600 symmetrical effective amperes. This same test again shows that the manufacturers' momentary rating of 20,400 initial peak amperes is conservative. Here again this rating would be doubled and the transformer still be safe.

D21-300/5—The test at 15,800 effective amperes had no noticeable effect on the transformer either mechanically or thermally. The second test at 24,500 effective amperes resulted in the burning off of one of the terminals after 18½ cycles. After replacing the burned-off terminal with a standard cable terminal another test was made at an effective current of 29,700 effective amperes. This test resulted in the other terminal burning off after 11.5 cycles, but there was no other mechanical or thermal effect on the transformer aside from its becoming quite warm.

The second terminal which burned off was also replaced with a cable terminal, and a fourth test was made on the transformer at an effective current of 31,600 effective amperes. This caused the transformer to fail thermally. Large volumes of smoke were emitted from both ends and the compound was melted (Fig. 6), permitting the cone-shaped ends to separate from the cylindrical part. Examination of the transformer after this test showed that a number of the primary strands had fused and the turns had short-circuited in the center of the core.

The highest peak current of 54,300 amp. had no noticeable mechanical effect on the transformer. This corresponds to $54{,}300 \div \sqrt{2} \times 1.8 = 21{,}300$ effective symmetrical amperes. The manufacturer's rating of $70 \times 300 \times \sqrt{2} \times 1.8 = 53{,}400$ peak amperes is also less than the peak value actually obtained, which gave no mechanical damage to the transformer.

The tests showed that the terminals burned off before the transformer itself failed thermally. With the old terminals, then, the two-second safe rating based on the first test would be only:

$$\sqrt{\frac{15{,}800^2 \times 20.5}{50}} = 10{,}100 \text{ amp. (effective).}$$

However, with new terminals the transformer can be safely rated on a two-second basis at:

$$\sqrt{\frac{24{,}500^2 \times 18.5}{50}} = 14{,}900 \text{ amp. (effective).}$$

In all the above tests the currents were practically of sustained value. The short-circuit currents under actual service conditions, however, are usually not sustained but have considerable attenuation due to the demagnetizing action of the generator fields. It was desirable to determine the corresponding time for failure under the short circuit obtained under service con-

TABLE IV—TEST OF TRANSFORMER KB-200/5

Heated up and emitted smoke on first test; with 43,000 s.e. amp. for 11 cycles it blew open and caught fire.

Test No.	Time	Initial Peak Amperes	Symmetrical Peak Amperes	Symmetrical Effective Amperes	Cycles
182	2:58 a.m.	48,800	39,800	28,100	19.5*
185	1:35 a.m.	66,000	61,400	43,300	11

* Estimated time.

TABLE V—TEST OF TRANSFORMER D21-300/5

Has conservative rating of 10,100 s.e. amp. with old terminals and 14,900 amp. with new.

Test No.	Time	Initial Peak Amperes	Symmetrical Peak Amperes	Symmetrical Effective Amperes	Cycles	Result of Test
217	1:25 a.m.	31,400	22,400	15,800	20.5	No effect
218	2:30 a.m.	53,800	34,600	24,500	18.5	Terminal burned off
223	1:22 a.m.	49,000	42,000	29,700	11.5	Terminal burned off
229	1:50 a.m.	54,300	44,900	31,600	21.5	Primary short-circuited; smoked badly.

TABLE VI—TEST OF SPECIAL 100/5 TRANSFORMER

Suitable for 9,700 s.e. amp. for 2 sec.; primary short circuited at 18,300 s.e. amp. after 15 cycles.

Test No.	Time	Initial Peak Amperes	Symmetrical Peak Amperes	Symmetrical Effective Amperes	Cycles	Result of Test
215	3:40 a.m.	35,000*	21,200*	15,000*	21	No effect
216	3:50 a.m.	45,000*	25,800*	18,300*	22.5	Primary short-circuited; smoke and flame emitted from small hole.

* Estimated.

ditions of 17,530 amp. initial and 7,360 amp. final. Something proportional to the total heat input under the test currents can be obtained by squaring the current and multiplying the result by the time in cycles (amperes^2 $\times$ cycles). The corresponding time for failure under actual conditions of short circuit is then obtained from a curve (Fig. 7) which gives amperes^2 $\times$ cycles for the above short-circuit currents obtained in service (radiation neglected).

From the results of test 223, which is the worst case, the terminals would be expected to burn off in service in not less than 3.9 seconds. However, it must be borne in mind that the terminal which burned off in test No. 223 previously withstood more current in test 218 without failure. The first terminal which burned off, according to the above calculations, would have required 5.3 seconds to burn off in service. It thus seems that the terminal which failed in test No. 223 may have been injured to some extent in the previous test.

However, even in the worst case, where 3.9 seconds would be required to burn the terminals off in service, there seems to be sufficient factor of safety to justify their use with the old terminals.

KB-600/5/5.—In tests Nos. 208-213 there was no noticeable effect either mechanically or thermally on this type of current transformer. However, on the last test, No. 214, a small amount of smoke was emitted from around one terminal. According to the oscillogram there was no internal damage. Inasmuch as the transformer withstood safely 41,300 effective amperes for 22 cycles, the two-second ratings would be 27,400 effective amperes. The highest peak amperage obtained without any mechanical damage was 90,000. This corresponds to 35,400 symmetrical effective amperes for the mechanical rating.

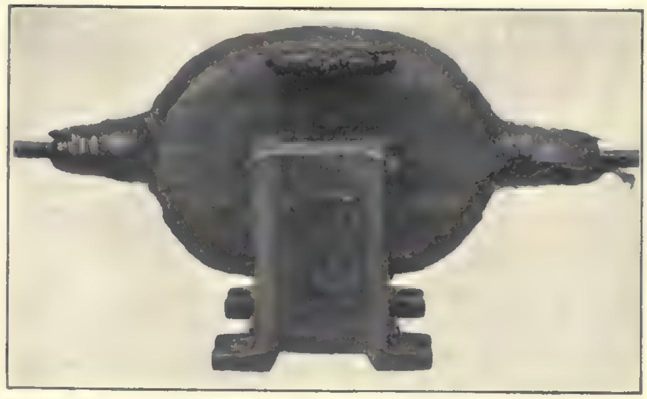


FIG. 4—KB-100/5

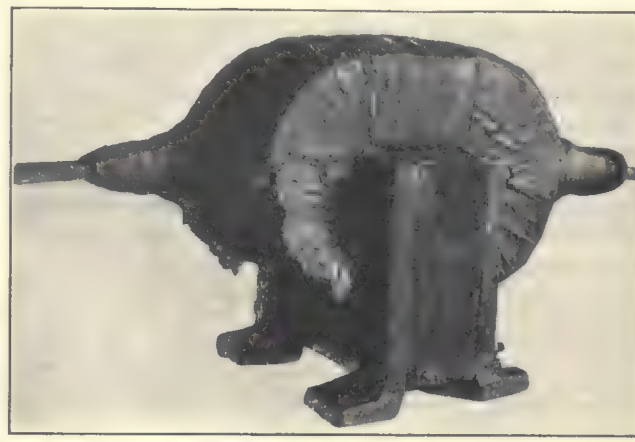


FIG. 5—KB-200/5

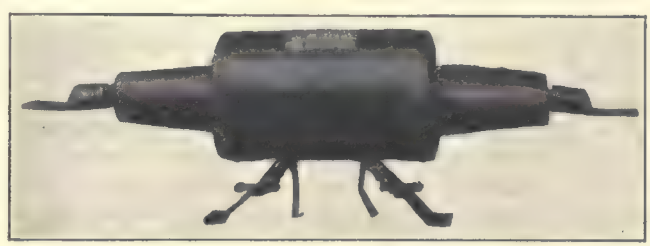


FIG. 6—D21-300/5

The manufacturer's rating of $40 \times 600 \times \sqrt{2} \times 1.8 = 61{,}000$ is thus very conservative.

"Special" 100/5.—This transformer was built with strong mechanical bracing, consisting of an angle-iron brace around the whole transformer, and in addition it was designed for high thermal capacity.

The first test, at 15,000 effective amperes, had no effect whatever on the transformer either mechanically or thermally, and no heating was perceptible after the test.

The second test, at 18,300 effective amperes, resulted in a thermal failure of the transformer. Flame and smoke were emitted from a small hole near the terminal, and some of the compound melted and ran out. The oscillogram indicated that the primary turns short-circuited after 15 cycles, and examination after the test confirmed this fact.

The tests showed that the transformer withstood 15,000 amp. for 21 cycles without any damage. Its safe two-second thermal rating then would be 9,700 effective amperes. The estimated peak amperage which this transformer withstood safely is 45,000. This corresponds to a symmetrical effective current of 17,700 amp. for a mechanical rating.

The K48-100/5 transformer comes within the manufacturer's claim of 120 times normal full-load current momentarily. It would be considerably improved if the primary lugs were much heavier. As it stands its thermal rating would be 8,220 amp. for two seconds.

The K28-300/5 transformer does not come within the

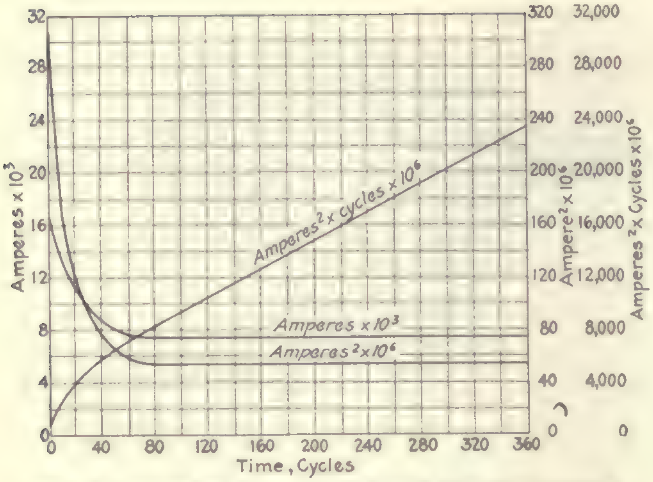


FIG. 7—CURVE FOR DETERMINING THE TIME FOR FAILURE UNDER SERVICE CONDITIONS

maker's claim of seventy times normal full-load current, it is believed. The design of the transformer is incorrect, for the primary is oval and tends to become circular when subjected to heavy currents. It is believed to be safe at forty-seven and one-half times normal full-load current. It is believed that it will safely withstand 16,000 symmetrical effective amperes for two seconds.

The maker's rating of forty times normal full-load current is thought to be conservative for the KB-100/5 transformer. The tests show that it will withstand probably eighty times the normal full-load current. The thermal rating would be 7,870 symmetrical effective amperes for two seconds.

As should be expected from the previous tests, the KB-200/5 transformer was found to stand up to more than eighty times normal full-load current, instead of forty as the manufacturer claimed, and should be safe at these currents. The thermal rating is 17,600 symmetrical effective amperes for two seconds.

The D21-300/5 transformer, with its old terminals, is not safe for more than 10,100 effective amperes on a two-second basis. If new terminals are put on, the safe two-second rating can be increased to 14,900 effective amperes. Mechanically these transformers are sufficiently strong for the service intended, and they also come within the manufacturer's rating.

Mechanically the KB-600/5/5 transformer is well

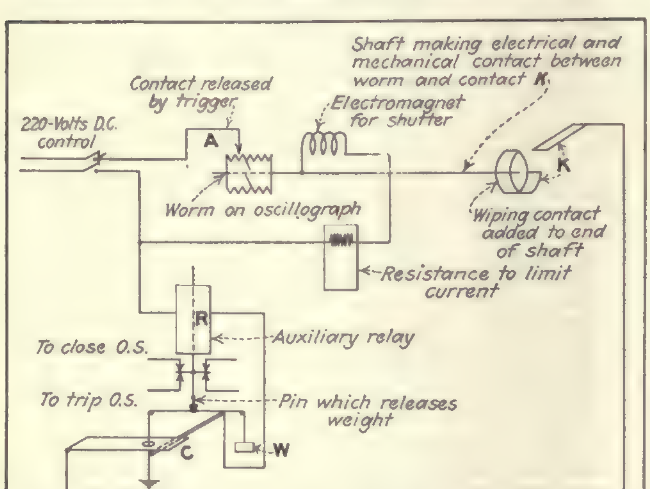


FIG. 8—THE OIL BREAKER MADE AND OPENED THE SHORT CIRCUIT AFTER A PREDETERMINED NUMBER OF CYCLES

TABLE VII—TEST OF TRANSFORMER KB-600/5

Two-second rating is 27,400 s.e. amp.; 46,000 amp. after 23.5 cycles caused small amount of smoke to be emitted around terminal.

Test No.	Time	Initial Peak Amperes	Symmetrical Peak Amperes	Symmetrical Effective Amperes	Cycles	Result of Test
208	1:55 a.m.	32,400	25,900	18,300	21.5	No effect
209	2:44 a.m.	45,000	38,700	27,400	17+1	No effect
210	3:55 a.m.	59,800	46,100	32,600	21.5	No effect
211	4:03 a.m.	69,100	49,500	35,100	22.5	No effect
212	4:45 a.m.	80,000	54,700	38,700	23.0	No effect
213	1:25 a.m.	75,000*	58,500*	41,300*	22.0	No effect
214	2:00 a.m.	90,000*	66,200*	46,900*	23.5	Small amount of smoke emitted from around one terminal

* Estimated.

within the manufacturer's rating. The two-second rating is 27,400 effective amperes.

The tests showed that the two-second safe rating of the "special" 100/5 transformer is 9,700 effective amperes. Tests on the KB-100/5 transformer showed that its two-second safe rating was 7,870 effective amperes. The manufacturer's claim of a higher thermal capacity is thus substantiated, there having been an increase of approximately 23 per cent. The "special" transformer also was subjected to a somewhat higher peak ampere than the KB-100/5 transformer, without any mechanical injury. However, there was no mechanical failure of the KB-100/5, so that it is difficult to say whether or not it is stronger mechanically, although it is reasonable to think that with the added bracing around it it is.

The tests tend to confirm the experience of the operating companies making these tests and indicate their present practice to be in the proper direction with a reasonable margin of safety. Where the smaller sizes of current transformers must be used in locations of possible high short-circuit currents, special attention should be given to have transformers of proper or even special design, or other precautions should be taken. Thus where current transformers of small ratings are desirable for metering purposes but might be danger-

TABLE VIII—SUMMARY OF TESTS

Transformer	Ratio	Maker's Rating, in Initial Peak Amp.	Test Current Without Mechanical Injury, in Initial Peak Amp.	Two-Second Rating (Safe), in Symmetrical Effective Amp.	Actual Current Which Destroyed Transformer, in Symmetrical Effective Amp.	Corresponding Time in Cycles	Cause of Failure in Previous Column
K-48	100/5	30,600	33,900	8,220	15,000	17.5	Terminal burned off
K-28	300/5	53,400	36,200	16,000	Approx. 35,000	Probably in a few cycles	Primary blown in form of circle
KB	100/5	10,200	21,500	7,870	12,600	19.5*	Insulation burst open; smoked badly
KB	200/5	20,400	48,800	17,600	43,300	11	Primary burned open; transformer caught fire
D-21	300/5	53,400	54,300	10,100	24,500	18.5	Terminal burned off
K-B	600/5/5	61,000	90,000	27,400	46,900	23.5	Smoke emitted from around terminal
"Special"	100/5	Not known	45,000	9,700	18,300	22.5	Primary turns short-circuited

* Estimated.

ously located in case of short circuits, the Pennsylvania Water & Power Company has followed the practice of either protecting all the equipment, including the current transformers, by insertion of reactors or resistors on the high side between the bus and the equipment to be protected or using current transformers of larger rating for relay purposes in series with the smaller ones used for metering purposes, thus accepting the eventual destruction of the latter but relying on the former for clearing the short.

An important point brought out by these tests is the thermal effect. The destructive effect of magnetic stresses in current transformers seems to be well recognized, but the thermal effects under abnormal currents have probably not been so well appreciated. The melting of lugs and windings produces destructive effects sometimes in excess of those caused by magnetic stresses. Both the magnetic and thermal effects on a given transformer are proportional to the square of the current, but with this important difference—that if the transformer withstands the first initial (displaced) wave it will not be destroyed mechanically, but may fail a little later owing to the cumulative effect of the heating. Current transformers of larger rating but the same design will have proportionally fewer primary turns and will, therefore, both mechanically and thermally, withstand higher currents directly in proportion to their size. If used at a place where a given maximum short-circuit current obtains, the effect of replacing a smaller current transformer with a larger one, on the other hand, will be to increase the safety factor proportionately with the square of the current.

Tests and actual experience indicate that it should be possible for the manufacturer to build a commercial transformer of reasonable magnetic strength at a reasonable cost. However, considering all factors, magnetic and thermal stresses, accuracy and costs, the problem is more involved. It may be of easy solution in the larger sizes, but perhaps not in the smaller sizes, where special and more expensive transformers might be required for points of large capacity. On the other hand, the operating companies should carefully study each application and balance the various factors involved. It is important to have complete knowledge of current-transformer applications, and it seems desirable that a survey of the system should be made with the object of determining just what current transformers are safe and just what are unsafe, based on the possible short circuits obtaining at those points.

The foregoing information is based on data furnished by J. E. Allen, chief of tests with the Pennsylvania Water & Power Company.

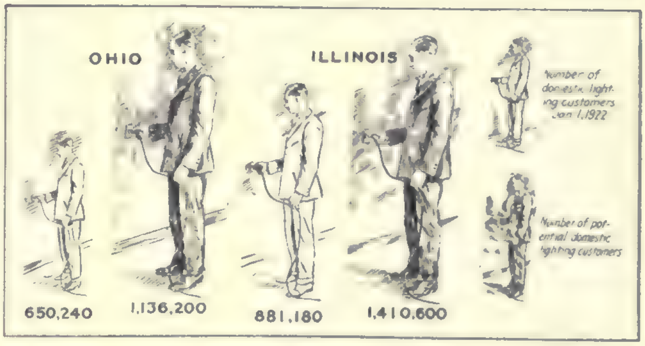
Potential Customers in Ohio and Illinois Total 3,123,000

"Electrical World's" Estimate of Present and Potential Customers in Ohio and Illinois by Counties Indicates that a Total of About 1,015,380 Homes Are Possible of Future Electrification

CONTINUING its study of the distribution of present and potential central-station customers in the counties of the various states, the ELECTRICAL WORLD presents in the accompanying tables its estimate of the consumers in the counties of Ohio and Illinois. Studies have previously been made for New England and the Middle Atlantic States, and the results were published in the issues of April 28 and June 16, 1923, respectively. Similar data for other states of the Union will appear in early issues of the ELECTRICAL WORLD.

This study is based upon reports which have been received by the ELECTRICAL WORLD from operating companies representing about 70 per cent of the installed generator rating of the country, supplemented by data on population and industrial power issued by the United States Census Bureau. The data obtained in this way were referred to a representative company operating in the county concerned with the request that an opinion be given as to whether the data represent with a fair degree of accuracy existent conditions in that county.

In the few cases where the operating companies to which the figures were sent indicated that the ELECTRICAL WORLD'S figures were at variance with conditions in the county a new study was made and the data were corrected accordingly. The figures of the various counties, while estimates, are believed to indicate very clearly the present and future potentialities of the counties as ultimate purchasers of electrical apparatus, appliances and supplies.



THE DOMESTIC LIGHTING FIELD IN ILLINOIS AND OHIO IS ABOUT 60 PER CENT DEVELOPED

The method used in determining the number of potential residential-lighting customers, potential commercial-lighting customers and potential industrial-power customers was adopted after careful study. To arrive at the number of potential domestic-lighting customers of any county it was assumed that all of the families residing in the urban districts of that county fall within this category. It was also assumed that all

the families residing in rural towns are potential domestic-lighting customers and that 50 per cent of the remaining families in rural districts are potential customers. Adding these three quantities gives the total potential domestic-lighting customers of that county.

Present and Potential Central-Station Customers in Ohio by Counties

County	Population (Census of 1920)			Domestic Lighting Customers		Commercial Lighting Customers		Industrial Power Customers	
	Total	Urban*	Rural	Total (Jan. 1, 1922)	Total Potential (Including Present Customers)	Total (Jan. 1, 1922)	Total Potential (Including Present Customers)	Total (Jan. 1, 1922)	Total Potential (Including) Present Customers
TOTALS FOR OHIO	5,759,394	3,915,235	1,844,159	650,240	1,136,200	102,450	179,910	26,360	58,000
Adams	22,403	2,832	19,571	720	2,140	90	270	30	150
Allen	68,223	47,988	20,235	8,250	13,490	1,400	2,280	330	340
Ashland	24,627	11,136	13,491	2,200	5,200	450	600	90	180
Ashtabula	65,545	36,038	29,507	5,080	11,240	890	1,970	150	670
Athens	50,430	19,400	31,030	3,930	6,990	440	1,160	200	400
Auglaize	29,527	14,014	15,513	2,110	4,800	370	840	50	250
Belmont	93,193	42,390	50,803	5,900	13,560	1,110	2,550	170	950
Brown	22,621	3,199	19,422	840	2,400	110	310	30	150
Butler	87,025	65,415	21,610	8,470	17,680	1,600	3,340	120	1,190
Carroll	15,942	3,299	12,643	750	1,930	110	280	20	40
Champaign	25,071	10,317	14,754	1,940	4,410	300	680	40	80
Clark	80,725	63,126	17,599	8,470	17,520	1,560	2,000	710	800
Clermont	28,291	6,613	21,678	1,440	3,680	200	510	30	60
Clinton	23,036	8,212	14,824	2,110	3,850	490	720	120	150
Columbiana	83,131	56,930	26,201	7,530	16,010	1,380	2,930	290	830
Coshocton	29,595	10,847	18,748	2,480	4,000	210	450	140	300
Crawford	36,054	22,112	13,942	3,230	6,970	560	1,210	210	540
Cuyahoga	943,495	919,994	23,501	188,400	216,320	20,540	23,000	5,000	5,200
Darke	42,911	11,512	31,399	3,000	5,730	700	1,340	400	700
Defiance	24,549	11,254	13,295	2,000	4,210	340	710	110	200
Delaware	26,013	8,756	17,257	1,680	3,950	260	610	40	200
Erie	39,789	26,036	13,753	3,750	7,980	670	1,430	300	600
Fairfield	40,484	14,706	25,778	2,520	5,910	420	990	110	350
Fayette	21,518	0	21,518	540	1,850	50	170	20	40
Franklin	283,951	245,097	38,854	30,750	63,780	5,860	12,160	1,880	3,870
Fulton	23,445	6,951	16,494	1,350	3,290	200	490	30	150
Gallia	23,311	6,070	17,241	930	2,460	150	400	20	100
Geauga	15,036	1,566	13,470	540	1,570	70	200	10	50
Greene	31,221	13,500	17,721	2,840	5,130	750	860	127	150
Guernsey	45,352	15,879	29,473	2,360	5,740	400	970	20	330
Hamilton	493,678	470,634	23,044	59,800	124,840	11,900	24,900	4,550	11,900
Hancock	38,394	19,691	18,703	3,320	7,260	550	1,210	200	470
Hardin	29,167	11,154	18,013	1,950	4,560	310	730	40	200
Harrison	19,625	2,084	17,541	590	1,820	70	220	30	150
Henry	23,362	6,696	16,666	1,200	3,150	220	510	30	130
Highland	27,610	8,700	18,910	1,690	4,090	250	610	50	250
Hocking	23,291	6,986	16,305	1,070	2,600	170	410	20	100
Holmes	16,965	2,098	14,867	490	1,810	60	220	30	150
Huron	32,424	17,490	14,934	2,790	6,420	460	1,060	60	300
Jackson	27,342	13,923	13,419	1,640	4,090	300	750	40	200
Jefferson	77,580	45,234	32,346	5,620	12,550	1,150	2,570	120	440
Knox	29,580	10,431	19,149	1,860	4,470	280	670	30	150
Lake	28,667	15,647	13,020	1,490	4,830	260	840	30	150
Lawrence	39,540	15,858	23,682	1,830	4,820	340	890	90	310
Licking	56,426	29,816	26,610	4,790	10,560	780	1,720	280	600
Logan	30,104	10,683	19,421	2,330	5,250	370	830	50	250
Lorain	90,612	68,195	22,417	8,370	20,000	1,660	3,520	220	990
Lucas	275,721	247,581	28,140	29,510	60,670	5,950	12,230	2,230	3,800
Madison	19,662	6,363	13,299	1,400	2,980	220	470	20	100
Mahoning	186,310	155,197	31,113	22,500	49,000	3,800	5,500	150	200
Marion	42,004	27,891	14,113	5,200	11,000	900	1,500	250	450
Medina	26,067	9,412	16,655	2,920	3,870	460	610	60	300
Meigs	26,189	8,066	18,123	1,270	3,220	190	480	20	100
Mercer	26,872	7,924	18,948	1,230	3,060	220	550	40	200
Miami	48,428	29,374	19,054	4,940	10,600	770	1,650	250	690
Monroe	20,660	2,394	18,266	500	1,670	60	200	30	150
Montgomery	209,532	163,008	46,534	36,830	43,400	4,870	6,700	1,520	2,400
Morgan	14,555	1,618	12,937	610	1,490	60	150	20	200
Morrow	15,570	2,946	12,624	310	1,730	40	200	20	200
Muskingum	57,980	33,112	24,868	4,770	10,990	800	1,850	180	640
Noble	17,849	2,756	15,093	410	1,610	40	160	20	100
Ottawa	22,193	6,834	15,359	1,460	3,350	250	570	30	150
Paulding	18,736	3,169	15,567	840	2,150	130	330	20	100
Perry	36,098	13,561	22,537	2,090	4,930	370	870	30	150
Pickaway	25,788	8,081	17,707	1,330	3,270	220	540	30	150
Pike	14,151	1,625	12,526	340	1,130	40	130	10	50
Portage	36,269	15,408	20,861	2,490	5,690	420	960	60	300
Preble	23,238	4,313	18,925	1,520	4,010	230	610	40	200
Putnam	27,751	6,816	20,935	1,500	3,800	250	630	40	200
Richland	55,178	33,402	21,776	4,940	10,570	900	1,920	430	780
Ross	41,556	15,831	25,725	2,470	5,820	430	1,010	10	230
Sandusky	37,109	19,513	17,596	2,870	6,430	480	1,080	210	430
Scioto	62,850	44,827	18,023	4,640	11,480	920	2,280	40	430
Seneca	43,176	22,704	20,472	3,510	7,740	600	1,330	190	620
Shelby	25,923	8,590	17,333	2,500	4,110	350	580	150	300
Stark	177,218	133,323	43,895	31,860	47,500	6,130	8,200	1,590	3,250
Summit	286,065	252,263	33,802	38,500	57,400	6,730	8,500	1,200	1,800
Trumbull	83,920	51,106	32,814	6,610	14,310	1,260	2,730	210	830
Tuscarawas	63,578	34,160	29,418	5,150	11,170	950	2,060	130	690
Union	20,918	5,236	15,682	1,150	3,270	170	480	20	100
Van Wert	28,210	10,676	17,534	1,960	4,760	340	830	30	150
Vinton	12,075	1,307	10,768	290	960	30	100	10	50
Warren	25,716	6,467	19,249	1,530	3,670	230	550	40	200
Washington	43,049	16,457	26,592	2,590	6,150	420	1,000	190	450
Wayne	41,346	16,245	25,101	2,790	6,440	460	1,060	70	350
Williams	24,627	8,318	16,309	1,930	4,360	300	680	40	200
Wood	44,892	10,656	34,236	2,770	6,550	450	1,070	40	200
Wyandot	19,481	6,196	13,285	1,270	2,980	200	470	30	150

* Cities and towns of over 1,000 population.

Present and Potential Central-Station Customers in Illinois by Counties

County	Population (Census of 1920)			Domestic Lighting Customers		Commercial Lighting Customers		Industrial Power Customers	
	Total	Urban*	Rural	Total (Jan. 1, 1922)	Total Potential (Including Present Customers)	Total (Jan. 1, 1922)	Total Potential (Including Present Customers)	Total (Jan. 1, 1922)	Total Potential (Including) Present Customers
TOTALS FOR ILLINOIS	6,485,280	4,756,462	1,728,818	881,180	1,410,600	171,380	289,970	27,250	48,740
Adams	62,188	37,016	25,172	8,100	13,080	1,380	2,220	220	490
Alexander	23,980	15,203	8,777	3,080	5,860	520	990	40	160
Bond	16,045	3,091	12,954	1,270	2,750	180	390	10	30
Boone	15,322	7,804	7,518	1,910	3,200	310	520	10	40
Brown	9,336	1,932	7,404	890	1,690	100	190	10	30
Bureau	42,648	16,352	26,296	5,140	8,500	920	1,520	20	80
Calhoun	8,245	0	8,245	310	1,510	20	100	10	30
Carroll	19,345	8,340	11,005	2,620	4,370	380	630	130	150
Cass	17,896	9,734	8,162	2,320	3,790	270	440	10	10
Champaign	56,959	27,668	29,291	6,960	11,440	1,210	1,990	350	480
Christian	38,458	17,877	20,581	4,300	7,390	730	1,260	10	40
Clark	21,165	5,848	15,317	2,440	4,690	230	440	10	60
Clay	17,684	3,558	14,126	1,320	2,890	190	420	10	50
Clinton	22,947	8,329	14,618	1,900	4,000	330	700	20	80
Coles	35,108	21,377	13,731	4,530	7,310	770	1,240	120	280
Cook	3,053,017	2,993,620	59,397	490,050	742,000	101,670	168,200	20,420	33,300
Crawford	22,771	6,715	16,056	1,650	3,670	240	530	10	60
Cumberland	12,858	2,379	10,479	830	2,000	110	270	10	10
De Kalb	31,339	15,110	16,229	3,970	6,690	650	1,090	20	100
DeWitt	19,252	7,576	11,676	2,000	3,680	310	570	10	40
Douglas	19,604	8,113	11,491	2,140	3,800	350	620	10	40
Du Page	42,120	25,464	16,656	5,050	8,140	940	1,510	30	130
Edgar	25,769	9,086	16,683	2,670	4,950	410	760	20	90
Edwards	9,431	1,584	7,847	930	1,780	140	270	20	40
Effingham	19,556	5,376	14,180	1,430	3,080	220	470	10	60
Fayette	26,187	4,653	21,534	1,450	3,750	190	490	10	50
Ford	16,466	5,267	11,199	1,570	3,010	260	500	10	40
Franklin	57,293	35,814	21,479	6,160	10,730	1,210	2,100	10	50
Fulton	48,163	20,926	27,237	5,630	9,650	920	1,570	10	60
Gallatin	12,856	5,134	7,722	1,090	2,110	190	370	10	30
Greene	22,883	9,051	13,832	2,300	3,500	500	600	50	60
Grundy	18,580	7,611	10,969	2,020	3,850	360	690	10	60
Hamilton	15,920	1,927	13,993	760	2,160	90	260	10	30
Hancock	28,523	8,266	20,257	3,160	5,810	460	850	10	60
Hardin	7,533	2,577	4,956	170	1,440	90	760	10	10
Henderson	9,770	0	9,770	850	1,700	130	260	10	10
Hendry	45,162	25,670	19,492	5,430	9,390	940	1,620	40	200
Iroquois	34,841	8,215	26,626	2,930	5,900	460	930	10	60
Jackson	37,091	16,970	20,121	3,700	6,630	650	1,170	10	50
Jasper	16,064	2,083	13,981	760	2,250	80	240	10	50
Jefferson	28,480	9,815	18,665	2,360	4,830	370	760	10	50
Jersey	12,682	3,839	8,843	940	2,080	130	290	10	30
Jo Daviess	21,917	8,607	13,310	2,360	4,250	380	690	20	80
Johnson	12,022	0	12,022	480	1,560	50	160	10	50
Kane	99,499	82,524	16,975	14,950	22,080	2,880	4,260	230	600
Kankakee	44,940	23,348	21,592	4,500	7,710	870	1,490	40	170
Kendall	10,074	1,473	8,601	840	1,770	120	250	10	10
Knox	46,727	28,263	18,464	6,730	10,500	1,120	1,750	110	260
La Salle	92,925	63,663	29,262	10,620	24,000	2,780	5,800	630	,4001
Lake	74,285	44,040	30,245	7,770	12,340	1,720	2,730	180	860
Lawrence	21,380	9,502	11,878	1,790	3,500	360	400	50	[illegible]
Lee	28,004	10,135	17,869	3,010	5,260	680	790	30	40
Livingston	39,070	13,607	25,463	3,360	6,620	380	750	30	130
Logan	29,562	14,565	14,997	3,150	5,370	410	700	30	120
McDonough	27,074	11,819	15,255	2,930	5,240	330	590	20	90
McHenry	33,164	13,970	19,194	3,800	6,380	470	790	20	80
McLean	70,107	38,160	31,947	8,820	14,370	1,510	2,330	140	280
Macon	65,175	45,011	20,164	9,310	14,170	1,670	2,540	120	290
Macoupin	57,274	29,190	28,084	6,440	10,810	1,160	1,950	20	100
Madison	306,895	80,824	26,071	14,820	22,150	2,840	4,240	90	170
Marion	37,497	19,560	17,937	3,990	7,240	670	1,220	70	350
Marshall	14,760	6,807	7,953	1,600	2,780	280	490	10	40
Mason	16,634	5,494	11,140	2,030	3,200	550	700	130	170
Massac	13,559	5,055	8,504	1,160	2,390	170	350	10	50
Menard	11,694	3,673	8,021	1,160	2,150	180	330	10	30
Mercer	18,800	3,379	15,421	1,870	3,560	280	530	10	40
Monroe	12,839	3,522	9,317	840	1,940	120	280	10	40
Montgomery	41,403	19,923	21,480	4,970	8,170	880	1,450	20	90
Morgan	33,567	17,223	16,344	3,890	6,450	700	1,160	90	170
Moultrie	14,839	4,011	10,828	1,250	2,510	200	400	10	30
Ogle	26,830	8,654	18,176	2,790	5,180	420	780	10	50
Peoria	111,710	87,900	23,810	17,000	27,000	3,600	5,000	900	1,000
Perry	22,901	12,534	10,367	2,280	3,960	390	680	10	40
Piatt	15,714	4,946	10,768	1,640	2,970	260	470	10	30
Pike	26,866	4,962	21,904	2,050	4,580	280	630	10	50
Pope	9,625	1,242	8,383	410	1,290	40	130	10	30
Pulaski	14,629	5,417	9,212	1,420	2,590	240	440	10	30
Putnam	7,579	2,727	4,852	820	1,370	160	270	10	10
Randolph	29,109	11,209	17,900	2,330	4,630	390	780	20	80
Richland	14,044	4,491	9,553	1,230	2,520	180	370	10	50
Rock Island	92,297	77,127	15,170	14,740	21,040	2,780	3,980	230	380
St. Clair	136,520	110,849	25,671	20,260	30,330	3,800	5,680	210	800
Saline	38,353	16,212	22,141	3,840	6,770	690	1,220	10	50
Sangamon	100,262	69,673	30,589	13,020	20,810	2,400	3,840	310	550
Schuyler	13,285	2,275	11,010	900	2,130	120	180	10	10
Scott	9,489	2,549	6,940	820	1,660	120	240	10	30
Shelby	29,601	6,159	23,442	2,370	5,050	340	730	10	50
Stark	9,693	2,611	7,082	850	1,780	280	400	50	100
Stephenson	37,743	20,818	16,925	4,850	8,040	780	1,290	120	270
Tazewell	38,540	18,313	20,227	4,500	7,500	750	1,270	200	280
Union	20,249	4,109	16,140	1,280	2,830	210	460	10	50
Vermilion	86,162	48,117	38,045	10,750	17,440	1,890	3,070	110	370
Wabash	14,034	7,456	6,578	1,590	2,720	270	460	10	40
Warren	21,488	8,116	13,372	2,100	2,500	350	400	110	130
Washington	18,035	2,209	15,826	1,100	2,660	150	360	10	40
Wayne	22,772	2,754	20,018	1,030	3,070	110	330	10	40
White	20,081	3,967	16,114	1,410	3,200	200	460	10	50
Whiteside	36,174	17,713	18,461	4,200	7,180	690	1,180	20	90
Will	92,911	48,853	44,058	9,550	16,410	1,780	3,060	100	500
Williamson	61,092	33,333	27,759	6,430	11,270	1,170	2,050	20	80
Winnebago	90,929	68,175	22,754	14,230	17,200	2,860	3,170	710	[illegible]00
Woodford	19,340	6,674	12,666	1,860	3,400	310	570	40	6[illegible]

* Cities and towns of over 1,000 population.

Explosion Pots Reduce Switch Trouble

Bernard Price Believes Breaker Improvement Lies in Development of This Principle —Increases Velocity of Contact Separation, Protects Tank from Extreme Pressures, Minimizes Explosions

EXCELLENT results have been obtained in reducing oil-switch explosions and increasing rupturing capacity by the incorporation of explosion chambers in the circuit breakers on the Rand Electric Power Companies' systems, declared Bernard Price recently before a meeting of the South African Institute of Electrical Engineers. Prior to their use more trouble was experienced by this company with gaseous explosions and oil fires resulting from switch failure than by any other company of which he had knowledge, Mr. Price added.

"As the size of the system increased it soon became apparent that the switches were incapable of meeting the increasingly severe conditions obtaining on the occurrence of a fault.

"Reactors were installed in series with all the large generators on the system, and the neutral of each separate distribution network was earthed through a non-inductive resistance. Experience showed, however, that no reasonable increase in the inherent reactance of the system would sufficiently limit the rush of energy flowing to a fault between phases to bring it within the rupturing capacity of the switches as originally designed.

Gases Must Have Free Path

"In this type of switch a free path exists for the gases produced by the arc to pass upward through the oil until they reach the air within the cover above the tank. Unless the arc is finally quenched before the gases reach the surface of the oil, or unless the gases themselves are sufficiently cooled in transit through the oil, a gaseous explosion may occur inside the switch, which bursts open the tank, expels a portion of the oil, and in some instances ignites the oil inside or outside the switch, thus producing an oil fire. Less frequently the gaseous explosion does not occur inside the switch, but the gases generated at the arc displace the air within the switch cover and eventually explode with the outside air on leaving the vent pipe which passes through the cover of the switch. It is probable that these external explosions occur only when the arc inside the switch is maintained for a period after the moving member has reached the end of its travel so that the gases have time to displace the air above the oil until finally a jet of flame or an incandescent particle escapes through the vent pipe and ignites the gaseous mixture outside the switch, or the gases themselves reach the air at a sufficiently high temperature to produce ignition.

"The first switches to give trouble were the triple-unit, single-pole switches controlling the 40,000-volt arteries of the system. Later the single-unit, three-pole, 20,000-volt feeder switches at substations in overhead sections of the system and the triple-unit, single-pole, 10,000-volt feeder switches at one of the generating stations gave similar trouble.

"When deciding how best to solve the problem we realized that the first essential was to eliminate the possibility of the gaseous explosion. Any ordinary damage to the replaceable contacts of the switch was of no concern provided the switch performed its duty of breaking the circuit without causing extensive damage to itself and neighboring apparatus. The means adopted for achieving this object were to inclose the arc in a relatively small insulated chamber (known as an explosion pot) attached to the insulator which carries the fixed contact inside the switch and arranged so that the gases generated therein by the arc were forced to follow the moving contact through an aperture in the lower end of the chamber and then bubble up through the mass of cold oil in the tank. This arrangement was not novel, and in adopting it we did not count upon any large increase of quenching power of the oil at the arc. Our primary object was to interpose a physical barrier in the path of incandescent particles between the arc and the air above the oil and to insure that the gas be too cool to ignite by the time it reached the air.

Pots Eliminate Danger of Explosions

"The installation of these explosion pots in the 40,000-volt switches proved completely effective, there having been no subsequent instance of a gaseous explosion. When it became necessary to tackle the 20,000-volt substation switches we feared there might not be room in the three-pole single-tank units to accommodate six explosion pots of adequate size. Special tests were therefore carried out, and we took the opportunity to experiment also with certain alternative arrangements. We soon found that explosion pots of adequate size could be satisfactorily accommodated in the existing switches, but, of course, in this case, as in the previous case of the 40,000-volt switches, the length of break and depth of tank had to be increased considerably to insure that the moving contact would move well clear of the aperture in the pot at the end of its travel. Without waiting for further investigation about twenty feeder switches in substations were equipped with six explosion pots per switch, and no further trouble has occurred with these altered switches.

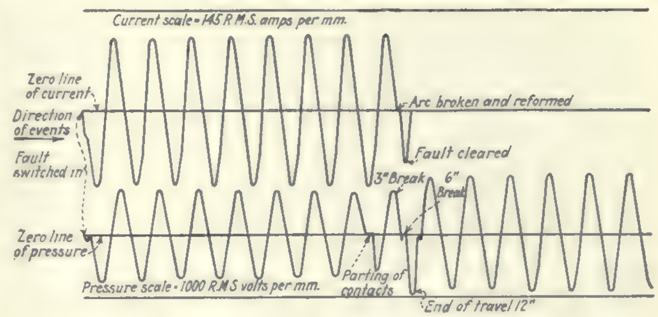
"In the case of the 10,000-volt, triple-unit, single-pole switches we first tried the effect of merely increasing the length of break of the existing switches, but this, though an improvement, was inadequate. Explosion pots were therefore inserted in about twelve switches.

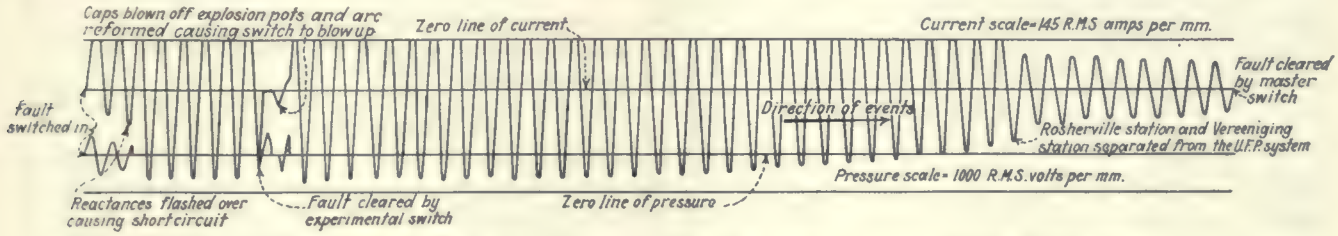
"The investigations carried out by the aid of the oscillograph when testing switches of various types on heavy faults with the whole system behind them brought out clearly the merits of the explosion-pot principle. We were not able to impose sufficiently severe conditions to reach (probably not even to approach) the limiting capacity of such switches, because, although we went so far as to switch a very heavy load onto the system as a whole, we did not feel justified in applying a dead short circuit to plant which was in commercial service.

"As anticipated, the gaseous pressure generated by the arc in the pot, acting on the moving member of the switch, accelerated the speed of the moving contact and of the operating mechanism to which the moving member

is connected. It became clear, moreover, that all excepting relatively small loads were interrupted during the very short interval of time taken by the arcing contact to traverse the length of the aperture of the pot. At the highest loads applied during the experiments we were unable to observe from the oscillograms any continuance of the arc after the contact had left the aperture. The point in the travel of the contact at which rupture of the circuit took place appeared to be fixed within the length of the aperture of the pot, and consequently the time of existence of the arc tended to become shorter as the severity of the fault increased and the velocity of the arcing contact became greater.

"One switch was specially designed to have only one explosion pot per pole and a moving member which could operate under the influence of the gaseous pressure in the pot independently of the operating mechanism. This moving member was arranged to follow a circular path and was designed so that its inertia and impedance to movement in the oil were a minimum. Tests showed that it attained a velocity of about 75 ft. per second when rupturing a load of only 100,000 kva. at a relatively high power factor, a figure which is several times greater than that usually attained in switches of normal design. Much higher velocities would, of course, be reached under the conditions of a short circuit, but we were unable to measure these.





PERFORMANCE OF EXPERIMENTAL CIRCUIT BREAKER HAVING SLIDING-SLEEVE MECHANISM

"By a fortunate accident, however, we were able to prove that the rupturing capacity was ample for meeting short-circuit conditions on our system. Choking coils without additional resistances had been inserted in the circuit of a size calculated to produce a load approximately equal to the 100,000 kva. above mentioned, but with a power factor of only about 10 per cent lagging. Immediately on closing the experimental switch these reactances flashed over and caused a short circuit which from the oscillogram is shown to have reached a practically steady value of about 8,700 amp. by the time when the switch contacts began to part. This very heavy load wiped out the voltage, and consequently no detailed records of the times and speeds of opening were obtained, but the oscillogram shows that the time taken for the switch to rupture the fault current was about the same as when breaking the 100,000 kva. in the previous test, namely, rather less than one complete cycle from the moment when the contacts began to part.

"About half a cycle after the circuit had been ruptured the switch blew up, and this reimposed a short circuit on the system. The oscillogram clearly shows this restarting of the load and the manner in which it gradually diminished until at the forty-third cycle the operation of sectionalizing switches at generating stations subdivided the system and reduced the capacity of plant feeding the fault. At the fifty-second cycle the fault was cleared by the master switch, which had been connected in series with the experimental switch and which was set to operate with a time lag of one second. This master switch was one of our 40,000-volt switches fitted with explosion pots and operated at 20,000 volts.

"On examining the experimental switch it was found that the fiber insulating caps which formed the lower ends of the explosion pots had been blown out on two of the three phases owing to defective screw threads on the steel locking rings which hold these caps in place. Abrasions on the fiber corresponding with the configuration of the moving contact prove conclusively that these caps had been blown on to the moving contact after the latter had cleared the aperture in the cap, and this evidence combined with the oscillogram leaves no doubt that the switch had ruptured the circuit quite satisfactorily and that no subsequent damage would have occurred if the caps of the explosion pots had been properly held in place.

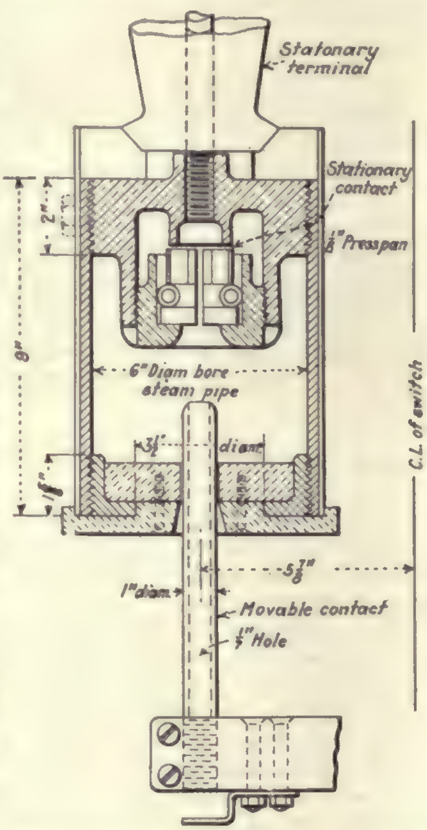
"The conclusion drawn from all these tests with explosion pots was that the rupturing capacity at the moment when the arcing contact is passing through the aperture of the pot is exceptionally high (we failed in fact to determine where the limit is reached), and I think a little consideration will show that this is only to be expected. From the moment when the contacts part from one another gas is generated at a more or less uniform rate along the length of the arc. This means that after a given interval of time, counted from the moment when the contacts first separate, the quantity of gas which has been generated at any particular point along the path of the arc will be a function of the period during which the arc has existed at that particular point. Assuming, for example, that the arcing contact has almost reached the inner entrance of the aperture, so that the arc is passing from the fixed contact to a point near the lower end of the pot, then the quantity of gas generated at the upper end of the arc will be greater than that at the lower end.

"During the movement of the arcing contact the volume of that portion of the moving member which has passed out of the pot will have been replaced by an equal volume of gas generated under high pressure in the pot, and inasmuch as the major portion of this gas has been generated in the upper regions of the pot the tendency will be for the oil to be forced radially outward from the upper portion of the arc and radially inward to

fill the space vacated by the moving contact at the lower end of the arc.

"Now imagine what happens when the moving contact continues its travel and passes through the aperture in the lower end of the pot. This aperture may be of any desired length. In the pots used during the experiments it consisted of a circular hole through the thickness of the end disk of the pot. This disk had to be made of insulating material strong enough to withstand the high gaseous pressures created in the pot and was about 1 in. in thickness.

"It will be clear from the above that the oil at the lower end of the pot will be forced to follow the arcing contact and in flowing inward radially to enter the aperture will be projected into the arc at high velocity. This velocity will depend upon the speed at which the arcing contact is moving. If injection of oil into the arc at this velocity fails to rupture the circuit, a further change occurs when the arcing contact leaves the aperture of the pot. Immediately the aperture is thus opened the velocity of the oil which is following the contact is no longer controlled by the speed at which the contact is moving, and the gaseous pressure inside the pot is at once relieved by a sudden rush of oil through the aperture, and therefore through the arc.



CROSS-SECTION OF EXPLOSION CHAMBER WITH WHICH EXPERIMENTS WERE CONDUCTED

"The explosion pot harnesses the energy dissipated by the arc and puts it to that beneficial use. Not only does it confine the damaging effects produced by the arc and thus relieve the whole structure of the switch from mechanical strain and prevent the arc from gaining access to the air, but it applies the energy in the arc to accelerate the speed with which the arc is lengthened and the velocity with which the quenching medium is introduced into the lengthening arc. A further most valuable feature of the principle in question is that the available energy increases with the severity of the task it is called upon to perform.

"Looking forward there would seem to be room for further development of the explosion-pot principle in the direction of increasing the velocity of both moving contact and oil. The velocity of the moving contact can be increased by enlarging the area on which the pressure operates, but this involves a corresponding increase in the area of the aperture through which the oil is expelled from the pot when the moving contact is withdrawn. So great is the pressure in the pot at this moment that its sudden release through a relatively large aperture can impose considerable mechanical strain on the inclosing structure of the switch.

"Maximum quenching power will occur when the velocities of the moving contact and oil are both a maximum, and this occurs when the moving contact has just left the aperture in the pot and the flow of oil, being no longer controlled by the velocity of the moving contact, is discharged under the influence of the full difference of pressures inside and outside the pot. In order to give the moving contact the highest possible velocity at this moment without imposing an undue strain on the outer structure of the switch, the aperture may be fitted with flap doors, a spherical plug or other suitable means for partially closing the aperture at the moment when the moving contact is leaving the pot. These doors operate under the influence of the oil as it follows the moving contact into the exit passage and automatically constrict the aperture to any desired extent before the moving contact has left the passage. In this way the arc may be confined to a passage through which the oil is forced at the full velocity which the difference of pressures can produce, which passage is automatically constricted from an initial size large enough to produce maximum acceleration of the moving contact to a final one small enough to prevent any undue strain being imposed on the outer structure of the switch.

"Another arrangement which would render the velocity of the oil independent of the velocity of the moving contact at an earlier point in the travel of the switch is one in which a vent passage is provided in the body of the moving member itself so arranged that its entrance is located at the center of the surface from which the arc strikes and its exit at a suitable point along the side of the moving member. During the earlier portion of the travel of the moving member the exit of this internal passage would be inside the aperture of the pot and would therefore be closed by the side of that aperture, but immediately the exit has passed outside the pot the oil would find a free exit through the passage and would be discharged at full velocity under the difference of pressures inside and outside the pot. The stream of oil entering the passage would have to flow across the arc at every point, and by placing the exit at a suitable position along the moving member the sudden discharge of oil could be made to take place at any desired point during the travel of the moving contact inside the pot. Unless the aperture of the pot is relatively small in area, however, it would still be necessary to provide means such as those already described for constricting that aperture when the moving contact is fully withdrawn, as unless this were done the surrounding structure would be subjected to mechanical strain.

"In my opinion, the high-tension switch of the future will embody the explosion-pot principle and may be developed along some such lines as those I have indicated. Development in the direction of bomb-proof switch tanks is, in my opinion, mistaken because it does not attack the problem at its source."

Mr. Price stated that he did not anticipate that the use of explosion pots would cause any undue retardation of the moving member when synchronizing, as the clearance between the sides of the moving member and the aperture of the pot was appreciable and there were two small vent holes at the top of the pot through which the gases generated at the arc were able to escape.

Electric Furnaces Extensively Employed in Germany

Seventy per Cent of Steel Works Use Them for High-Grade Steel—Induction Furnaces Finding Wide Application—Results Obtained from Several Installations Are Cited

By CAPT. GODFREY L. CARDEN

IN THE course of visits to iron and steel works in central Europe in the past three months I was impressed by the very general recourse to electric furnaces. Both induction and arc furnaces are in evidence, the Röchling-Rodenhauser induction furnace appearing to be the one most in favor. The arc furnaces in use are mostly of the Bonn or the Gesta types. The Bonn is an arc-radiating furnace while the Gesta is an arc-resistor furnace.

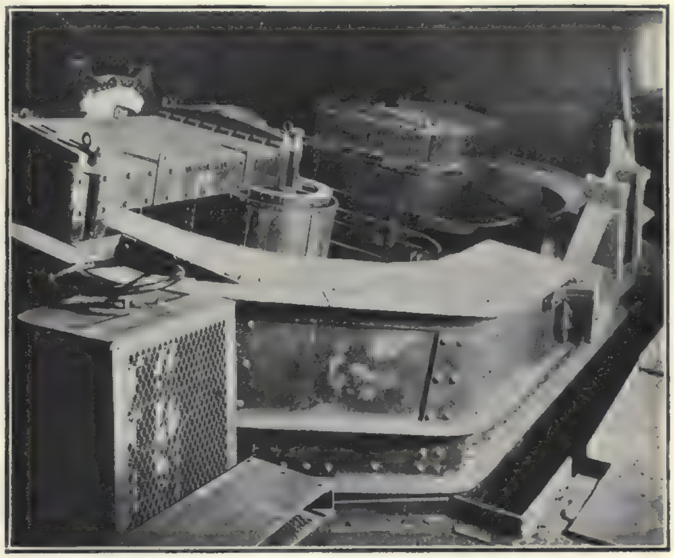
Dr. Engelhardt, the director of the electric-furnace construction department of Siemens & Halske Company, Siemens-Schuckert Works, and a recognized authority in Germany on electric furnace work, pointed out to me that fully 70 per cent of all the high-class steel-making firms of Germany today are employing electric furnaces, which are installed either singly or in groups. These furnaces are being used either independently or as complements to older-type furnaces. This recourse to electric furnaces, he said, is a development of the last few years and has come about through the success attending the first serious attempts to produce high-grade steel by the electric process.

Viewed from the economic standpoint, Dr. Engelhardt says, the electric furnace offers its greatest advantages in territory where cheap electric energy is obtainable from streams. In Germany these natural advantages are not present and in consequence the energy must be obtained mostly from coal. Notwithstanding the higher cost, the Germans have found the electric furnace too important an accessory to ignore, and especially so because of the superior services rendered in production problems of different kinds.

The electric furnace, it is found, can readily be adapted to varied applications in steel works and quickly adjusted to handling of charged as well as finished material. In Germany as a general rule one finds the electric furnace in use in the small crucible steel and metal works in lieu of a crucible or cupola furnace. Machine shops and shipyards, too, have got into the habit of using electric furnaces for smelting on jobs where steel or cast-iron parts are wanted urgently.

Among the larger German high-grade steel works the electric furnace supplements the Martin furnace or converter. Here, it is observed, the charge can be decarbonized and dephosphorized and then carried over in liquid form for a further treatment in the electric furnace. The steel that results from this treatment is more satisfactory, it is declared, than the usual form of Martin or Thomas steel.

The German iron industry is using very generally the electric furnace for remelting ferric alloys, metal and metal alloy. A decided advantage results from this practice when comparison is made with similar



ONE OF THE SIX 8-TON RÖCHLING-RODENHAUSER INDUCTION FURNACES PRODUCING HIGH-ALLOY STEEL AT THE BECKER STEEL WORKS, KREFELD

work produced by cupola or hearth furnaces. Recourse to the electric furnace assures elimination of practically all influx of external impurities and prevents diminution in the metal consumption. Distinct advantages possessed by the electric furnace, in comparison with the older types, are: (a) Ability to obtain an extraordinarily rapid and intense heat; (b) ability to obtain higher temperature than can be reached in other furnaces; (c) easy adjustment of temperature by means of regulating the furnace voltage; (d) the electric current gives the purest heating by eliminating all impurities from fuel or combustible; (e) the process of refinement of the charge can be carried out to any desired extent and the highest-grade steel produced for machine-tool steel, high-alloy plate iron for dynamo engines and transformers and other forms of high-class construction work.

In the light of every-day practice, the German iron and steel works are employing the electric furnace for work as follows:

1. For the melting of scrap and other cold charges.
2. In oxidation process for the removal of such impurities from the molten charge as can be disposed of by oxidation.
3. For the deoxidation of a melted bath for removing sulphur after eliminating the oxide dissolved in the iron.
4. For carbonizing, alloying and finishing of steel.

As to the particular type of electric furnace to be used, this depends on the work to be performed, the

THREE 4-TON HEROULT FURNACES, TWO OF WHICH ARE SHOWN, MAKE STEEL FROM COLD IRON SCRAP IN THE SAXON STEEL CASTING WORKS, DÖHLEN

purity of the charge and the finished material, the assumption always being that the purpose is to produce high-grade steel.

Where an arc-system furnace is employed the type may be either direct or indirect arc heating. The smaller steel works are inclined to use the Bonn type of furnaces. This is a direct-arc-heating furnace standardized for three-phase current. Here the pressure varies from 105 volts to 135 volts according to the size of the furnace. By means of a stationary transformer this furnace can be connected to any three-phase circuit. It is the common practice to use this furnace for charges of 200 kg. to 3,000 kg.

The Bonn furnace is regarded as especially advantageous for treating scrap, shavings and similar material. A small electric motor is used for tipping the large tanks; when small tanks are used they are arranged for tipping by hand. The tank is lined with refractory bricks and compound having basic or acid quality according to the kind of steel to be produced.

Direct-Arc Furnaces—Larger Type

For charges of 20 tons or more the Germans seem to be favoring the Heroult direct-arc furnace. This type, which is probably better known in America than more recent furnaces, is employed in Germany for reducing cold iron or steel scrap into cast-steel form, or high-grade steel, and also for the treating of liquid charges. The furnace department of Siemens & Halske Company, Siemens-Schuckert Works, has succeeded through the use of electrode regulators in reducing the current surges ordinarily occurring during the working process. Recently these furnaces have been supplied with especially constructed graphite electrodes which permit operation at a very high current density. A high production per kilowatt-hour is obtained, and the consumption of electrodes has been greatly reduced. For example, in the steel-casting process the energy consumption per ton in a furnace of from 5,000 kg. to 6,000 kg. holding capacity is 650 kw.-hr., and in high-speed machine-tool steel production between 800 kw.-hr. and 900 kw.-hr. The electrode consumption when using graphite electrodes amounts on the average to from 3.5 kg. to 4 kg. per ton of product.

Wide application of the induction furnace is now being made in German high-grade steel works. It is estimated that fully 70 per cent of the German works making high-grade steel are employing induction furnaces. The furnace which is being used has a hearth which is accessible through two doors—one for charging or admitting alloy and the other for removing slag. It is especially fitted for handling a liquid charge as a supplement to the preliminary work carried on in the Martin furnace or converter.

The Röchling-Rodenhauser furnace has been found especially advantageous because of its good over-all

thermal efficiency, ease and accuracy of temperature regulation, small unit energy consumption and very low electrode consumption. This last is important because of the present high cost of electrodes in Germany.

Because of its advantages the induction furnace has come into very general use for making high-grade dynamo steel, ferro-manganese, brass and bronze. The zinc losses are roughly 1 per cent with a charge of 1,000 kg. at a temperature of about 1,050 deg. C. The circulation of the liquid charge gives a nearly perfect mixing effect for steel, brass and bronze. In a number of the German high-grade steel works these induction furnaces run to ratings of 8 tons to 12 tons capacity. There are no losses from metal burning during the smelting process when using this furnace in smelting ferro-manganese. In this case the saving is about 30 per cent.

The Röchling-Rodenhauser furnace is built for experimental work for charges of from 200 kg. to 500 kg., and for ordinary work for charges ranging from 2 tons up to 20 tons. For smelting copper alloys the furnaces employed have capacities ranging from 200 kg. to about 6 tons.

Typical Installations in German Factories Using Large Induction Furnaces

Noteworthy among the German works using induction furnaces are the following:

Stahlwerk Becker A.G. at Willich near Krefeld.—Six 8-ton induction furnaces especially adapted for production of high-alloy plate iron.

Edelstahlwerk Röchling A.G. at Völklingen on the Saar.—One furnace of 10 tons, one of 8 tons and three of 7 tons. These furnaces are designed for making high-grade steel from liquid charge obtained from Thomas and Martin steel furnaces.

Stahlwerke Burderus-Röchling A.G. at Waltzlar.—Two furnaces of 8 tons and one furnace of 4 tons, all used for making high-grade steel from liquid Martin steel.

Werk Dommeldingen der Vereinigten Hüttenwerke Burbach-Eich-Düdelingen A.G. at Dommeldingen.—Three furnaces of 3.5 tons capacity for making high-grade steel from liquid Martin steel, and two furnaces of 1.5 tons and one of 0.7 ton for bronze work.

Krefelder Stahlwerk A.G. at Krefeld.—Two furnaces of 8 tons for making high-grade steel from liquid Martin steel.

Berglische Stahlindustrie, G.m.b.H., at Remscheid, Rhineland.—Two furnaces of 5 tons capacity each for working high-grade steel from liquid Martin steel.

Arc Furnaces Used in German Foundries

Of late the German cast-iron plants have taken up the use of electric furnaces, utilizing them for enriching the liquid cast iron as it comes from the cupola furnaces. In smelting aluminum, for example, and in working zinc both induction and arc furnaces are employed. Arc furnaces are more generally used where the problem calls for the smelting of a succession of different kinds of metal. The induction furnaces are deemed better to employ where longer periods are required, as, for example, in smelting bronze and aluminum. Dr. Engelhardt is of the opinion that the induction furnace is yielding the best and purest results, viewed as a smelting apparatus. He bases this statement on the extremely insignificant metal loss, which, he declared, is only 0.5 per cent.

There is no question, from what I observed, that the induction furnace has come to stay among the German plants and that its use accounts for much of the success which the Germans are achieving in the production of high-grade metals.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Field Test for Insulators

To the Editors of the ELECTRICAL WORLD:

Under the heading "Practical Field Testing of High-Tension Insulators" in the July 14 issue of the ELECTRICAL WORLD mention is made of a method of testing transmission line insulators by the use of a vacuum tube detector.

More than a year ago C. J. Barrow talked with me in reference to some method of testing transmission line insulators which would show on an instrument scale the electrical condition of a transmission line insulator. After some study I suggested the use of a vacuum tube detector for this purpose and sketched out and described several apparently possible ways of using this scheme.

Development of the idea was delayed by other work, but recently considerable experimenting has been done along this line with promising results. E.P.PECK,

General Superintendent Electrical Department.
Utica Gas & Electric Company,
Utica, N. Y.

[Credit is due Mr. Peck for the idea incorporated in the editorial mentioned.—EDS.]

Applauds Professor Karapetoff's Message

To the Editors of the ELECTRICAL WORLD:

Just as a plain lay reader, I was interested in Professor Karapetoff's letter in the ELECTRICAL WORLD of July 7, published under the title "Working for Unborn Generations." It seems to me that the writer represents the true scientific spirit and has given us a helpful message, for which he is entitled to thanks. Let us all try to be sane, well-balanced human beings in our work and in our play, trying always to give fellow mortals a lift, trying not to take ourselves too seriously, on the one hand, or over-modestly on the other.

Chicago, Ill. CHICAGOAN.

Part Which A. E. S. C. Plays in Standardization

To the Editors of the ELECTRICAL WORLD:

In several recent meetings at which the question of standards in the electrical industry has been discussed it has been brought out that there is frequently a misunderstanding on the part of people and of organizations as to the particular part which the American Engineering Standards Committee plays in standardization. I think it should be emphasized, and repeatedly, that the American Engineering Standards Committee is not itself a standardizing body; that the sectional committees are committees of the sponsor bodies, responsible to the sponsor bodies for their reports and findings, and that the American Engineering Standards Committee can take no action until the sponsor body, through its committee, is ready to submit its findings for American standardization.

Organizations not fully acquainted with the A. E. S. C. should not look upon it as a super body to produce standards; it does not take away the rights and prerogatives of other organizations in this regard.

C. E. SKINNER,
Assistant Director of Engineering.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

Periodic Meter-Testing Methods

Sectional Map of City Found Useful in Routine Testing of Residence Meters—Unit Testing Costs Are Given and Record Cards Shown

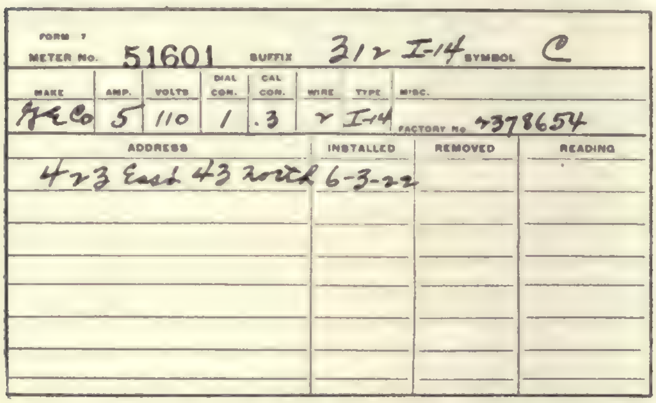
Testing of fifty thousand residence meters once every three years in compliance with the requirements of the utilities commission is a task that requires careful and systematic planning to keep testing cost to a minimum. To do this the Portland (Ore.) Railway, Light & Power Company keeps a crew of eight testers in the field continuously. The residential section of Portland is divided into sections eight blocks square and to each section a number is given. Testers are assigned to various sections and complete all tests in one section before beginning on the next. When a section has been completed, the date and the name of the tester are written in the section on the map and shaded in red. By this means the progress of testing is noted at a glance. The same order is followed every three years, so that the meters are tested at equal intervals. The tester goes to each house where service enters and thereby becomes responsible for testing every meter in that section. Formerly the method of writing out a test card from the meter location records and giving the test cards to the tester to follow up was used to cover the entire district. It was found that this method was too cumbersome and that by following the section method twice as many meters could be tested.

The rules of the Public Service Commission require that residence meters be tested every three years, small power meters yearly and large power meters every six months. In addition every meter must be tested within thirty days after installation. On account of the installation test no shop tests are made on new meters or old meters removed, except where a meter seems to be defective or a complaint has been made. Testing requirements on meter accuracy are from 96 to 104 per cent, although meters are to be left calibrated within 1 per cent according to the rules. With these limits a record of meter tests is kept showing various types of meters found running between 96 and 104 per cent, under 96 per cent and over 104 per cent. Tests during 1921 showed 91 per cent of all meters operating between 96 and 104 per cent, 7 per cent below 96 per cent and 2 per cent above 104 per cent of accuracy. In other words, only 2 per cent of all meters were operating in a way detrimental to the customer.

From sixteen to twenty residence meters are tested daily on routine tests, and from twelve to sixteen on installation tests. In addition, from eight to twelve small power meters and six to eight large power meters are tested each day. Average testing costs per meter are: Residence meters, 38 cents; small power meters, 58 cents, and large power meters, 80 cents to $1.40, depending upon whether a helper is required. A crew of eight testers is required for residence meters, two for small power meters and one tester and helper for large power meters.

The standards used consist of a primary standard, Leeds & Northrup potentiometer, secondary standard, Westinghouse, General Electric and Weston wattmeters, voltmeters and ammeters, laboratory rotating standards, Westinghouse rotating watt-hour meter, portable rotating standards, Westinghouse, General Electric and Mowbray watt-hour meters. The secondary standards are tested every three months, the laboratory rotating standard once a month and the portable standards once a week. The standards used in the field for testing residence meters are equipped with lamp banks for loading. A phantom load box is used for power meters having an inductive load and a carbon rheostat for direct-current meters. Large-capacity direct-current meters on continuous service are tested on a series of running loads.

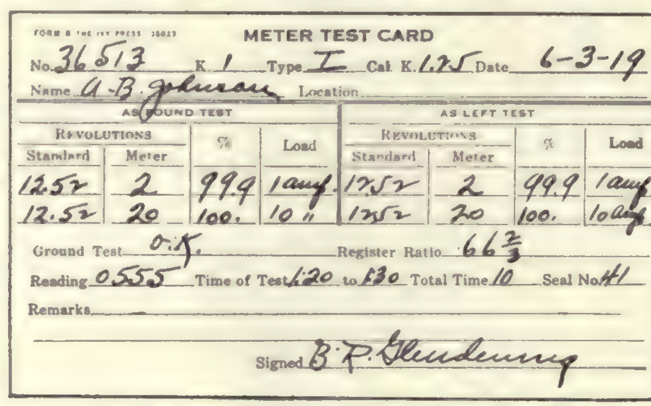
The records consist of a meter card (shown herewith) filed numerically according to the meter numbers, a


FORM 7

METER NO. 51601 SUFFIX 312 I-14 SYMBOL C

MAKE	AMP.	VOLTS	DIAL CON.	CAL CON.	WIRE	TYPE	MISC.
G E Co	5	110	1	.3	2	I-14	FACTORY No. 4378654

ADDRESS	INSTALLED	REMOVED	READING
423 East 43 North	6-3-22		


METER TEST CARD

No. 36513 K. 1 Type I Cal. K. 1.25 Date 6-3-19

Name A. B. Johnson Location

As Found Test				As Left Test			
Revolutions Standard	Revolutions Meter	%	Load	Revolutions Standard	Revolutions Meter	%	Load
12.52	2	99.9	1 amp.	12.52	2	99.9	1 amp.
12.52	20	100.	10 "	12.52	20	100.	10 amp.

Ground Test O.K. Register Ratio $66\frac{2}{3}$

Reading 0555 Time of Test 1:20 to 1:30 Total Time 10 Seal No. 41

Remarks

Signed B. R. Glendenning

AT LEFT—SAMPLE METER CARD FROM CONSECUTIVE CARD FILE. AT RIGHT—TYPE OF CARD FOR RECORDING TEST DATA

location card filed according to address, and a test card (also shown) for records of tests. It is thus possible to locate a meter either by number or address. A separate location card file is also kept for all meters which are required to be tested at six-month or yearly intervals so that periodic tests of these meters may be made. Changes in location, etc., are posted on these active files from service orders on which "connects" or "disconnects" are executed.

A. H. KRUEL,
Assistant Superintendent
Meter and Service Department.
Portland Railway, Light & Power Company,
Portland, Ore.

Power Rake Handles Trash in Large Quantities

FEW hydro-electric plants have to contend with as much trash in the forebay as the Morgan Falls station of the Georgia Railway & Power Company on the Chattahoochee River. Trash not only floats on the surface but comes down the river in various stages of submergence so that booms are of little avail except in diverting the upper layer. Furthermore, the trash is not alone small débris but even includes waterlogged stumps, trunks, branches, scows, etc., washed into the river from the extensive watershed by the spring torrents.

After about twenty years' experience handling such trash by various methods, W. C. Sullivan, foreman of

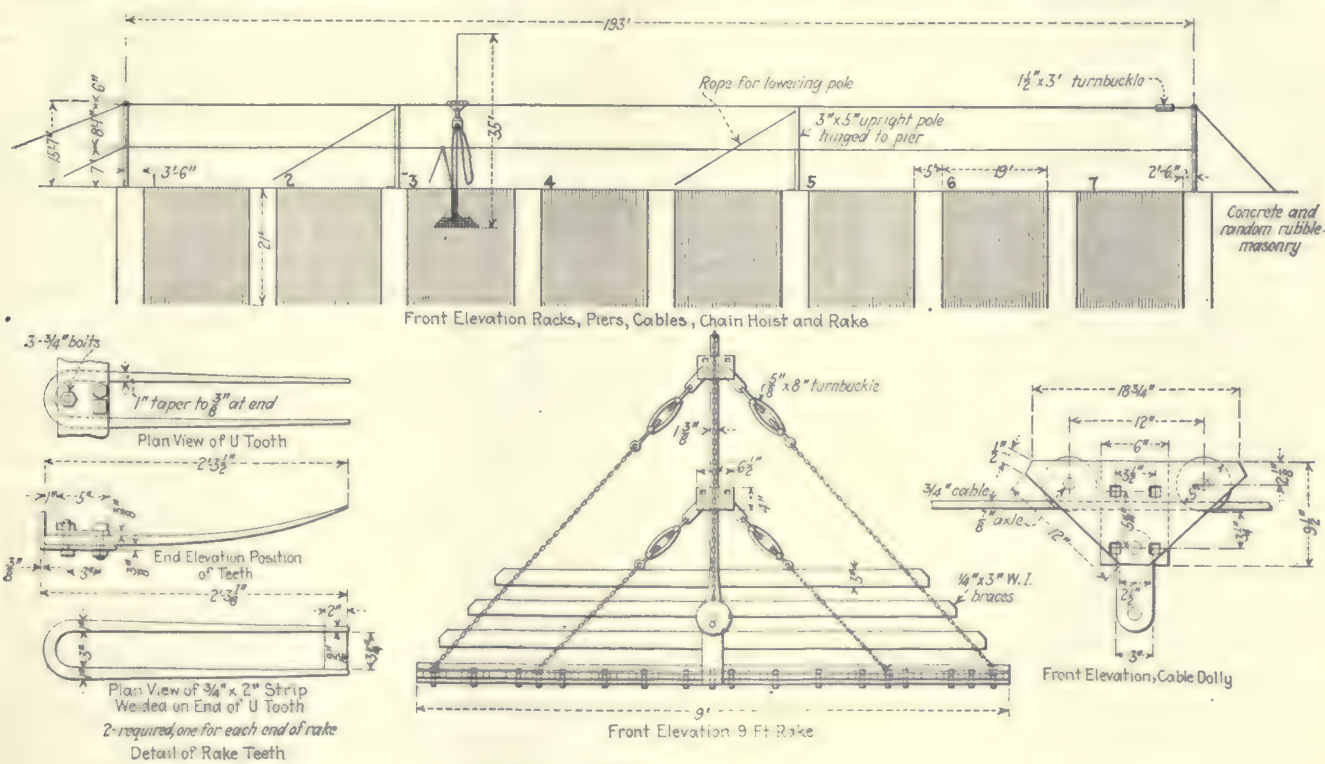
ELECTRIC HOIST RAKE THAT EFFECTIVELY CLEANS TRASH FROM FOREBAY

the Morgan Falls station, devised an electric hoist rake which he made out of surplus material around the plant, the electric hoist being about the only part requiring an investment. According to Fred W. Hadley, superintendent of water power of the company: "The power rake has given by far the best satisfaction in handling material of the kind with rapidity of anything that I have yet known about. The best thing about it is that it is heavy and rugged and does not get out of order."

The construction of the outfit and method of using it are well shown by the accompanying illustrations. In general, it consists of a structural-steel rake with tool-steel teeth and a 1$\frac{3}{8}$-in. steel handle which slides through a short section of pipe attached to the motor-driven chain-hoist carriage. The hoist carriage runs on a plow-steel cable stretched between supports so that it runs over the top of the forebay racks. About 24 ft. upstream from the racks and just above the water level is stretched a $\frac{1}{2}$-in. guy wire carrying a dolly to which a $\frac{1}{2}$-in. block and tackle is fastened for pulling the rake away from the racks while lowering it to take a load.

The rake proper consists of a 9-ft. "L" measuring $\frac{7}{16}$ in. x 3 in. x 6 in., to which are fastened U-shaped teeth about 27 in. long and slightly more than 3 in. between centers. Between the tips of two teeth at each end of the rake are welded strips which prevent the teeth projecting through the rack. The method of fastening the teeth to the cross-bar of the rake is shown.

The handle of the rake, which consists of a 1$\frac{3}{8}$-in. tool steel 35 ft. long, is flattened at its lower end and bolted to a piece of strap iron, which in turn is bolted to the rake cross-member. A ring is also fastened to this strap for attaching the chain from the motor-driven hoist and the block and tackle for pulling the rake away from the racks in lowering.



GATE RACKS AND RAKE AT MORGAN FALLS DEVELOPMENT OF THE GEORGIA RAILWAY & POWER COMPANY

Chains containing turnbuckles at the upper ends tie the outer ends of the rake and intermediate points to the tool-steel handle. In the latest model of the rake ¼-in. x 3-in. strap-iron pieces are fastened to the chains parallel to the rake cross-member to prevent the load on the rake falling out between the chains. Other details, such as the method of preventing the span wire sagging too much, are shown in the illustrations.

The 1-ton electric chain hoist, which does not show in the illustration, is of the hook type and is equipped with a 35-ft. lift chain and a special cover to keep off the rain. No trouble has been experienced with it due to moisture or exposure.

At the station where this rake is used insufficient space is provided at the top of the racks for depositing the débris raked from the racks —at least 15 ft. or 20 ft. should be available. Hence in clearing away the trash which is raked onto the platform at the top of the racks it has to be loaded onto a flat boat with coke forks. The flat boat used is just long enough to rest against the piers on each side of a rack while being loaded. If a sufficiently wide platform is provided at the top of the racks, a sluiceway is not needed as the débris deposited there can be cleared away by cheap labor.

FIELD EDITOR ELECTRICAL WORLD.
New York City.

Extracts from an Operating Code*

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

Charging Control, Power and Excitation Batteries

IMMEDIATELY after discharge the deposit on the plates of storage batteries is soft and porous and can be readily penetrated by the electrolyte, if recharged at once. On standing discharged for some length of time the deposit becomes hard and impervious to the action of electrolyte on charging. This hardening of the deposit is known as sulphation.

In the charging of a battery a certain amount of current is expended in chemically changing the deposits upon the plates. Any amount of current above this passed through the battery causes electrolysis of the water in the electrolyte with the formation of oxygen gas bubbles at the positive plate and hydrogen at the negative. Similar gassing is produced by continuing the normal rate of charging current after the battery is fully charged. If gassing is excessive, it is likely to cause shedding of the active materials from the plates and to develop resistance to the charging current, on account of polarization, which causes heating.

If the service of a battery is such that it must stand idle for considerable periods of time, local action takes place between the plates and the electrolyte, causing loss of charge and eventual deterioration of the plates. To prevent this, a trickle charge which is just sufficient to maintain the voltage and specific gravity constant but not to replace any loss due to use is applied at all times, except when the normal charge is being given, or a floating charge which is sufficient both to prevent local action and to replace the loss of voltage and specific gravity due to use is applied continuously.

When a method of trickle charging or floating is provided maintain the specified charging rate at all times, except when the battery is being charged normally.

*Abstracted from the operating code of the Philadelphia Electric Company.

Charging Control and Power Batteries

1. Charge these batteries as often as the daily readings of the pilot cell or the voltage and specific-gravity readings of the individual cells indicate that it should be done. The lower limit for voltage is 1.85 volts per cell in the case of control batteries and 1.9 volts per cell in the case of power batteries. The lower limit for specific gravity is 0.030 lower than the maximum reached on the previous equalizing charge.
2. If the charging equipment is not such that the charging current decreases automatically as the voltage across the battery increases, reduce the charging current as the battery approaches the fully charged condition.
3. The battery is fully charged, first, when all cells are gassing moderately and uniformly from both positive and negative plates; second, when the specific gravity is 0.003 lower than the maximum reached on the preceding equalizing charge.
4. Once every week, in the case of power batteries, and once every two weeks, in the case of control batteries, give the battery an equalizing charge by continuing the charge until there is no increase in the specific gravity of the pilot cell or in the voltage across the battery, as shown by five successive fifteen-minute readings.
5. Keep the room well ventilated while the battery is being charged.
6. Do not bring an unprotected flame into the battery room (blowtorch, lighted cigars, cigarettes or pipes, etc.).

Charging Excitation Batteries

The conditions of use of these batteries vary at different stations. Where the conditions are similar to those of power batteries follow the rules of charging power batteries. Where conditions are similar to those of control batteries follow the rules for charging control batteries.

Instructions for Starting Turbo-Generators

ASSURANCE that bearings are floated in oil and warming up a unit gradually are two of the outstanding requirements in starting turbo-generators, especially when they run into large sizes. Before the load is actually put on the turbine every precaution must be taken to reduce the amount of air in the condenser to a minimum and steam must be admitted gradually, not only to minimize strains in the turbine but also to prevent any pocketed water which may exist, causing damage to the blades. Any excessive vibration of the unit during starting should be considered as a precursor of trouble within the unit. To minimize the air in the condenser the relief valve on the top of the discharge end of the condenser should be open when the condenser is being filled with water so that air will not become trapped. This will also indicate by overflowing when the condenser is filled with water. In establishing a vacuum an air ejector will handle a considerable volume of air against a low vacuum, while the air pump will handle smaller quantities of air against high vacuum. Consequently the ejector is used up to 10 in. or 15 in. of vacuum, from which point it is replaced by the air pump. Until the turbine gets up to speed it is the function of the auxiliary oil pump to put pressure upon the bearings and governor until it is automatically replaced by the shaft-driven oil pump. When shutting down a machine the auxiliary pump also serves to put oil pressure on the bearings to prevent any possible damage.

Detailed instructions for inspecting the turbine before starting and for starting follow:

Inspection Before Starting

1. When a gravity lubricating system is used, see that oil is being supplied to all bearings.
2. Remove all bolts, tools and other articles which may have been left on or near the machine.
3. Make a general inspection to see

that the machine is in proper condition for operation.

Starting Horizontal Turbines

1. Receive and answer the signal "Slow" from the switchboard operator.
2. Start the circulating pump.
3. Open the air relief valve on the discharge end of the condenser and close it when water begins to overflow.
4. See that all drains on the turbine are open.
5. Start the auxiliary oil pump for the bearings and governor.
6. Turn on the cooling water to the main bearings and oil cooler.
7. Turn on steam to the seals of the turbine.
8. Close the vacuum globe valve on the condenser.
9. Put on the condenser air ejector until 10 in. to 15 in. of vacuum is reached.
10. Start the air pump.
11. Shut off the condenser air ejector.
12. Start the hot-well pump.
13. See that oil and water are circulating to all the main bearings and use as little water as possible to keep the bearings within the desired temperature limits.
14. See that the governor is being supplied with oil.
15. Examine all gages and see that the steam gage shows proper pressure, the vacuum gage shows proper vacuum and the oil and water gages show proper pressure.
16. Open the throttle until the turbine starts to revolve. Watch the first stage pressure gage, which should register 15 lb. to 18 lb. Maintain this pressure until the machine turns over.
17. As soon as the machine turns over reduce the throttle opening to the point just necessary to keep the machine turning over slowly until it has warmed up. Note.—The time allowance for warming up should be approximately one minute per 1,000 kw. capacity.
18. Signal "Slow" and receive an answer from the switchboard operator.
19. After receiving and answering the signal "Speed" from the switchboard operator, open the throttle until the first stage pressure is 0 lb. and maintain this pressure until the machine comes up to speed, as indicated by the speed indicator on the gage board, by the closing of the admission valves by the governor, and by the reduction of the first stage gage pressure below 0 lb.
20. If the turbine has water seals, admit a small amount of water to the seals at approximately half speed; then, as the speed increases, increase the amount of water and reduce the amount of steam to the seals until the steam is entirely shut off. These adjustments must be made carefully, in steps small enough to avoid sudden temperature changes or blowing of water from the seals by high steam pressure.
21. Open the throttle wide, noting that no increase takes place in the first stage pressure or in the turbine speed, as indicated by the frequency meter.
22. Trip the throttle by hand.
23. Reset the throttle trip (for governor control).
24. Open the throttle wide, not exceeding 0 lb. pressure on the first stage, until the machine comes up to speed, as indicated by the speed indicator on the gage board, by the closing of the admission valves to the governor, and by the reduction of the first stage gage pressure below 0 lb.
25. Make general inspection of the oil from bearings and of all gages.
26. Signal "Load" to the switchboard operator and receive answer. Note.—The load should be increased at the rate of approximately 1,000 kw. per minute.
27. See that the steam valves are open on the auxiliary oil pump and that it is under governor control.
28. Close the turbine drains.
29. As the load increases regulate the amount of steam supplied to the seals.

Individual Drive in Paper Mill Effective

TO ELIMINATE belts, countershafts, oil bearings, etc., of belt-driven paper platers, the individual motor-driven plater shown herewith has been developed. The paper mill in which this equipment was installed increased its production on this particular plater by 20 per cent after the replacement of the belt drive by the reversing-motor drive.

The drive is simple, rugged and compact. The phase-wound reversing motor has high torque characteristics and is mounted on a bedplate common to the plater and coupled to the plater pinion shaft. The external rotor resistance assists in keeping the motor cooled by dissipating outside of the motor much of the heat of the reversal. The control consists of three units, namely, a three-position master switch, a cabinet-inclosed contactor panel and an oil-circuit-breaker primary switch. The small drum controller, or master switch, with one forward, one reverse and one off position, is mounted on the end of the plater table with a short piece of flexible conduit attached to allow the table to be raised or lowered. The length of the travel of the switch handle is very short and therefore does not tire the operator's wrist. This master switch controls the two magnetically operated contactors of the contactor panel. The contactors are mechanically interlocked, one furnishing power to drive the plater forward, the other to drive the plater in the reverse direction.

As the duty of the reversing plater drive is rather heavy, the equipment is made rugged to withstand this type of service. Ordinarily the plater is reversed from ten to twenty times a minute, but when starting to plate a thick "book" that is full of air the reversals may reach a frequency of thirty to the minute. The shorter time of reversal and the increased speed of the rolls made possible by direct motor drive permitted an increase of 20 per cent in the production of this machine. The particular 36-in. plater shown, having 17-in. diameter rolls and operated at 20 r.p.m., plates seventy-two books of very high-grade bond in two and one-half hours with an energy consumption of 10.8 kw.-hr. when plating 41-lb. paper.

INDIVIDUAL DRIVE FOR PAPER PLATER INCREASES PRODUCTION 20 PER CENT

A. F. PAIGE.
Westinghouse Electric & Manufacturing Company,
Springfield, Mass.

Automatic Circuit Breakers Reduce Maintenance

THREE automatic reclosing circuit breakers have been in service for three years at a substation of a steel company in Pennsylvania without requiring any repair expense. During this period the only trouble has been a slight corrosion on the contacts of the reclosing solenoid, which was very easily remedied.

These 250-volt breakers are installed in a motor-generator substation and provide protection to various feeder circuits. Two of the breakers, rated at 5,000 amp., are used on a generator circuit and a feeder circuit to a 400-ft. double trolley gantry crane in the coal-storage plant. The other breaker, having a capacity of 2,000 amp., is placed on a feeder circuit to another part of the plant. The switch duty has not been severe, since under the worst conditions the breakers have not opened more than three to four times a week.

The substation attendant also takes care of outside electrical repairs and the maintenance of the crane, and therefore these reclosing breakers save much time which he would otherwise have to spend in resetting tripped breakers by hand. This saving has aided in paying the cost of the installation. The station is not automatic since a manual starter is employed.

To increase further the protection for this crane, limit switches were installed on the bridge runway so that, should the crane control become stuck, the bridge itself would open the track limit switch. This switch being connected in series with the circuit-breaker solenoid in the substation, the breaker would then trip, thereby stopping the bridge before it struck the bumpers.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

Effective Oil-Testing Apparatus

THE arrangement of apparatus shown herewith was devised to test the insulating properties of oil used in large high-voltage transformers to determine when the oil had been sufficiently dehydrated. The outfit takes the place of an expensive oil-testing outfit, and, although it is lacking in a number of refinements, it will accurately detect the presence of moisture in the oil in the most minute quantities. It is made up of apparatus usually carried in stock by the central station, and this apparatus may be returned to stock when the testing has been completed.

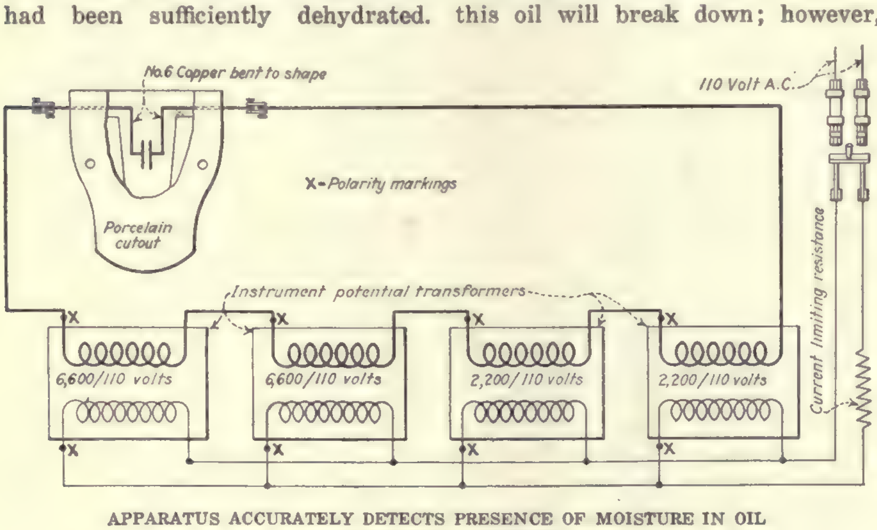
PLUG CUT-OUT FOR OIL HOLDER

The illustration shows the apparatus as it was used. An inverted porcelain plug cut-out is employed as an oil cup. In it are mounted the two electrodes which form the spark gap. These consist of two pieces of sheet copper, cut 1 in. square, soldered to pieces of No. 6 copper wire and spaced 0.1 in. apart. They are rigidly held in place by the terminal screws of the cut-out. A convenient gage for the gap is a piece of bare No. 10 wire which has a diameter of 0.1018 in. It is essential that the gap be accurately gaged, but when once set it needs no further adjustment. The gap is mounted so that it will be 1 in. below the surface of the oil when the cup is filled with oil. A glass pipette, made of glass tubing, is used to empty the cup. The potential of 17,200 volts effective, or approximately 25,000 maximum, was supplied by two 6,600/110-volt and two 2,200/110-volt instrument potential transformers. The high-voltage windings are connected in series with the spark gap and the low-voltage windings in parallel through a low current-limiting resistance. A 6-lb. flatiron element served this purpose.

The practice followed was to first test the oil from the bottom of the transformer. In nearly every case this oil will break down; however, if it does not, the oil receives no further attention. If the oil from the bottom breaks down under test, a sample is then taken from the top. If this sample breaks down, the oil is in a dangerous condition, and the entire amount in the transformer must be dried at once. In case the oil at the top does not break down, as is usually the case, oil is drained from the bottom until a sample is obtained that stands up under the voltage test. The quantity drained out is then dehydrated until it stands up under test, when it is placed back in the transformer.

By following this procedure it was found that much unnecessary work was eliminated, owing to the fact that only the oil needing attention is worked on. RALPH PITTMAN.

Pine Bluff Company,
Pine Bluff, Ark.



APPARATUS ACCURATELY DETECTS PRESENCE OF MOISTURE IN OIL IN MINUTE QUANTITIES

Cost of Installing 5,000-Kva. Transformers

A NEW ENGLAND central-station Company purchased and installed during 1922 three 1,667-kva. transformers for stepping up the voltage at a 13,200-volt bus to 22,000 volts in order to meet the demands of increased business on a trunk-line feeder. The itemized cost of this work is given in the accompanying table.

EXPENSE OF INSTALLING TRANSFORMER BANK

	Per Unit	Total
Three 1,667-kva. units, per kva.	$2.50	$12,531.25
Busbar supports	...	37.34
Iron oil drum	...	15.00
No. 2/0 secondary cable 1,544 ft.	0.1575	243.24
No. 2 secondary cable, 1,112 ft.	0.1068	118.76
No. 6 weatherproof wire, 72 lb.	0.154	11.09
No. 2 weatherproof wire, 192 lb.	0.1647	31.62
Three-conductor cable, 205 ft.	1.0729	219.95
Twelve rolls tape	0.1724	2.07
Gasoline	...	0.48
Two 4-in. iron clips	2.00	4.00
Four 13,000-volt pot-heads	43.9222	175.69
Twelve 4-deg. copper sleeves	0.1733	2.08
Wiping solder, 34 lb.	0.1638	5.57
Oxide, 2 gal.	1.60	3.20
Three cans "Conduline"	2.32	6.96
Two cans "Condecell"	4.33	8.66
One can asphaltum	...	1.53
Two rolls tape, No. 355	0.789	1.58
Two ½-lb. condulets	0.385	0.77
Four 3-amp., 600-volt fuses	0.2187	0.87
Four 30-amp., 600-volt fuses	0.483	1.93
Solder, 2 lb.	0.2729	0.55
Miscellaneous material	...	21.21
Freight	...	206.19
Teaming	...	154.00
Transportation by company	...	32.89
Payroll, labor, per kva.	0.105	523.80
Total, per kva.	$2.87	$14,362.18

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Advantages of Machine Billing*

Simplified System Reduces Clerical Help from Seven to Five and Produces 340 Bills Daily—Machines Speed Up Billing Operations

BY INDMANN P. MARKING
Chief Clerk Wisconsin-Minnesota Light & Power Company, La Crosse, Wis.

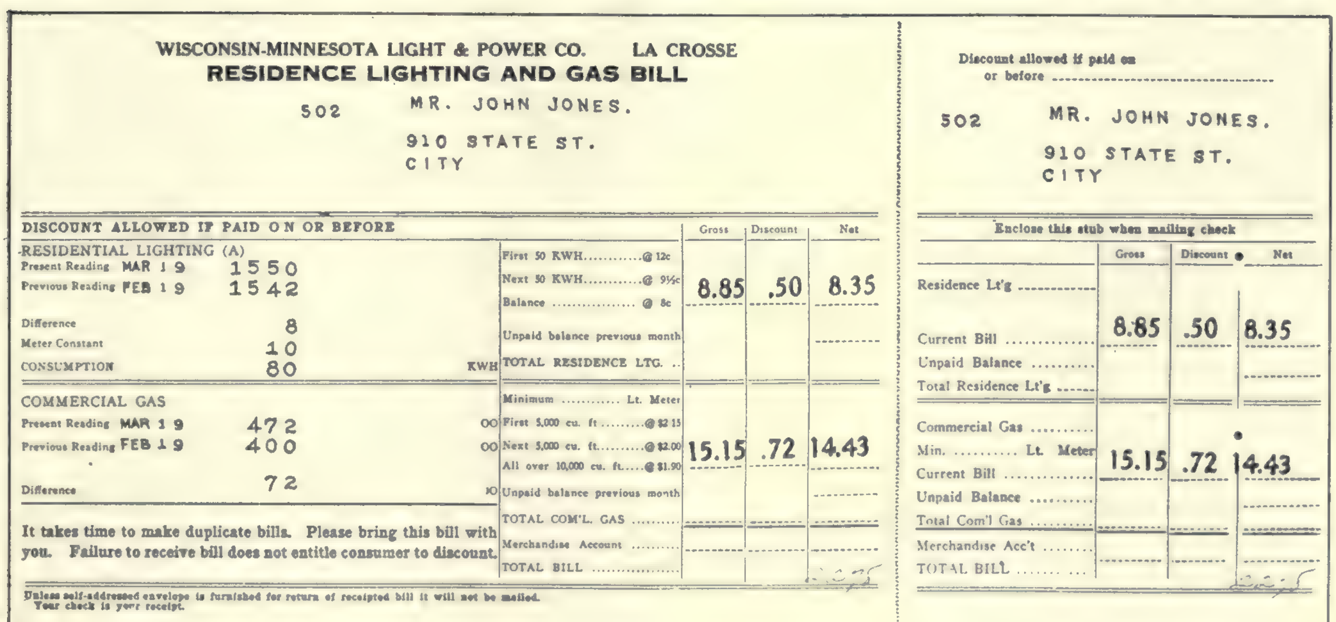
ON AUG 1, 1922, our company's gas, electric and merchandise accounts, numbering between eight and nine thousand, were transferred from a form of bookkeeping using the Boston style of ledgers to an entirely different form using machine billing and bookkeeping machines and loose-leaf ledgers. At first hand this would appear to be a big job and one to be viewed with some misgivings. However, many test billings were made in order to determine the maximum number of bills, both gas and electric, that could be put through the billing machine in an hour's time. Test runs were also made to determine the number of debit and credit postings that could be made on the posting machine in the same period. A special form of ledger sheet suitable for keeping gas and electric accounts was prepared. It was also necessary to prepare a different form of bill with the spacing entirely different from the old form. After many tests had been made, we were in a position to see that the installation of one billing machine and one posting machine would enable us to reduce the clerical force by two. The accompanying comparison shows the different office clerks before and after the system was installed, together with an outline of their duties.

It will be noted that under the new system five clerks are doing the work which required seven under the old system. Approximately 13,500 gas and electric meters are read and billed through our office monthly. Assuming that there are twenty-five working days in the month this means that 540 meters are read daily by two meter readers. If we were to have a billing on gas and a billing electricity on every bill that is sent out, the number of bills we send out each month would be 6,750. But all of our consumers do not have both gas and electric service. We have made a check and have found that only 25 per cent of the bills leaving our office show a billing for electric or gas service alone; therefore approximately 8,500 bills are sent out monthly. On the basis of twenty-five working days to the month we send out 340 bills daily in order to keep up our billing. A table giving the time necessary for each step of approximately one day's billing follows:

	Hours	Minutes
300 bills through addressograph..	..	20
300 bills through billing machine.	1	45
300 bills, rubber stamping.......	..	30
300 bills, getting predetermined total..........................	..	40
300 bills posted to ledger.........	3	..
300 bills, entering merchandise amounts due...................	..	15
300 bills, totaling................	..	20
Total time....................	6	50

Meter reading commences on the last day of the month except when the last day falls on Sunday. Readings are turned in to the office each day, which gives the billing department the opportunity of billing on the day following the meter reading.

*A paper presented before the Accounting Section of the Wisconsin Utilities Association, Milwaukee, March 23, 1923.


WISCONSIN-MINNESOTA LIGHT & POWER CO. LA CROSSE
RESIDENCE LIGHTING AND GAS BILL
502 MR. JOHN JONES.
910 STATE ST.
CITY
DISCOUNT ALLOWED IF PAID ON OR BEFORE

				Gross	Discount	Net
RESIDENTIAL LIGHTING (A)			First 50 KWH..........@ 12c			
Present Reading	MAR 19	1550	Next 50 KWH..........@ 9½c	8.85	.50	8.35
Previous Reading	FEB 19	1542	Balance .... @ 8c			
Difference		8	Unpaid balance previous month			
Meter Constant		10				
CONSUMPTION		80 KWH	TOTAL RESIDENCE LTG. ..			
COMMERCIAL GAS			Minimum .... Lt. Meter			
Present Reading	MAR 19	472 00	First 5,000 cu. ft ....@ $2.15			
Previous Reading	FEB 19	400 00	Next 5,000 cu. ft.........@ $2.00	15.15	.72	14.43
			All over 10,000 cu. ft.....@ $1.90			
Difference		72 00	Unpaid balance previous month			
			TOTAL COM'L. GAS			
			Merchandise Account			
			TOTAL BILL			

It takes time to make duplicate bills. Please bring this bill with you. Failure to receive bill does not entitle consumer to discount.

Unless self-addressed envelope is furnished for return of receipted bill it will not be mailed. Your check is your receipt.

Discount allowed if paid on or before ....
502 MR. JOHN JONES.
910 STATE ST.
CITY
Enclose this stub when mailing check

	Gross	Discount	Net
Residence Lt'g			
Current Bill	8.85	.50	8.35
Unpaid Balance			
Total Residence Lt'g			
Commercial Gas			
Min. .... Lt. Meter			
Current Bill	15.15	.72	14.43
Unpaid Balance			
Total Com'l Gas			
Merchandise Acc't			
TOTAL BILL			

FIG. 1—COMBINED RESIDENTIAL LIGHTING AND GAS BILL FORM
Figures are posted on this form directly from the billing machine.

Streets running north and south are read first, commencing on the north end of the first street and finishing at the extreme south end. Street No. 2 is commenced on the south end and worked north; then street No. 3 is commenced on the north end and worked south. After all the streets running north and south have been

is necessary to do this. Fig. 1 shows the residence electric and gas bill form and indicates the meter reading data as printed by the billing machine.

It will be noted that the billing form has been designed so that there is enough space under both electric and gas for two sets of meter read-

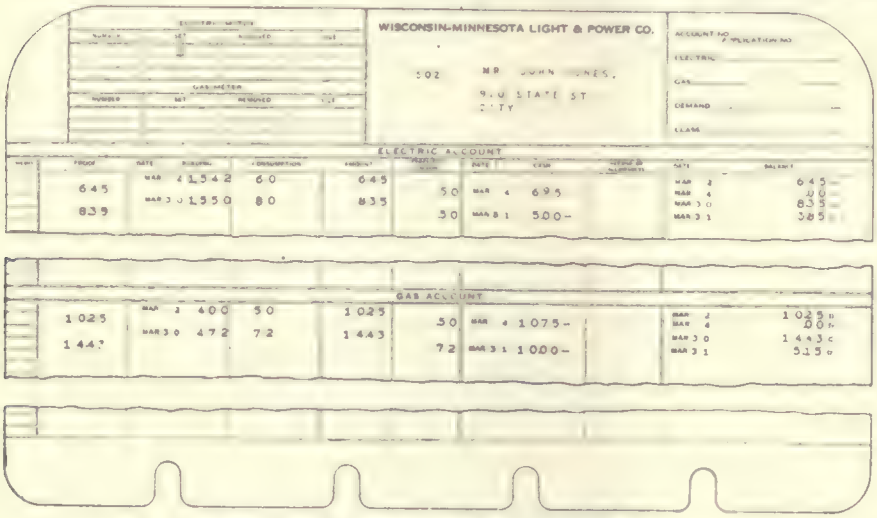


FIG. 2—LEDGER SHEET FOR BOTH ELECTRIC AND GAS ACCOUNTS, WITH SPACE FOR METER DATA

read, the streets running east and west are worked in a similar manner. Addressographing bills takes only a few minutes each day and is taken care of by the man who distributes bills. It is his duty to see that there are at all times enough bills printed ahead to supply the billing department for three or four days.

The billing machine used has six columns of figures which can print meter readings up to 999,999. After the bill has been properly placed in the carriage of the machine to have the electric meter readings printed, the operator presses down the respective keys for the month, day of month and present meter reading. Then she operates the touch bar and the machine prints the date and meter reading thus: "March 2, 545." The machine then automatically moves the bill up one space. The operator now presses the respective keys for the month, date and figures of the previous meter reading. Then comes the final operation, which is to operate the touch bar for the second and last time. This prints the month, date and previous meter reading and at the same time subtracts the meter reading and prints the difference. The operator next pulls a lever attached to the carriage of the machine; this operation moves the bill into a position for printing the meter readings, differences and dates. Only one motion of the lever

ings, which might be necessary because the consumer has two electric or two gas meters, or because the meters have been changed during the month. If the electric meter carries a constant as shown on the bill, it can be printed by the machine, but two extra operations of the machine are necessary to do this.

Rubber-Stamping the Discount

The next step in the making of the bill is to insert the gross amount, discount and net amount. Rubber stamps for both electric and gas consumptions have been made for this purpose. They are of a special size to fit the spacing on the bill and print the required information in this manner:

3.00 .25 2.75

These stamps are arranged in convenient order in a flat box, 12 in. x 17 in. x 2½ in., where they rest on an ink pad placed in the bottom of the box. There is a stamp for each step of electric consumption up to 100 kw-hr. and for each step of 100 cu.ft. up to 10,000 cu.ft. of gas. The stamps are numbered according to the consumption, so that if the billing clerk wishes to bill the amount of a consumption of 25 kw.-hr. and of 5,100 cu.ft. of gas, she merely reaches for the electric stamp No. 25 and the gas stamp No. 51. Both the consumer's portion of the bill and the cashier's stub are stamped.

Electric bills on the commercial lighting rate, which involve figuring "thirty hours' use" of the maximum demand, are not stamped, but the amounts are filled in with pen and ink. We have, however simplified the method of figuring these commercial bills by preparing a chart giving the net amount of all bills where the thirty hours use of the maximum demand is less than 100 kw.-hr. This chart has been placed on a revolving drum and is very convenient for the billing clerk.

The next step toward completing the bill, that of taking the predetermined total, is very simple and is done by the telephone operator. She takes off on an adding machine the consumption and net amount of the residence lighting bills, the commercial lighting bills and the gas bills—separating the residence gas from industrial gas. This predetermined total is used for checking the entries made on the ledgers by the posting clerk, and when found correct it is filed away for future reference. Fig. 2 is a specimen of the ledger sheet. In the upper left-hand corner space is provided for three electric and three gas meter charges; the name and address are placed at the top in the middle, and in the upper right-hand corner are the account number, class of consumption, rate and so forth.

Below this information the electric and gas entries are made in the col-

CLERICAL FORCE REQUIRED

Prior to New System		After New System	
Kind of Clerk	Duties	Kind of Clerk	Duties
Assistant chief clerk	Assisted in billing and balancing	Assistant chief clerk.	Balances ledgers
Billing clerk........	Figured all gas and electric bills and operated addressograph	Billing clerk........	Figures all gas and electric bills
Ledger clerk........	Entered all gas and electric bills	Posting clerk........	Enters all gas, electric, merchandise, power and heat bills. Posts all cash
Cash and balance clerk............	Posted cash and balanced books	Power and merchandise clerk.......	Bills all merchandise and power
Merchandise and heat clerk............	Billed and entered merchandise and heat	Bill distributor......	Distributes bills and operates addressograph
Power clerk.........	Billed and entered power		
Bill distributor......	Distributed bills		

umns provided. This ledger sheet can be used on both sides and will easily accommodate twenty-six debit or credit postings for both electric and gas on one side of the sheet. These sheets are contained in substantial binders holding between 550 and 600 sheets separated into lots of fifty by index files having the number on a tab at the top and staggered so as to be readily observed.

Posting Debits

The operator of the posting machine places the bills to be entered at her left, and the ledger binder is placed in a rack at her right She first looks at the bill to get the consumer's name and address, then out of the binder the corresponding ledger sheet and places it in the posting machine. She first carries forward the balance—if there is one. If not, the touch bar is operated and the carriage with the ledger sheet moves to the next column. Then the meter reading and the consumption are entered. The amount of the charge is then entered and the carriage with the sheet moves to the left so that the right-hand balance column moves into position. The total key is held down and the touch bar operated, thereby totaling the amount owed by the consumer, including the old balance and the new charge, to be printed in the right-hand column. If the consumer is in arrears, these items are written on the bill in pen and ink by the posting clerk and then the bill is totaled. This total must check with the amount shown in the right-hand balance column of the ledger sheet. The ledger sheet is then put back in the binder and is set out to the right. showing that there has been a charge made against that particular account. After all charges are made for one route, they are compared with the predetermined total, and if found correct, the sheets are set back in place in the ledger binder.

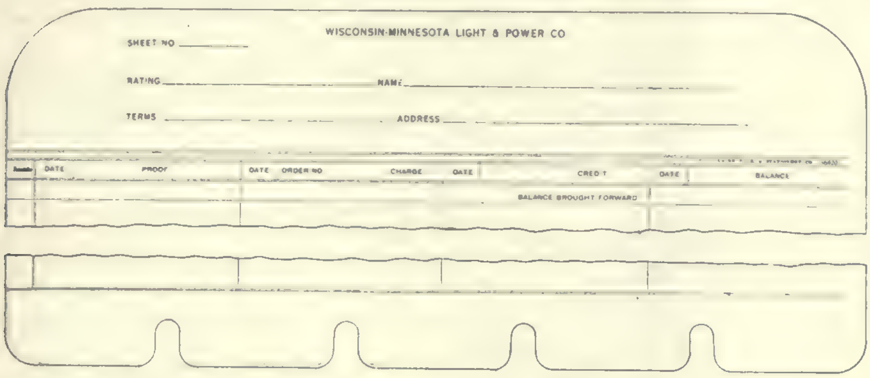

WISCONSIN-MINNESOTA LIGHT & POWER CO
SHEET NO
RATING
NAME
TERMS
ADDRESS
DATE PROOF DATE ORDER NO CHARGE DATE CREDIT DATE BALANCE
BALANCE BROUGHT FORWARD

FIG. 3—LEDGER FOR MERCHANDISE ACCOUNTS

After the merchandise amount due has been inserted in the proper place on the bill, it is ready to be totaled and dated. In very few cases are bills mailed, this being done only by special request of the consumer. We have found that distributing our bills is more satisfactory to the consumers and is cheaper than mailing. Fig. 3 shows the ledger sheet used for merchandise accounts. When changing the posting machine from the electric and gas consumers' ledger sheet to this sheet we merely change the control and stop bars which determine the spacing of the machine.

Posting of Cash

It has already been mentioned that it takes three hours to enter the debits of 300 gas and electric bills. The forenoon of each day is devoted to this work and the afternoon is devoted to the posting of cash credits. Our cash is closed at 10 o'clock each morning, when the cash is balanced and the bill stubs totaled by the cashier. As soon as the cashier finds her total, the stubs are given to the telephone operator, who sorts them as to light and gas, power and merchandise. They are again sorted as to street and account number and divided into lots according to the different ledgers. A separate total is taken for each ledger, and the grand total of these totals must agree with the cashier's total. As soon as this has been done the cash credits are ready to go to the ledgers. The posting of cash to 300 accounts takes considerably more time than does the posting of charges to this number. This is due largely to the fact that the debits for one day are entered in one or possibly two ledgers, whereas it is not at all uncommon to have to open each of the sixteen ledgers in order to post one day's cash.

The new system has worked out very satisfactorily. It has increased the efficiency of our office work, besides reducing the number of clerks. Less office space is required as the five Boston-style ledgers were very bulky and took up a great deal of desk room when open, while the sixteen new-style ledgers are kept on two portable racks. The new system makes for greater neatness and accuracy of accounts as well as of bills. The employees are better satisfied and find it easier to handle the new-style ledgers as they are much lighter in weight.

How Far Practical Home Electrification May Be Carried

ELECTRIFICATION of the home of the average customer depends largely upon his financial ability to purchase and the amount of advertising and sales effort expended by the central station company. How far it is possible for an electrical man to go with the installation of useful electrical devices is very well illustrated in the equipment of the home of E. S. Lincoln, consulting engineer, in Portland, Me. Following the appliance contest conducted by *Electrical Merchandising* during the N. E. L. A. convention in New York, Mr. Lincoln has written the ELECTRICAL WORLD describing the electrical equipment which he has in every-day use in his home.

Mr. Lincoln did not participate in the contest mentioned, and his remarks are particularly significant to central-station men as they indicate the possible extent of practical home electrification. His letter reads in part as follows:

"I have always been a liberal user of appliances, and in my laboratory I have made thousands of tests on devices of every kind. At the present time I am pretty well electrified in my own home, as you will see by the following description:

"My service is underground, consisting of a three-phase and single-phase three-wire service. The supply is from one set of transformers through two independent conduits. Heavy wire is used, as my house sets back about 200 ft. from the street. This service is measured by three meters; one is for light, one for power, and the third for heating and cooking.

"For lighting, I use eighty-five lamps, practically all of which are

controlled by push switches. There is not a dark space in the entire house, lights are provided in all closets, hallways and so forth. In the owner's room is a switch which controls a sufficient number of lamps to give illumination of the entire house in case of necessity. Tell-tale lights are used in the basement, attic and other places where lights are liable to be forgotten. Besides the lighting system, electricity is used for cooking and hot water heating.

"There are twenty-one outlets in various parts of the house for using electrical appliances. Special plugs are provided in the kitchen and dining room for the common appliances. As I have virtually all the appliances manufactured, many in duplicate, I will not go into this list in detail.

"Electricity is used in my home for freezing ice cream, operating the phonograph motor, a moving picture machine and a stereopticon. I have a small shop which is operated by a motor, and our water pumping is also done electrically as we are several miles from the city water supply.

"My wireless telegraph outfit is installed permanently, wires being concealed and terminating at plugs. It is possible to plug a phone or a loud speaker in any part of the house. My boys, in their play room, have an elevated electric railroad of 2-in. gage, consisting of 160 ft. of track together with automatic signals, switches and lights. We also have a few interior telephones as well as the ordinary electric bells and alarm systems.

"In the garage there is a charging set for charging batteries and an electrically driven tire pump. I also have a laboratory in the house which contains a lot of electrical equipment. As we are somewhat out of the city I find it necessary to use a storage battery in case the service is 'off' for any length of time, but fortunately this is not called into use more than once or twice a year.

"I have considerable special lighting equipment for photographic purposes such as high-powered tungsten lamps, arc lamps, etc.

"At the present time I am in the process of installing an electrically driven refrigerating outfit, so that I feel we are pretty well up to date electrically."

None of this equipment appears unnecessary to Mr. Lincoln, and it is not made up of "freak" installations or useless contraptions. He has in this electrification of his home set an example which many central-station men would do well to emulate if they expect to convince their customers of their sincerity in preaching the gospel of the home electric.

A Graphic Picture of a Utility's Development

TO VISUALIZE to the public how its service has developed during the past twenty years the Montreal Light, Heat & Power Consolidated is displaying in its office a painting which is shown in the accompanying illustration. The company serves a large industrial load in and around Montreal, Que., and the growth of the company's business is depicted by a workman of increasing size at the end of each five-year period. In 1903 the company's power load was only 17,900 hp., while during 1923 the total connected load is expected to reach 275,000 hp.

The painting also serves to remind people in both French and English that "a city can progress only as fast as its public utilities can develop."

What Other Companies Are Doing

Cleveland, Ohio.—The Electrical League of Cleveland has been conducting an electrical home contest among the wives of the electrical men of that city for the complete electrification of their homes. Six prizes of $10 each were awarded for the best electrically equipped homes.

Denver, Col.—During the recent "Better Homes" show in this city a night was given to the Electrical Co-operative League at which the electrical idea was featured. More than three hundred electrical men and their families were in attendance at the closing session. The idea of electrification was injected into every feature of the show—in wiring, lighting and equipment in the modern rooms, convenience outlets, etc.

Wallingford, Conn.—Eighty electric ranges are now in service on the lines of the local lighting department, and A. L. Pierce, superintendent, states that from four to six ranges averaging 8 kw. connected load each can be wired from one 10-kw. transformer on account of the excellent diversity factor. For electric range service the customer is billed at the rate of 3.5 cents per kilowatt-hour for the first 100 kw.-hr., the excess being billed at 3 cents per unit. Even the poorhouse at Wallingford is equipped with an electric range.

Davenport, Iowa. — Life insurance policies totaling $150,000 were presented to employees of the People's Light Company recently at their annual picnic. A policy was given to each employee whose term of service exceeded six months. They averaged about $1,000 each.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Hydro-Electric Development and Steam Equipment

Lago Bianco Reservoir. — FILIPPO ORSATTI.—This reservoir consists of the joining of two lakes (Lake Bianco and Lake Scala) which are about 7,300 ft. above sea level. By damming at the opposite extremities of the two lakes, the waters join, forming one single large reservoir. The water level may be raised or lowered 18 ft. above or below the normal, thus providing a natural reservoir giving a reserve water supply of 350,000,000 cu.ft. The outlet, the construction of which is given in accurate details, was artificially located at the middle of the reservoir by the construction of a special well and a tunnel cut through the rock. Owing to the altitude of the two lakes the work presented numerous difficulties which are illustrated and discussed.—*Ingegneria,* Vol. II, No. 3.

Efficiency of Steam Plants with Very High Pressure. — H. GLEICHMANN. — The author assumes an existing steam plant, operating at 16 atmospheric pressure, and investigates the theoretical possibilities and efficiencies resulting from an increase of the boiler pressure to 101 atmospheres, driving with this high pressure a turbine, the exhaust of which would drive under a pressure of 16 atmospheres the existing turbine. Assuming the output of the present plant to be 10.000 kw., the high-pressure set could deliver 4,400 kw. at an investment of about the same amount as a new 4,400-kw. set built for operation on 16 atmospheres. The cost of the high-pressure turbine would be somewhat less, that of the boilers somewhat more, and the pipe lines, which can be smaller but have to be heavier, cost about the same as the corresponding parts for 16 atmospheres. Efficiency charts show the effect of an intermediate superheater between the two turbines and the financial gain achieved with this system.—*Siemens Zeitschrift,* June, 1923.

Collecting Cinders from Flue Gases. —L. B. SALT. A combined induced-draft fan and cinder collector is described. In this unit a pocket is built in the blades of the fan with inclined channels leading into dust chambers in the side of the housing where the cinders caught in the pocket can settle. Two such fans used by the Interborough Rapid Transit Company (New York) have shown excellent results both for cinder elimination and air efficiency. Each of these fans handles the gases from six 500-hp. boilers, and during a run with the boilers at 200 per cent of rating collected 250 lb. of cinders an hour. Other installations of these combined units are also described.—*Combustion,* June, 1923.

Graphic Method for Computing Heat Balance.—F. A. SHORKEY.—The author has devised a series of charts with a view of eliminating sources of error and the lengthy calculations for making a heat balance, and also to facilitate and expedite the calculation of these balances. A chart is presented for the determination of hydrogen, and one for the determination of volatile carbon. Several charts are also given showing the losses due to moisture, burning of hydrogen, combustible in ash and sulphur correction, dry flue gases, and CO in dry flue gases.—*Blast Furnace and Steel Plant,* June, 1923.

Transmission, Substations and Distribution

Swiss Outdoor Substation.—After very careful investment and operating cost comparisons, the Swiss Federal Railways decided in favor of an outdoor substation for one of its branches of electrified roads. This station, with a total and continuous output of 10,000 kva., serves to step two incoming single-phase, 60,000-volt, 16⅔-cycle lines down to the railway overhead voltage of 15,000. Three self-cooled 3,000-kva. conservator-type transformers and one identical spare unit, with the necessary switching, measuring and protective apparatus, are installed in a large yard next to the railway tracks. To keep the oil in switches and transformers in good condition a central filtering plant has been provided in the remote-control switch house, which also contains a well-equipped general repair shop. A complete wiring diagram, station layout and general views of the yard illustrate the paper.—*Bulletin Oerlikon,* April, 1923.

Short Circuit Forces in Transformers—II.—J. BIERMANNS.—The first installment of this article contained the complete derivation of fundamental equations for the calculation of mechanical forces in a transformer under short circuit. In the second and final part is shown how to compute radial and axial stresses if a short-circuit occurs across the terminals or only across a part of the winding of a transformer with concentric arrangement of low and high-voltage coils. The transitory character of the forces is then explained, distinguishing between the initial short-circuit current rush and the stationary or damped part of it. The effect of these forces upon the winding itself and its supporting structure is then investigated, assuming a certain amount of assymmetry between the primary and secondary, such as is unavoidable in the course of design and assembly. On an actually built 20,000-kva., 110,000 / 6,000-volt, 50-cycle Y-delta transformer all the above calculations are illustrated with concrete values.—*Bulletin de l'Association Suisse des Electriciens,* May, 1923.

Poles of Reinforced Concrete Centrifugated. — A 75,000-volt transmission line built with poles of reinforced concrete centrifugated is described in this article, which also shows how the poles are manufactured. A previously built steel armature is placed in a wooden form which is half filled with concrete. This assembly is made to rotate at 600 r.p.m. to 1,000 r.p.m. by a centrifugal machine until the concrete obtains a good set. This operation lasts about ten minutes. After the form has been removed the pole is kept under wet sand for seven to eight days. — *Sincronizzando,* May, 1923.

Units, Measurements and Instruments

Dielectric Research.—JAMES MOULD. —The author considers the variations of dielectric constant with frequency and energy loss in standard dielectrics. The materials selected were ebonite, glass, micanite, india rubber, gutta percha, etc. The author also measured the energy loss in these dielectrics at various frequencies with a view to the possible analysis of the loss into its various parts.—*Beama,* June, 1923.

Technical and Commercial Aspects of Power Factor.—H. E. YERBURY.—The author considers the reason for low power factor in machines and apparatus as commonly used, the means that are available at the present time for improving the existing conditions and what can be accomplished in the reduction of charges as affecting the supplier and consumer. He states that the highest possible efficiency of an electrical undertaking can be obtained only by studying all the factors which at present militate against a low selling price per unit. The low average power factor existing on many undertakings could be raised and consumers should be encouraged to improve their power factor by the establishment of the principle of rebate for a high power factor.—*Journal of the Institution of Electrical Engineers (England),* June, 1923.

Dielectric Strength Ratio Between Alternating and Direct Voltages.— J. L. R. HAYDEN and W. N. EDDY.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A.I.E.E. summer convention, July 7, on page 15.—*Journal of the A.I.E.E.,* July, 1923.

Measurement of a Single-Phase Load at a Low Power Factor.—A. DOVJIKOV. —The author considers the measurement of single-phase loads at power factors below 5 per cent, enumerates the difficulties that are encountered and gives a remedy of how these can be overcome. He discusses errors due to inductance of voltage coil, eddy

currents in wattmeter, effect of resistance of voltage coil, etc.—*Electric Journal*, July, 1923.

Illumination

The Electrical and Illuminating Equipment of the Eastman Theater and School of Music.—F. A. MOTT and L. A. JONES.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A.I.E.E. spring convention, May 5, 1923, on page 1033.—*Journal of the A.I.E.E.*, July, 1923.

Motion-Picture Protection with Incandescent Lamps.—C. M. DOOLITTLE.—Cleanliness, economy, steadiness, quietness, softness of light, comfort and simplicity are the advantages of using incandescent lamps for motion-picture production. The construction of the lamp, special protectors, lamp-setting devices, automatic current regulator for alternating current and the field of application of the incandescent lamp are among the features discussed. —*Electric Journal*, June, 1923.

Motors and Control

Automatic Drive for Air Compressors.—R. RÜCKERT.—For large compressed air supplies, where the compressor is driven by a three-phase motor, the maintenance of a steady pressure is difficult with a motor running always at the same speed. A system, where a by-pass on the compressor is opened when full pressure has been reached, causing the motor to run idle, is not desirable on account of the poor power factor of the motor during its no-load run. Best results have been obtained with a method, whereby the motor is pressure controlled, starting and stopping automatically when the air reservoir pressure is below or above a predetermined value.—*A. E. G. Mitteilungen*, May, 1923.

Practical Details and Tables for Laying Out Motor Windings.—A. C. ROE.—The author considers motors having twenty to twenty-four poles and shows where larger groups are placed in the windings which have unequal groups. — *Industrial Engineer*, June, 1923.

Heat Applications and Material Handling

Welding Machines for Mines.—B. LETSCH.—For general repair work and the proper maintenance of its various power-driven machinery, a coal mine realized great savings from the installation of a stationary and a portable electric welding outfit. It is claimed that the investment of these welders paid for itself within a few months. The described equipment comprises a stationary welding plant with two 460/600-amp. generators, one portable 460/600-amp. welder on a four-axle car, a 150/225-amp. welder on wheels, and one 52-kva. resistance butt-welder. To enable the portable outfits to connect to either the 2,200-volt high-tension three-phase supply or the 550-volt direct-current trolley lines, they are each equipped with one alternating-current and one direct-current driving motor for the welding generator.—*A. E. G. Mitteilungen*, May, 1923.

Heating a Cotton Weave Shed By Electricity.—C. T. GUILDFORD.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A.I.E.E. spring convention, May 5, 1923, on page 1026.—*Journal of the A.I.E.E.*, June, 1923.

Electric Brass Furnace Practice.—H. W. GILLETT and E. L. MACK.—A 334-page report published to record the progress made so far in melting brass electrically. Its princpal purposes are to aid the plants which have not yet taken up such melting by pointing out the types of furnaces available, describing their performance and indicating their possibilities and their limitations, and to encourage further experimentation with and the development and installation of electric brass furnaces. A mass of very valuable information is gathered here and should be of the greatest value to users of brass furnaces or those intending to use them. —*Bulletin No.* 202 *of the Department of the Interior, Bureau of Mines.*

Traction

Automatic Train-Control Developments. — Marked developments have been made in train-control equipment and the system described is designed to limit the speed of a train to any degree at any point. The fundamental princ ple consists of a time-element device on the locomotive operating in combination with pairs of inductors placed along the right-of-way, the spacing of the inductors determining the speed at which a train may pass the point in question without an automatic application of the brakes.—*Railway Electrical Engineer*, June, 1923.

Locomotives for the Virginian Electrification.—R. L. MCCLELLAN.—The electrification of this railway embraces 134 route-miles (213 miles of track) between Mullens, W. Va., and Roanoke, Va., and includes the district most difficult of operation because of the severe grades. A general description of the service that must be rendered on this road is given. The locomotives will weigh 600 tons and will develop 5,115 hp. at 14 m.p.h., and 5,970 hp. at 28 m.p.h. Current is collected by pantographs from an 11,000-volt trolley wire.—*Railway Age*, June 16, 1923.

Financial Prospects of Railway Electrification.—PHILIP DAWSON.—In this paper, presented before the Institution of Transport (England), the author gives the principal results of an investigation into the financial status of the electrification of the suburban line services at Brighton, Eastbourne and Worthing. He considers electric operation, increased traffic, gross receipts and expenses, results achieved by electrification and capital expenditures of various English systems.—*Electrician (England)*, June 1, 1923.

Telegraphy, Telephony, Radio and Batteries

The Electrical Plant of Transocean Radio Telegraphy.—E. F. W. ALEXANDERSON, A. E. ROACH and C. H. TAYLOR.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A.I.E.E. summer convention, July 7, 1923, on page 21.—*Journal of the A.I.E.E.*, July, 1923.

Railroad Signaling with Train Control.—Three-indication color-light automatic block signals, operated by alternating current, together with ramps and control equipment for automatic train control, have been installed on 40 miles of single track between Charlottesville, Va., and Staunton, on the Chesapeake & Ohio. Operating difficulties on this stretch of track, special signal indications, signal layout protection at tunnels and economies effected by the signaling system are considered. —*Railway Age*, June 9, 1923.

Influence of Motor Ignition Upon Radio Receiving on Airships.—V. S. KULEBAKIN.—Radio reception on airships is seriously impaired by the emission of short wave lengths from the ignition system of the gas motor. This influence limits to a large extent the use of receiving amplifiers because they will amplify also the disturbance from the spark plugs. The author gives a description of the usual ignition systems and goes into very detailed theoretical investigations of the cause and the exact nature of these short wave emissions. A complete metallic shielding of the ignition apparatus of the engine, including all high-voltage and low-voltage connections, gives in most cases a satisfactory solution, but complicates the engines and makes them less accessible. A new system is mentioned, by means of which the amount of emitted electromagnetic energy is completely compensated, resulting in what is claimed to be absolute relief in all cases. The system itself, however, is not described. — *Elektrotechnische Zeitschrift*, June 7, 1923.

Miscellaneous

Mechanical Rectifiers.—B. SCHAFER.—Synchronously vibrating mechanical rectifiers are described in this paper. These are capable of delivering singly or with two vibrators in parallel up to about 1½ kw. of direct-current energy, which is sufficient to feed projection arc lamps or to charge batteries. Tungsten contacts, careful tuning of the vibrator and condensers across the contacts insure a sparkless operation. It is claimed that these rectifiers are much cheaper than motor generators, and have at the same time a considerably higher efficiency. For an output of up to 6 kw. the author suggests the use of rotating commutators, driven by and mounted upon the shaft of a fractional horse-power, self-starting synchronous motor. Such a rectifier for a capacity of 5,000 watts direct current operates with an efficiency of more than 75 per cent. — *Elektrotechnische Zeitschrift*, June 14, 1923.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Reproduction Cost

Cannot Be Considered Controlling Element in Valuation, Says Wisconsin Supreme Court

REPRODUCTION cost of public utility properties in Wisconsin cannot be considered as the controlling factor or even as a considerable factor in fixing the valuation of such properties for rate-making purposes by the State Railroad Commission, according to a decision handed down by Judge M. B. Rosenberry of the Wisconsin Supreme Court.

The decision was made in the case of the Waukesha Gas & Electric Company against the Railroad Commission of Wisconsin and directly involved the valuation of public utility property. His decision upholds the power of the Wisconsin Railroad Commission to fix rates for public utilities and justifies the commission in disregarding to a large extent the claim of replacement values made by utility companies in resisting demands for lower rates. In affirming the recent decision of the Circuit Court of Dane County, which restrained this company from increasing its electric rates here on the basis of a revised valuation of its properties, the state Supreme Court practically stabilizes the valuation of utility companies for rate-making purposes and does away with expensive revaluations and rate hearings.

The attitude of the Wisconsin court toward the theory that cost of reproduction should govern the fixing of values of public utilities is thus stated by Justice Rosenberry:

"With all due respect, the proposition that the cost of reproduction new, less depreciation, although it should no doubt be considered, is entitled to controlling or even considerate weight under present abnormal conditions appears to us to be unsound."

Situation Not Clarified

The court points out that the United States Supreme Court, in three cases decided in May and June of this year, has not entirely clarified the situation as none of them contains a statement as to what weight should be accorded to the cost of reproduction new, less depreciation. One of these was the Southwestern Bell Telephone Company case from Missouri, which was interpreted at the time as upholding the reproduction cost theory of valuation.

Stating that it does not attempt to lay down a formula for valuing public utilities, the Wisconsin court says if it were to accord rank to the various factors to be considered in accordance with the weight to be given each in determining present fair value for establishing a rate base, such formula would be this:

1. Actual cost of plant when the investment has been prudently made.
2. Under normal conditions, cost of reproduction new, less depreciation. (When conditions are abnormal, cost of reproduction new, less depreciation, should be fourth).
3. Going concern value.
4. Working capital.
5. Other elements of value which may be presented in a particular case.

Mexico Has Federal Power Commission

The Mexican government, according to a report to the Department of Commerce, has announced the organization of a National Commission of Motive Power (Comision Nacional de Fuerza Motriz), for the organization, development, planning and supervision of the commercial exploitation of the natural power resources of the republic. Studies will be made of the legislation in other countries relative to the developments of hydro-electric power and the generation and sale of electric energy.

The commission's program includes advising the government which bodies of water should be withheld from power exploitation, division of the principal rivers of the country into sections according to their respective possibilities for power or irrigation development, revision of the Federal or local tax laws which may hinder the establishment and operation of hydro-electric plants, study of the advisability of abolishing or modifying the present Federal tax on water concessions, study of the desirability of preserving, restricting or extending the privileges generally granted to power companies, assistance to power companies in obtaining subventions from the government when it is considered that these are for public interest, and the study, in co-operation with local authorities, of the desirability of electrifying certain railroad and street car lines.

It is planned also to exercise control and supervision over hydro-electric plants already functioning with a view possibly to revising the privileges which authorize the establishment of these plants. Similar plans will probably be developed where the energy is generated from sources other than hydraulic.

Survey of Water Power

Inventory of Water Power on Public Lands to Be Made by Interior Department

A COMPLETE inventory of the water-power resources of the public-land states is being prepared under the program announced by the Department of the Interior. The surveys will form the basis for the classification of public lands with reference to their value as power sites.

Public lands reserved for use in connection with power sites and shown to be without power value will be recommended for restoration to entry. Lands that may be used in connection with power sites but that are well adapted for other uses will be recommended for restoration to entry with a reservation of the right of the government or its permittees to use them as power sites. Public lands that are found to be valuable as power sites and that are not already reserved will be classified as power-site land and withdrawn from entry.

Detail of Program

The program for the 1923 field season includes:

Oregon—300 miles of Rogue River and tributaries will be mapped and surveys of dam sites will be made.

Northern California and Oregon—Survey of Klamath River from Keno, Ore., to its mouth, will be completed, involving 100 miles of additional surveys.

Utah—Surveys covering 100 miles will be made on the east or Yellowstone fork of Lake Creek, west fork of Lake Creek, Rock Creek, Duchesne River, and Uinta River.

Idaho—Surveys of a dam and reservoir site will be made on Salmon River.

Montana—A dam site on the south fork of Flathead River will be surveyed and a reconnaissance will be made to determine the possibilities of using the Missouri River and its tributaries above Great Falls, Mont., for power purposes.

Colorado—Surveys will be made on South Boulder River, Clear Creek, St. Vrain Creek, South St. Vrain Creek and Middle Boulder River, all tributaries of the South Platte River.

Wyoming—Surveys will be made in September on Sweetwater, North Platte and Encampment Rivers.

Arizona and Nevada—300 miles of Theola River will be mapped.

Washington—Investigations of the Columbia basin irrigation project are now being made.

To Build Mouth-of-Mine Plant on Ohio River

Penn-Ohio Edison Company Plans Call for 240,000-Kw. Station to Use Pulverized Fuel

EXTENSIVE developments involving the construction of a mouth-of-mine power plant with an ultimate capacity of 240,000 kw. and the building of a 132,000-volt transmission line are being planned by the Republic Railway & Light Company through its recently organized subsidiary, the Penn-Ohio Edison Company. The latter company, by ownership of their common stocks, will control the following: Pennsylvania-Ohio Power & Light Company, Pennsylvania Electric Company, Ohio River Edison Company, the Salem Lighting Company and the Pittsburgh District Electric Company.

The Ohio River Edison Company will probably start construction within the next thirty to sixty days of a $10,000,000 steam plant using pulverized fuel on the Ohio River near Toronto, Ohio. The initial installation will consist of two 33,000-kva. units and the plans provide for future additions to the plant in generating units of the same size until the ultimate capacity is reached. The company controls about 7,000 acres of coal land immediately surrounding the site for the plant and development of this source of fuel is now under way. The plant when completed will be leased to the Pennsylvania-Ohio Power & Light Company for 999 years at an annual rental sufficient to show a substantial chance for dividends.

In addition to the proposed developments by the Ohio River Edison, controlled companies of the Penn-Ohio Edison Company now have an aggregate generating capacity of 105,540 hp., distributed by 315 miles of high tension transmission lines.

To transmit the power from the new station north to the Youngstown district a 132,000-volt line will be built which will be tied in with the 66,000-volt line of the Ohio Power Company near Wellsville. A 66,000-volt transmission line is also being constructed from Elwood City to Junction Park, Pa., at which point a tie-in will be effected with the transmission system of the Duquesne Light Company.

YOUNGSTOWN DISTRICT TO BE INTERCONNECTED

Live Sales Problems Discussed at Association Island

The Sales Managers' Association held its twelfth annual convention on Monday, Tuesday and Wednesday at Association Island, Henderson Harbor, N. Y., with L. R. Wallis of Boston, the chairman, presiding. This body, having as its membership the sales managers and selected representatives of the larger central stations, holds its meetings behind closed doors. The following program was presented: "Back-Door Selling," by O. R. Hogue, Chicago; "How a Central-Station Can Keep Its Merchandising Department From Injuring the Independent Dealers," R. S. Hale, Boston; "Development of Electric Cooking and Heating Load," S. M. Kennedy, Los Angeles; "Recent Developments in Merchandising," A. Edkins, Chicago; "Merchandising and Accounting," D. R. Smith, Baltimore; "Illuminating Engineering and the Central Station," Julius Daniels, Boston; "Organized Sales Efforts," T. L. Phillips, Cincinnati; "Some Practical Notes on Domestic Refrigeration," N. T. Wilcox, Boston; "Some Service Suggestions," G. J. Liebman, Brooklyn; "Some Notes on Relations with Customers, with Special Reference to Bills," W. R. Boyd, New York; "Advertising," Ralph Neumuller, New York; "A.-C. Multiple Street Lighting Energy Supplied from Residence Secondary Mains an Undeveloped Source of Revenue," G. E. Miller, Cleveland; "Arrangements for Street Lighting in Suburban Towns," G. M. Mangan, Washington; "Electric Power in Building Construction," H. T. Luscomb, New York; "Results of an Electric Load Census," R. H. Tillman, Baltimore; "The Detroit Edison Company's Loop System of Alternating-Current Supply in the Downtown Area," J. D. Noyes, Detroit; "The Commercial Possibilities of the Non-Ferrous Electric Furnace," C. A. Barton, New York.

A special open session was held on Wednesday evening, which was addressed by M. H. Aylesworth, executive manager of the National Electric Light Association, who outlined in general terms the plans now forming for a nationwide survey of residence conditions by member central stations of the N.E.L.A. W. L. Goodwin of the Society for Electrical Development also spoke. An executive committee was elected for the coming year.

Anthracite Report Stirs Up Diverse Comment

National Emergency Clause Displeases Operators and Employees—Freight Rates to Be Investigated

THE storm center of the anthracite report of the United States Coal Commission is the recommendation that the President be authorized to declare a national emergency, in case of a deadlock between operators and mine workers, and be empowered to take over the operation of mines and the distribution and marketing of the product. The operators fear that this would prove to be nationalization's entering wedge. Labor objects to it because there at least would be the coercion of public opinion brought to bear to make men work against their will. The public, however, seems to regard the measure with favor, not that it is anxious to see the government undertake any business activity, but because it believes the industry will avoid any invoking of the emergency powers and, with that alternative hanging over it, will reach an agreement.

The fact that the commission has indorsed, in effect, a combination of big business interests, under suitable regulation, throws into the congressional arena another highly controverted problem of our industrial life. It has been very popular in Congress for many years to lambaste any large business enterprise on the assumption that being big is *prima facie* evidence of its predatory character. Opinion, even in Congress, is changing to the point where the efficiencies of big business and the various benefits to the public of combinations are becoming apparent. It is true that the Coal Commission admits the possibilities of unjustifiable profits on the part of the anthracite combination, but on the whole its report shows that it was not afraid to commend it despite the fact that it is big.

Apparently the Interstate Commerce Commission is disposed to go to the full limit of its powers to assist in stabilizing the coal industry. This is indicated by the very prompt action it took in ordering an investigation of anthracite freight rates. The order was issued the day following the appearance of the report of the Coal Commission, in which such a recommendation was made.

There are some who believe that the decision in the assigned car case was expedited by the commission before the Coal Commission could have any opportunity to lay the responsibility at its door for the evils growing out of a practice which the commission had approved.

The carriers have made formal application to the commission for a rehearing in the assigned car case. This follows a meeting of railroad executives in Washington on July 10, at which meeting it was decided to take that action. If the commission does not believe a rehearing justified, it is asked to allow the carriers to present additional arguments. In case that request is not granted, the carriers then suggest that the commission give further attention to the situation of carriers purchasing for substantial periods the total output of mines and the situation of carriers owning their own mines and using the output thereof solely for railroad fuel.

Transmission to Be Main Topic of Del Monte Convention

Four technical sessions have been provided in the provisional program issued for the Pacific Coast convention of the American Institute of Electrical Engineers, to be held at Del Monte, Cal., on Oct. 2-5. This program is as follows (Monday being devoted to registration and recreation):

WEDNESDAY, OCT. 3

Morning—Address, President F. B. Jewett; address, "Researches Relating to High-Tension Transmission," President-elect H. J. Ryan; symposium on construction of modern power lines: "Electrical Construction of Modern Power Transmission Lines and Insulators for High-Voltage Lines," H. R. Wakeman and H. W. Lines, Portland Railway, Light & Power Company; "Evolution of the High-Voltage Insulator," J. Koontz, Great Western Power Company; "Design of Anchor and Supporting Structures for the Carquinez Strait Crossing," L. J. Corbett, Pacific Gas & Electric Company; "Special Features of Design of Transmission Tower Lines as Imposed by Electrical Conditions," Walter Dreya, Pacific Gas & Electric Company; "Group Operation of Systems Having Different Frequencies" (two papers), E. R. Stauffacher, Southern California Edison Company, and R. R. Robley, Portland Railway, Light & Power Company; also papers by C. B. Carlson, Southern California Edison Company, and M. T. Crawford, Puget Sound Power & Light Company.

Afternoon—Symposium on waterwheel construction and operation: John Harrisberg (Puget Sound), E. D. Searing (Portland), E. W. Breed (Pelton Water Wheel), H. L. Doolittle (Southern California), and "A Study of Irregularity of Reaction in Francis Turbines," R. Wilkins (Pacific Gas & Electric); from papers on high-voltage switches, bushings and lightning arresters by D. W. Proebstel (Portland), M. Michener (Southern California), A. W. Copley (Westinghouse) and L. N. Robinson (Stone & Webster).

THURSDAY, OCT. 4

Morning—"High-Voltage Insulation," J. L. R. Hayden and C. P. Steinmetz, General Electric Company; "Power Resources of the United States" (illustrated), F. G. Baum; "Generating and Substation Machinery for Long Transmission Systems," W. Smith (Westinghouse); symposium on high-voltage transformers: "Performance of Auto-Transformers with Tertiaries Under Short-Circuit Conditions," J. Mini and R. Wilkins (Pacific Gas & Electric); A. W. Copley (Westinghouse), L. J. Moore (San Joaquin) and L. N. Robinson (Stone & Webster).

Evening—Presentation of Edison medal to Dr. R. A. Millikan, who will make an address.

FRIDAY, OCT. 5

Morning—Symposium on radio communication as applied to power transmission networks: J. Koontz (Great Western), E. A. Crellin (Pacific Gas & Electric), R. Ashbrook (Southern California); symposium on theory and practice in high-voltage operation: R. C. Wood (Southern California), W. D. Shaw (Southern California), A. W. Copley (Westinghouse); "Economics of Power-Factor Control of Long High-Voltage Transmission Lines," A. V. Joslin (Pacific Gas & Electric); "Methods of Voltage Control of Long Transmission Lines by the Use of Synchronous Condensers," J. Koontz (Great Western); papers on telephonic and radio communication by J. Koontz, E. A. Crellin and R. Ashbrook.

Sports, trips and entertainment will fill the time not devoted to technical sessions.

Delay Versus Speed in Passing on Water-Power Projects

Some difference of opinion has arisen between the Chief of Engineers and the staff of the Federal Power Commission in regard to the degree of promptness which must be exercised in answering declarations of intention to make use of the power resources of a stream. The Power Commission's staff interprets the requirement of the act that an investigation be made and a finding reached without delay to mean that a special effort must be made at once to report on the proposed project. It is recalled that in the debate on the water-power bill the fear was expressed that federal red tape would entail long delays before any development could proceed. So that it may not be open to that criticism, the staff of the Power Commission has been particularly careful to decide quickly as to whether or not it has jurisdiction.

Two months ago the Power Commission received a declaration of intention from C. Boice, covering a power site on the Pigeon River in North Carolina. This stream is a tributary of the Tennessee. A report from the Chief of Engineers is required to determine whether or not the Federal Power Commission has jurisdiction. That official, however, has stated that it will be impossible to make this report until that stream can be reached in the orderly completion of the survey of the upper Tennessee which is now in progress. This does not please the declarant, who is anxious to proceed.

Incidentally, any delay in acting on the declaration of intention is thought to be highly pleasing to the Tennessee River Improvement Association and others who are particularly interested in Muscle Shoals. Apparently they fear that the location of industries on the upper tributaries of the Tennessee will take from Muscle Shoals what otherwise might have been located there. In this particular case it is believed that the Federal Power Commission will decline to take jurisdiction.

Rural Telephone Users in Oklahoma to Be Educated

A statewide program designed to improve the service from the rural telephone lines will be undertaken in Oklahoma by the Southwestern Bell Telephone Company, and the Oklahoma Utilities Association will carry on a similar campaign among the rural companies not reached by the Bell company. The method of approach is to invite all patrons of a group of rural telephone lines to a conference and to show by lectures and demonstrations the greater efficiency and better service afforded by properly constructed facilities. It is proposed to place ordinary telephone supplies with dealers in small towns in order that ordinary repairs can be made without delay. The meetings will be attended and addressed by competent men.

Merger in New York

Niagara Power to Supply Towns in Cohocton Valley — Extensions Planned in Other Territory

THE New York Central Electric Corporation, incorporated last December, has filed papers with the Public Service Commission asking for authority to merge the Warsaw Light & Power Corporation, the Perry Light & Power Corporation, the Hornell Electric Company, the Yates Electric Light & Power Corporation of Penn Yan and the Wayne Power Company, which supplied power to all the towns of the Cohocton Valley north of Kanona.

These same interests now are operating all the companies and recently acquired the plant at Dansville, and have approached Hammondsport. Bath is considering the sale of its electric plant to the same company.

The New York Central Power Corporation now holds a contract with the Lockport, Niagara & Ontario Power Company, which provides for the delivery of power to the New York Central Corporation at Niagara. Supply lines already have been constructed from Warsaw to Perry and now are under construction from Perry to Hornell.

George W. Olmstead of Ludlow, Pa., is president of the New York Central Electric Corporation, and E. L. Phillips of New York, formerly of Prattsburg, is vice-president.

In the interests of the corporation franchises for the extension of the lines have been granted by the towns of Bradford, Wayne, Bath, Pulteney, Wheeler, Prattsburg and Thurston in Steuben County, Orange in Schuyler County, Barrington, Benton, Milo and Tory and the village of Dresden in Yates County.

With the extension of the Niagara lines into the New York Central Electric Corporation's territory, the Lamoka Power Corporation and the Lamoka Electric Water Power Corporation of Corning are assured of a practical market for their power.

The Lamoka company was reorganized recently and William H. Foxall of Rochester was made president and Dr. George F. Showers of Corning was chosen secretary and treasurer.

In the interests of the Lamoka Power Corporation 2,600 acres of property in the Mud Creek Valley have been taken over, as have also the Kanona Roller Mills and the water rights of the Savona Roller Mills.

Electragists Meet in Denver

James R. Strong of New York City, president of the International Association of Electragists, and Laurence W. Davis of the Empire city, director of promotion and development for the association, were the principal speakers before the convention of the Mountain States division of the International Association of Electragists' meeting, held in Denver, July 16. The Mountain States division comprises the states of Colorado, Wyoming, New Mexico, Utah, Montana and Idaho. About 100 delegates attended. President Strong, after explaining just what the association has done and is planning to do, said:

"The benefits to be desired from an association are directly proportionate to the amount of study given by the members to the educational data. Be first an electragist and then give at least five hours a week to the study of your particular business and to the educational data furnished." Mr. Davis spoke on "Estimating and Selling the Job."

A. P. Peterson, Western field representative from Minneapolis, spoke on the subject "Residence Wiring Survey" and showed where one job submitted to eighteen contractors brought in bids ranging from \$60 to \$187. It was proved that the actual cost was \$93.50, and he then urged the necessity of understanding estimates and showed how to compute them. He will remain in Denver for an indefinite period to develop the work of the association.

Wisconsin Utilities Prosperous

Due to the ever-increasing demand for gas, electric, telephone and street railway services, the public utilities of Wisconsin show a tremendous growth in the amount of money invested in the business, in the total revenues received and in the number of customers served, according to the latest report of the railroad commission, which does not include the figures for 1922.

Electric light and power companies, however, show the greatest growth of all utilities in Wisconsin in investments as well as in revenues and number of customers. Although the revenues increased to a considerable extent between 1917 and 1920, the operating expenses increased even more rapidly, and the amount available for return upon the investment decreased from 5.62 per cent to 5.48 per cent. The increased cost of operating the electric utilities made it necessary to increase the rates in many instances, and this increase in rates is reflected in the increased revenues for the year 1921. This fact, together with a decline in prices, increased the rate of return to 6.99 per cent for the year 1921.

"The total amount of capital invested in all electric utilities in Wisconsin in 1921 was \$116,564,856," says the commission's report. "This is an increase of \$12,064,488, or 11.5 per cent, over the property value of 1920, and \$44,528,616, or 61.8 per cent, over that in 1917.

The rate of return on the money invested in all these properties for 1921 was 6.99 per cent. Electric consumers in 1921 were 285,209, an increase of more than 15 per cent over 1920. Street railways carried in 1920 287,905,241 passengers and in 1921 265,392,587, a decrease of 7.8 per cent. Telephone subscribers increased from 401,338 in 1920 to 414,345 in 1921. Gas consumers increased from 214,294 in 1920 to 219,320 in 1921.

Cooper Plan Outlined

St. Lawrence Development Plans Propose the Immediate Installation of 1,200,000 Hp.

THE development of the St. Lawrence River is exciting a great deal of interest in the electrical industry. Several corporations have plans outlined and one of the most active is that of the Frontier Corporation, which is backed by the Du Pont Company, the General Electric Company and the Aluminum Company of America. Colonel Hugh L. Cooper, consulting engineer for the corporation, filed the plans of development of that corporation with the International Joint Commission, which reported to the United States and Canada on the development.

At present the 120-mile stretch between Ogdensburg and Montreal, with a drop of 220 ft., transports 4,500,000 tons of freight a year and develops 200,000 hp. The International Joint Commission report, based on recommendations of government engineers, proposed three dams, nine locks, 31 miles of canals and the installation of 4,545,000 hp. capacity, at a total cost of \$506,000,000 without interest during construction.

Colonel Cooper's plans call for five dams, six locks, 6 miles of canals and 5,400,000 hp. capacity, at a total cost, including all charges, of from \$1,250,000,000 to \$1,400,000,000. Of this development 4,200,000 hp. would go to Canada by treaty right, but it is considered probable that part of this power could be used in the United States until Canadian markets require it. An annual movement of over 100,000,000 tons of freight is forecast should the project be completed.

As the first step in this program, Colonel Cooper proposes the installation of a 1,200,000-hp. unit at Cat Island, about midway between Morrisburg and Cornwall.

The Frontier Corporation now owns in fee Cat Island and about 4,200 lineal feet of New York shore line opposite to and above the island.

These interests are prepared to furnish all funds for the construction at that point of a control dam 2,750 ft. long and two power houses each 3,100 ft. long, with their hydraulic and electrical contents, up to and including the low tension bus bars, at an estimated cost of \$200,000,000. At the same time, Colonel Copper points out that the cost of this first unit will be so great that the concerns behind the Frontier Corporation can never be more than leaders and minority holders of the necessary securities.

All navigation facilities would be paid for, owned, operated and maintained by the two governments. Interests behind Colonel Cooper would act as construction agents for a fixed fee equal to 6 per cent of the adopted cost estimate. Cost of a 30-ft. channel at the site is estimated at \$30,000,000. All structures connecting upstream ends of the power

houses with navigation facilities and the shores would be paid for, owned and maintained by the two governments.

The principal opposition to the plan thus far has come from the Great Lakes-St. Lawrence Tidewater Association, which fears navigation may be subordinated to power, and also from New York and New England.

Proposes Farm Power at $5 per Hp.-Yr.

Report of American Farm Bureau Federation Outlines Power Development Policy—Backs Ford

THE annual report on American Farm Bureau Federation legislation activities, presented by Gray Silver, Washington representative to the executive committee, has just been issued and widely distributed in pamphlet form. Among other subjects it deals voluminously with power and its relation to farmers. The following extracts of the report will be read with interest by the electrical industry:

We have made a start in the direction of legislation affecting the lowering of farm costs in what we buy. But that is a field that remains largely with the future. The first part of it is to establish through the adoption of the Henry Ford Muscle Shoals plan the principle of amortization of capital costs in hydro-electric power development.

ELECTRIC POWER COST MOSTLY INTEREST

We are told on the highest technical authority that in the case of a certain so-called "cheap electric power production," which costs $24.42 annually, no less than $18.90 goes to pay for interest on the investment. The average investment per horsepower in hydro-electric plants is $300. And east of the Rocky Mountains the average annual cost per horsepower is about $30 a year, of which, roughly, $24 goes up in the smoke of interest. That is, about 80 per cent of the cost of generating hydro-electric power goes now and, under the present system, tends to go on forever to pay interest on the first cost of the plants. For while it is true that these plants are now financed on the old basis, they do, however, carry a charge against the business equal to an amortization charge to retire the capital securities. As this is now usually done, at the end of the amortization period instead of signalling reduced rates it is too often an occasion for further "financing" or "melon-cutting" that will keep the interest fires burning. It is not in human nature for the interests that own and build great power plants to apply income to retiring their principal when they can keep it forever at interest. The new way means that we will eventually get power for $5 or $6 per horsepower per year instead of $25 or $30, that interest will not run on forever, and that during the pay-off period interest will be 4 per cent instead of 8 per cent, which represents the difference between public and private credits.

CHEAP POWER AND THE FERTILIZER PROBLEM

Cheap power is of tremendous interest to farmers in more ways than are apparent at present. Perhaps the most important meaning of cheap power on the farm at present is cheap fertilizer. We are coming into an age when artificial fertilizer must be universally used if the production and value of our farms are to be maintained.

We must look for the solution of this pressing problem in the fixation of nitrogen from the air and in the cheap production of other fertilizing elements by the use of the electric furnace.

Muscle Shoals is only a step—the first step—in the solution of the great power problem, but it is supremely important because if we succeed in our advocacy of the Ford tender we shall have established a ruling precedent for the future utilization of water power development on the plan of paying off and then charging off forever the original improvement costs with no chance of their continuation through melon-cutting stock dividends, improvement bonds, etc. If we fail here interest will grip and hold indefinitely all of the great water powers the government still controls and our children's children will be paying interest on capital investment on every stream in the land long after such investments have in equity been paid off.

This principle is now asked in the development of the Colorado River with 5,000,000 potential housepower, in the huge Columbia River Basin irrigation project, and, in fact, altogether may eventually reach to perhaps 50,000,000 water horsepower without the building of storage works and 200,000,000 hp. with a universal system of storage. To wipe out interest charges on 50,000,000 hp. means at least $1,000,000,000 of annual savings in interest charges along and of $4,000,000,000 on the potential power development of America. Moreover, as original costs are always pyramided, that is, included in interest and profit computations again and again in each step on the way from the producer to the consumer, the wiping out of an interest charge of $1,000,000,000 means perhaps as much more by the time the bill gets to the consumer for the commodities made by the power. Electricity is the ideal power. There are almost no limits to which electric power can ultimately be transmitted. Farmers residing hundreds of miles from hydro-electric power plants will have their power in that form.

HIGHER AND HAPPIER FARM LIFE

The mechanical application of power in modern civilization puts mechanical genii to work for us. Today there are thirty such helpers working for the average American, but the farmer is far from having his share of them. Electricity at $10 or less per horsepower per year will carry the water from the spring or well to the home and to the barn; will milk the cows; will wash the clothes and iron them; will sweep the house; will do away with the necessity of filling, trimming and washing kerosene lamps; will replace the boy at the woodpile; will substitute the electric cook stove with its automatic control for the wood or coal stove and thereby remove the necessity for frequent sweeping and scrubbing to remove wood and coal soil from the floors. Cooking, washing, ironing over superheated cook stoves will then be of the past, for the electric cook stove with its insulation will control the heat so the kitchen will be almost as cool as any room in the home. The electric refrigerator will come to the farm home and provide not only storage but also abundant ice ready for use. It will be found also in the farm dairy. Moreover, electricity will grind feed, shell corn, run the cream separator and the churn, cool and heat the house, and in fact, permit the use of labor saving devices and comfort making equipment which will eliminate most of the drudgery of farm home life.

Once the principle of wiping out the dead burden of unnecessary perpetual interest charges is established it may be applied in other processes than in the development of hydro-electric power. The steam electric power of the future will be developed at the coal mines and we will haul weightless electricity on wire cables instead of heavy and bulky coal in lumbering gondolas on costly railroads, thereby greatly reducing railroad rates. Such power will take care of the regions that have not enough water power to meet their needs. There are still immense areas of coal land and oil fields in the public domain. The principle of amortization can and will be applied to these central power stations.

The development of cheap electric power on a huge scale portends the electrification of the railways, which indeed is one of the inevitable solutions by which the present baffling problem of railway congestion, excessive transportation costs, and inefficiency is to be overcome. Electricity means more efficient service—and more economical. That spells cheaper transportation rates. Hydro-electric power, on this basis, used on a railway locomotive is equivalent to using coal at 92 cents a ton instead of $3 to $3.25.

The above extracts are only part of the voluminous treatment of power and power legislation.

Lightning Arrester Test Set

WITH this test set, installed at the plant of the Westinghouse Electric & Manufacturing Company, it is claimed that a 240,000-volt discharge with an instantaneous power maximum of very nearly 3,000,000 kva. can be obtained.

It is being used chiefly to test the relative merits of different types of lightning arresters. The apparatus consists of eight condensers having a total capacity of 0.1 microfarad charged through electron tubes to 240,000 volts by the transformer at the left. In one test which was made shunting a 15,000-volt pin-type insulator with a sphere gap in series with a resistance of 1,000 ohms the resistance proved too high to prevent insulator flashover, whereas a 15,000-volt "autovalve" arrester under the same conditions did protect the insulator.

No Market for Alaska Water Power

Applicants for Water-Power Licenses Losing Interest—Many Small Sites Available

DURING the President's stay in Alaska sight seems to have been lost of the fact that economic conditions have a bearing on water-power development. Some of the Alaskans seem to be of the opinion that most of the water power in the territory would be developed immediately were the Federal government to withdraw its restrictions. But an analysis of the Alaskan applications indicates that there are economic reasons why these developments have not gone forward. Coupled with this has been an apparent misconception on the part of the local interests as to their responsibilities in connection with these applications. In many instances applicants lost interest when they ascertained that expense is entailed in complying with the conditions of preliminary permits. Excluding the licenses, covering half a dozen small plants, which were in existence prior to the enactment of the water-power law, only one license for a major project has been granted out of the entire number. Fifteen preliminary permits have been granted, but there are only two which show promise of going through.

A careful reconnaissance has shown that there are twenty power sites in southeastern Alaska where power is available for pulp mills of sufficient size to make possible their operation on the most economical scale. So far as compliance with the Federal water-power act is concerned, there would be little difficulty in securing rights for these developments. The information which has reached the Federal Power Commission, however, is to the effect that economic conditions are not favorable at this time to the development of the pulp industry in Alaska.

New Development Committee N.F.P.A. Holds First Meeting

The first public meeting of the newly appointed sub-committee on new developments of the electrical committee of the National Fire Protection Association was held at 123 William Street, New York City, on July 17. The committee presented for discussion a new Underfloor duct system, manufactured by the Johns-Manville Company, and a new twin-conductor wiring material known as Romex, manufactured by the Rome Wire Company.

The morning was devoted to a hearing on the new underfloor duct system, which consists of a semi-circular fiber duct with suitable junction boxes and other fittings imbedded in concrete floors of fireproof buildings. The afternoon was devoted to a hearing on the Romex cable, which is a twin conductor consisting of rubber-covered wires with special non-metallic protective coverings intended for use in wiring circuits in both open and concealed work without metal armor, conduit or flexible tubing. Strenuous objection was voiced to both these products on the score that they would tend to break down the high standard of the code and increase the electrical fire hazard.

A very strong appeal was made in behalf of Romex cable by Ernest McCleary of Detroit, representing the contractor's viewpoint, stressing the great need for more economical material for the wiring of small buildings. A representative of the farm-lighting industry described the great benefits which will follow the establishment of some approved method for wiring the farm home more quickly and more cheaply.

At a meeting of the committee on new developments, held on July 18, it was voted that the committee should notify the submitters of the Underfloor and Romex materials and the electrical industry as represented at the public hearings that the committee extends the period within which briefs on these products may be filed to Oct. 1, 1923, and that it is the expectation of the committee that action will be taken on these subjects at a meeting to be held as soon after the above-mentioned date as possible.

The committee requests that briefs submitted be sent with twelve copies, one for each committee member.

St. Louis Utility Properties Consolidated

The Missouri Public Service Commission has granted the Union Electric Light & Power Company of St. Louis, a subsidiary of the North American Company, permission to purchase the Missouri properties of the Light & Development Company. The purchase price of the St. Louis properties of the latter was given at approximately $9,000,000, but only about $5,000,000 will actually change hands, the Union Electric company assuming about $4,000,000 indebtedness of the Light & Development Company. The commission directed that the Union company keep separate accounts in each of the several towns where the utilities will be maintained, and that it add only so much of the purchase price to its capital stock as the commission shall later find is a fair value of the property.

These properties are chiefly light and power plants in the territories served by the Union Light & Power Company in and around St. Louis, the two companies having competed in some localities.

The purpose of this merger, it is said by officials of the North American Company, is to remove competitive situations and improve service. Economies in operations are also expected to result from the consolidation and better and more reliable service.

Federal Views on the New York Water Power Report

No Concessions Granted by Federal Commission—State Suit Should Be Pressed or Withdrawn—No New Interpretation of the Water-Power Act

FEDERAL officials are not inclined to concur in the recommendation of the New York State conferees that the suit in the United States Supreme Court against the Federal Power Commission should not be pressed for the present. The Federal officials who are familiar with the situation contend that the state should either press the suit or withdraw it.

The report on behalf of the New York Water Power Commission makes frequent reference to concessions on the part of the Federal Power Commission. There have been no changes whatever in the policy of the commission as a result of the conference with the officials of the state of New York.

Particular exception is taken to the statement in the report that "if the state is not able to obtain from its own Legislature a grant of favorable legislation, it makes little difference whether it is the Federal commission or the state commission which licenses the state's power to private interests, as in either case the water power of the state will be out of the hands of the people of New York, who really own it." The outstanding feature of the Federal water power act is that the public retains its possession of the resource and simply leases it under certain specified conditions to those who undertake its development.

The report as a whole is regarded as an effort to retire gracefully from an untenable position.

Ford Uses Auxiliary Steam Plant at High Dam

The Ford license covering the High Dam development at St. Paul has been amended so as to include the use of additional government land sufficient in extent to furnish a site for the auxiliary steam plant, the terminals of the tunnels and other connections between the power house and the factory. The auxiliary steam plant is to be erected immediately adjacent to the hydro plant. It may be simply an extension of the same building.

Col. L. H. Brittin, who went to Washington to negotiate the amendment to the license, reports rapid progress on the part of Stone & Webster, who are in charge of the construction work.

Hydro Development on the Clackamas River

Portland Railway, Light & Power Plans 105,000-Hp. Plant to Cost $15,000,000

THE Portland Railway, Light & Power Company is proceeding with the construction of a gigantic hydro-electric development, which involves the expenditure of $15,000,000, approximately 60 miles southeast of Portland in the region of the headwaters of the Clackamas River and its tributaries. The complete project, which is to be built in three units, involves the drainage of 318 square miles of forest lands in the heart of the Cascade Mountains, which have been leased for a period of fifty years from the government, as they lie in a forest reserve.

The complete plant will develop a total of 105,000 hp. and will be constructed in units of 35,000 hp. each and will supplement the other plants of the company, among which are the plant at Faraday, which produces 20,000 hp., and the one at River Mill, developing 16,000 hp. Both of these plants are located on the Clackamas River and about 20 miles nearer Portland than the new installation and derive their water supply from that stream.

COMPLETE UTILIZATION OF 318-SQUARE-MILE DRAINAGE AREA

The first unit of the present project involves the construction of a diversion dam on the Oak Grove Fork of the upper Clackamas River, 29 miles above the site of the present plant at Faraday. There is available at the new site 430 sec.-ft. of unregulated flow at an elevation of 2,035 ft. From the intake at this dam the water is to be conducted through a steel conduit a distance of 6 miles to the summit of Cripple Creek Knoll, which is 1,850 ft. above sea level. From this knoll penstocks will extend 900 ft. down the face of the cliff to the turbines in the power house on Three Links Creek.

The steel plate for the conduit was produced by the Bethlehem Steel Company at Sparrow Point, Md., and was transported by water to Portland, where it has provided work for 500 men for six months in the shops of the Willamette Iron & Steel Company in forming it into pipe. Ninety-five hundred tons of steel was required, of a thickness of from $\frac{5}{16}$ to $\frac{11}{16}$ in., for the pipe, which is in sections of 40 ft. in length and 9 ft. in diameter. These sections are now being transported in wooden cradles on flat cars to the location of the line.

A 400-ft. right of way is being cleared for the pipe and transmission lines to protect them from falling trees and a trench is dug by steam shovels for the pipe, trestles being used to carry it across ravines.

The pipe line is terminated in a 360-ft. tunnel which pierces Cripple Creek Knoll with a fall of 48 ft. and ends at the penstock above Three Links Creek. A surge tank will rise from the roof of the tunnel, 20 ft. above the knoll and 5 ft. above the top of the dam at the intake, 6 miles away. The penstocks have a slope of 35 deg. and a length of 900 ft. The steel pipe is 8 ft. in diameter at the top and 6 ft. at the bottom.

From the power plant the energy will be transmitted at high voltage a distance of about 20 miles to Faraday, where it will connect to the existing high-tension lines. Seventy-three-foot steel towers will support the lines, which cross the river eighteen times during the distance.

Construction of the second unit involves the building of a 3-mile tunnel to connect the upper fork of the Clackamas at Big Bottoms with the intake reservoir on Oak Grove Creek. This will make necessary a second pipe line from the intake to the Three Links plant.

The third unit contemplates the building of a storage reservoir of 1,139 acres surface area at Timothy Meadows on Oak Grove Fork and one of 992 acres area at Big Bottoms.

Seventeen construction camps have been required on the first unit, which employs some 1,700 men, who occupy tent houses with board walls and floors. Ninety-one thousand meals are served monthly, consuming 217 tons of foodstuffs in that period. It is expected that operation of the new plant will begin by July, 1924.

Hydro Plant for Northeastern Pennsylvania

Interests associated with the Pennsylvania Power & Light Company have bought the Pennsylvania, New York & New Jersey Power Company and plans are now being made for the immediate development of the power site formerly owned by that company on Wallenpaupack Creek, located in the northeastern part of the State of Pennsylvania, near Hawley.

The plans contemplate the building of a hydro-electric development to have an installed generating capacity of 40,000 kw. The work in connection with this development will include a concrete dam 1,150 ft. long with a maximum height of 50 ft. above the riverbed. This dam is expected to create a reservoir about 12 miles in length covering an area of 5,600 acres.

Water will be conducted through a 14-ft. pipe line, about 3½ miles long, to a surge tank and thence by two 8-ft steel penstocks, each 750 ft. long, to the power house, which is to be situated on the south shore of the Lackawaxen River.

Electric energy will be fed 50 miles to the south into the Pennsylvania Power & Light Company's present system over several transmission lines, one of which is to be a 220,000-volt steel tower line.

It is estimated that the final cost of the complete development, together with the transmission lines that are to be constructed, will be approximately $8,000,000. Construction work, which will take about two years to complete, will be begun as soon as possible in order that water may be impounded in the reservoir next spring.

In connection with this work there have also been purchased by the same interests the Wayne Development Company and the electric companies operating in Honesdale and Hawley. During the last several months companies have been organized by Pennsylvania Power & Light Company interests in various townships between the Wallenpaupack power site and the present system of the Pennsylvania Power & Light Company so that transmission lines can be built and this additional territory served with electric power and light. It is contemplated that all of these companies, including those involved in the Wallenpaupack development, will in due course be absorbed.

This latter company and associated companies now operate in an extensive territory in eastern Pennsylvania and furnish electric power and light service in more than 140 communities, including the Allentown-Bethlehem industrial section, the anthracite coal district in and around Wilkes-Barre, Hazleton, Shenandoah, Shamokin and Mount Carmel, and the industrial and agricultural section along the Susquehanna River around Milton, Danville, Bloomsburg, Berwick, Sunbury and Williamsport.

Brief News Notes

English Road Electrifies.—The Southeastern Railway has accepted the offer of the Metropolitan Vickers Electrical Company to build 508 electric motors and control gear. It is the intention of the company to electrify its road within a radius of 15 miles in the suburban sections. The contract is probably the largest main line electrification ever placed in England.

Activity in Iowa.—The Iowa Electric Company of Cedar Rapids has purchased the plant of the Cascade Electric Light & Power Company and will supply the city of Cascade over a lin^ from Monticello. The Iowa Service Company has received permission to construct a $40,000 line from Red Oak to Villisca and the Southern Iowa Electric Company has been granted a franchise to serve Williamson.

St. Joseph Valley, Indiana, Booming.—With plans for the construction of a $16,000,000 electric power plant in the St. Joseph River valley near South Bend has come the announcement of plans for a large paper mill on a site near the power plant. The paper mill will be constructed by the Lasalle Paper Company and will cost $250,000. It is hailed as the first step in a St. Joseph Valley industrial boom which is expected to follow the establishment of the new power plant.

Progress of Houston Company.—The Houston (Tex.) Lighting & Power Company, which has, according to a report filed with the Public Service Commission, spent $2,632,000 on the first four-million-dollar unit of its new plant, besides nearly $2,000,000 for substations and improvements, expects that during the present year the company will be called upon to serve 200,000 customers, an increase of 5,000. The increased load in horsepower expected during the year is 10,000, which would bring the total to 121,260.

Westinghouse Scholarship Winners Announced.—The winners of the four Westinghouse War Memorial Scholarships for 1923 have been announced. They are: George Earl Doty of Pittsburgh, who will study electrical engineering at Carnegie Institute of Technology; Lawrence B. Biebel of Oakmont, Pa., who will take a course in electrical engineering at the University of Pittsburgh; Paul M. Williams of Wilkinsburgh, Pa., who will study electrical engineering at Carnegie Institute of Technology, and Lee P. Doyle of San Francisco, who will go to Ohio State University for a course in electrical engineering.

Alabama Power Takes Over Greenville Properties.—An agreement has been reached whereby the Alabama Power Company will take over the properties of the Greenville Electric Manufacturing Corporation of Greenville, Ala., provided permission is given by the Alabama Public Service Commission. President Thomas W. Martin of the Alabama Power Company was in Greenville recently, where he addressed a large delegation of business men from Greenville, Bolling, Foresthome, McKenzie, Georgiana, Luverne and other places. The cities are anxious for enlarged hydro-electric facilities and it is practically certain that the state utility board will grant the petition for the entrance of the Alabama Power Company.

San Francisco Body Opposes Retailing of Hetch-Hetchy Power.—The San Francisco Bureau of Governmental Research is opposing a plan for the city to acquire and dispose at retail of available power from the Hetch-Hetchy development, on the ground of insufficient city funds to make distribution pay. Interest and redemption charges, the bureau says, will total $2,800,000 for the next fiscal year and increase as idle bond funds available for reinvestment decrease. It also points out that the city is within $9,000,000 of its debt limit under official interpretation and its engineers estimate it will require $12,400,000 to carry the proposed Hetch-Hetchy program up to Dec. 31, 1924.

International Radio Rules.—For the purpose of considering the necessity of an international wireless convention, a meeting of telegraphic experts representing the British, French and Italian governments was held July 18 at the London office of the League of Nations. The experts agreed on the drafting of international regulations with regard to wireless communications and the proposed convening of an international wireless and telegraphic conference at the beginning of next year. Negotiations to this effect are already in progress between certain governments, and if these are not successful before Oct. 1 the experts again will meet to support the proposal emanating from the Italian government for calling such a conference under the League of Nations.

Hydro-Electric Investigation on Cumberland.—Extensive development of hydro-electric power on the Cumberland River by the Federal government in connection with its present program of rendering the stream more navigable may be the outcome of an investigation into the advisability of constructing three large power-navigation dams between Carthage and Burnside, Ky., to be started by Major Harold C. Fiske, United States district engineer. Orders to suspend operations on ten proposed sets of locks and dams between Lock No. 8, near Carthage, and Lock No. 21, at Burnside, pending a full investigation of the amount and market for hydro-electric power that can be developed on the Cumberland River in this area, were received and a conference was held with interested parties on July 23. The length of the river between Burnside and Carthage is approximately 170 miles and contains a fall of 114 ft.

Associations and Societies

Rural Electrification to Be Discussed by Agricultural Engineers.—The seventeenth annual meeting of the American Society of Agricultural Engineers will be held in Chicago on Nov. 8, 9 and 10. Among other things on the program, a special rural electrification session will be held on Friday, Nov. 9. It is expected that men from the central-station and agricultural fields will be heard at this session.

Special Lighting for I.E.S. Convention.—Detailed plans for the special features which will mark the 1923 convention of the Illuminating Engineering Society to be held at Lake George, N. Y., Sept. 24 to 28, are nearing completion. A battery of great searchlights forming a scintillator of moving colored beams will be located on the wharf in front of the Fort William Henry Hotel, convention headquarters. An elaborate program of fireworks is another feature, a high point of which will be the explosion of the largest bomb used in such displays. A jeweled emblem of the society, illuminated in various colors by floodlights, is another thing of interest on which the committee is working. The officers of the convention committee consist of Mr. Ryan as chairman, Henry W. Peck, vice-chairman, and H. E. Mahan, secretary. Announcement is expected to be made shortly on the program of business sessions and entertainments for the ladies.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

National Electrical Credit Association—Boston, Aug. 9-10. F. P. Vose, 1347 Marquette Bldg., Chicago.

New England Division, N. E. L. A.—Swampscott, Mass., Sept. 5-8. Miss O. A. Bursiel, 149 Tremont St., Boston.

Conference of Electrical Leagues.—Association Island, Sept. 16-19. Society for Electrical Development, 522 Fifth Ave., New York.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 17-19. O. A. Weller, 900 15th St., Denver.

Association of Edison Illuminating Companies—Dixville Notch, N. H., Sept. 17-21. P. S. Millar, 84th St. and East End Ave., New York.

Michigan Electric Light Association—Grand Rapids, Sept. 18-20. Herbert Silvester, Detroit Edison Co., Ann Arbor.

Illuminating Engineering Society—Lake George, N. Y., Sept. 24-28. S. G. Hibben, 29 West 39th St., New York.

Association of Iron and Steel Electrical Engineers—Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

Indiana Electric Light Association—French Lick Springs, Sept. 26-29. T. Donahue, Northern Indiana Gas & Electric Co., Lafayette, Ind.

American Electrochemical Society—Dayton, Ohio, Sept. 27-29. Colin G. Fink, Columbia University, New York.

American Institute of Electrical Engineers—Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

Association of Electragists International—Washington, Oct. 8-13. Farquson Johnson, 15 West 37th St., New York.

Commission Rulings

Amortization of Abandoned Property.—A sufficient amount was allowed by the Indiana Public Service Commission in fixing the operating requirements of the Martinsville Gas & Electric Company to cover long-time amortization of property rendered useless. The commission held that if any portion of the present standby property was not used and useful, it should be eliminated from the rate base, but the stockholders should not be arbitrarily deprived of any part of their equity.

Discontinuance of Free Service as Part Payment for Right-of-Way Approved.—One John L. Grimes complained to the Pennsylvania Public Service Commission that a contract provision for free gas as part of the consideration for a right-of-way had been disregarded by the Manufacturers' Light & Heat Company. This action by the company the commission found to be right, as under the Pennsylvania commission law free service was unlawful. The commission had no jurisdiction over the question of the right of the company to continue to occupy the right-of-way in question.

Obsolete Character of Equipment Reflected in Fixing Rates.—Finding a complaint against the Peekskill Lighting & Railroad Company justified as to the rates charged by it for gas but not as to the rates charged for electricity, the New York Public Service Commission had these observations to make on the condition of the plant and the necessity for amortizing depreciation as related to the fixing of a proper return: "The property may be 100 per cent efficient for operating purposes, but not be at anything like 100 per cent as representing what the securities outstanding were put out for or what the properties as shown by the balance sheet have cost the investors. The various buildings and apparatus which are used in the service of a public utility corporation have been designed to work and to last in their working as long as possible. The value of such items in any operating property is the value of the items to give their service, and if the power to give service is partly exhausted and the items are on the way to the point where severally they have to be discarded and replaced by new, there is a lessened power to serve in the plant represented at least by what the necessary replacement items not yet put in will cost. There is no reason why this partial exhaustion of capital or value should not be regarded in determining the value of the property and the rate of return which the consumer is to be called upon to pay to the investor for the use of the latter's property estimated upon the basis of the cost of that property less such depreciation. The consumer, however, should, in the rate that he pays for the service given by the properties, cover an amount which shall provide as part of the operating costs for the annual accruing depreciation in order not only to keep up the efficiency of the property as an operating property, but also to keep up the continued value of the property for service in the future. This value for service is what is really back of the securities which may be authorized to be issued by the company. In the present case, as the testimony shows, the properties, generally speaking, both gas and electric, are over twenty years of age, and of the electric properties the engines and generators are practically obsolete and would never be installed at the present time. They are used only as a standby plant for a few hours a year during the winter months."

Evidence of "Going Value" Requisite—Unexplained Increases in Operating Expenses.—In ordering a reduction in the gas rates of the Rutland Railway, Light & Power Company the Vermont Public Service Commission said the fact that a utility business is an active going business should be taken into consideration as evidence in determining present-day value, but no specific allowance should be made for going value when there is no evidence of early losses or cost of developing business and when, in addition, the property was purchased by the present operating company as a going concern. An enormous increase in operating expenses when no effort was being made to extend the business of the company and when, on account of a decline in prices, savings might reasonably have been looked for, and the fact that the results of the year's business showed a loss of sales and a great increase in the cost of carrying on the business, indicated poor management or a plan to curtail the business.

Powers of Michigan Commission.—Declaring its lack of power to abolish discrimination by an electric utility in favor of power consumers operating in a municipality where rates are limited by franchise, the Michigan Public Utilities Commission, in adjudicating a complaint brought against the Consumers' Power Company by the Alabastine Company, said it could neither increase the rates within the city to the rate charged a power consumer outside the city nor discriminate against other power customers outside the city limits by lowering the rate. "We think," said the commission, "it was the intention of the Legislature that this commission should not have the authority to set aside franchise rates, even if such rates are burdensome to the public or to the utility, unless, by mutual agreement between the municipality and the utility, the fixing of such rates should be submitted to it. We also believe that the only authority this commission has to remove discrimination is in territory where rates are fixed by this commission. Where there is discrimination in franchise territory, the courts will remove it."

Recent Court Decisions

What Constitutes Beginning of Construction Work Under Franchise?—In City of El Dorado vs. Citizens' Light & Power Company, the city sought to annul a franchise granted to the company, permitting it to furnish lighting and water service, alleging among other things that construction work had not been begun by the time specified on a sufficient scale to fulfill the contract terms. The Supreme Court of Arkansas found for the defendant, declaring that where a franchise to construct and operate a system for furnishing light and water in a city provided that grantees within three months begin active operations and work in laying water mains, erecting lines and poles and constructing sufficient power plant and wells, and if powers granted were not exercised within six months the franchise should become void, the franchise is treated as a unit, and its only requirement was that work should be substantially commenced on the construction of the facilities as a single unit within the named period. Poles having been erected and wires strung within the required time, the court held that the condition had been met. (250 S. W. 882.)*

Powers of New Hampshire Commission.—In dismissing an appeal taken by the Plymouth Electric Light Company against the New Hampshire Public Service Commission, the Supreme Court of New Hampshire denied the company's contention that the commission was prohibited by law from lowering the rate base within two years after a previous reduction. The court held also that the commission's expert's procedure in taking as a basis of unit values average costs during a three-year period and deducting therefrom depreciation as of the date of valuation did not show a failure to give due weight to present-day values; that the sale price of all the assets and good will of the company was not a fair criterion of value, it being but the estimate of an individual and based largely on the report of an accountant hired by the utility; that records indicating actual operating expenses, though valuable, were not conclusive evidence of the requirements of the company, and that, having failed to keep its accounts as required by statute, the company could not complain because the expenses of other companies were considered in arriving at a rate base. An allowance of $20,000 a year for operating expenses of a company with an established value of $35,000 was held not inadequate. (120 At. 689.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

J. H. Drake Made Vice-President Jersey Central P. & L.

John H. Drake has been appointed executive vice-president and general manager of the Jersey Central Power & Light Corporation, a consolidation of several utilities recently acquired by A. E. Fitkin & Company. Mr. Drake, who has had many years experience as a public utility manager, is in charge of the operation of all properties, with

J. H. DRAKE

headquarters at Morristown. Since 1912 he has been associated with the Morris & Somerset Electric Company, Morristown, N. J., one of the properties included in the consolidation, when he became its general manager. Six years later he was made vice-president and general manager, the office he occupied at the time of his recent appointment. He also served as vice-president and general manager of the Boonton (N. J.) Electric Company until it was merged into the Morris & Somerset Electric Company a year ago. Mr. Drake was formerly connected with the testing and foreign engineering departments of the General Electric Company. From 1903 to 1907 he was associated with Ford, Bacon & Davis and subsequently served as electrical engineer, in charge of overhead and underground distribution, both construction and maintenance, with the Chicago City Railway Company. For three years previous to his connection at Morristown he was superintendent of lighting of the Knoxville (Tenn.) Railway & Light Company.

F. F. Martin, auditor of the Louisville (Ky.) Gas & Electric Company, has been made treasurer of the company by the board of directors to fill the vacancy left by the resignation of T. B. Wilson. Mr. Martin will continue to perform the duties of auditor. He has been a member of the forces of H. M. Byllesby & Company since 1911, serving that organization on the Pacific Coast and subsequently in Chicago. He was transferred to Louisville in 1920.

C. S. Walters Succeeds Plummer in Asheville

C. S. Walters has been made vice-president and general manager of the Asheville (N. C.) Power & Light Company, succeeding Harry W. Plummer, whose resignation became effective on July 1. Mr. Plummer has been connected with the company for twenty-six years and is one of the best known electric power officials in the state. Mr. Walters' early business connections were with steam railway operation in both transportation and traffic departments, and in 1909 he went with the Oregon Electric Railway as general agent, with headquarters at Salem, Ore. In 1911 he was appointed vice-president and general manager of the Walla Walla Valley Railway, an electric interurban and street railway in the State of Washington. In 1913, in addition to his duties as vice-president and general manager of the electric railway, he was appointed district manager of the Pacific Power & Light Company's gas and electric properties in the Walla Walla Valley, which position he occupied until going to Asheville.

E. R. Wood, president of the Dominion Securities Corporation and vice-president of the Brazilian Traction, Light & Power Company, was recently elected a director of the Northern Canada Power Company, Timmins, Ont.

Van Horn Ely, president of the American Electric Power Company, sailed for Europe today. Mr. Ely will be away for several months and while abroad will study transportation and public utility problems in various European countries.

F. H. Farnum has been appointed manager of the securities department of the Central Maine Power Company, with headquarters at Augusta, succeeding Percy H. Whiting, who recently resigned to head the customer ownership division of the securities department of Henry L. Doherty & Company, New York. Mr. Farnum has been associated with the Central Maine company for about six months. He recently resigned from the United States Army with the rank of major, and during the World War served overseas as chief of staff of the Fortieth Division.

L. M. Klauber New President of Pacific Electrical Association

Lawrence M. Klauber, who was elected president of the Pacific Coast Electrical Association at the convention held recently in San Francisco, is general superintendent of the San Diego (Cal.) Consolidated Gas & Electric Company. Mr. Klauber has taken an active part in the affairs of the association he has been selected to head, and during the past year served as its first vice-president. Mr. Klauber's other activities in the National Electric Light Association have included membership on the electrical apparatus committee, chairmanship of the Pacific Coast engineering committee, the vice-chairmanship and chairmanship of the overhead systems committee and he is at pres-

L. M. KLAUBER

ent vice-chairman of the technical national section. He is also a member of the American Institute of Electrical Engineers. Mr. Klauber became associated with the San Diego Company in 1911 as new-business solicitor. Subsequently he served as engineer in charge of record department, superintendent of the electric department, assistant general superintendent, and in 1920 was promoted to be general superintendent, his present position. Mr. Klauber is a graduate of Stanford University and has been a frequent contributor to the technical press.

Harris J. Ryan, president of the American Institute of Electrical Engineers, is spending a few days in New York in connection with the institute's affairs and is expected to leave for the Pacific Coast Aug. 3.

Frank G. Baum, consulting engineer, who has been spending some time in the East in connection with superpower development for the United States, left Saturday, July 21, for the Pacific Coast for a two months' visit and business trip.

Wyndham S. Wallace has been placed in charge of the work of the department of commercial and industrial lighting recently organized by Charles H.

Tenney & Company, Boston, for the use of properties under the Tenney management and other clients. Mr. Wallace was formerly manager of lamp sales for the McKenney & Waterbury Company, Inc., electrical supply jobbers, Boston, and was previously on the staff of the East Boston Lamp Works of the General Electric Company.

Frank Howard Receives New Appointment

Frank Howard, general superintendent of the Ohio Power Company, was appointed assistant general manager on July 1 of the Ohio Power Company, the Ohio Service Company and the North Western Ohio Light Company, with offices at Canton, Ohio. Mr. Howard previous to his association with the Ohio Power Company as general superintendent acted in the same capacity for the Wheeling Electric Company and the eastern divisions of the Ohio Power Company, with headquarters at Wheeling, W. Va. Before 1913 he was located at Scranton, Pa., as superintendent of distribution for the Scranton Electric Company. All of these properties are subsidiaries of the American Gas & Electric Company of New York. Before his connection with these properties he was general superintendent and manager of the Standard Electric Light, Heat & Power Company, furnishing service to the territory located in the Lackawanna Valley between Pittston and Scranton, Pa.

John C. Moore, who has been with the Pennsylvania Power & Light Company as storekeeper for the past five years, has been promoted to the position of business manager.

W. E. Thumith of the Connecticut Power Company's Canaan office has been transferred to the Middletown division as sales manager, to succeed George H. Weatherbee, who recently resigned.

John S. Gadbois, formerly in the electric construction department of the Brooklyn Edison Company, is now engineer and office manager with the Lyme Electric Power Company, East Lyme, Conn.

Lucius Rossiter, formerly secretary and treasurer of the Terry Steam Turbine Company, Hartford, Conn., was elected vice-president and treasurer of the company at a recent meeting of the board of directors, and R. L. Thomsen, sales manager, was elected secretary. President D. H. Thomson was re-elected.

N. A. Wolcott, president and general manager of the Packard Electric Company, Warren, Ohio, was the guest of honor at a banquet given at Brookside Inn, Cortland, on Monday evening, July 16. On that day Mr. Wolcott completed twenty years of service with the Packard company and as an expression of appreciation a group of executives of the company and of his closest friends and business associates planned the surprise.

C. A. Sears Heads Iowa Section

C. A. Sears, manager of the Mississippi River Power Company, Keokuk, Iowa, was elected president of the Iowa Section of the National Electric Light Association at the annual meeting held recently at Mason City. Mr. Sears was born in Portland, Ore., and received his education and early training in the construction and operation of electric plants in that state. After serving in the transport service during the Spanish-American war, he became connected in 1901 with Stone & Webster at Seattle, Wash., where his work was principally in connection with water-power development and operation. These activities included the construction and operation of the Electron plant of the Seattle Electric Company, charge of construction of the Snoqualmie and White River (Washington) hydro-electric developments and construction of the Keokuk development. After the Keokuk plant of the Mississippi River Power Company was started in 1913, Mr. Sears filled the position of general superintendent until September, 1919, at which time he was made manager of the company. He has been active in the National Electric Light Association as a member of the electrical apparatus and hydraulic power committee and as a member of several committee of the Mid-West Division.

C. A. SEARS

A. L. Board, manager of the Lodi district of the Western States Gas & Electric Company for several years, has been promoted to the position of assistant superintendent of electric distribution. H. D. Miller of the Stockton office has succeeded Mr. Board at Lodi.

E. F. McKay, who is the acting manager of the Oklahoma Utilities Association, is a lawyer whose legal experience has been related directly to the utility industry. Following ten years with metropolitan daily newspapers and three years as owner and editor of a weekly and daily in Oklahoma, he was admitted to the bar. His legal experience includes ten years with the Oklahoma Corporation Commission, two years with the gas division of the Empire Companies at Bartlesville, Okla., and one year in private utility practice.

M. C. Wheyland, formerly lieutenant in the United States Navy, has recently joined the San Diego (Cal.) Consolidated Gas & Electric Company in the capacity of assistant superintendent of electric production.

J. W. Ward of Latrobe, Pa., formerly president and general manager of the Ward Tool & Forging Company, has been appointed general superintendent of the Porcelain Insulator Corporation at Lima, N. Y., having direct charge of all manufacturing operations.

B. L. Delack, formerly manufacturing engineer of the Erie Works of the General Electric Company, has been appointed assistant manager of the Erie Works. Mr. Delack became associated with the General Electric Company in the testing department at the Schenectady Works in 1903. Two years later he entered the railway motor engineering department at Schenectady, serving in various capacities until transferred to the Erie Works, Jan. 1, 1920, as manufacturing engineer in charge of motor manufacture, in which capacity he continued until the present.

William J. Merten, metallurgical engineer of the Westinghouse Electric and Manufacturing Company, has been appointed a member of the committee on heat treatment of carbon steel of the National Research Council and has also been elected chairman of the Pittsburgh Chapter of the American Society for Steel Treating. Both honors have been given to Mr. Merten because of his accomplishments in the metallurgical field, and are evidence of recognition of his work by metallurgists and metallurgical organizations. His appointment to the committee on heat treatment of carbon steel of the National Research Council, which is also known as the Henry M. Howe Committee, is for a period of three years, and his election as chairman of the Pittsburgh Chapter of the American Society for Steel Treating is for the ensuing year.

E. R. Treverton has recently rejoined the Henry L. Doherty & Company organization in the securities department and is handling the customers' ownership sales in the Ohio Public Service Company's property at Elyria, Ohio. Mr. Treverton was formerly associated with the Westinghouse Electric & Manufacturing Company at East Pittsburgh and assisted in designing and engineering for its various shops there a scientific industrial lighting system. For three years he was with the illuminating engineering department of the Westinghouse Lamp Company, later becoming chief engineer of that department. Prior to its incorporation in the ELECTRICAL WORLD he was managing editor of the *Lighting Journal,* New York, and took an important part in the work of the Illuminating Engineering Society's work. Since the war he has been engaged in the management of electrical properties in the South.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

The "Spoiled Child of the Industry"—I

A Discussion of the Character of the Electrical Contractor—How His Condition Has Been Improved in One Locality—How the Industry Has Benefited

By W. R. Herstein
Vice-President Wesco Supply Company, Memphis, Tenn.

Any discussion of the electrical contractor as a class must take into consideration the fact that the class is composed of an almost infinite variety of individuals. The average, or composite, personage has a character as many-sided and as full of whims and fancies as the proverbial spoiled child. I use the simile of the spoiled child purposely, because many circumstances conspire to make the contractor the spoiled child of the industry. His lack of adequate business preparation, frequently his lack of common school education, his incomplete scientific training, his inadequate financial resources, the intense and destructive competition to which he is subjected by his own class and those not of his own species, his undefined status in the industry—all have a tendency to convert his character into one of suspicion, resentfulness, perverseness and frequently hopelessness as to the future.

If I seem to draw an unpleasant picture of the average contractor, it is only because we must realize and acknowledge the adverse circumstances influencing his destiny if we sincerely desire to be of help to him. His place in the general picture cannot be vacated. His title to recognition cannot be denied. Production and distribution of electrical supplies are of no avail without a medium of their practical application.

Obstacles He Faces

The work of installation is the particular function of the contractor. It is quite true that in this he is frequently thwarted by amateur wiremen and would-be electricians, who appear on the payroll as janitors, engineers, building superintendents, and whatnots, as well as by responsible business men, employing irresponsible journeymen in the mistaken hope of cheapening the job and saving a few dollars, but in the main the contractor is the man upon whom we must depend for installation, and the degree of success which the industry is to meet in using him for this purpose and in training him to be both satisfied and prosperous depends upon our method of approach and our treatment of him after the contact has been established.

For this purpose a sympathetic understanding and appreciation of the contractor's problems are essential. I have already enumerated what I believe to be the fundamental obstacles lying in the pathway to success. Any assistance the jobber, the manufacturer and the central station may render him in overcoming these obstacles will result in an improvement of the contracting industry as a whole, and any assistance the jobber may give him as an individual will result in his becoming our customer and giving us his business, which, after all, is the thing we desire.

Tackling the Problem

When I embarked upon the electrical jobbing business, some twenty years ago, one of the facts which first became patent was that the electrical contractor was a poor sort of customer. A superficial investigation brought out the chief reasons for this, as already enumerated, lack of education, both business and scientific, and intensive competition, coupled with an almost complete lack of ambition beyond the earning of his daily bread. The first step, therefore, was obviously to implant ambition and hope in him, and then to secure his consent and co-operation in the direction of education for himself and his competitors. This was done, first, by heart to heart talks, then by words with groups, and finally by organization, pointing out always the unlimited possibilities of the industry, the fact that business men acquired a competency in other lines which were equally crowded and less exclusive, and that properly directed effort as individuals and as a body could not fail to bring adequate reward.

Not all the subjects worked upon were responsive to the treatment. Some of them were flat failures, as would have been the case in any other industry. The majority, however, when once convinced that their case was not hopeless, began using their brains, not only in their own immediate business, but for the benefit of the entire local situation, and thereafter the task of the devoted few who had instigated the evolution became greatly simplified.

Education Plus License

The first effort was toward self-education. The body endeavored to teach its members the first principles of profit-making; the use of common sense in business. The elimination of competition, though often discussed, was never attempted. Competition between the more intelligent and progressive contractors was by degrees established upon a sensible plane. Competition from the curbstone or carpet bag type was recognized as an evil which could not be entirely suppressed, but which was regulated to a fairly satisfactory extent by securing the enactment of a state statute requiring the examination, licensing and bonding of contractors, so that those who stood the test represented at least a class somewhat superior to the journeyman. As a by-product, the statute put a stop to the practice of journeymen deserting their employer today and going into competition with him tomorrow.

The good will of the dealer was furthered by assuming the leadership in an electrical league, by inducing the central station to assist in promotion campaigns and electric

shows, by planning and executing co-operative newspaper advertising ventures calculated to gain public consideration of the contractor and his functions, as contrasted with the competition offered by irresponsible or non-electrical concerns. Friendly feeling was increased by a conscientious effort to avoid direct competition between jobber and dealer, as well as assisting the dealer, whenever called for, upon specific jobs.

The Practical Result

These policies and practices, while applied intensively to our home town, were extended, in whatever degree might be possible, to outlying territory. It frequently happened that we were able to assist in organizing mutual welfare efforts in neighboring cities and in influencing competing jobbers to respect trade functions and rights as established by local customs. The ever-present idea was to bring about the recognition of a well-defined identity of interest between jobber and contractor, so that trade relations would not depend upon the presence of a salesman for each separate order, but that a daily and constant flow of orders would result from a feeling on the part of the dealer that he might rely upon the jobber's prices as being fair, the jobber's integrity dependable and the jobber's friendship of real advantage and tangible value.

The practical result of all this was not, of course, to secure all the available business in the territory, or even in our home town, but the expense of securing business was greatly lessened, or, to put it in another form, the same amount of effort secured a greatly increased volume of business. In addition, the moral effect upon the salesman was decidedly advantageous. A kindly reception from his customers increased his aggressiveness in looking after old and securing new accounts, and the friendly feeling existing between his house and the trade made him a happier and at the same time a more contented employee.

The result of my twenty years' experience in selling the contractor leads me to believe that he is not only the jobber's legitimate customer, but that he is the jobber's golden opportunity. Some of the obstacles to the further development of this opportunity I will outline in my succeeding paper.

The Status of the Electric Vehicle

Too Large a Proportion of Repeat Orders a Sign of Weakness—The Attitude of Central Station and Manufacturer

BY S. W. TRAWICK
New Orleans Public Service Company

THE electric vehicle has been manufactured and available for practical commercial purposes for nearly a quarter of a century. For the greater part of this period the growth of the industry has been comparatively slow and discouraging when compared to other types of motor vehicles having neither the theoretical nor practical advantages of the electric truck.

Considering the situation from a historical as well as a commercial standpoint, the progress made by the electric truck in the past three years, however, has been remarkable. It is needless to go into the data in elaboration of this statement, as the fact is outstanding and the figures are available from many sources.

However, to analyze the situation further, we may well take one item of these accumulated data as applied to the development in New York City for the year 1922. More than 86 per cent of electric truck sales in New York during 1922 were "repeat" orders.

Excess of Repeat Orders

The activity in New York City has been perhaps proportionately greater than that in any other section of the country, due to the very close and intelligent co-operation of central station, manufacturers and their representatives. This co-operative selling effort resulted in the development of new business to a gratifying extent, yet 86 per cent of the total sales were repeat orders, or, in general, orders secured from fleet owners already sold on the idea and actually using the electric truck. This record is one of the greatest compliments that could be paid the designers and builders of electric vehicles and batteries. It proves beyond a doubt that the theory and practical development of the electric vehicle is all and perhaps more than has been claimed by its sponsors. It is the last word in sales argument.

Upon studying the subject still more carefully it becomes apparent that the repeat orders (predicating the situation throughout the country upon the record quoted) are so far in excess of new business secured that there might be some weakness in the methods, arguments and logic now in accepted use for the widening and developing of the practically untouched field of possibilities.

Central-Station Attitude

Very noticeable activity has manifested itself recently as indicated by the interest taken by central stations all over the country, by the augmented and highly attractive advertising campaigns carried on by truck and battery manufacturers, by the detailed studies and carefully compiled data available through the National Electric Light Association and by the many splendidly written and widely distributed articles from the pens of enthusiasts of national repute. Close co-operation is said to exist among all the allied interests of the electric vehicle, but does it really exist as perfectly as we would like to believe?

The central station organizations, although vitally interested in the filling of the so-called "night valley" and theoretically in favor of the electric vehicle, strange as it may seem, occasionally assume a slightly antagonistic attitude, and in some cases are not willing even to consider the electric truck as applied to their own use. The greater portion of this feeling results from lack of knowledge, misinformation, lack of interest and the mistaken idea that excessive speed capacity is an essential in their hauling units.

Further, no provision is made for the handling of the units of the small fleet or single truck owner. The electric vehicle representative of the central station (if it has progressed so far as to have a representative) is usually classed as a sort of supernumerary solicitor and is given little or no support and backing. The company representative takes what figures he can collect and, by much talk and dwelling upon the phenomenal success of the electric truck in other localities, is supposed to induce the rather dubious public to invest large sums of money in what to it is an experiment, no doubt a success in other localities and under other conditions, but very possibly not exactly fitted for its own particular use.

The average truck and battery representatives feel strongly that

the central-station organization is not giving them full co-operation. They feel that the usual representative of the utilities is not so well equipped as they themselves for the merchandising of their product. And at times they somewhat resent the active entry of this representative in the field of their particular and pet prospects.

The manufacturer of electric trucks, well satisfied with the recent exceptional increase in the demand for his output and operating near, if not up to, his production capacity, is more than half willing to let the repeat orders of enthusiastic owners constitute the bulk of his business. He is inherently slow in deviating, even in the smallest degree, from the established path of fixed procedure, no matter what logic, pressing necessity or prospective development is placed before him.

He expects the central station organization, his own representatives and satisfied users of his product to develop the field and clear the path of all obstacles, then build to the demand.

The One Best Argument

There have been vast amounts of money expended in talk, print and propaganda, and volumes of most attractive and accurate facts spread broadcast, but no provision has ever been made, except in isolated cases, for the most successful, practical and unbeatable argument in favor of the electric truck; that is, the practical demonstration of the unit to the prospect over a reasonably long period, in his own work and under his own observation—all at a reasonable or nominal cost to him.

The truck in operation for the prospect will in practically every case sell itself. In witness thereto, again consider the fact that 86 per cent of all sales in New York City during the year 1922 were "repeat" orders.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

ALTHOUGH much activity is seen in the appliance and conduit markets the general situation is of little feature. Sales by the jobbers are said to be running close to ordinary requirements of any midsummer period of the last two years. However, the trade is optimistic and is preparing for the fall months, when a great deal of construction will be completed or nearly completed.

In the New York territory prices of sockets dropped approximately 9½ per cent during the week. Wire prices are slightly softer, with armored cable prices remaining quite firm after the important reduction of two weeks ago.

Porcelain Scarcity Hampers High-Tension Equipment Production

HIGH-TENSION equipment sales are now at a stage where production overshadows the previous main issue of order taking. In fact, this condition has been in existence for some time since all manufacturers felt the renewed response in the industry which started in the fall of last year.

But now production is seriously hampered by the slowness of porcelain arrivals from the insulator companies. One manufacturer declared that his business could absorb twice as much porcelain as he was now receiving. The situation in that keynote industry appears to be contingent on the old economic supply and demand law where the demand far exceeds the supply. Sentiment among the high-tension people regarding these delays appears to indicate that this situation might well lead to the formation of other producers of porcelain because of the present limited capacity. No difficulty is experienced in procuring other raw materials, such as copper and steel. So deliveries which formerly took a week are now being held up several weeks or more. Deliveries have become a function of porcelain receipts. However, while this situation is none too good, it is no worse than in other lines of business where conditions are more acute.

In order to relieve as much of this congestion as possible, the manufacturers are strongly urging the sale of their standardized equipment in place of special designs; they are doing this in their effort to lessen the time utilities must wait their turn in obtaining special equipment. Naturally with production standardized on certain classes of equipment, which has been developed through years of experience, any variation in design must necessarily await its turn because it conflicts with the regular process of production.

The distribution of the present active demand is very widespread throughout the country since central-station power developments are practically uniform all over. But particular activity is occurring in New England, along the Atlantic Coast and in the Middle Western territory. Of the industrials, the cement mills, the coal mines and the steel mills appear to be the most active from the volume of business received. As to the type of equipment ordered, the manufacturers declare that about 70 per cent of their sales are for outdoor use. And of this number about 50 per cent has a rating of 33,000 volts or over. Regarding the trend toward higher voltages, the rate of development can be taken from a thought expressed by a manufacturer of liquid fuses. With each issuance of his catalog, he has been required to develop and manufacture still higher voltage fuses so that his present highest capacities are rated at 132,000 volts. This high-voltage trend in fuses is also paralleled in the design of other protective equipment which includes lighting arresters, busbar supports and disconnecting switches.

Business for all the companies is traveling on a higher plane than existed last year. For several firms, the orders arriving this spring have been the greatest in the history of those organizations. One concern is operating 100 per cent better than for the same period in 1922. Prices remain firm around the level established by the increases announced last May, and indications are that the drive for further quantity production will absorb the future increases in raw materials before becoming reflected in higher prices for high-tension equipment.

Issues Federal Specifications for Purchase of Snap Switches

THE Federal Specifications Board has just issued Standard Specifications No. 62 for the use of departments and independent establishments of the government in the purchase of snap switches. The latest date on which this specification shall become mandatory is Sept. 15, 1923. The specification may be put into effect, however, at an earlier date if desired.

According to the specifications by the government all snap switches must be constructed so that the current-carrying parts shall be mounted on noncombustible, non-absorptive, insulating bases, such as slate or porcelain, and the holes for supporting screws shall be countersunk not less than ⅛ in. There shall in no case be less than $\frac{3}{16}$ in. space between supporting screws and current carrying parts.

Included in the specifications are the following points of interest:

In switches designed only for use on heating devices and which have special bases such that they are not adapted for wall mounting or other general uses, the sealing compound may be omitted provided live parts are countersunk ⅛ in. and screws and nuts are staked or otherwise reliably prevented from loosening.

In surface snap switches used as integral parts of electric heaters, the sealing compound may be omitted provided live parts are countersunk, ⅛ in. on under side of the base, nuts and screws are staked or otherwise reliably prevented from loosening, and the requirement as to countersinking is complied with.

For sealing nuts or screw heads in surfaces which upon installation of the switch will be immediately in contact with the sur-

face upon which the switch is mounted, the countersinking shall be such that there will be a full ⅛ in. of sealing over the live part and below the surface of the base. For other locations 1/16 in. will be accepted provided the sealing is reliably held in place.

Sealing compounds shall comply with the specifications of Underwriters Laboratories for materials of this class.

All switches shall have ample metal for stiffness and to prevent rise in temperature of any part over 54 deg. F. (30 deg. C.) at full load. The whole device shall be mechanically well made throughout.

Iron or steel, plain or plated, shall not be used for parts which are depended upon to carry current or for movable wire-binding screws or nuts, or except where soldering lugs are used, for any wire-binding screws or nuts.

Insulating materials used for buttons and handles shall retain their insulating and mechanical strength when subject to continued use, and shall not soften at a temperature of 150 deg. F. (65 deg. C.).

Boiler Deliveries Now Running at Five and Six Months

OF GREAT importance in the boiler manufacturing industry is the improvement of raw materials deliveries to the plants in both the Eastern and Middle Western territories. Four months ago deliveries of raw materials were running at the rate of three to four months from the Ohio and Pennsylvania mills. Now those same deliveries can be had in from five to six weeks.

With this improvement of raw material deliveries to the boiler manufacturers has come deliveries of boilers and economizers at the more favorable period of between five and six months in place of deliveries of between seven and eight months, which prevailed during the slower production schedules of the steel mills.

Business by boiler and economizer makers is running 70 per cent ahead of the first half year of 1922. No near advances or decreases in prices are expected by the leading manufacturers. They are of the opinion that business has hit its normal stride and will continue so for at least six months. The price of $2.50 for steel plate prevails, and these makers do not believe that either possible higher labor costs at the steel mills or increased consumption of steel by other industries will cause much marking up or down on steel plate prices during the remaining months of 1923.

The three-shift eight-hour a day plan which has been put into effect in some of the independent steel mills of Ohio has not taken any labor from the boiler plants in that state due to the fact that the boiler manufacturers are paying unskilled labor at the much higher rate of 50 cents an hour.

According to an important maker of economizers the use of economizers in this country has passed through what might be considered a cycle, being in common use a number of years ago, then for a period falling rather into disuse, and at the present again coming into greater favor. While economizer installations have never been as general in this as in other countries, this country appears to be approaching European practice more nearly, and it is definitely stated by this firm that economizers are receiving today more favorable consideration than ever.

Flexible Armored Cable Reduced 12 per Cent in Chicago

ELECTRICAL jobbers in Chicago say that business is continuing at a normal rate. An important reduction in flexible armored cable was announced this week, when the price on No. 14 single-armored was reduced to $39 per 1,000 ft., Pittsburgh, a reduction of about 12 per cent over the previous prices. This puts the conductor back at the price quoted in January of this year. While there has been an advance in steel prices the decline in the copper market no doubt accounts for this reduction. It is expected that the price will advance again later on in the summer or early fall.

No further reduction in rubber-covered code wire is announced, although one manufacturer is offering wire at about 20 per cent off the prices quoted prior to July 1. Also, lead-covered cable is being quoted at prices in effect last February. Certain types of motors advanced 10 per cent again.

High-tension equipment sales are still keeping up at a fair rate; one manufacturer's sales are averaging 100 per cent higher this year than last. Pole line hardware demand remains active.

The conduit situation is the same with firm prices and long delivery. It is not expected that a price reduction will be announced, as merchant pipe prices remain firm and the pipe is hard to get in all sizes. Watchful waiting seems to be the password of the electrical trade in Chicago, as it appears that they are holding off placing commitments. Building activity still continues high, although labor shortage is retarding the jobber's business.

New England Stocks Being Kept to Present Requirements

MIDSUMMER quiet with a disposition to hold new business until later in the season characterizes New England wholesaling trade as the month closes. Stocks are being carefully kept close to present requirements and the absence of heavy inventories is one of the chief grounds for expecting an active fall volume of sales. Prices are steady this week.

Appliance sales are very active and in some quarters the demand for electric ranges is outrunning the supply. Industrial plant improvement work is absorbing considerable motor and control equipment at this season. Retail trade in general is good in this section.

Cotton textile mills are curtailing considerably and at Holyoke, Mass., a strike of firemen has thrown 4,000 employees out of work in twenty-seven paper mills. Building operations continue in good volume.

Americans Overcoming Difficulties in English Market

SOME exceedingly interesting pioneer work is being done in England at present by a number of American manufacturers of large household electrical appliances. Fundamentally the market offers the same opportunities for development that it does in this country. Electric vacuum cleaners, clothes washers and ironing machines supply a need that is as universal in the British Isles as in America, but the process of popular education and market development has not been carried as far nor will it be as easy to work up.

One difficult factor in the selling of the larger appliances in England is the increased cost which is entailed in export selling. A washing machine that sells in this country for $150, for instance, will have to be sold in England for more than $200 in order to cover ocean freight and other incidental expenses. Both steamship and British railroad freight, however, will probably be reduced somewhat when it is possible to establish a specific classification on these goods. At present an electric clothes washer is classified at the same rate as an electric motor, because it embodies a motor in its equipment. The American exporter must ship his motors separately and assemble the machines in England or he must pay the high rate. An effort is being made, however, to establish a more favorable classification, and this has already been accomplished in some individual cases. In one instance the freight rate from London to Glasgow has been reduced from 40s. to 19s. by reclassification.

Another difficulty lies in the multiplicity of voltages, which are encountered in English communities. There are seventeen voltages in London alone, with which the manufacturer of domestic appliances must contend. However, progress is being made toward standardization and already 75 per cent of the utilities are furnishing energy at 250 volt, 50 cycles, alternating current, or 220 volts direct current. The trend is toward the adoption of this as a general standard.

As a result of all this, these Ameri-

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.0337	$0.034	$0.0276
Cold finished shafting, per lb.	0.0428	0.042	0.0355
Brass rods, per lb.	0.1825	0.1850	0.1650
Solder (half and half), per lb.	0.276	0.2862	0.21
Cotton waste, per lb.	0.1231	0.1231	0.101
Washers, cast iron (½-in.), per 100 lb.	4.66	4.66	3.83
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.08	3.08	3.11
Machine oil, per gal.	0.349	0.349	0.36
Belting, leather, medium, off list	37%	42½%	46⅓%
Machine bolts, up to 1-in. x 30-in., off list	44½%	44½%	53⅓%

can electrical household appliances are salable practically only to people of means, and it is not possible at the present time to develop any considerable market among the middle class homes which must eventually provide the greater part of the demand. American manufacturers are therefore concentrating on the English country home and the English town house, both of which today are very inadequately supplied with laundry facilities. For the most part there are no central heating plants, and in the country the laundry work is usually done in outside laundry buildings where the water is heated by stoves. There are also very few stationary washtubs in England, and in a great many cases two washing machines are being sold, one for the washing and one for the rinsing, and the machine used for washing is equipped with a gas heater, so that it can heat its own water.

Thinks Mexico Will Be America's Best Foreign Market

MEXICO will soon be our best customer if conditions there continue to improve as rapidly as they have recently been doing, according to C. V. Allen, manager for Mexico of the Westinghouse Electric International Company, who has returned to the United States on a short business trip.

Mr. Allen is enthusiastic about the future of Mexico. He says the climate is ideal, the people are intelligent and industrious and there are enormous natural stores of valuable minerals. The present government, moreover, is doing its best to get the country straightened out politically and Mexico is now in better condition than it has been since the revolution. The railroads, most of which are operated by the government, are in good condition and cover the country very thoroughly. The government telegraph and postal services also can be depended upon by business men just as much as in the United States. Already the number of industries has increased considerably and all that is needed to make Mexico one of the most productive countries in the world is foreign capital.

One of the main hindrances to progress in Mexico in the past, said Mr. Allen, was the ignorance of most of the poorer Indian class, which makes up about 12,000,000 of the 14,000,000 population of the country. The present government is doing its best to overcome this evil and is spending a great deal of money on popular education. Already the good effects of this policy can be seen, for the younger generations are learning to read and write.

In future years machinery will be the largest import from the foreign countries, for there are practically no machinery manufacturers in Mexico, and with the development of industry, much machinery will be needed. Already there are a number of large textile mills, some owned by foreigners and some by natives, and shoes are, of late, being manufactured in large quantities. With the development of mines and oil fields, other imports of machinery will be needed. To America, rather than to Europe, Mexico will naturally turn for its imports, because the nearness makes prompt delivery possible and reduces the expense of transportation. This is not true of many of the countries of South America, which are actually nearer to Europe by boat than to the United States. For the machinery trade, this proximity is of particular importance; the necessity of securing repair parts with the least possible delay is a great advantage that American machinery has over competitors in European countries.

Betterment Noticed in Demand for Rigid Conduit

A DECIDED increase in the demand for steel conduit was reported in that market last week. With the near completion of many new apartment houses and office buildings in the large cities, the largest volume of the last fifteen months is now on the move, according to the manufacturers and jobbers of the East and Middle West.

Prices continue firm at the mills, although production is continuing at a high rate. Producers estimate that the elimination of the twelve-hour day will add over $4 a ton to average costs of manufacturing pipe, and as the profit margin is not large at current levels, some take the attitude that it would be better to stop production than cut prices so soon before the largest business is expected from jobbers.

Jobbers, however, feel that the demand will soon grow to unusual proportions and that their now well-proportioned stocks will soon be consumed on the rising market. Three jobbers in the Eastern market expect higher prices will come within the next two weeks. Black conduit, ½-in., per 1,000 ft., is being quoted at $61.10, and white at $66.16. One inch is at $112.06 for the black and at $122.19 for the galvanized. One-inch black elbows are at $19.26 and white $21.46. One-inch black couplings are at $10.65 and white $11.42.

Armored Conductor Drops 20 per Cent in San Francisco

BUILDING construction in the San Francisco territory is showing a seasonable lull. There has been no depression, but a recent period of caution has its compensation in the fact that it prevented the tendency to pyramid orders.

Armored conductor and all cords have dropped about 20 per cent. Rubber-covered wire has declined about 10 per cent. The Christmas tree outfit season is beginning, with lower prices, improved quality and practical clearance of all stocks carried over. Conduit is again showing shortages, particularly of larger sizes, in face of large inquiries. Schedule material prices are still firm despite a 10 per cent drop in fuse plugs and cartridge cutouts.

The Metal Market

A CHEERFUL and optimistic tone prevails in the metal markets although buying during the last week has not been at all active by the electrical interests. On the whole sales are better than those of the week before.

Production of copper this month is expected to show a decline from that of June owing to the shutdown of some of the smaller producers in this country. Several of the smaller properties have shut down since the cessation of operations by the North Butte Mining Company because of lower prices for the metal and increasing costs of operation. Some small producers which resumed operations recently have been holding on, but it is believed that within a short time they will have again suspended operations which are resulting in net losses due to high costs.

Producers are surprised that buying of substantial tonnage of copper could have been deferred so long, but they are not yet much alarmed about it; they feel that consumers are allowing their stocks to run to the lowest possible point and that September requirements remain to be ordered. statistically copper is in excellent position, and as the producers seem financially able to carry what copper they have on hand for a few weeks longer, no panic to market copper at any price that it will bring is expected. The metal is going well into consumption, most rolling and brass mills operating at as close to capacity as labor supplies will allow.

During the week, producers have been encouraged by increased export business, though the total volume cannot yet be called large. Both Germany and the Orient have entered the market again, and further supplies have been purchased for Scandinavian consumption.

Finished steel prices remain remarkably stable and inasmuch as prices have held so long during a comparatively dull time the buyers are not so confident that recessions will take place, particularly since the fall buying movement cannot be many weeks off.

NEW YORK METAL MARKET PRICES

	July 17, 1923 Cents per Pound	July 24, 1923 Cents per Pound
Copper, electrolytic.	14.75	14.75
Lead, Am.S.& R.price	6.00	6.00
Antimony	6.75	6.75
Nickel, ingot	27.00 to 32.00	27.00 to 32.00
Zinc, spot	5.90	6.10
Tin, Straits	38.08	38.08
Aluminum, 98 to 99 per cent	26.00 to 27.00	26.00 to 27.00

Platinum Consumption by Electrical Manufacturers.—According to reports just issued, electrical companies consumed 24,988 troy ounces of platinum in 1922. In 1921 these manufacturers used up 20,574 troy ounces. In both years the electrical industry was second in consumption to the jewelry manufacturing industry, which used 108,527 ounces in 1922 and 101,258 in 1921.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Babcock & Wilcox Company Sells Its Sixty-first Economizer

When a sales bulletin on "Wrought Steel Economizers" by the Babcock & Wilcox Company, New York City, was distributed in February, 1921, it gave a list of sixteen orders for such equipment taken up to that date. Last week the company's order books showed a list for a total of sixty-one economizers.

According to A. G. Hall, vice-president of the company, this signal progress in introducing these economizers is gratifying, particularly in view of the relatively small proportion of "Babcock & Wilcox" boiler jobs with which such equipment can be installed advantageously. So far as the company knows, only two installations of high-pressure economizers have been ordered from other manufacturers for use with "B.&W." boilers.

General Electric Transfers Gear Manufacturing to River Works

The manufacture of turbine reduction and ship propulsion gears heretofore carried on at the Erie Works of the General Electric Company is being transferred to the River Works, West Lynn, and will be consolidated there with the manufacture of other metal gears and pinions.

The design engineering on all metal gears and pinions, except those used with railway motors, will be under the direction of A. A. Ross, whose headquarters will be transferred from Schenectady to the River Works.

Form New Tape Firm in St. Louis

A new company has been formed to operate the friction and rubber insulating tape department of the former St. Louis Rubber Cement Company, located in St. Louis. This company is called the Superior Insulating Tape Company and is specializing in high grades of electrical friction and rubber tape. The officers of the new company are: J. A. Schweig, president; E. Olsen, vice-president; J. Miller, secretary, and A. M. Freund, treasurer.

Russell Secures More Space to Manufacture New Iron

The Russell Electric Company, manufacturer of electrical appliances, 340 West Huron Street, Chicago, has recently rented the large basement in the building it occupies and has moved all of its heavy machinery for manufacturing purposes into those quarters, thus giving it 10,000 sq.ft. of floor space for the assembling of its new flatiron.

Officials of the company state this new flatiron has met with exceptional favor from the trade and predict that sales will be limited only by its production facilities.

Edison Electric Appliance Sales Show Large Increases

Electric range sales by the Edison Electric Appliance Company, Inc., Chicago, are exceeding those for the two springs months, April and May, which was a period when range sales were reported as 75 per cent above the corresponding period of 1922. The outlook for increased business by this company in October and November is very good due to the fact that a great deal of residential construction will have been finished at that time.

In keeping with the growing sales of ranges, the general market for heating appliances is increasing by leaps and bounds. It is said that this year will be the largest in the company's history. According to officials of the company, in the first quarter of 1923 sales to jobbers in the Chicago territory increased 53 per cent over the same period of 1922. Production of irons is at the rate of one iron every six seconds, and ranges at the rate of one every four minutes.

Westinghouse Bookings and Billings Gain $15,530,205

Official bookings and billings of the Westinghouse Electric & Manufacturing Company for the first three months of the fiscal year ended June 30 showed an increase over the corresponding period of 1922 of $15,530,205 in new orders taken and advance of $9,381,177 in goods billed out.

The following tabulation shows bookings and billings for the quarter ended June 30, 1923, and compares with that quarter of 1922:

	Quarter Ended June 30— 1923	1922	Inc.
Bookings	$47,649,129	$32,118,924	$15,530,205
Billings..	35,094,884	25,713,707	9,381,177

Bookings for the quarter ended March 31, amounting to $45,741,000, showed an increase of approximately 51 per cent over the corresponding period of the year previous, while billings of $39,537,000 compared with $22,712,700. Bookings for the first three weeks of July are over $5,000,000 in excess of those of the first three weeks of June. Unfilled orders of Westinghouse Electric are approximately $12,500,000 greater than at the beginning of the fiscal year.

The Hirsch Brothers Machinery Company, El Paso, Tex., has just completed its new warehouse and machine shops and is seeking further connections with manufacturers of all kinds of machinery to represent it in western Texas, Arizona, New Mexico and the northern part of Mexico. The company is particularly interested in electrical equipment, boilers, electric pumps, etc.

The Vaughan Electric Company, 4220 University Way, Seattle, is planning the installation of a plant in a building at 4240 University Way for the manufacture of electric fixtures and equipment. The company recently acquired the property and business of the M.&M. Electric Company, Seattle, and is concluding negotiations for the purchase of the plant and equipment of the Sterling Electric Company, Tacoma, Wash. It is purposed to remove some of the latter machinery to Seattle.

The Niehoff Corporation, recently organized, has leased a plant at 224 West Illinois Street, 40 ft. x 100 ft., and will manufacture magnetizers, coil springs, bridges, platinum and tungsten contacts. Officers are P. G. Niehoff, president; Wilson Compton, vice-president, and E. A. Harrington, secretary and treasurer.

The Jones, MacNeal & Camp Manufacturing Company, Otis Building, Chicago, recently incorporated, has a plant at Warsaw, Ind., and will manufacture electric steel drills and portable drill stands. Officers are Kenneth MacNeal, president, and G. W. Wilson, vice-president.

The Electrolock Manufacturing Company, Inc., Grove and Washington Streets, Vicksburg, Miss., recently organized, will operate an assembling plant for the manufacture of special locking devices. It has contracted with Gustave Lidseen, 832 South Central Avenue, Chicago, general machinist, for the production of dies and steel parts, and with the Cutler-Hammer Manufacturing Company, Milwaukee, for the manufacture of electrical parts. Later it is proposed to establish a plant for parts production. W. Hemingway, Jr., heads the company.

The Line Material Company, New York City, announces the establishment of its New England warehouse, 128 Sidney Street, Cambridge, Mass.

The Republic Lamp & Fixture Works, Inc., 732 Daly Street, Philadelphia, manufacturers of lighting fixtures, has leased two floors in the building at 610 Arch Street for extensions.

The Dillon Electric Company, Canton, Ohio, has completed a two-story and basement addition, 70 ft. x 105 ft., which will double the floor space.

The Canadian Westinghouse Company, Hamilton, Ont., has awarded a general contract for the erection of a $200,000 addition to its plant. This will be a part of the West Hamilton plant and will be the first of a series of buildings to be erected at a total cost of $1,500,000.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Australia (No. 7,269) for electrical household appliances, glassware, bells and buzzers and motors for household and manufacturing purposes.

Purchase and agency is desired in Vienna, Austria (No. 7,227), for electrical household appliances, such as vacuum cleaners, etc.

Purchase is desired in Algiers, Algeria (No. 7,272), for electric motors, and radio equipment.

An agency is desired in Reval, Esthonia (No. 7,226), for radio equipment.

An agency is desired in Glasgow, Scotland (No. 7,220), for electrical specialties.

Purchase is desired in Asuncion, Paraguay (No. 7,212), for electric wiring supplies and fixtures.

Purchase and agency is desired in Donnybrook, Ireland (No. 7,213), for wireless receiving sets.

Purchase and agency is desired in Habana, Cuba (No. 7,242), for refrigeration plants.

An agency is desired in Adelaide, Australia (No. 7,250), for refrigeration plants for domestic use.

ELECTRIC METERS FOR SYDNEY, AUSTRALIA.—Tenders will be received by the City Council, Sidney, New South Wales, Australia, until Sept. 24 for 1,775 direct-current meters (5 to 150 amp.), and 35,200 single-phase meters (5 to 50 amp.)

PROPOSED POWER PLANT IN ARGENTINA.—Permission has been granted to Señor Mayorino Rossi to construct and operate an electric power plant at Altos de Chiplón, in the Department of San Justo, Argentina.

ELECTRIFICATION OF FRENCH RAILROADS.—The first section of the program of the electrification of the Orleans and Midi Railroads, according to *Commerce Reports*, has been approved by the Minister of Public Works. The electrification program for the Midi during the years 1923 to 1927 involves 1,576 km. and includes in addition to the line from Toulouse to Dax, with branches to the Pyrenees, work on which is well advanced, the line from Bordeaux to Irun, with various branches, and the further extension of a number of short Pyrenees lines. The first division of the program for the electrification of the Orleans Railroad involves the electrification of the lines from Paris to Brive, with various side lines, totaling 916 kw.

PROPOSED WATER-POWER DEVELOPMENT IN INDO-CHINA.—Applications have been made by two companies, *Commerce Reports* states, for permission to utilize the falls of Song Nam in the Tonkin mining region for power purposes in connection with tin and zinc reduction plants. It is proposed to utilize 14,000 hp. in an electro-metallurgical plant.

New Apparatus and Publications

TURBINE.—The B. F. Sturtevant Company, Hyde Park, Boston, is distributing catalog No. 311, covering its type 12 turbine, which is particularly adapted for direct connection to blowers, fans, electric generators and centrifugal pumps.

CONVEYOR FEED STOKER.—"Burning Pocahontas Coal on a Conveyor Feed Stoker" is the title of a bulletin issued by the Laclede-Christy Company, St. Louis, in which it describes results obtained with the "Stowe" stoker at the plant of the Gloucester (Mass.) Electric Company.

LIGHTING FIXTURE.—A new fixture designed especially for kitchen lighting, type "STFD," has been developed by the Edwin F. Guth Company, St. Louis. It is supplied both with and without pull switch.

RADIO APPARATUS.—The Metropolitan-Vickers Electrical Company, Ltd., Trafford Park, Manchester, England, is distributing supply leaflets Nos. 640/2 and 660/1, describing its "Cosmos" crystal set amplifier and "Cosmos" radiophone protective device respectively.

BATTERY CHARGER. — The Holmes Electrical Manufacturing Company, 3,229 Sheffield Avenue, Chicago, has placed on the market a mechanical rectifier for charging automobile and radio storage batteries.

ELECTRIC STOVE. — The Apex Electrical Manufacturing Company, Cleveland, is now manufacturing a lamp-socket electric stove, known as the "Rotarex Kook-Rite," formerly made by the Electrical Appliances, Inc., Muncie, Ind.

SOCKET.—A socket "Turn-Nob," for use on lamps and portables which can be installed where a socket is not required has been brought out by the E. H. Freeman Electric Company, 10 Prince Street, Trenton, N. J.

FIREBRICK MORTAR. — The leading article in the June issue of the *Laclede-Christy Bulletin*, entitled "Lay Laclede Firebrick with Laclede 'Mortarmix'," calls attention to the use of "Mortarmix" for laying firebrick and gives its advantages over ordinary raw-clay batter.

WASHING MACHINE. — An electric washing machine, "Everybody's," made entirely of metal with the exception of the wringer, has been placed on the market by the Vermont Farm Machine Company, Bellows Falls, Vt.

COIL SHAPER.—An electric coil-duplicating machine has been brought out by W. P. Hunsdorf & Company, 720 Frankfort Avenue, Cleveland.

OIL DEHYDRATOR.—A centrifugal dehydrator permanently attached to the transformer tank has been brought out by the Industrial Products Company, Goshen, Ind.

LIGHTING PLANT. — The Universal Products Company, Oshkosh, Wis., has placed on the market a lighting plant, "Upco," for either 110 watts or 32 watts and a generating capacity of 350 watts.

ELECTRIC BOTTLE TESTER.—A bottle tester which can be driven by hand or motor has been developed by D. H. Burrell & Company, Little Falls, N. Y.

ELECTRIC DISHWASHER.—The Walker Dishwasher Corporation, Syracuse, N. Y., has placed on the market an improved model of the "Walker" dishwasher.

PIPE-THAWING MACHINE.—An electric pipe-thawing machine, equipped with fuses and signal lights for indicating when the machine is operating, has been placed on the market by the Domestc Supplies & Phonograph Company, 314 Spruce Street, Scranton, Pa.

BOX-BAR AND SWITCH SUPPORT.—The Electrical Equipment & Manufacturing Company, 1139 Champlain Street, Toledo, Ohio, has developed a box-bar and switch support "Lead-All."

CONNECTOR AND ANGLE ADAPTERS.—The Rattan Manufacturing Company, New Haven, Conn., has placed on the market a panel-box connector and a 90-deg. angle adapter.

MOTOR-GENERATOR SET.—A motor-generator set for charging storage batteries under the constant-potential system has been placed on the market by Roth Brothers & Company, 1401 West Adams Street, Chicago.

TELEPHONE BATTERY SETS.—Stanley & Patterson, Inc., 250 West Street, New York City, has placed on the market a line of battery sets for the operation of telephone systems.

ELECTRIC CORN POPPER.—The Electrovend Company, Cleveland, has developed an electric corn popper, "Marvel," in which the entire process of popping and separating the corn is exhibited under glass.

ELECTRIC FLASHER. — An automatic electric flasher, "Bossard Flashmore," designed for railway grade-crossing and highway signals, has been placed on the market by the Bossard Railway Signal Corporation, Troy, N. Y.

New Incorporations

THE OAKBORO (N. C.) POWER & LIGHT COMPANY has been chartered with a capital stock of $50,000 by J. A. Groves, E. E. Snuggs and W. C. Heath.

THE WEYBRIDGE (VT.) LIGHT & POWER COMPANY has been incorporated by B. O. Wales, E. L. Wright, C. C. Shaw, W. T. Sturtevant, H. A. Bois and C. W. Baker of Middleberry. The company is capitalized at $5,000 and proposes to furnish electricity in Weybridge and adjacent towns.

THE WARM SPRINGS POWER COMPANY, Blackfoot, Idaho, has been incorporated with a capital stock of $750,000 to construct and operate power plants and to generate and distribute electricity.

Construction News

Projects, Plans, Bids and Contracts Contemplated or Under Way

New England States

KEENE, N. H.—Work has begun by the Keene Gas & Electric Company on the construction of a hydroelectric plant at Marlboro, to cost about $300,000. The work includes a power station and reservoir. L. H. Shattuck, Inc., Manchester, is contractor.

PLAISTOW, N. H.—General contract has been awarded by the Merrimac Clay Products Company, 53 State Street, Boston, for its proposed new plant at Plaistow to the L. H. Shattuck Company, Manchester, N. H. The plans include a power house and machine shop.

BOSTON, MASS.—The Walter Baker Company will build a one-story power house at its chocolate plant at 11 Central Street.

FALL RIVER, MASS.—The Montaup Electric Company has applied for permission to issue $600,000 in capital stock, the proceeds to be used for the purchase of electric light and power properties, and for extensions and improvements.

HOLYOKE, MASS.—Plans are being completed and bids will soon be called for the construction of a new municipal electric plant, to cost about $500,000. McClintock & Craig, 33 Lyman Street, Springfield, are engineers.

Middle Atlantic States

BROOKLYN, N. Y.—The Brooklyn Edison Company plans to erect a one-story addition to its substation at 372 Sumpter Street.

BROOKLYN, N. Y.—The Jamaica Water Supply Company, Shelton Avenue, Jamaica, plans to construct an electrically-operated pumping plant on 128th Street, Richmond Hill.

CANASTOTA, N. Y.—The Adirondack Power & Light Corporation, Amsterdam, has acquired the property of the Canastota Power & Light Company. Extensions and improvements are planned.

ORCHARD PARK, N. Y.—The Depew & Lancaster Light, Power & Conduit Company has applied for a franchise to supply electricity for light and power service here.

OSSINING, N. Y.—Bids will be received by Charles F. Rattigan, superintendent of state prisons, Capitol, Albany, until July 31 for construction of refrigeration plant, clinic building No. 8, and building No. 4, electric elevators, mess hall and kitchen building, No. 4; one 200-kw., direct-current generating set, etc., at the Sing Sing Prison, Ossining. Sullivan W. Jones is state architect.

UTICA, N. Y.—The Utica Gas & Electric Company contemplates the construction of a hydro-electric plant in the vicinity of Canada Lake, Stewarts Landing.

WATERTOWN, N. Y. — Arrangements are being made by the Power Corporation of New York to purchase the Soft Maple dam site on the Beaver River. It proposes to build a hydroelectric plant, to include power house, concrete dam, penstock, high-tension transmission line, etc., to cost about $500,000. W. P. McCreager, Northern New York Trust Company Building, is chief engineer.

CAMDEN, N. J.—The Philadelphia & Reading Railroad Company, Reading Terminal, Philadelphia, plans to build a storage battery plant at its new local terminal.

HADDONFIELD, N J.—The Iona Light, Heat & Power Company, recently organized, plans to furnish electricity for light in this section. Theodore Blank, Haddonfield, heads the company.

NEWARK, N. J.—The Public Service Electric Company plans to build a substation at 304-12 Norfolk Street, to cost about $78,000.

PENNINGTON, N. J.—Bids will be received by the Borough Council, Henry L. Laning, clerk, until August 26, for electrically-operated pumping machinery for

the municipal waterworks. Remington & Vosbury, 601 Market Street, Camden, are engineers.

BERLIN, PA.—The power plant of the John O. Ream Mining Company was recently damaged by fire, causing a loss of about $25,000.

CONEWAGO, PA. — The Conewago-Dauphin and Londonderry-Dauphin Electric Companies, recently organized, are planning to erect a transmission line for light and power service in this section. L. D. West and W. H. Schubert head the companies. Olmstead, Snyder & Miller, Harrisburg, are representatives.

COOPERSBURG, PA. — The Pennsylvania Power & Light Company, Allentown, has acquired the system of the Coopersburg Electric Light & Power Company. A substation will be built and extensions made in transmission system.

EASTON, PA.—The Pennsylvania Edison Company has contracted with the Saylorsburg (Pa.) Light & Power Company, for power supply and will erect a transmission line to this point. Plans are being considered for building a transmission line for service to a number of communities in the vicinity of Stroudsburg.

LATROBE, PA.—The West Penn Railways Company, Pittsburgh, is preparing plans for the erection of a new power plant in the Kingston section, to cost about $500,000.

PHILADELPHIA, PA.—A power house will be erected at the textile plant of the Philadelphia Tapestry Mills, Inc., Hutchinson Street.

PHILADELPHIA, PA. — The Frank Schoble Company will build a power house at its hat-manufacturing plant at Tenth and Oxford Streets, to cost about $40,000.

PHILADELPHIA, PA.—Electric power equipment will be installed in the new printing plant to be erected at Broad and Callowhill Streets by the "Philadelphia Inquirer," to cost about $800,000.

PHILADELPHIA, PA.—Fred Pearson & Company, Inc., will build a power house at its plush mill at Leverington and Wilde Streets. W. E. S. Dyer, Land Title Building, is engineer.

PHILADELPHIA, PA.—The Bureau of Water will install electrically-operated pumping equipment in a new station at Germantown and Southampton Avenues. Fred C. Dunlap is chief of the bureau.

PHILADELPHIA, PA.—The Philadelphia Electric Company has contracted with the Pennsylvania Railroad for power supply for the Broad Street Station and office building, and will install a substation for the service to cost about $25,000.

SHENANGO, PA.—The North, South and West Shenango Township Light & Power companies have been chartered to install and operate electric systems in the respective townships. A. A. Culbertson, Erie, is treasurer of all three utilities.

BALTIMORE, MD.—The Flynn & Emrich Company, 305 North Holiday Street, is planning to erect a new plant on Taylor Avenue, consisting of a machine shop, foundry, power house, etc., to cost about $75,000.

BALTIMORE, MD.—Electric power equipment will be installed in the proposed printing plant to be erected by the "Baltimore News and American," at Commerce and Pratt Streets, to cost about $500,000. G. R. Vallis, Jr., American Building, is architect.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company plans to erect an addition to its substation at 700-24 West Pratt Street. An extension will also be built at the battery station, 10-12 McClellan Street, to cost $32,000.

CHARLESTON, W. VA.—A site has been acquired on California Avenue for the proposed power plant for the new State Capitol Building.

NORFOLK, VA. — The Norfolk Sugar Refining Company will build a power house in connection with its proposed local refinery to cost about $3,000,000.

North Central States

DUNDEE, MICH.—The plant of the Dundee Power Company has been acquired by the Detroit Edison Company. A substation will be erected and electricity will be supplied from Detroit.

LANSING, MICH.—The erection of a power house, to cost about $100,000, at the State Industrial School for Boys is under consideration.

NORTHVILLE, MICH.—The Ford Motor Company plans to construct a power plant at its local works. Albert Kahn, 1000 Marquette Building, Detroit, is architect.

AKRON, OHIO. — The Northern Ohio Traction & Light Company contemplates building a substation at 461 Water Street, to cost about $135,000. J. E. Eckrode, Terminal Building, is engineer.

CLEVELAND, OHIO—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until Aug. 3 for economizers, forced and induced draft fans for the division of light and power.

COLUMBUS, OHIO. — The Pennsylvania Railroad Company plans to construct a new power house at its local shops.

HAMILTON, OHIO.—The Council is considering the construction of a municipal electric light and power plant, to cost $650,000, for which bonds have been voted, to replace the present plant.

WARREN, OHIO. — The Ohio Public Service Company has issued bonds for $500,000, part of the proceeds to be used for extensions and improvements.

BURNSIDE, KY.—Application has been made to the Federal Power Commission by the Cumberland Hydro-Electric Power Company, Ind., for permission to build three power projects on the Cumberland River, two above Burnside, and one on the south Fork of the Cumberland River, to cost about $900,000, including a steel tower transmission line.

WHITESBURG, KY.—The Kentucky & Virginia Power Company, Hazard, is planning to extend its transmission lines to Logan, in the coal field of West Virginia. From Logan connection will be made with Charleston, and from there the lines will eventually be extended to Wheeling.

CAMBRIDGE, IND.—Extensions and improvements are contemplated by the Cambridge Light & Power Company, to cost about $50,000.

FORT WAYNE, IND.—Plans are under way by the National Handle Company for the erection of the first unit of its proposed plant on Erie Street, including power house, to cost about $100,000.

FORT WAYNE, IND.—Plans are being prepared for the construction of a power plant at Concordia College. J. M. Riedel, 305 Noll Building, is architect.

SOUTH BEND, IND.—The Studebaker Corporation has begun work on the erection of a new foundry, 683 ft. by 732 ft., a car storage building and crane shed, 59 ft. by 76 ft., by 722 ft., and an addition to the power plant, 68 ft. by 89 ft.

AURORA, ILL. — The Aurora Cotton Mills plan to install a new lighting system and to electrify all departments of their plant. Lockwood, Greene & Company, 38 South Dearborn Street, Chicago, are engineers.

CHICAGO, ILL. — The Commonwealth Edison Company contemplates the construction of three substations, to be located on Marshfield Avenue, near Fifty-first Street, at Harrison and Des Plaines Streets, and on Center Street near Cleveland Avenue, respectively.

VENICE, ILL.—The Illinois Power & Light Corporation plans to construct a local power plant, to cost $1,200,000, with transmission system.

ALGOMA, WIS.—The City Council has given its approval of an ornamental lighting system in Lakeside Park.

BARRON, WIS.—The City Council has decided to build a new hydro-electric plant at the Taylor Dam, to cost about $15,000, which will be supplementary to the present municipal plant.

MILWAUKEE, WIS.—Bids, it is understood, will soon be asked by the city of Milwaukee for coal and ash-handling equipment for the steam generating unit of the Riverside pumping station. R. E. Stoelting is commissioner of public works.

COON RAPIDS, IOWA.—The Iowa Railway & Light Company, Des Moines, has been granted a franchise to erect a high-tension transmission line from Coon Rapids to Glidden.

HAMPTON, IOWA.—The Hampton Brick & Tile Company contemplates the construction of a power house at its proposed tile-manufacturing plant, to cost about $80,000.

MANNING, IOWA. — Preliminary plans are being prepared by A. Dohmen, architect, 68 Wisconsin Street, Milwaukee, for a hospital building and power house and laundry, to be erected in Manning, to cost about $300,000.

RED OAK, IOWA—The State Railroad Commission has granted the Iowa Service Company permission to erect a transmission line from Red Oak to Villisca.

CAMERON, MO.—At an election held recently the proposal to issue $75,000 in bonds for improvements to the municipal electric lighting and water systems was defeated. Another election, it is understood, will soon be held. E. E. Harper, 3031 Park Avenue, Kansas City, is engineer.

DREXEL, MO.—The installation of electrically-operated pumping machinery at the new municipal waterworks is under consideration by the City Council. J. P. Davis, Central Trust Building, Jefferson City, is engineer.

GLASGOW, MO.—The Kansas City (Mo.) Power & Light Company, it is understood, will build a large power plant at Glasgow to furnish service in this district, including Blackburn, Sweet Springs, Mayview, and Waverly.

KANSAS CITY, MO.—Electric power equipment will be installed at the proposed waterworks plant, to be constructed by the Board of Fire & Water Commissioners, to cost about $1,000,000. Fuller & Maitland, Kansas City, are consulting engineers.

ORAN, MO.—Preliminary plans are under way for the construction of a municipal power plant in conjunction with a waterworks station, to cost about $65,000. The W. A. Fuller Engineering Company, Railway Exchange Building, St. Louis, is engineer.

HOT SPRINGS, S. D.—The Water, Light & Power Company contemplates extensive improvements to its plant and distributing system including the construction of an auxiliary plant.

MILLER, NEB.—Plans are under way for the erection of an electric transmission line from Miller to Sumner for local commercial service. A. N. Bliss is town clerk.

TOPEKA, KAN.—The City Council is considering the installation of ornamental lamps on Quincy Street.

Southern States

KINSTON, N. C.—Bids will be received by the Caswell Training School, until July 31, for equipment for a steam-operated electric generating plant. H. A. Underwood, Commercial Bank Building, Raleigh, is architect.

RALEIGH, N. C.—Bids will be received by the Board of City Commissioners, until August 1, for electrically-operated pumping machinery at the municipal waterworks, in connection with extensions to cost $350,000. C. C. Page is engineer.

FERGUSON, S. C.—The Columbia Railway & Navigation Company, Columbia, has been granted a preliminary permit by the Federal Power Commission to construct a hydroelectric plant on the Santee River, with initial capacity of 125,000 hp., to cost about $1,500,000.

THOMASVILLE, GA.—The Georgia-Alabama Power Company, Albany, it is reported, contemplates the erection of a high-tension transmission line from Pelham to Thomasville, to supply energy here.

OCALA, FLA.—The Marion County Lime Company, recently organized, contemplates the construction of a power house at its proposed local lime plant, to cost about $100,000.

CHATTANOOGA, TENN.—The installation of an ornamental lighting system on Eighth Street is under consideration.

KNOXVILLE, TENN.—Bids will be received by L. S. Pope, director of institutions, Nashville, until Aug. 16 for construction of school building, dormitory and power plant at the State Deaf and Dumb School in Knoxville, to cost about $250,000. Marr & Holman, Stahlman Building, Nashville, and Barber & McMurray, Burwell Building, Knoxville, are architects.

MEMPHIS, TENN.—Plans are under way by the Wabash Screen Door Company, Florida Street and Trigg Avenue, to double the output of its power plant, at a cost of about $50,000.

MEMPHIS, TENN.—The Indiana Board & Fiber Company contemplates the construction of a power house at its proposed local pulp mill, to cost about $500,000.

NASHVILLE, TENN.—Bids will be received by J. H. Kirkland, chancellor of Vanderbilt University, until Aug. 14 (extension of date from July 16) for construction of hospital and laboratory, nurses' home, power plant and laundry on Campus, to cost about $2,000,000. Coolidge & Shattuck, 122 Ames Building, Boston, are architects.

SHELBYVILLE, TENN.—The Southern Cities Utilities Company, Chattanooga, is planning to erect a power plant at Shelbyville.

MONTGOMERY, ALA.—The City Commission is considering an ordinance requiring all electric wires in the fire district to be placed underground.

LEAKESVILLE, MISS. — The Leakesville Veneer & Lumber Company, recently organized, contemplates the construction of a power plant in connection with a new mill, to cost about $200,000. Max Bryant is head.

CONWAY, ARK.—The installation of a 200-hp. oil-engine generating unit in the municipal electric plant is under consideration.

MANGUM, OKLA.—An election will soon be called to vote on the proposal to issue $8,000 in bonds for extensions to the municipal electric plant.

MINCO, OKLA.—The Chickasha (Okla.) Gas & Electric Company has acquired the local municipal electric plant, which it will remodel for a substation. A transmission line erected to Minco.

BRECKENRIDGE, TEX.—The Thermatomic Carbon Company, Sterlington, La., contemplates the construction of a power plant in connection with its proposed local helium works, to cost about $250,000.

CALVERT, TEX.—The Western Public Service Company, Colorado Springs, Col., has acquired the system of the Calvert Water, Ice & Electric Company. Extensions and improvements will be made, including the erection of a transmission line.

DALLAS, TEX.—The Texas Power & Light Company will construct a 22,000-volt transmission line to the Powell oil fields, about 12 miles. A substation will also be erected in the Powell district.

FORT WORTH, TEX.—The Trinity Portland Cement Company, Dallas, plans to construct a power plant in connection with its proposed local cement mill, to cost about $750,000.

HOUSTON, TEX.—The Houston Lighting & Power Company contemplates the construction of a substation on Yale Street, to cost about $140,000.

PORT ARTHUR, TEX. — The Eastern Texas Electric Company is preparing plans for an addition to its power plant at Riverside Drive and Houston Avenue, to be equipped for switching and distributing service, to cost about $135,000. It is also proposed to build a steel tower transmission line to Beaumont, to cost about $300,000. Stone & Webster, Inc., 147 Milk Street, Boston, is engineer.

Pacific and Mountain States

SEATTLE, WASH.—Bids will be received by the Bureau of Yards & Docks, Navy Department, Washington, D. C., until August 15, for one electric traveling bridge crane at the Puget Sound Navy Yard. (Specification 4861.)

FULLERTON, CAL.—The Clay Products Company contemplates building a power house in connection with a new tile manufacturing plant to cost about $85,000.

GLENDALE, CAL.—The installation of a 400-hp. synchronous motor in the municipal electric light plant is under consideration.

LOS ANGELES, CAL.—The Los Angeles Molasses Feed Company, recently organized, plans to construct a power house in connection with its proposed plant on Terminal Island, to cost about $350,000. J. A. Love, Kansas City, Mo., heads the company.

MODESTO, CAL.—The Modesto Irrigation District plans constructing an electric substation on Coldwell Avenue.

PITTSBURGH, CAL.—The Pacific Gas & Electric Company, San Francisco, is planning to erect a local substation, to cost about $100,000.

SAN DIEGO, CAL.—Bids will be received by the Bureau of Yards & Docks, Navy Department, Washington, D. C., until August 15, for electrical installation at the local navy yard. (Specification 4821). Also for wiring in the mess hall at the naval station. (Specification 4843.)

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company plans to erect a power plant, on Stevenson Street near Fifth Street, to cost about $250,000. The company is also building a substation on East Fiftieth Avenue, Oakland.

SAN LEANDRO, CAL.—The installation of an electric lighting system on Davis Street is under consideration.

SANTA BARBARA, CAL.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system on State Street from Ocean Front to Mission Street.

FLORENCE, ARIZ.—The board of directors of the Electrical district No. 2 has called an election to vote on the proposal to issue $528,150 in bonds, to be used for the erection of a transmission line to Florence.

NEEDLES, ARIZ.—G. H. Stetson, 8 Fortieth Street, New York City, has applied to the Federal Power Commission for permission to construct and operate a hydro-electric plant on the Colorado River, near Bulls Head Rock, in the vicinity of Needles, with an initial capacity of 160,000 hp.; also to build a plant at Bouldre Canyon River on the Colorado River.

Canada

REDCLIFF, ALTA.—The local power plant, owned by the municipality of Medicine Hat, was recently destroyed by fire, causing a loss of about $15,000.

ACTON, ONT.—The Hydro-Electric Commission of Ontario contemplates the installation of three 100-kva. transformers in the local station.

GALT, ONT.—Plans are under consideration to change the voltage of the local system from 2,200 to 4,000. The installation of a second power line to the west side is under consideration.

KENORA, ONT.—The installation of new equipment, including boilers, in the municipal electric light plant is under consideration.

OTTAWA, ONT.—The Lower St. Lawrence Power Company has been granted permission to erect a transmission line from Rimoski to Riviere Metis, a distance of about 22 miles.

OTTAWA, ONT. — The Ottawa Light, Heat & Power Company plans to issue $6,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

TORONTO, ONT.—The Hydro-Electric Power Commission of Ontario contemplates building an addition to the transformer station on Davenport Street, to cost about $150,000. F. A. Gaby is chief engineer.

Electrical Patents

Announced by U. S. Patent Office

(Issued July 10, 1923)

15,644 (reissue). LINE SWITCH; J. N. Reynolds, Greenwich, Conn. App. for reissue filed June 7, 1921. Construction and assembly of a crossbar switch for telephone mechanism.

15,652 (reissue). OPERATOR'S OUTFIT FOR ELECTRIC WELDING; W. Woltmann, New York, N. Y. App. for reissue filed Dec. 31, 1919. Welding machine with fixed voltage and amperage.

1,461,056. SIGNALING APPARATUS; W. L. Walker, New York, N. Y. App. filed June 22, 1917. Submarine signaling apparatus.

1,461,064. MULTIPLEX TRANSMISSION CIRCUITS; DeL. K. Martin, Orange, N. J. App. filed Feb. 10, 1921. Employs carrier currents for communication.

1,461,072. RHEOSTAT WITH AUXILIARY CONTACT SYSTEM; D. H. Sheriff, Jr., Kansas City, Mo. App. filed Dec. 4, 1922. For electron tubes.

1,461,100. METHOD OF TREATING FILAMENTS FOR INCANDESCENT ELECTRIC LAMPS; H. H. Smith, Newark, N. J. App. filed Dec. 19, 1917. Treatment to prevent filaments from sagging.

1,461,103. GOVERNOR FOR ELECTRIC CIRCUITS; E. J. Tomlinson, Newark, N. J. App. filed June 8, 1920. For phonograph motors.

1,461,117. FILAMENTARY BODY FOR ELECTRIC LAMPS AND METHOD OF MAKING THE SAME; R. D. Hall, East Orange, and H. H. Smith, Newark, N. J. App. filed Dec. 19, 1917. Method of preventing filament from sagging.

1,461,118. FILAMENT; R. D. Hall, East Orange, N. J. App. filed Dec. 19, 1917. Non-sagging filament.

1,461,140. METHOD OF TREATING FILAMENTS FOR INCANDESCENT ELECTRIC LAMPS; J. H. Ramage, Norfolk, Va. App. filed Oct. 15, 1917. To prolong life of filament.

1,461,148. INDICATOR FOR VACANT THEATER SEATS; W. L. Guerin, New Orleans, La. App. filed Dec. 23, 1921. Lamp for each seat on indicating board.

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Operating Companies and the College-Bred Engineer

A RECIPROCATING engine belted to a dynamo, a wooden switchboard with a couple of shaky knife switches and a gravity voltmeter, "Jim the engineer" in overalls, with a long-spouted oil can, and a begrimed fireman at a distance—what an attractive picture for a college student to think of as a possible career for himself! True, this is only a picture of an irrevocable past in so far as the operating side of the industry is concerned, but do the best college boys of today understand that this is a picture of the past and that the real immense problems of design, construction and operation of large electric properties call for men of first-rate ability?

Perhaps the word "operating" is the first obstacle encountered when one tries to arouse interest among the most energetic students in becoming public utility engineers. "A guy in overalls shovels coal at one end and another guy, with a white collar on, collects money at the other end. The franchise excludes competition, a fair price is fixed by some commission, and that is all there is to it," is a young graduate's opinion. Possibly if the word "operating" were replaced by the word "fighting," "struggling," "overwhelming" or some such forceful adjective, this career would appeal to real red-blooded American youths much more, and perhaps it would be more significant of the real activity of the men who keep our homes lighted and industries operating, rain or shine, through troubles little known. Somehow the words "operating," "operative," "operator," suggest an anemic girl who slowly and automatically performs the same simple mechanical motion day after day, year after year.

There is no use in blaming teachers of engineering for the evident ignorance among the students of the really great and perplexing problems of power generation, distribution and use. The best instructors teach neither the manufacture nor the operation of electrical apparatus. They teach the fundamental laws of nature in the form applied to electrical apparatus and circuits. It is for the leaders of the operating industry itself to make up their minds that they need the best young engineering talent and to go after it as they have gone after manufacturers to produce better generators, better insulators and better cables.

The principal manufacturers of power and communication apparatus have been spending considerable effort and money to attract the best young engineers, and their endeavors are bearing ample fruit. The largest operating companies might well pool their efforts and maintain a joint educational department, with a properly laid out apprenticeship course, and also have their best men travel among the colleges and explain to the students the outstanding problems and opportunities of the industry. The N. E. L. A. committee on relations with educational institutions can only lay down the general principles of this activity. Like any unpaid large committee of busy men, its work will be slow, and the large operating companies might just as well make up their minds to put real money into the recruiting of young engineers.

Earnest McCleary

An electrical contractor who has contributed greatly to the development of the electrical code and the advancement of the standards of electrical construction.

THE story of the electrical contractor in this country has been a record of a long struggle by a mere handful of far-seeing leaders to raise the standard of electrical wiring by organization and education and to secure for the guidance of the men engaged in it a practical, understandable and progressive code. One of the conspicuous pioneers who have persisted in the effort for many years is Earnest McCleary, now president of the McCleary-Harmon Company of Detroit. For nearly a quarter of a century he has worked for the development of better electrical construction and the closer organization of that branch of the industry.

Born in 1865, Mr. McCleary was thrown on his own resources at the early age of twelve and supported and educated himself until, at eighteen years, he was stricken with tuberculosis. In the hope of regaining his health he shipped before the mast on the Lakes and succeeded in building up a robust strength that has never again failed him. Then he became a groundman for the Michigan Bell Telephone Company and by degrees worked up until he was superintendent of the Electric Supply & Engineering Company in Detroit, and in 1900 he organized a company of his own.

In 1901 Mr. McCleary was one of the thirty-one men who organized the National Electrical Contractors' Association, serving soon after as the association president, and from that time on he has been one of the conspicuous leaders of this branch of the industry. In 1905 he was made chairman of the N.E.L.A. code committee and later he became a member of the electrical committee of the National Fire Protection Association, where for fifteen years he fought the contractors' battle for a more liberal and intelligible electrical code.

Mr. McCleary is a man of striking personality, forceful in debate, and an able organizer, with strong qualities of leadership and executive capacities. He is gifted with an almost unfailing memory and has come to be an authority on co-ordinate organization in the electrical industry. He has a host of friends and a wide acquaintanceship throughout the industry.

Mr. McCleary has been exceedingly successful as a contractor, and at present is engaged in the installation of a $300,000 electrical equipment in the new $6,000,000 Masonic Temple in Detroit, probably the largest single job of its kind on record, given into his hands to develop according to his own judgment and under his own inspection—no small tribute to his reputation as a man and a contractor.

Editorial Comment

Electrical World, August 4, 1923

Volume 82 Number 5

A General Awakening to the Importance of Public Relations Work

INDIVIDUALLY, progressive companies long since realized the value of harmonious public relations and have striven to promote them. But, collectively, operating companies have never before manifested such an earnest desire to bring about a better understanding between utilities and the public as was demonstrated in various sessions of the N. E. L. A. convention recently held in New York. It was inspiring, to say the least, to observe every one searching for the same thing—a method of serving the public best. It would have been fortunate if every employee and representative of every company, utility or other, could have listened to the speeches and caught the spirit of the convention, for the lesson is universal.

Service and courtesy, of course, lie at the bottom of all activities which prosper permanently—not service in one direction only, but in every department, in every point of contact with the public. Employees who fail to qualify in this vital particular are incompetent—a fact recognized today by progressive utility companies everywhere, which rightly refuse to retain in their service those who cannot or will not perform their duties in this spirit. These companies know that their treatment of patrons may mean the difference between success and failure and grasp the self-evident fact that the company whose officials never find it too much trouble to talk over things with a complaining customer is the one which will in turn receive the most considerate treatment at the hands of the public.

Given service and courtesy, the next need is mutual understanding—an understanding on the part of the public of the industry and its problems and, what is equally important, an understanding by the industry of the mental attitude of the public toward it. Understanding, like charity, begins best at home, and the wise utility will take the first step in its own household; that is, the executives will take their subordinates into their confidence and tell them frankly about capitalization, franchises, size of investment required, how money is raised and all the other things about which the old plan of secrecy has no proper place in honest business.

To approach, interest and instruct the outside public is not quite so easy, but many avenues exist. For the younger generation there are the schools, in many of which in all parts of the country information on public utilities is now given. In the civics courses in high schools a special field is open, and it should be feasible to include instruction on public service (including rate making and regulation) in new or revised textbooks. More mature customers, actual or potential, may be enlightened through speeches before chambers of commerce and men's and women's clubs of every sort and through the activities of public utility information bureaus. Close relations with financial institutions will help to spread the story, which should be made familiar to every bond salesman.

The various prescriptions for improving public relations that are contained in the convention report printed in the ELECTRICAL WORLD for June 9 are full of merit and deserve careful study from executives awake, as virtually all are, to the paramount importance of the matter.

Practical Development of Water Power—the Farmers' Interest

IT IS rather surprising that the American Farm Bureau Federation should circulate as an apparently official document the report of Gray Silver, its Washington representative, containing as it did his personal dicta on water-power development and fixed costs as an element of cost of power (see ELECTRICAL WORLD, July 28, 1923, page 197). The picture which Mr. Silver paints of the benefits of electrified farms is one which all fair-minded men are anxious to see made a reality as soon as possible. Electricity on the farm will be one of the most potent forces toward a satisfied, balanced American society. But with Mr. Silver's conclusions as to financial and economical means of providing this service there is sure to be disagreement. It is not a question of capitalism versus communism. The point is not government versus private ownership and operation (though Mr. Silver refers to the lower interest cost of public credits). The Farm Bureau Federation officially and through its president, O. E. Bradfute, is already on record as recognizing the more efficient and effective development through private control. The question is really one of first principles as to the soundness of Henry Ford's ideas on practical finance in quasi-public enterprises where large first costs are involved. Are these first costs to be paid by present users and the future users to benefit therefrom? It seems pertinent to inquire whether the farmer expects the purchaser of his first year's wheat crop to pay the price of the wheat plus the cost of the entire farm as well so that next year's purchaser may have cheaper wheat. Fixed labor in the form of capital costs is as much a part of the cost of each kilowatt-hour as are current labor and materials, and the practical, equitable division of these costs between all users, both present and future, is what is to be desired.

A comprehensive—a complete—electrification of American farms is desired by all electrical men, from a viewpoint of national pride and of constructive development of the nation as well as of selfish interest in providing more work for the electrical industry to do. Such reports as Mr. Silver's, however, make it increasingly apparent that the Farm Bureau Federation and the electrical industry, already co-operating in research to find how best to apply power to the farm, must be even more certain that past experience in the development and production of electric service is put to good use in bringing to realization a practical electrification of American farms.

Is Kansas Three-Part Gas Rate a Prophecy?

DEFINING the terms "customer charge," "demand charge" and "gas charge," the Kansas commission has established a three-part gas rate scheme for the state that is significant in its probable influence on the general utility rate situation in that and possibly other states. The customer charge consists of the expense of bookkeeping, billing, collecting, setting, removing and repairing meters, gratuitous complaint service, office rents, meter reading and other expense and a part of the fixed charges on the physical property, the total of which the commission declares will be identical for all customers regardless of whether they use large or small amounts of gas or none at all.

Demand charges are declared to consist of the expense of providing and maintaining a production, transmission and distribution system of sufficient capacity to render service as required. It is declared that this charge should be distributed among the customers in proportion to the demand which is contracted for by each customer. The gas charge is defined as that part of the cost of producing, transmitting and distributing the gas which is in proportion to the amount of gas handled.

The three-part rate has been the subject of experiment on a number of Kansas gas properties for several years and the results, according to the utility men who have been instrumental in the work, have been thoroughly satisfactory, a conclusion that the action of the commission seems to justify. That the three-part rate scheme is adapted from the electrical field need not be told. If it proves satisfactory to the gas consumers of the state, which means that it will cover the residential as well as the business and industrial consumers, the question is how long will it be before the same scheme is applied to the whole field of electrical rates in the state. If, as the commission declares, it results in eliminating discrimination between all classes of consumers, it will not be long before the same thing will be declared of the field of electric service. If this effect is produced, it may result in a need for some basis on which to apply such a rate to the small electric consumer. This has not been generally done in the United States, though some progress in that direction has been made, notably the work of the past year or two in the residential service field at Hartford, Conn. The experiment of the Kansas commission will be watched with a great deal of interest and it may go far in its influence on the whole rate structure of both the gas and the electric industry in the United States.

Circuit-Breaker Engineering Is Making Progress

FEW beneficiaries of intercommunication are in a position to realize the pressure upon the designing engineer in the circuit-breaker field under present conditions of system growth and plant expansion. A short time ago it was satisfactory to the operating man if he were supplied with breakers capable of rupturing arcs of 150,000 to 200,000 kva. without difficulty. Now manufacturers are building breakers designed to rupture 1,500,000 kva. in the arc in both high-voltage and low-voltage equipment, and as superpower development extends, it is not improbable that still greater demands will be forthcoming. In this rapid development lies one of the major causes of the high cost of circuit breakers for heavy duty. Three dozen of the largest units now available would cost around a million dollars, so that the selection of such apparatus and its adaptation to important network or transmission service is no small problem.

Although the industry is growing too fast to permit thorough standardization of circuit breakers at this time, it is gratifying to observe that many engineers are trying to help bring this result about. Designers are no longer working in the dark as to probable performance in field service. At heavy expense testing facilities have been established in the factory which make it possible to short-circuit a turbo-generator of more than a score of thousand kilovolt-ampere rating through breakers under various conditions of voltage, line connections and reactance. The analysis of test "shots" by the oscillograph now possible within a few minutes after the arc is ruptured tells a story of great significance to both designing and operating engineers. In view of the great importance of protection on large interconnected systems with their heavy investment in transmission lines, transformers and generating units, it will pay purchasers of the higher-powered breakers to spend no little thought upon the advance determination of maximum possible short-circuit energy deliveries at different points in networks and to support thorough factory investigations of breaker performance under different conditions liable to develop in their particular fields. In this work the calculating table is already winning fresh laurels.

Admirable progress is being made at present in breaker design. Improved methods of suppressing arcs, of getting rid of gases and of adapting tanks and parts subjected to stress to more effective resistance of the explosive forces liberated are receiving the close attention of designers. Some of these problems may almost be classed as those of the artillery engineer. It is well that minute consideration is being given to such matters as quality of material, dimensions and proportions of structures, treatment of oil, limitations of breaking capacity in relation to speed of opening and length of arc, and other related matters. At the moment there is a decided trend toward compensated mechanical coupling in isolated phase work, which some engineers consider superior to electrical tripping. Isolation of arcs and the separation of oil and gases mark real progress in this field, and competition among manufacturers lends zest to the selection problem.

Electricity in German Agriculture

ANOTHER glimpse of the extent to which the use of electrical energy is being developed in foreign countries was given in the article on "Electricity in German Agriculture," by August Petri, in the July 21 issue of this paper. The principal motive force back of this special development is the economic situation in Germany created by the war. Men are scarce and machine equipment must accomplish tasks heretofore allotted to human hands or these tasks must go undone. Coal is scarce and high in cost. Steam-driven agricultural machinery on the showing made requires a considerably greater amount of coal than that required to produce and distribute electrical energy from central stations; therefore, if possible, electrical energy must be used. The same argument can be extended to the field of oil fuel. It is an argument that is old in the central-station field and on it is built the present develop-

ment of American central-station and transmission systems. The significant fact is that German agriculture, and also that of other European countries, is being driven to the same conclusion regarding the use of power toward which all other industry is tending and which it has already accepted widely.

If the European farmer is driven by economic conditions toward such a solution of his difficulties and is able in some degree to meet the competition from the more favored agricultural regions of the world, what will be the result when the inevitable balance of economic forces is restored and the world is once more on a fairly level economic keel? Past experiences prove that the savings in fuel are likely to remain on the same proportional basis. The cheap-labor bar to the development of equipment that has made Europe lag behind America in mechanical methods of doing work will no longer exist in the agricultural field because the equipment will already be in use. The inevitable result is likely to be a competition with the American farmer which will make his lot still more unpleasant. At present he is meeting world competition and suffering from it with a large part of this competition under somewhat artificial handicaps.

The picture might be made a dark one if pessimism were to prevail. As a sober matter of fact the extent to which the development will or can proceed is unknown. Better still, America has as fine an equipment in its agricultural experiment station and agricultural school development as any country in the world, and that equipment is being utilized to find the answer to the problem of using electrical energy in agriculture. The account of German accomplishments, therefore, becomes merely a valuable bit of experience that can be studied and turned to profit in our own research on the subject. With a record, according to Dr. Windel, of a lighting consumption of 12.5 kw.-hr. to 22.5 kw.-hr. and a power consumption of 27.5 kw.-hr. to 42 kw.-hr. per acre from thirty-four German agricultural centers in 1920-21, against the present American average, which is probably not in excess of 5 kw.-hr. on the farms actually served, there is food for thought. The question is: How can the utilization of electricity found profitable on European farms be made profitable in America?

Formulistic Line Solutions Not to Be Relied on Wholly

FREQUENT attempts are made to set up formulas for the economic solution of a high-tension transmission installation. Generalized formulas are a valuable aid in many engineering tasks when supporting data prove the accuracy of the equations, but, on the other hand, few formulas can be used blindly, and this condition exists to an extreme degree in transmission work. The cost of a transmission system is interlinked with so many operating, social, legal, economic and technical elements that installation on the least-cost basis is a rather indefinite problem. The distance, the power transmitted, the voltage, the power factor of the load, the regulation, the efficiency, the load factor and the load distribution are technical elements linked up with the prices of various materials used in the construction of the line. Beyond these lies the realm of such intangibles as corona, lightning, ice, wind and safety. Any equation involving all such elements must be complicated, cumbersome and applicable only to a specific case.

On the other hand, a rule-of-thumb design or one based solely on comparisons with other lines is not the type of solution that should be used. The working out of such problems should be based on research, a study of existing lines, a knowledge of the properties of electric circuits, a knowledge of the terrain and a knowledge of social, economic and climatic conditions in the location and at the time the project is to be installed and operated.

The solution can be facilitated by grouping the technical elements peculiar to the electric system in one unit and the elements peculiar to the economics of the problem in another unit. The use of graphs and computations alone cannot be depended upon to lead to the correct solution. Judgment backed by long experience must give the proper weight to the various factors involved.

New Ideas That Advance Art

IN THE development of the 65,000-kva. turbo-generators briefly referred to on page 229, Dr. Robert Pohl, chief electrical engineer of the Allgemeine Elektricitäts-Gesellschaft, and his associates have produced an excellent design, original in conception and finished in execution. It is the kind of work that advances the art. However, some details of the construction appear to be so radical that it may be questioned whether they will survive.

One decided advantage of the construction is the considerable reduction in the size of the rotor forging made possible by dovetailing thereto packets of teeth punchings instead of cutting slots in the rotor. As a result many of the uncertainties inherent in large ingot forgings are eliminated. Since the rotor is assembled so as to produce stresses during building which are equal to or greater than the running stresses, the success of the structure depends largely on the quality and integrity of the workmen. Because of this demand for careful skilled workmanship, increased reliability in performance may be expected only if workmen of good quality are available. One imagines that post-war Germany cannot count on this as certainly as could pre-war Germany.

Another novel feature of the design is the use of band wire for holding the coil ends instead of the usual forged or rolled alloy-steel rings. Not every engineer will agree that the stress conditions described by Dr. Pohl (constant stresses at standstill and during running) are actually obtained. While the band-wire construction has some desirable features, particularly in the high quality of available material, the increased difficulties attending repair, as compared with a ring that may be pressed off, may serve to prevent its general adoption.

Dr. Pohl's reference to temperature rises by detectors should not be misunderstood. He points out that the generators have a single coil side per slot. With this winding arrangement the detector does nothing more than measure the tooth temperature. With the two-coil-per-slot winding universally used by American builders, the detector placed between coil sides more closely approaches the actual copper temperature. Temperatures obtained by measuring the increase in resistance of the armature winding are also of little value in large turbo-generators on account of the time taken for the rotor to come to rest and the cooling that occurs in the winding before the hot resistance is measured.

220,000-Volt Auto-Transformers

THE 220,000-volt auto-transformers at the Eagle Rock substation of the Southern California Edison Company are the largest ever constructed and have been in operation at 220,000 volts since May 6, when transmission at this voltage was first accomplished. To avoid making changes in the Eagle Rock substation, which is designed for 150,000 volts, the auto-transformers are used to step down the voltage of the Big Creek transmission lines from 220,000 to 150,000. An interesting feature is that the auto-transformers are tied in solid with the transmission lines and form an integral part of them. The units are single-phase and are rated at 36,700 kva. each, making the capacity of each bank 110,100 kva. From the bottom of the case to the top of the bushings the units measure 27 ft.

Self-Starting Synchronous Motors Get Service Test

Investigation Shows Pull-Out Torque, Power Input for Starting, Braking and Reversing, Speed of Stopping and Other Characteristics Important to Rubber-Mill Operation

By S. H. MORTENSEN
Electrical Engineer Allis-Chalmers Manufacturing Company

THE development in rubber-mill drives has been governed by a number of factors, chief among which are safety and efficiency of operation. The haards assumed by workers operating rubber-mixing mills have been recognized and a series of devices have been developed and tried out for the purpose of stopping the mill rolls in the shortest time practicable when a worker is caught between the grinding rolls.

In the more recent rubber mills electric motor drives have for reasons of economy replaced the engines. With this class of installation it has been possible to effect a marked saving in the manufacturing cost, and at the same time the safety of operators has been materially increased. The motor is usually connected to the mill line shaft by means of a safety cut-off coupling which can be opened from any part of the mill by means of a suitable switching arrangement, thereby disconnecting the mill from the motor. In addition to this a powerful brake, acting on the mill side of the drive, is put into action when the clutch is opened from the emergency circuit.

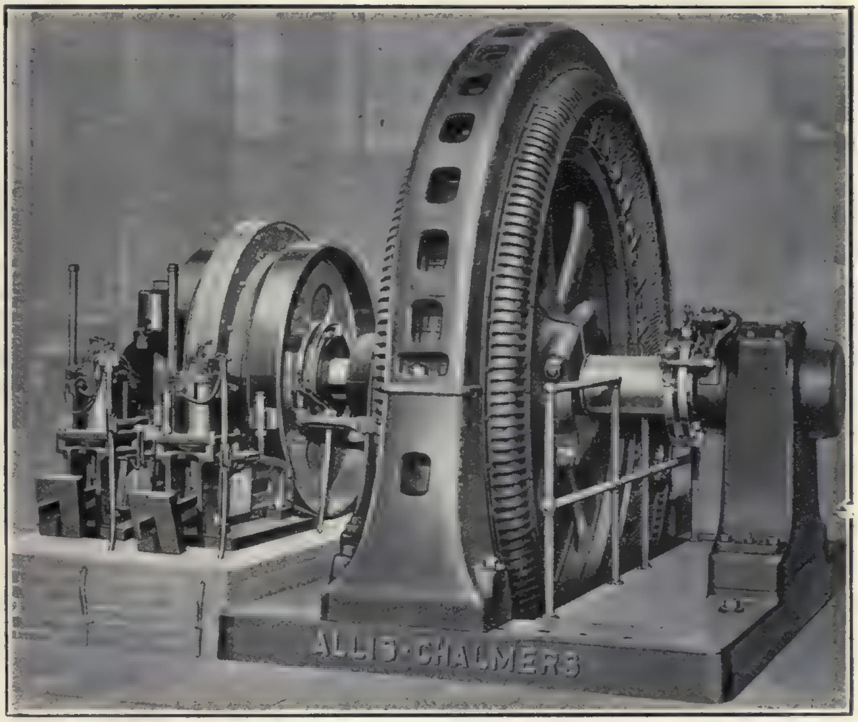


FIG. 1—1,000-KVA., 2,200-VOLT, 60-CYCLE, THREE-PHASE, 120-R.P M. SYNCHRONOUS MOTOR DRIVING MILL AT PLANT OF FIRESTONE TIRE & RUBBER COMPANY

It is equipped with a magnetic clutch and a solenoid brake which is put into action when the clutch is opened from the emergency circuit. The mills may be brought to a stop within a fraction of a revolution as compared with the older engine-driven installations, which may allow several revolutions of the rolls before coming to a stop. Threading of the rolls is also facilitated by this drive.

The magnetic clutch combined with a solenoid brake gives excellent service and can, when properly adjusted, bring the mill rolls to a stop within a fraction of a revolution The distance the rolls will travel after the emergency switch has been operated depends upon the load on the mills and upon the adjustments of the brake band and the condition of the braking surfaces. When the adjustment is perfect and the brake surfaces clean, a stop can be effected in a fraction of a revolution of the rolls. On the other hand, if the adjustment is imperfect or the brake surface greasy or dirty, it will be less effective. Upkeep and inspection of the brakes are therefore factors that should have careful consideration.

The majority of the motors applied for driving rubber mills are induction motors. These, on account of their rugged construction and simplicity of operation, give excellent service. Installations of this kind are, however, usually operated at a low power factor as the motors operate part of the time at fractional loads. This fact has a direct bearing upon the efficiency of the operation and cost of the product, and it led to the next step in the development of mill drives, namely, the application of the self-starting synchronous motor as a means for combating the evil effects of low power factor and thereby reducing the power cost involved.

CHARACTERISTICS OF SYNCHRONOUS-MOTOR INSTALLATION

A pioneer installation of this kind was undertaken by the Allis-Chalmers Manufacturing Company in 1918, when a 500-hp. self-starting synchronous motor with its switching equipment was installed for the B. F. Goodrich Rubber Company, Akron, Ohio. The motor in question replaced an induction motor and it was connected to the mill by means of a magnetic clutch. The mill was also equipped with a solenoid-operated brake. The procedure of operation is as follows: The motor is started with the magnetic clutch opened, which disconnects the mill. The starting voltage is obtained from the taps on an auto-transformer. After the motor is excited and brought into step upon the starting tap, it is quickly connected to the line and by energizing the magnetic clutch the mill is put into service. Provisions

are made so that the direction of rotation of the motor can be reversed in case it becomes desirable to back up the mill rolls.

As this was a novel application of the synchronous motor, it was deemed advisable to make a series of tests to make certain that the motor was suitable for this class of service. This test, records from which are reproduced herewith, included an attempt to pull the motor out of step. The load on the motor was provided by loading the four mills which it drives to their maximum capacity with the toughest rubber obtainable. As this did not pull the motor out of step, the magnetic clutch was tripped when the maximum peak load was reached. After the mill had come to a dead stop the clutch was re-energized, thereby suddenly applying a load of 1,090 kw. to the motor, which stayed in step. As the rated output of the motor is 372 kw., the peak load to which it was subjected was 2.9 times its rated value. This was the heaviest load which could be obtained and it was not considered practicable to pull it out of step. During these tests the motor-field excitation was unaltered from the value corresponding to its rated load.

As the tests and subsequent operation have proved this installation to be a complete success, the introduction of the self-starting synchronous motor in the rubber-mill industry is an accomplished fact. Characteristics of this motor are given in accompanying curves.

Simplification and More Security in New Installations

Further improvements have been made in a synchronous-motor-driven rubber mill recently put into operation in the Fisk rubber plant in Cudahy, Wis. The improvements are in the nature of simplification of the drive and additional security to the operators. These objects are accomplished by supplying a self-starting synchronous motor with characteristics that not only make it possible to omit the safety cut-out coupling between the motor and the mill but also make the auxiliary brake unnecessary as the motor itself may be used as a brake and will stop the mill effectively. The advantage of this feature from the safety point of view is apparent when it is borne in mind that the braking effect of the motor when once adjusted is constant, whereas the efficiency of the auxiliary brake depends upon its maintenance and may vary greatly.

Omitting the clutch makes it necessary for the synchronous motor to develop sufficient starting torque to operate the rubber mills under the severest load conditions. The motor is rated at 500 hp., 90 per cent leading power factor, 2,200 volts, three-phase, 60-cycle, and is coupled directly to the line shaft in a four-mill drive. It starts the mill from rest and brings it up to speed on reduced voltage. By exciting it it can be brought into step on the starting tap. After it is connected to the line the mills may be loaded.

In case of accidents when it becomes necessary to stop the mill, this can be accomplished by operating an emergency switch mounted on the respective mills. This disconnects the motor from the power supply and short-circuits it through a suitable resistance, bringing the motor to a sudden stop. By making suitable adjustments on the motor or the amount of resistance through which it is short-circuited, a wide range of adjustment with respect to the amount of travel of the rubber rolls in emergency cases can be obtained. Pro-

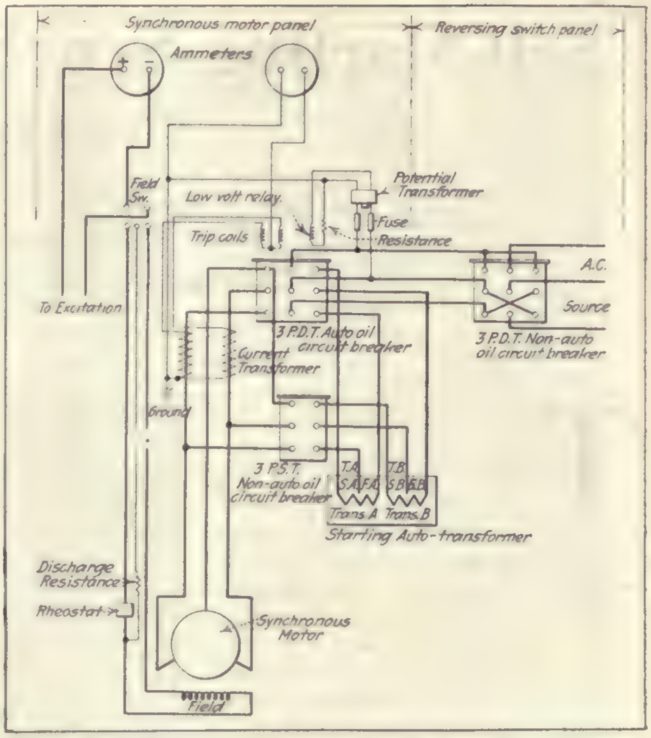


FIG. 2—CONNECTIONS AND SWITCHING ARRANGEMENT USED WITH SYNCHRONOUS MOTOR AT AKRON RUBBER MILL

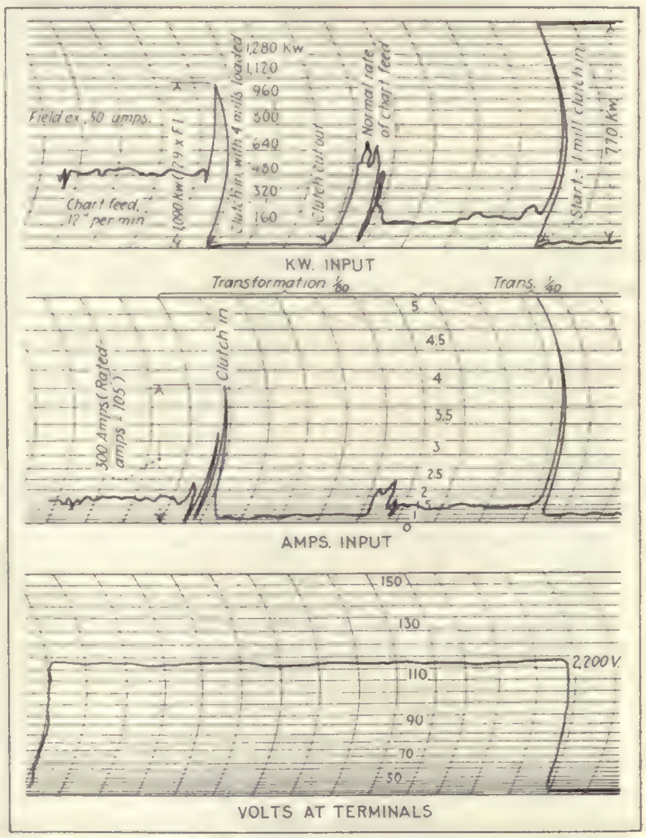


FIG. 3—ABILITY TO STAND UP UNDER HEAVY OVERLOADS WITHOUT PULLING OUT OF STEP IS A REQUIREMENT OF THE SYNCHRONOUS MOTOR IN RUBBER-MILL DRIVE

This diagram shows the result of a test on a 500-hp., three-phase, 2,200-volt, 60-cycle motor installed at Akron, Ohio. The motor was first loaded by putting the toughest rubber available through the four mills. The magnetic clutch was then tripped, and after the mills had come to a dead stop the clutch was energized, throwing a load of 1,090 kw. on a motor whose normal rated output is 372 kw. The motor-field excitation remained unaltered from the value corresponding to the full rated load and the motor remained in step.

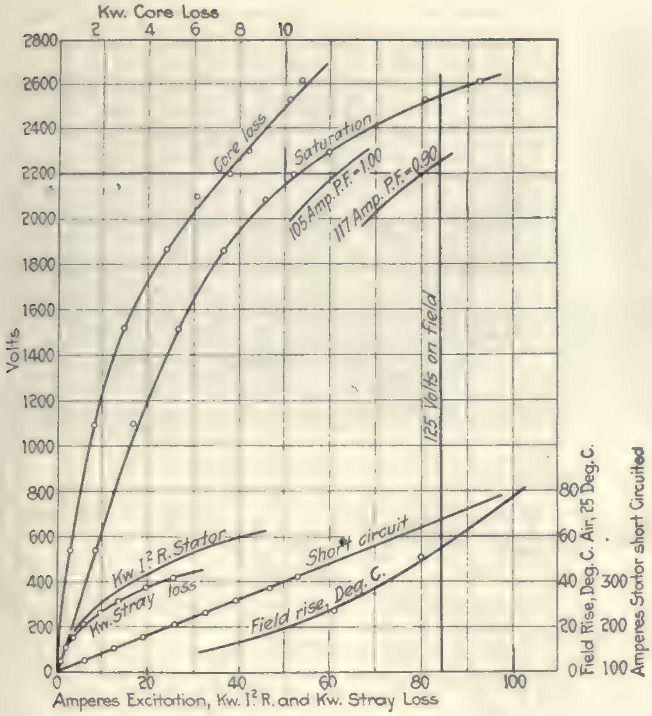


FIG. 4—CHARACTERISTIC OF 500-HP. SYNCHRONOUS MOTOR USED IN TESTS SHOWN IN FIG. 3

This refers to a 500-hp., 2,200-volt, 60-cycle, three-phase, 450-r.p.m. synchronous motor.

visions are made so that the direction of rotation of the rubber mills can be reversed. Graphical records are shown of the power input to the motor when it drives four rubber mills fully loaded and during one of the starting, braking and reversing tests.

On account of the novelty of this installation, it has been tested very thoroughly and is found capable of meeting all the requirements that may arise in a rubber-mill drive of this kind. The starting records indicate that with reduced starting voltage the motor would have ample torque to operate the mill under normal conditions. It was, however, decided to leave the taps as they were to insure ample torque in case of emergency, when it becomes necessary to back a heavy load of crude rubber out of the mills.

The tests also showed that the motor brought the loaded rubber mill to a stop in one-fifth of a turn of the rolls. By adjusting the resistance through which the motor is short-circuited the travel of the roll was reduced to less than one-sixth of a turn. During this test the mills were partly loaded. A repetition of the test with the mills empty showed that a stop was effected in less than one-fourth of a turn of the 22-in. mill roll. For the sake of comparison, two different induction-motor-driven mills, each equipped with magnetic clutch and solenoid-operated brakes, were stopped by tripping the emergency switch. Both mills were lightly loaded during this test, and they did not stop as quickly as the rolls stopped by dynamic braking.

Synchronous motors of standard design should not be applied for direct connection to rubber mills as their design and characteristics are not such as to meet the starting and reversing requirements without overheating. It is necessary that such motors be of particularly rugged mechanical design to meet the shocks occurring during the braking period. Owing to the reduction in first cost of installation and also of inspection and upkeep arising from the elimination of the magnetic clutch and solenoid-operated brakes, to the increase in efficiency and improvement in operation inherent in synchronous motors operating at unity or leading power factor, as compared with induction-motor installations, and, last but not least, to the increased security afforded the operators because of the efficient and consistent emergency stopping obtainable by dynamic braking, the synchronous motor will unquestionably make this type of installation very popular in grinding-plant extensions as well as in new rubber-mill installations.

Bureau of Standards Studies Street Lighting

THE Bureau of Standards is making a study of the various systems of street lighting used in cities and towns throughout the country. This work is now well under way and is receiving the hearty co-operation of municipalities and operating utilities. Several hundred replies to questionnaires on engineering practice and contract requirements have been received and are being carefully analyzed.

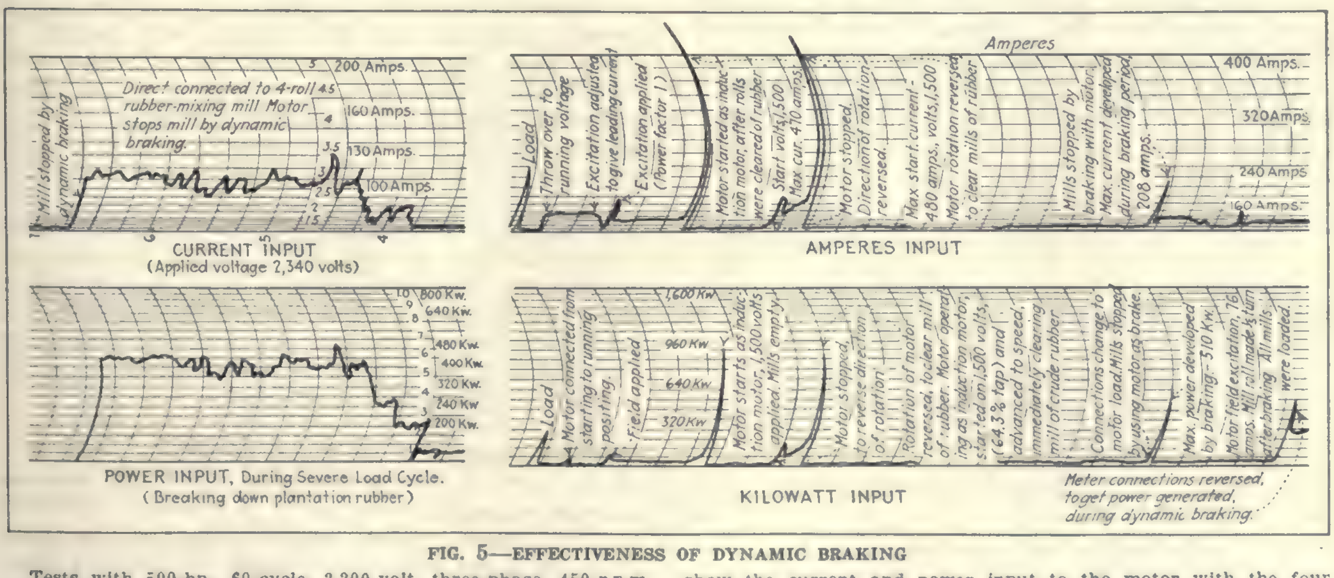
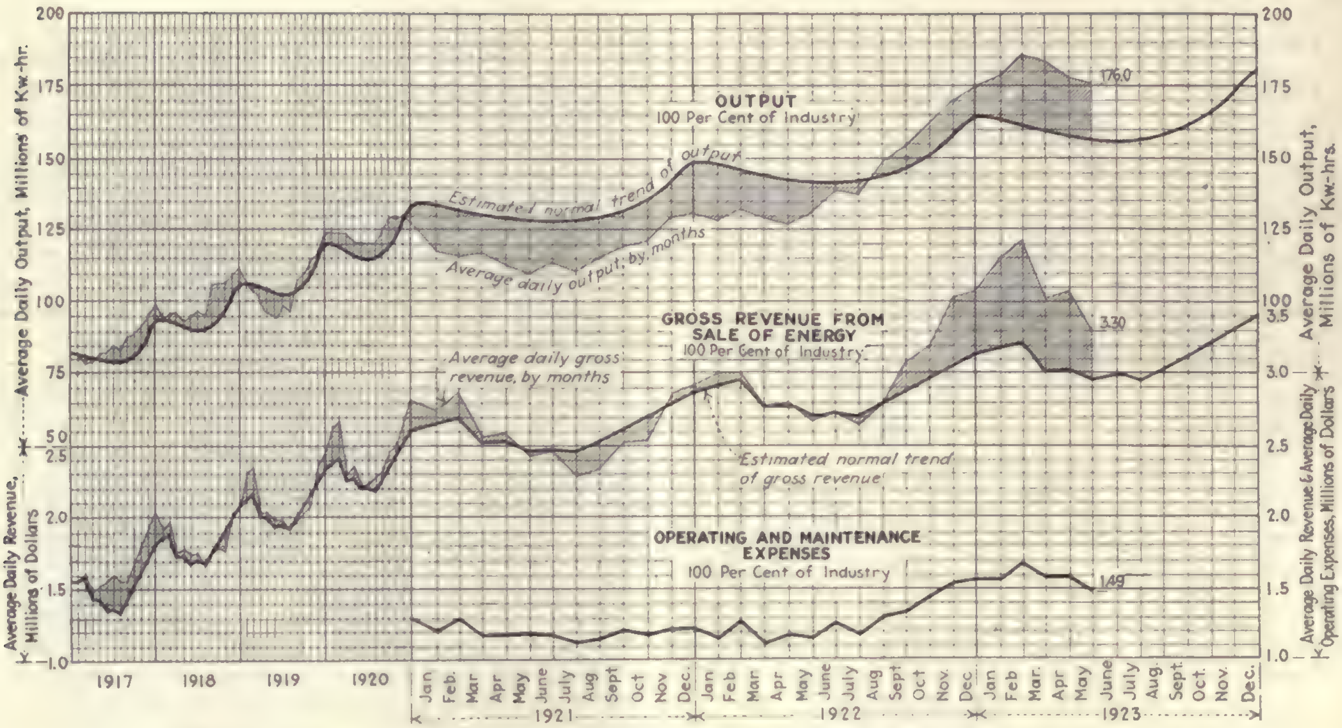


FIG. 5—EFFECTIVENESS OF DYNAMIC BRAKING

Tests with 500-hp., 60-cycle, 2,200-volt, three-phase, 450-r.p.m. synchronous motor using dynamic braking installed in the Fisk rubber plant at Cudahy, Wis., which show the ability of the motor to stand up under severe conditions. The short charts show the current and power input to the motor with the four rubber mills fully loaded. The longer charts show the current and power input to the motor during one of the starting, braking and reversing tests.



THE CENTRAL STATION OUTPUT DURING MAY WAS 12.4 PER CENT ABOVE NORMAL, AND THE GROSS REVENUE WAS 11.8 PER CENT ABOVE NORMAL

May Output About 12 per Cent Above Normal

REPORTS received by the ELECTRICAL WORLD for the month of May from central generating and distributing companies representing 74 per cent of the installed generator rating of the country indicate that the average daily output was slightly lower than that reported for April. Such a drop during May was to be expected, due to the advancing season and consequently decreased lighting requirements, with no unusual general increase in industrial activities.

A carefully worked out "normal trend of output and gross revenue" is presented in the accompanying diagram. This "normal trend" is based upon extensive studies made by the Federal Reserve Bank of New York City, with the exception that the rate of growth of the industry has been assumed as constant subsequent to 1917, whereas the Federal Reserve Bank believes that the rate of yearly growth is decreasing.

The average daily output during May was 175,987,000 kw.-hr., which is about 1,483,000 kw.-hr. below the figure reported for April. This output for May was 12.4 per cent above what would have been the seasonal energy requirement if growth in the industry had been normal, as indicated on the accompanying chart. A growth of 22.3 per cent in output is indicated over May of last year.

The average daily revenue from sales of energy during May was $3,303,000, which was about 8 per cent below the revenue reported for April. The decreased energy requirements of the high-revenue domestic lighting customers was the direct cause for this drop in revenue. This revenue, however, is 11.8 per cent above what would have been the revenue if growth in the industry had been normal. A growth of 20 per cent in gross revenue is indicated over May of last year.

Expressing the financial phase of the returns for the month of May in terms of the operating ratio, or ratio of operating expenses to gross revenue from sale of energy, indicates that the industry is financially in better shape than at this time last year. The operating ratio reported for May by companies having steam plants only, taken in the aggregate, was 51.3 per cent, as against 52.5 per cent for May of last year. It must be remembered that with May of last year the operating ratio of steam electric generating plants began to rise. The high point was reached in August when an operating ratio of 56.6 per cent was reported. By reason of the fact that there will probably be no marked rise in the price of coal during the coming summer, the operating ratio during the present year will undoubtedly remain several per cent below that recorded during the summer and fall months of last year.

The Pacific States were the only section reporting a material increase in energy requirements over those of April, which was undoubtedly due to the seasonal increase in energy requirements of irrigation customers in this section. Other sections reported operations about on a par with April except the North Central Section, which indicated a decreased consumption of about 3.6 per cent.

CENTRAL-STATION RETURNS FOR THREE MONTHS

Mos.	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting)			Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting)		
		1923 Thousands	1922 Thousands	Per Cent Increase		1923 Thousands	1922 Thousands	Per Cent Increase
Mar....	72	4,118,713	3,241,293	27.0	68	$74,158	$61,492	20.6
April..	73	3,886,794	3,071,879	26.5	68	73,124	60,892	20.1
May..	74	4,037,192	3,300,572	22.3	69	70,674	58,899	20.0

Mos.	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies Reporting)			Operating Ratio: Steam Plants		Hydro Plants		Combined Systems of Steam and Hydro	
		1923 Thousands of Dollars	1922 Thousands of Dollars	Per Cent Increase	1923	1922	1923	1922	1923	1922
Mar....	56	27,368	22,293	22.8	46.8	48.3	23.6	27.1	42.5	40.7
April..	56	26,249	21,265	23.4	48.2	49.0	30.8	28.8	44.7	42.0
May.	57	26,366	21,902	20.3	51.3	52.5	29.4	25.6	44.2	43.5

Department Store Illumination

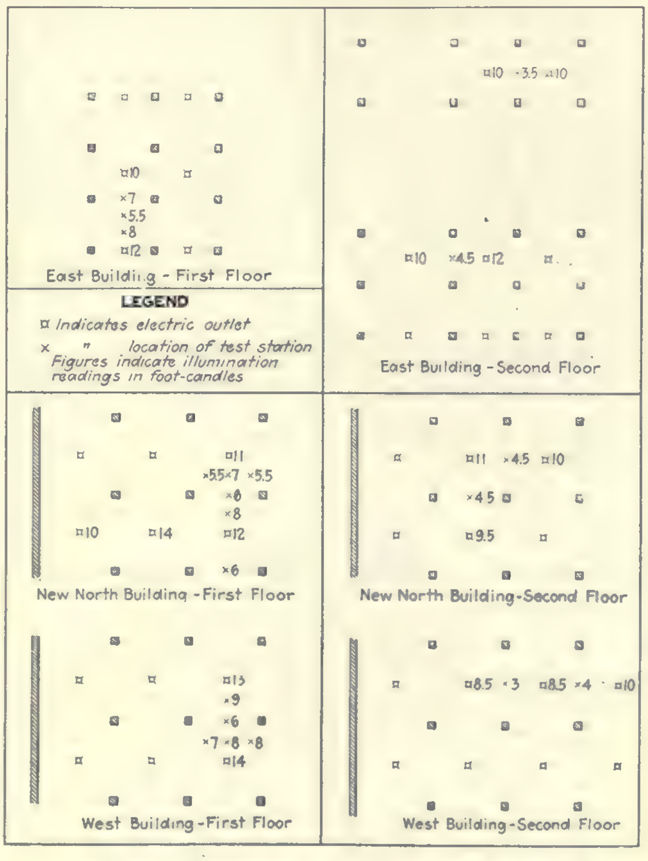
Building Committee of Joseph Horne Company Made Extensive Investigation Before Reaching Decision—Appearance, Diffusion, Distribution, Light Quality and Maintenance Have Special Consideration

THE best illumination which money could buy was sought by the Joseph Horne Company when it undertook an extensive addition to its department store in Pittsburgh, which has just been completed. The company was interested not only in harmonious appearance but in true economy. Illumination was desired that would carry with it the most effective sales atmosphere. The light must be without glare and show the patterns on white linen. Furthermore, it had to liven up the colors of an infinite variety of fabrics to be displayed. Above all, the light had to be such that wearing apparel would appear at its best.

Not only were two prominent architects engaged—Benno Janssen and W. Y. Cocken, Jr.—but also a well-known store-equipment expert—C. A. Wheeler. An opportunity was given to every manufacturer of lighting equipment to submit designs and guarantees. In addition to this, the building committee, which was formed to consider various plans submitted, visited other large cities to observe the lighting effects in various department stores.

Basing its conclusions on previous experience and the results of the study mentioned, the building committee decided that the first floor should be the most brightly illuminated to attract attention from the street and avoid what often appears to be gloom to a customer stepping from the daylight into a poorly lighted store. With the ceiling heights and dimensions of bays existing in this store it was considered necessary to use 750-watt units to obtain the intensity desired. Diffusion thus became the first problem. As the result of considerable experiment 20-in. diameter was selected as the minimum size of bowl which could be used without insufficient diffusion, but for appearance's sake, one of a little larger diameter—namely, 23 in.—was chosen for the main and second floors.

Various types of glassware were considered as to diffusion, light absorption, quality of light and so forth. Of these various grades of glassware "Celestialite" was looked upon with greatest favor, but there was a question at first whether its light absorption was not too great. To answer this question H. S. Whiting, the advocate of this glass and manufacturer of the luminaires, had tests conducted and it was shown to be 4 per cent less efficient than one other prominent make of glassware (see accompanying test), but it was contended that the quality of the light offset this lower efficiency. The question was finally answered in favor of "Celestialite" when colored fabrics were laid on a horizontal surface and a vertical partition placed over them in such a position that light from ordinary glass and light from color-corrective glass illuminated opposite halves of each fabric.



FOOT-CANDLE INTENSITIES AT 30-IN. ABOVE FLOOR IN DIFFERENT SECTIONS OF STORE

Three Methods of Supporting Luminaires

The fixture shown on the right was selected for use on the main and second floors, where artistic appearance and character of light distribution were most important. In sections where ceilings were low, as in the barber shop, a similar but smaller bowl was attached next to the ceiling. Elsewhere the fixture shown at the left was used. All of the luminaires have three-layer cased-glass bowls and hinged supports, permitting cleaning and replacements. To remove the bowl, withdraw pin in hinge.

With a 750 watt lamp hung in a bowl of this glass it was found that more desirable light distribution could be obtained by employing an enameled-steel reflector in a plane with the upper edge of the bowl. In fact, the downward illumination could be increased 15 to 25 per cent in this way. In the first experiments which were conducted with the reflectors holes were provided in the reflector to allow some upward illumination, but they were found to be unnecessary because the spacing of the fixtures and the shape of the bowl (see accompanying illustration) were such that enough light was directed at the ceiling without the holes to give a good effect.

As many as twenty to fifty drawings and models of specially designed hangers for these bowls were submitted by H. S. Whiting for comparison. The design finally adopted for the main floor was a relatively heavy casting. As shown in the accompanying illustration, the lower end of the lamp socket is supported about flush with the enameled-metal reflector. A split band is used to hold the bowl. Being hinged at one side and equipped with a safety chain at the opposite side, it can be swung down sufficiently to permit cleaning the inside of the bowl and the reflector and also changing the lamp. If it is necessary to take down the entire bowl for any reason, such as replacement, a pin can be withdrawn from the hinge and the bowl lowered onto a padded barrel. When the bowl is in the closed position a pin can be inserted through a hole in a tongue cast in the band on the opposite side from the hinge.

To improve the appearance of the unit an ornamental knob is attached to the lower side of the bowl. In this is a hole which, together with small holes in the reflector, permits a sufficient passage of air through the bowl to ventilate it without admitting too much dust.

These fixtures cost the Joseph Horne Company about $100 apiece, and the company's willingness to pay this price indicates the increasing importance that illumination is gaining in the minds of merchants.

Similar-shaped bowls with ornamental knobs were used on the other floors, but these were smaller in diameter, namely, 20 in. In the barber shop on the men's floor, for example, the bowls were supported in cast rings next to the ceiling. On other floors where the ceiling was higher a fixture like that shown above at the left was used. In all of these a hinged split band was used for clamping the bowl to facilitate cleaning and removal.

After the installation was completed illumination tests were made on the first and second floors to ascertain the foot-candle intensities obtained.

As explained before, the luminaires consisted of pendent inclosing globes of "Celestialite" three-layer cased glass (Gleason-Tiebout No. 5692, 23-in. diameter). The units, as indicated on the accompanying drawings, were situated in the center of each bay in the north and west sections of the building and down the center of the aisles on 24-ft. centers in the east section. In the case of the first two sections the typical bay was 23 ft. x 24 ft., or 552 sq. ft. in area. In the east section the aisles in which the reading were taken were 20 ft. wide, giving 480 sq. ft. to each unit.

The ceiling and mounting heights (measured from floor to bottom of globe) were as follows:

FEATURES OF LIGHTING INSTALLATION

All fixture dimensions are to bottom of glassware. A 4-in. round box is used in every instance.

Quantity of Fixtures	Building	Floor	Ceiling, Height (Ft. and In.)		Fixture, Length (Ft. and In.)		Height Above Floor (Ft. and In.)		Stud (In)	Center Stem Ornament
35	West–Old	1st	22	0	9	9	12	3	¾	Yes
18	West–New	1st	22	0	9	9	12	3	¾	Yes
25	East–Old	1st	20	5	8	2	12	3	¾	Yes
5	East–Old	1st	20 (on beams)	1	7	10	12	3	¾	Yes
35	West–Old	2nd	17	9½	6	5½	11	4	¾	No
40	West–New	2nd	17	0	5	9½	11	2½	½	No
30	East–Old	2nd	17 to 17	1 to 5½	*		11	4	¾	No
5	East–Old	2nd	16 to 17 (on beams)	10 to 1½	*		11	4	¾	No
34	East–Old	3rd	15 to 16	8½ to 2	*		10	0	¾	No
2	East–Old	3rd	15 (on beams)	7	5	7	10	0	¾	No
36	East–Old	6th	13	6	4	3	9	3	¾	No

* Electric plan necessary with height at each outlet.

Location	Celing Height (Ft.)	Mounting Height (Ft.)
First floor	22	12½
Second floor, north and west sections	18	11½
Second floor, east section	17½	12½

Each of the luminaires on the first floor was equipped with a clear 750-watt, 115-volt "PS-52 Mazda C" lamp, and those on the second floor were furnished with a clear 500-watt, 115-volt "PS-40 Mazda C" lamp. The walls and ceilings were finished in a glossy white and were fairly clean.

Illumination readings were made with a foot-candle meter at the positions indicated on the accompanying drawing. The instrument was placed on a table 30 in. high and all readings were made at this level. At the various positions the illumination was read independently by four observers and the average was recorded. Voltage readings were taken at the socket of one of the luminaires and were found to be so close to the voltage rating of the lamps and to remain so nearly constant that the effect on the illumination would not have been measurable.

The foot-candle readings for the various stations are recorded at their respective positions on the accompanying drawings. The average values of illumination on these two floors are as follows: First floor—12 foot-candles directly beneath luminaires and 6 foot-candles directly between luminaires; second floor—10 foot-candles directly beneath luminaires, and 4 foot-candles directly between luminaires.

These tests were made by the Illuminating Engineering Bureau of the Westinghouse Companies.

Comparisons of the efficiency of the glass selected for the globes with another well-known single-layer white diffusing glass are given below:

Type of Globe	Weight in Grams	Light Output in Percentage of Bare Lamp
Single-layer globe	1,443	79
"Celestialite" globe, No. 5920	1,479	75

In making this light-output comparison the incanmately ½ in. above the globe center and the top of the globe covered with white blotting paper. The light center was 3⅜ in. below the top of the globe. In each case a 150-watt ring-filament, clear-bulb lamp was used and the measurements of light output were made with an integrating sphere. The tests were made by the Electrical Testing Laboratories.

Signal Systems for Power Stations

Recent Practice in Providing for Various Alarm Signals Inside and Outside the Switchboard Room and for Operating Instructions as Well as General Communication—Not Too Elaborate but Still Adequate

By C. D. GRAY and M. M. SAMUELS

The J. G. White Engineering Corporation, New York

ALTHOUGH little attention was paid to signals in the older type of small power houses, it is rapidly becoming recognized that these important nerves of a power plant cannot be overlooked in modern design. Besides the customary signals in the switchboard room and general communication, provision must be made for calling the operator's attention to trouble in different pieces of apparatus and circuits, protection must be afforded against personal and equipment hazard, and intercommunication has to be provided between switchboard attendant, turbine operator, boiler foreman and other employees who must be kept in contact.

Extremes Should Be Avoided

Care must be exercised not to go from the one extreme of totally neglecting the question of signals to the other extreme of providing an over-elaborate system which will require too much care and attention. Particular care must be taken not to burden the switchboard panels themselves with too many unnecessary devices. It is not advisable to have an annunciator in the switchboard room giving a record of each individual oil switch, since this would only cause unnecessarily complicated wiring and would furthermore take the operator's attention away from the board where it should be. Neither is it necessary to provide three indicating lamps on the panel for each oil switch, one red showing when switch is closed, one green showing when the oil switch is temporarily open and one blue showing when switch is out of service. Such a multiplicity of lamps would tend only to complicate the wiring and to crowd the panel and increase the length of the control board. All are agreed that the tendency should be toward simple and short control boards.

Control Switch Shows Last Operation

A mechanical indicator on the control switch to show the last operation performed by the operator can take the place of the third lamp. There is at least one make of switch (Fig. 1) having a mechanical indicator which is both reliable and distinct and which also has the advantage that the position of the handle clearly indicates the last operation which has been performed by the operator.

The other extreme of disconnecting both lamps when the switch is not operating is dangerous since it is possible for a lamp to burn out, in which case the circuit would be thought of as not operating. Thus it is clear that the best signal for the individual circuit-breaker control on the panel is one red and one green lamp, one of which is always burning, combined with a control switch having a reliable and easily distinguishable mechanical indicator.

A well-balanced indicator system for a switchboard room taking care not only of the oil-switch alarm but likewise of the transformer alarm, telephone, etc., requiring only one bell (and one spare bell which can

be thrown on when the main bell fails on test) is shown in Fig. 2. For this system the oil circuit breakers of the station can be subdivided into as many groups as desired and a signal provided on the annunciator for each such group, such as "main switching No. 1," "main switching No. 2," "auxiliary switching," etc. All that is required on the switchboard is one bell-alarm relay for each group, actuated in the well-known manner when any of the oil switches belonging to this group trips, and being equipped with three contacts, one common, one for the bell and one for the annunciator sign. On the same signboard can be accommodated transformer alarm, telephone calls, etc., for which purpose the necessary relays can be accommodated within the signboard. It is difficult to obtain a transformer thermometer with three contacts, and the diagram therefore shows a relay for each transformer and a common relay for all transformers. The bell generally furnished with each telephone is omitted and a small relay substituted. This relay likewise is generally fur-

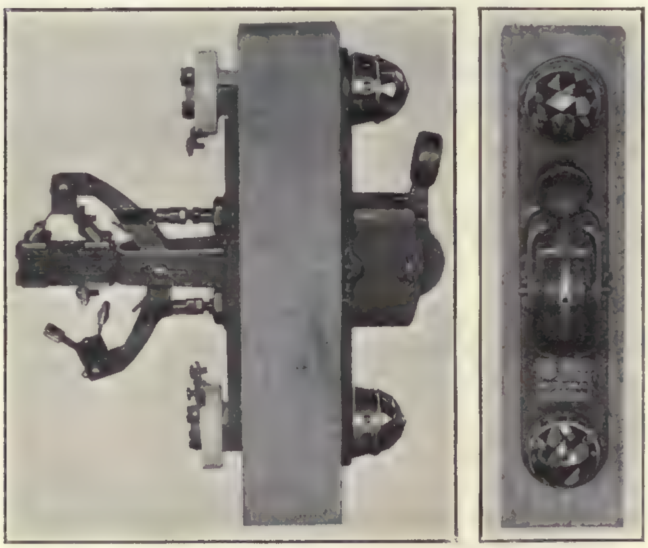


FIG. 1—CONTROL SWITCH THAT INDICATES LAST OPERATION

nished with only one pair of contacts, and an additional relay with three contacts is therefore shown on the diagram for each telephone. A multipole test switch is provided which can be closed daily for a moment and which will at once show any fault in the connections, fuses, relays, lamps or bell. No doubt relays with three contacts as well as transformer thermometers with three contacts will soon be developed, which will reduce the number of relays on the annunciator to a minimum.

For communication between the switchboard man and the turbine man the majority of older power houses have a pedestal near each turbine equipped with about six signal lamps operated from push-buttons on the switchboard and a number of push-buttons to operate return signal lamps on the switchboard. This system is both too complicated and requires too much space. Furthermore, it is a difficult matter to place the pedestal in the turbine room so that the man at the throttle can see it, and the throttle man has to delegate to a helper the operation of the return signals.

Plug-in Portable Telephone for Turbine Room

A system of communication which requires neither lamps on the switchboard nor obstructive and unsatisfactory pedestals in the turbine room and which is

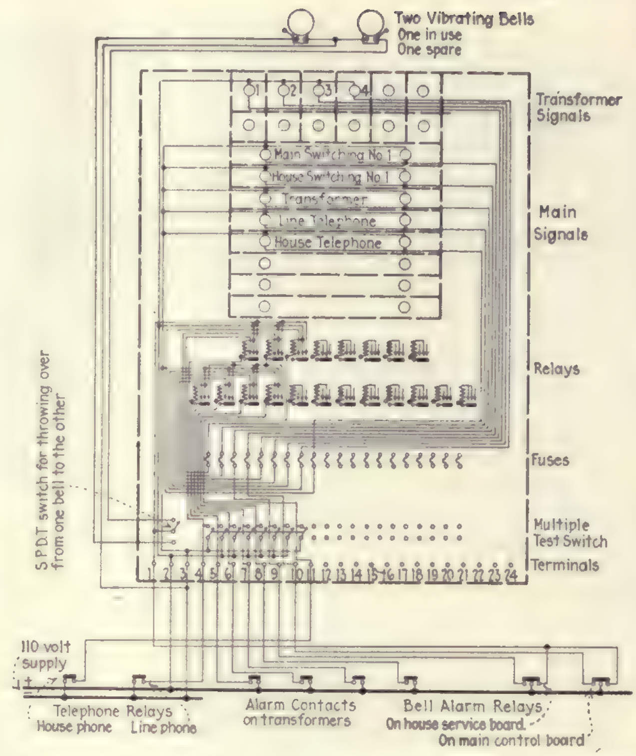


FIG. 2—CONNECTIONS OF ANNUNCIATOR FOR SWITCHBOARD ROOM, MAKING IT POSSIBLE TO USE ONLY ONE BELL FOR ALL PURPOSES

always within reach both of the switchboard operator and the turbine operator is shown diagrammatically in Fig. 4. A large signboard is provided on the turbine-room wall giving the unit numbers, and all there is on the switchboard is a double-pole push-button on each generator panel. When the switchboard operator requires the turbine man to go to a certain unit for starting up or other purposes, he pushes the button on the respective generator panel which both sounds a "howler" in the turbine room and shows in large illuminated letters the unit number to be attended. The switchboard room is equipped with an outfit for loud speaking and loud receiving, this being possible because there is generally very little noise in a modern switchboard room. A combined head and breast set is

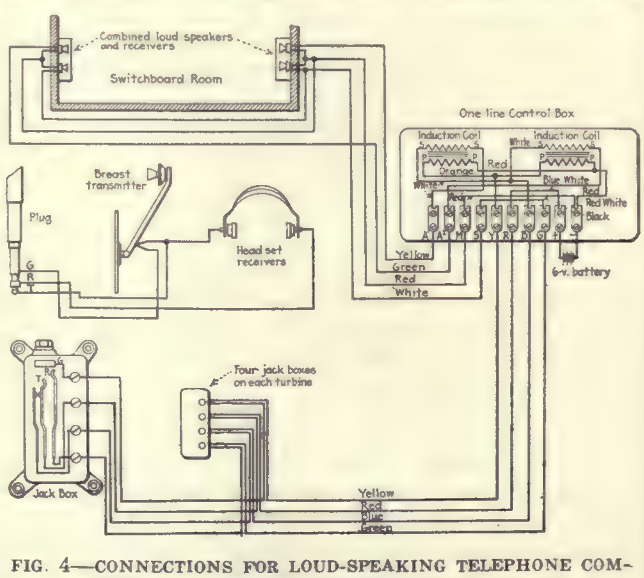


FIG. 4—CONNECTIONS FOR LOUD-SPEAKING TELEPHONE COMMUNICATION BETWEEN SWITCHBOARD MAN AND TURBINE-FLOOR MAN

available at each turbine unit, which can be plugged to any one of several jacks near the throttle. Thus a system of communication is established between switchboard room and turbine room, simple, unlimited in scope, requiring no operating of push-buttons and return buttons, and accomplished by means of four telephone wires. It is advisable to provide two signboards in parallel, one at each end of a long turbine room.

In large steam plants it is often advisable to treat the auxiliary load as if it represented customers and to establish substations in various parts of the plant to supply groups of motors for important auxiliary demands. The turbine-room basement, for instance, will generally have a great many motors, such as those for circulating pumps, condensate pumps, house pumps, etc. One or more auxiliary substations will generally be established in the turbine-room basement for the purpose, not directly under the control of the switchboard operator, but under the direct supervision of the pump man, whose attention must be directed to any motor which may trip out. For this purpose a headquarters is established in the basement for the pump man, where a signboard similar to the one in the switchboard room is provided, equipped with bell and test switch and indicating the group of motors one of which tripped. The individual motor affected can be determined by the handle of the respective circuit breaker on the auxiliary substation, which is generally hand-operated. The telephone signal for the pump man can likewise be taken care of on this signboard.

AUTOMATIC TELEPHONE FOR GENERAL COMMUNICATION

For general communication between the various operating men in a large power house the best that can be provided is an automatic telephone for direct calling by the well-known dial method, which is more satisfactory than the ordinary intercommunicating telephone. It allows for extension, is very reliable in operation, requires only one pair of wires per telephone and requires no push-buttons for calling. It is advisable to provide a "conference call" attachment, which allows the chief engineer to talk to all the operators in the stations and thus facilitates the issuing of general instructions, warnings or alarms.

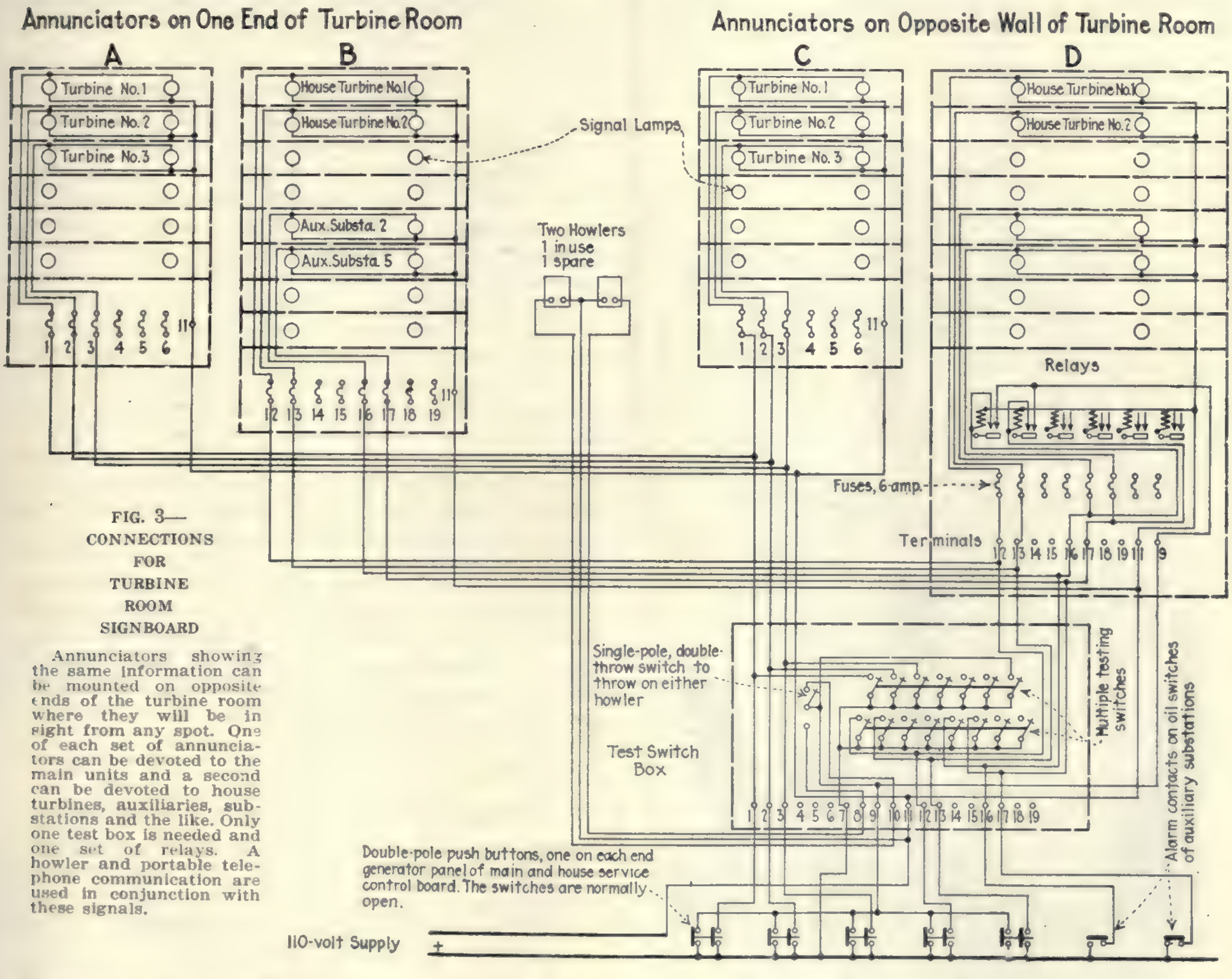


FIG. 3—CONNECTIONS FOR TURBINE ROOM SIGNBOARD

Annunciators showing the same information can be mounted on opposite ends of the turbine room where they will be in sight from any spot. One of each set of annunciators can be devoted to the main units and a second can be devoted to house turbines, auxiliaries, substations and the like. Only one test box is needed and one set of relays. A howler and portable telephone communication are used in conjunction with these signals.

Another feature for signaling in a large steam plant is the necessity to keep the boiler man informed of the existing load and, what is more important, to advise him of the expected load in order to enable him to have additional boilers ready when necessary. A very reliable system of communication for this purpose consists of a 24-in. diameter indicator installed in the fireroom and equipped with dial and two hands, one pointing at the existing load and the other at the expected load. The switchboard operator sets these two hands electrically from his desk by means of two small handles on a transmitter box, ringing a bell in the fireroom every time he changes the setting. The large

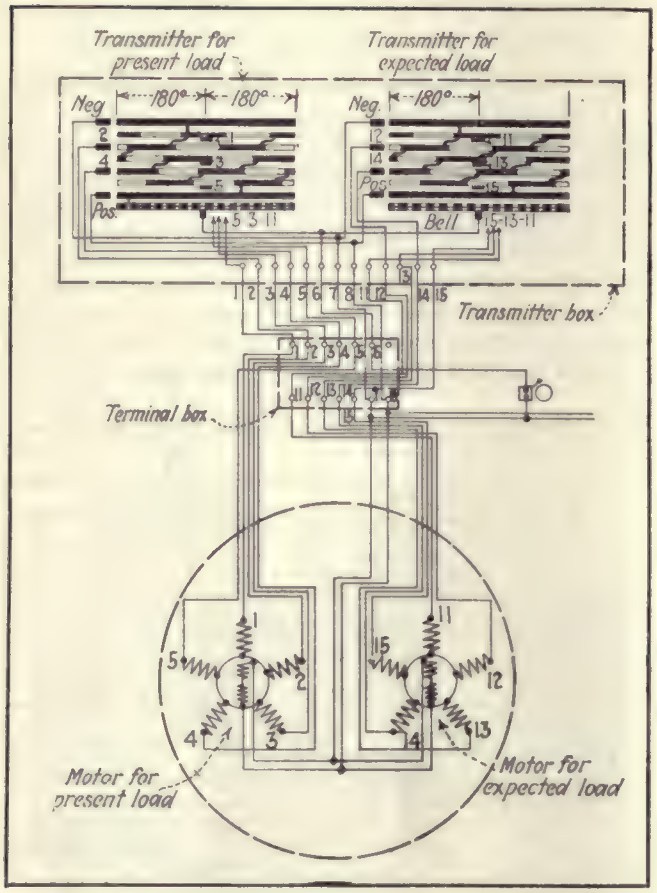


FIG. 5—CONNECTIONS FOR ADVISING BOILER MAN OF EXISTING AND EXPECTED LOAD FROM SWITCHBOARD ROOM

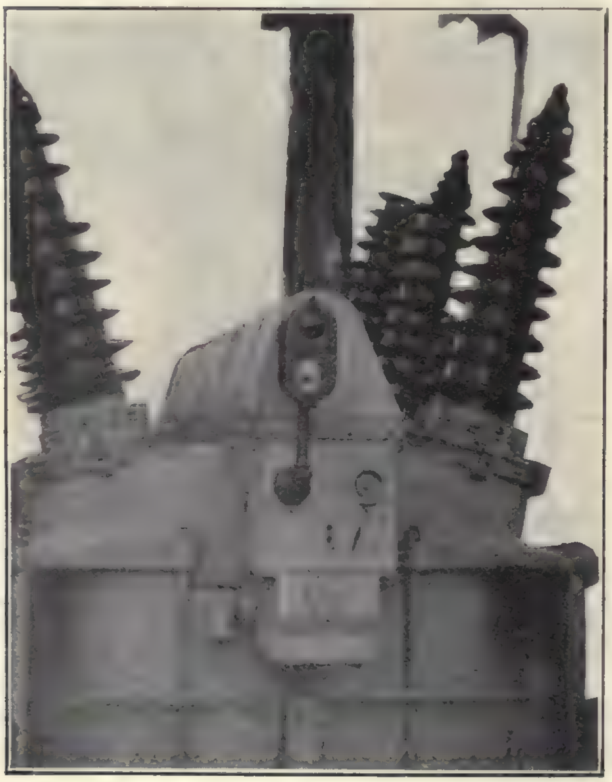


FIG. 6—SIGNAL BOX WITH RED AND GREEN SEMAPHORE LENSES MOUNTED ON TRANSFORMERS AND OTHER APPARATUS TO SHOW WHETHER EQUIPMENT IS ENERGIZED

dial on the fireroom indicator is illuminated and can be read from a great distance. The operation is accomplished by means of small motors which operate in perfect synchronism with the transmitters, so that they immediately resume their relationship upon resumption of their power feed, even though the pointers have drifted away while power was off.

Most of the large modern power houses have totalizing graphic wattmeters, and a system has recently been worked up whereby any number of totalizing indicating wattmeters can be operated at remote points from this totalizing graphic meter. When this system is used, the indication of the existing load in the fireroom can be accomplished automatically by means of such a totalizing indicating wattmeter with a large dial, and the signaling has only to advise the boiler man of the expected load.

TELLTALE LAMPS ON EQUIPMENT

The switching of a large power plant cannot always be done in "single-track" way, and oil switches, transformers and lightning arresters can be energized from more than one point. For this reason the danger ever prevails that an operator disconnecting a piece of apparatus from one source of energy may think the apparatus dead even though it may still be connected to another source. It therefore becomes necessary to provide a red and green indicating lamp on every transformer, lightning arrester, large oil circuit breaker, etc., the red lamp to light when the apparatus is energized from any source whatever and the green lamp to light only when the apparatus is disconnected completely. Such a box is shown in Fig. 6. It is of neat design having one red and one green semaphore lens, 2½ in. in diameter, and a hinged door, so that there is no possibility of interchanging red and green.

The devices described are being installed in the Pine Grove power plant of the East Penn Electric Company. The signboards and signal boxes are being supplied by Charles Cory & Sons, the loud-speaking telephone by the Callophone Company and the automatic telephone by the Automatic Electric Company. The power house was designed and constructed by the J. G. White Engineering Corporation.

British Electricity Supply Statistics

THE Electricity Commissioners have issued analyses and summaries of the fuel consumption and the kilowatt-hours generated during the year ended March 31, 1922, by 536 electrical undertakings in Great Britain. A new form has been adopted in which to present these statistics, classifying them into districts on the lines of the electricity districts determined by the commissioners. No very satisfactory comparison is thus possible with the figures given last year.

Steam stations (396) generated 4,732,000,000 kw.-hr., with an average consumption of 3.11 lb., the highest thermal efficiency of any such plant being 17.2 per cent; gas-producer stations (60) generated nearly 15,000,000 kw.-hr. on an average consumption of 2.64 lb. each and with a maximum thermal efficiency of 15.12 per cent, and oil-engine stations (52) generated 31,500,000 kw.-hr., using 2.08 lb. of oil per unit and displaying a maximum efficiency of 29.15 per cent. The remaining seventy-nine stations, of which fifty-one are composite in character, generated 105,000,000 kw.-hr. from waste heat, destructor refuse, gas and water power.

65,000-Kva. Generator Design

Respects in Which Plan Followed in Germany Differs from that Adopted in America—Constant Stresses and Self-Ventilation Are Main Features—Coil, Teeth and Rotor Designs Are Unusual

By DR. ROBERT POHL
Chief Electrical Engineer A.E.G. Turbine Works, Berlin

WHILE American engineers have all along been the pioneers in the development of large water-power plants and have done much of the work which created the modern long-distance transmission system, the German electrical industry may claim a conspicuous share of the credit which attaches to the evolution of the steam turbo-generator. The two 60,000-kva. sets at the Goldenberg works near Cologne, put into operation in 1919, perhaps give the most striking support to this claim. They are still of their kind the world's largest units in actual operation, though generators of similar output at 60 cycles are, I believe, in course of construction in the United States. The Goldenberg works generators have proved so successful, from the point of view both of economy and reliability, that an order for two further machines of slightly larger electrical capacity has recently been placed with the Allgemeine Elektricitäts-Gesellschaft, and the new units are now in course of manufacture.

Of the two alternators originally installed at the Goldenberg works only one was manufactured by the A. E. G., the other by the Siemens-Schuckert works. The design of the latter has been described by Reichel.* Its main features, especially those of its rotor, are somewhat similar to American designs. The six-pole rotor, weighing about 100 tons, consists of steel disks of 2.25 m. diameter shrunk upon a solid forging of about 1.1 m. diameter. The rotor slots are milled into the disks to receive the winding, which is laid down turn by turn, and the coil ends are held by bells of alloy steel. The total weight of the alternator is about 250 tons (4.2 kg. per kva.).

The A. E. G. alternator, though its weight and dimensions are very similar, is made after a different design, and the two other machines now in course of manufacture are improved only in details. Their output at 70 per cent power factor will be 6,600 volts, 5,250 amp., 60,000 kva., 50 cycles, 1,000 r.p.m., with a range of voltage variation between 6,000 and 7,000. At a higher power factor and 7,000 volts, each generator has a capacity of 65,000 kva. It was found that this capacity might have been obtained with a four-pole design; that is to say, with a working speed of 1,500 r.p.m., whereby a considerable economy in weight and dimensions might have been obtained. But because of the experience already gained with the six-pole design, as well as for reasons of interchangeability, it was decided to adhere to it.

The following illustrations will be of special interest to American readers, since the design differs in important respects from familiar practice, more particularly in regard to the rotor. The principle of construction adopted is to produce during the building up of the rotor and its windings stresses in all its parts so great as to exceed the stresses later on set up by centrifugal force even during the overspeed trial. There is thus no possibility of changing the balance, and the need for rebalancing on the site no longer occurs. Moreover, the mechanical factor of safety attainable with this

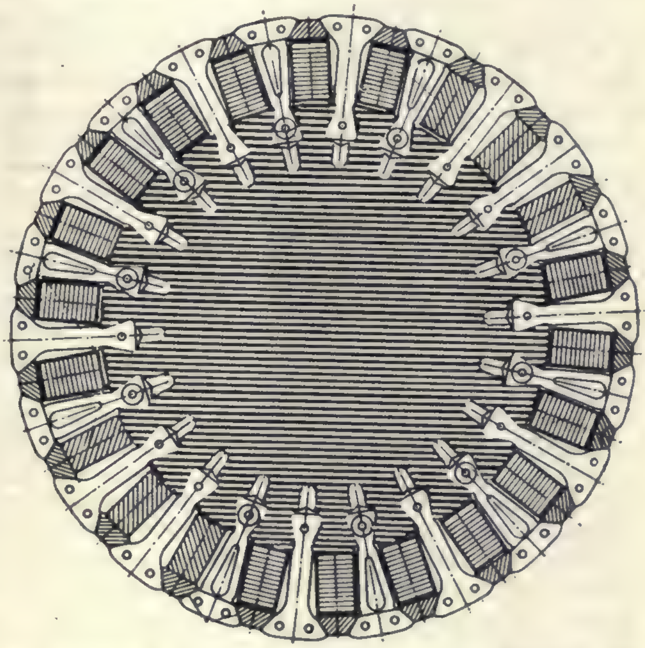


FIG. 1—ROTOR TEETH ARE DOVETAILED INTO THE ROTOR AFTER THE COILS ARE PLACED IN POSITION

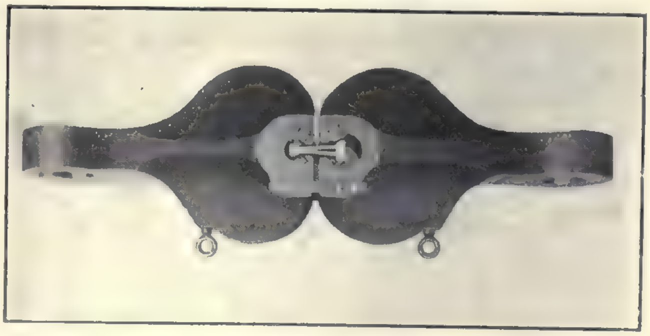


FIG. 2—TESTING ARRANGEMENT TO FIND THE MECHANICAL RELIABILITY OF TOOTH PACKETS

design is so high that an overspeed test of 35 to 50 per cent above normal speed, instead of the usual 15 to 20 per cent, can be resorted to. Pursuing this principle, the rotor coils are wound completely on a winding machine, baked at a temperature of 180 deg. C. and pressed to exact shape at about three times the running pressure. They are then hard and almost like solid copper. Such coils cannot, of course, be placed

*Zeitschrift des Vereines Deutscher Ingenieure, Aug. 27, 1921.

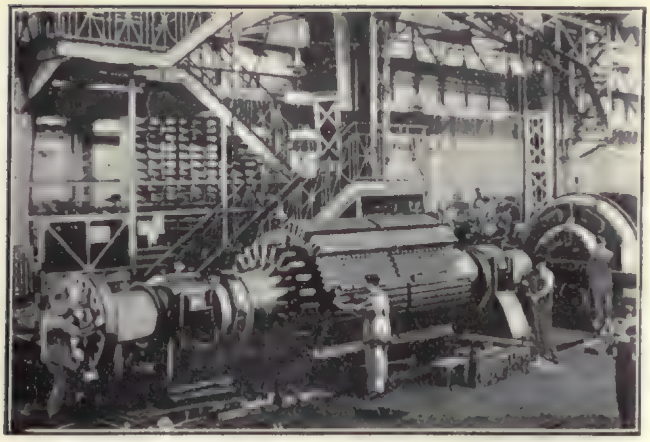


FIG. 3—NEW TYPE OF ROTOR WITH SHRUNKEN STEEL DISKS CONTAINING DOVETAILS FOR TEETH

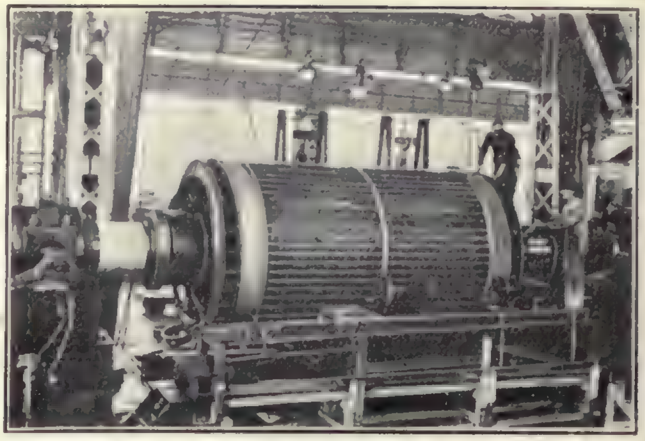


FIG. 4—STEEL-BAND WIRES ARE USED ON THE COIL ENDS INSTEAD OF END BELLS

into milled slots. They can be used only in a design in which the rotor teeth are dovetailed into the core after the coils have been placed in position. Hence the magnetic section of the rotor consists in principle of a solid core with dovetails around its circumference, into which packets of tooth punchings are threaded after assembly of the rotor coils. The packets are each riveted together and separated from one another by the projecting rivet heads. The vent ducts so created, together with the air grooves in the core and the air spaces alongside the coils in the slots, form an elaborate system of axial and radial ventilation. Heavy bronze wedges at the top of each slot, sliding upon a slightly wedge-shaped liner, finally secure all parts.

Applying the principle of construction which aims at constant stresses, whether running or standing, to the design of the rotor end windings, it is clear that the coil ends must not be allowed, under the influence of the centrifugal force, to lie against solid end bells, as is the case in most other designs. To create the desired constant stresses, the coil ends must on the contrary be pressed down upon a solid support by suitably designed steel wire bands, and these bands must be wound on under such a predetermined and recorded tension as to insure the desired result. If this is done, there is then no danger of rupture due to fatigue since fatigue results from varying tension and there is never any change of tension here, nor is there any risk of explosion. Moreover, the mechanical factor of safety is extremely high owing to the high tensile strength of binding wire. To make doubly sure, there is finally the searching overspeed trial of the complete rotor, which is extended over half an hour at 50 per cent above normal speed, and this speed must not cause any appreciable change of balance. The rotors of the new 65,000-kva. alternators differ in design from the foregoing description only because the core consists not of one solid forging as depicted, but, for obvious reasons, had to be divided into an inner solid forging and a number of steel disks shrunk upon the former. The steel disks are dovetailed around their circumference to receive the teeth. The photograph (Fig. 3) shows the state of the rotor in which the teeth are being provisionally mounted in position. Fans at either end supply the whole of the cooling air required. Self-ventilation, despite its somewhat lower efficiency, has in practice proved preferable to a separate slow-speed fan such as was used for one of the first two 60,000-kva. generators at the Goldenberg works.

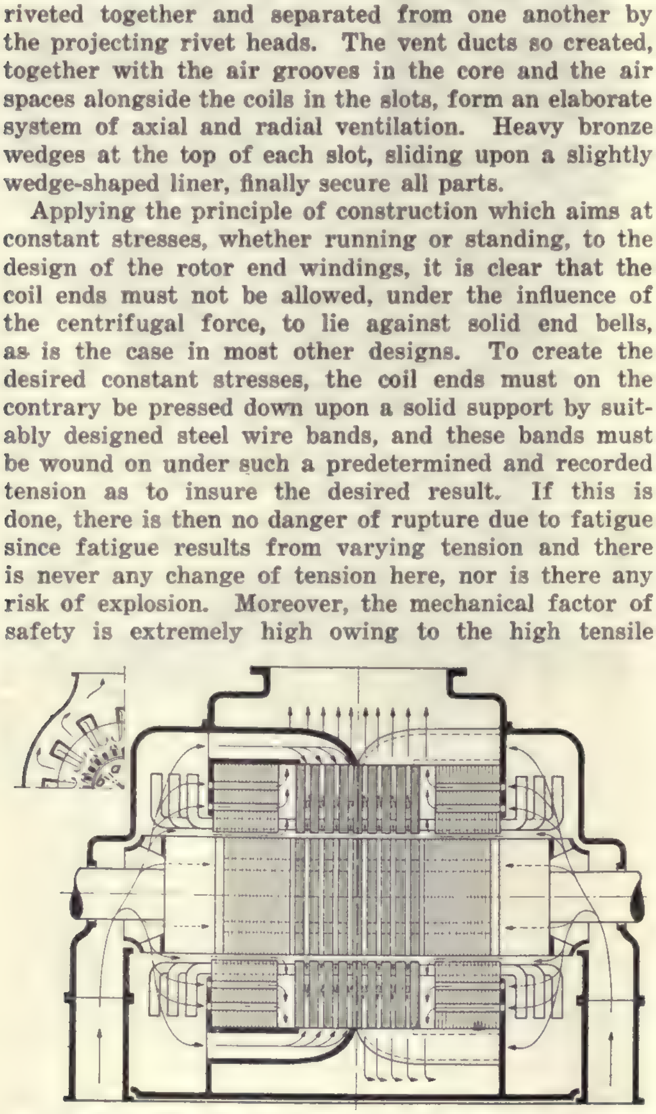


FIG. 5—VENTILATION IS RADIAL, WITH SOME AXIAL COOLING AT EITHER SIDE

The stator design, as far as the system of ventilation is concerned, corresponds to the usual plan of numerous radial ducts supplied with cooling air both from the inner periphery—i.e., from the rotor—and from the outer periphery. Axial channels are provided in the stator frame above the stampings which lead the cooling air to the radial ducts and thus insure practically uniform cooling over the whole length of the active material. Fig. 5 indicates the principle of ventilation in combination with purely axial cooling for a certain depth at either side. Local temperature measurements have shown that by suitably apportioning the amount of air to the center and the sides and distributing the ducts over the center portion hot spots are completely avoided. Thus the mean temperature of the stator winding as ascertained by the resistance method gives higher values than can be found by embedded thermocouples. In this connection it must be pointed out, however, that the stator winding, in accordance with European practice, is of the single-bar type, not of the double-bar or double-layer type customary in America. That is to say, there is only one laminated bar per slot. Hence the thermocouple can be placed only at the side of the bar, not between two bars. The end connections are of involute shape and braced in such a manner that reactors for limiting the initial short-circuit current may be dispensed with. The value of the latter does not exceed fifteen times the normal current, while the steady short-circuit current is only one and seven-tenths times the normal.

The Girl at the Window

Being a Philosophical Discussion of the Importance and the Influence of the Front Office, the Front Window and the Young Woman Who Sits Behind It

By WARREN R. VOORHIS
Vice-President American Water Works & Electric Company, New York

I HAVE great respect for chief engineers of local plants. They are at ease in the presence of vast, fearsome machines; they can read blueprints and make curves that will prove anything to one who does not understand their curves.

I am abashed in the presence of the financial directors of public utilities. Mostly they sit behind desks with glass tops. It is believed that they ponder over financial matters, and it is known that they figure with a slide rule and read New York financial journals which are not illustrated.

And who can doubt the value and influence of the general manager? The chief engineer keeps the physical plant in trim; the financial man provides the money, and the general manager co-ordinates these, and the result is a unit of service to the city.

Sometimes the general manager is even called tc the home office for a conference, and if this does not indicate his importance, I don't know what proof anybody would require.

The engineer, the financier and the manager—useful men these, and responsible.

The Cost of the Front Window

Now let us start this article—"The Girl at the Window."

For every patron who knows the engineer of the plant a hundred patrons know the Girl at the Window. Ninety-five per cent of the consumers will live in comfort and die in peace without ever being inside the plant, but 95 per cent of them know the front office and persons in charge there.

If you mention the light plant to a consumer, he will not think of the engineer, certainly not of the financial director or even the manager. He thinks of the front office.

Here is a matter for some thought.

When the price of coal goes up the engineer can measure the increased cost of operation accurately. When money is dear the financier can calculate its effect upon the company's operations.

I do not know how to measure exactly that reduced efficiency of a plant which can be caused by a mean disposition and a snippy tongue at the front window, but it must be considerable.

Front Office Appearance

The Girl at the Window will give the manager no peace until she gets a neat, clean front office.

Maybe not blue-veined marble and white tile and shining plate glass—soap and water and paint will help.

No wallpaper can stand constant exposure for more than ten years without giving way under the strain. If the county fair is over in July, the poster in the front office might as well come down shortly before Christmas. Some one ought to keep the wall calendar in the front office torn off to within ten days to two weeks of the true date.

In the public utility business there are two articles which never seem to wear out, cast-iron pipe and the blue window shades in the front office; but the pipe is buried in the ground, while the shades can be seen of all men.

Once or twice in a decade they should be turned bottom end to the top.

If there is a wall desk in the front office where people may write checks, the public pen should be changed annually.

It must be remembered that a patron writes such checks with great groaning of spirit at best, and if he is obliged to struggle with pasty ink and a rusty pen, by the time he gets to the front window he is far on the road to Bolshevism, and the most charming and courteous of girls will have a hard time to keep the peace with him.

There is a little front office down in Virginia which is a pleasure to remember. So clean, so bright and businesslike and wholesome, it was a fine setting for the very competent and charming young lady who, in Virginia, one would, of course, expect to meet.

If the company expects the Girl at the Window to help create and keep the good will of the patrons, don't handicap her by a front office which has the general color scheme of a waiting room of a flag station on a branch railroad line which is in the hands of a receiver.

Front-Window Conversation

Ths Girl at the Window always remembers she is dealing with people at a time when they are engaged in the distasteful business of paying for a necessity.

A man who appeals to high heaven for relief against the extortion of a soulless corporation when he pays a three-dollar gas bill will stand in line for hours to pay ten dollars for a ticket to a prize fight.

This is perfectly right and proper and as it should be, and in the perfect state all necessities will be free and we can spend our money for luxuries.

I only call attention to the fine opportunity this gives to the Girl at the Window to improve her disposition.

Anyobdy can get along with people when they are happy and cheerful and good-humored.

But in her dealing with scores of people of every degree, every day, when they are not especially gay or in a festive mood, she has an opportunity to develop that charm of pleasant, courteous personality for which there is room in every home or business on this earth.

But if the Girl at the Window wishes to cultivate a sarcastic style of conversation, she will never have a better opportunity. Brilliant repartee, it is called in collegiate circles; bright, snappy stuff, at the ten-cent stores. It sounds funny in magazine stories, and people laugh at it on the stage.

She can ask a customer what he expects the company to give him for three dollars, anyway. She can tell him that she should worry whether he pays his bill or not.

She can tell the world that she is not there to hear all the grief in town, but only to take in money. She can ask the man who doesn't like the way we run our company what he is going to do about it. Bright, snappy stuff, as we have said, and clever and original.

And so safe—for all the time she is behind her window and people can only pay and damn the company.

Or she can be a little more like that Girl at the Window down at Evansville. The other day the manager told me that she knew hundreds of patrons by name. He said she managed to slip in a friendly word with every receipt.

He told me that this girl had friends everywhere—from bank presidents to laborers.

This girl probably has a way with her. No doubt she is really interested in people and from her window looks out on a friendly world. I have noticed that friendly, happy people generally live in that kind of a world.

I gathered from my talk with the manager that the company intended to keep her as long as she would stay. I should think so.

What the Girl Should Be

The Girl at the Window is a business girl, and she knows it and looks it.

But, man of courage that I am, I can perhaps bring myself to a description of how she looks, but not how she achieves it.

If I were an old-fashioned person, this would be the place in this article for me to deplore the alleged fripperies, frivolities and transparencies of our girls.

But I am not an old-fashioned person. Anything but. And while my eyes are perhaps not so good as once they were, they have taken no injury from looking at the American girl.

But, just as I feared, I find I can only describe the impression she makes, not how she does it. She is that combination of trim, well-set-up and intelligent competence, plus a friendly, courteous charm of manner, which makes the modern American girl an important factor in business.

I have heard that there are two schools of thought among business girls as to the amount of information about the business which they should have.

One theory is that a girl needs to know only the one thing which she is employed to do and the boss has no business to expect her to know any more. I have heard that this is the view of many employees.

The other theory is that she should learn all she can of all sides of the business. I am told that this theory is held by many employers formerly employees.

The Girl at the Front Window is not perplexed by this rivalry of thought, for she is obliged to know all about all the business, or where the information can be had, in order to run her particular job.

One time, down in Alabama, I stood for a while by the front window, near enough to hear the talk.

It took far more knowledge of the plant than I had to answer the questions, but each patron got an answer of some kind. He either got the information he wanted or was told where to get it.

And she did not seem to take these questions and requests for information as a personal affront.

She actually gave me the impression that, in her opinion, people were entitled to courteous consideration along with the privilege of paying their bills.

A good many people appreciate that kind of treatment.

The Girl at the Window will find that a general knowledge of the business will be no serious impediment to her success.

The chief engineer is a harried man who lives in fear of increased operating expenses. He works for increased efficiency at lowest cost.

Here the Girl at the Window has a distinct advantage, for she can reduce friction between the company and the consumers without spending a dollar more for oil.

She knows that it does not take any more coal to pump water or supply electrical energy to a satisfied consumer than to one who is mad.

In the whole operation there is no place where efficiency can be increased at less money cost than in the front office.

A Word of Admiration

If I were writing this article to young men I would close with a few appropriate and well-chosen words of wisdom and advice.

But it is for the Girl at the Window, and no man living or dead ever added anything to his reputation for wisdom by giving admonition or advice to women.

If any girl reads this, she will take of it so much as she approves, first and properly remarking that no man who never stood one day behind a front window has any right to tell her about her business.

But if the Girl at the Window will have none of my advice, perhaps her repugnance to a word of admiration and appreciation is not invincible.

That is the purpose of this writing.

New Hydro-Electric Plant on the Rhone

The hydro-electric plant under construction on the Rhone, 20 km. below Geneva, reports the *Alpes Industrielles*, will be equipped to furnish a maximum of 40,000 hp. from a flow of 450 cu.m. per second, available during a part of the year only. The work is now under way simultaneously in France and in Switzerland as the frontier at the site of the dam follows the middle of the river. In the construction provision is made for the future necessities of navigation.

The height of the fall will be about 9 m. at low water. At high water it will be appreciably less because the upper levels must remain invariable because of administrative requirements, while the lower levels will be considerably raised. The equipment of the plant will consist of five turbines capable of developing 8,700 hp. each, functioning at a speed of 83.3 revolutions per minute. Each turbine will take 92 cu.m. of water per second, a figure which, it is claimed, constitutes a record in Europe. Above each turbine will be installed an alternator, operating at the same speed and transforming the energy into a three-phase electric current of 11,000 volts. A transformer station will change the current to 120,000 volts for greater facility of transport to places of utilization.

It is expected that this plant, which is intended primarily to furnish power for industrial needs in the Departments of the Ain and Saône-et-Loire, will be put into operation toward the end of 1924.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Why Not Reset Used Poles?

To the Editors of the ELECTRICAL WORLD:

In the operation of a large traction and electric service system replacements and rehabilitation of lines require a continual changeover of poles and during the course of several years the pole yard grows to cover a considerable area. Unless some means is devised to put these poles back on an earning basis for the company much money is lost or thrown away if the poles are "stubbed" or used indiscriminately.

However, the Traction Light & Power Company, Anderson Ind., has a system which eliminates this waste. As each group of old poles is brought into the yard they are sawed off at the ground line, if this section is badly rotted. At any rate they are all looked over and graded. Each pole is placed in a neat pile corresponding to its size, so that an accurate check can be made at all times of the various stocks of poles.

Then as construction orders come through for extensions to rural lines, or short runs in alleys, where old poles in good condition can serve just as well, the required number of poles are taken from this pile. Of course, a close check must be kept as to the actual physical condition of the poles, since there is an economic limit beyond which it would be unprofitable to use them again. However, our company estimates that if such a shortened pole will last five years on an alley or a short rural extension line that pole has more than paid for the cost of setting.

The entire question is an economic one, determining whether the remaining life of a used pole will outbalance the cost of its setting. Some thought must also be given to the waste of stubbing poles and putting them to better advantage. There is no need of cutting up a 25-ft. pole which has about ten more years of life when smaller poles will serve equally well!

Anderson, Ind. J. W. WALKER,
Operating Superintendent.

Protective Value of Weatherproof Wire

To the Editors of the ELECTRICAL WORLD:

A large number of engineers and operating men are guilty of the error of thinking that weatherproof wire does not afford any protection after a few years' use. I am ready to admit that this is true of some classes of weatherproof insulation, but a thorough canvass among line foremen and linemen who have worked for a number of years on heavy distribution leads in cities will convince the most skeptical that weatherproof insulation affords some real protection.

I undertook the investigation of this subject prejudiced against weatherproof insulation, and finished fully convinced that there are many places where it should be used. If it is to be used at all, the best insulation procurable should be used. In some of the correspondence I had on this subject one superintendent wrote that the only reason he used it was to comply with city ordinances, and he wanted the very cheapest weatherproofing that he could get.

My investigation showed conclusively that a large amount of first-class weatherproof insulation is damaged, when being strung, by pulling it over sharp-edged cross-arms. Linemen have told me that they have seen two braids of brand new wire cut through by this careless method of handling, and they have also admitted that a little ordinary care would have prevented it. Wire damaged in this manner and exposed to the weather for periods of one to three years becomes taggy and stringy, and of course gives no protection, and has created the impression that all weatherproofing is a farce and a fraud. I have seen cases where weatherproof insulation was hanging from the wires, caused by the wires being temporarily overloaded to such an extent that practically all the compound was melted out. On one occasion I saw a weatherproofed railway feeder so heavily overloaded for a short period that the insulation caught fire and was completely ruined for a distance of nearly a mile. It is occurrences of this kind, without all the facts being known, that have hidden the truth as to the protection afforded by first-class weatherproofing carefully installed. S. C. LINDSAY,

Puget Sound Power & Light Company, Seattle, Wash. Electrical Engineer.

Arc-Type Better than Induction Furnaces

To the Editors of the ELECTRICAL WORLD:

According to the article in your July 28 issue entitled "Electric Furnaces Exclusively Employed in Germany," it seems that induction furnaces are generally used, but I believe that the modern arc-type furnace with electric motor control for the electrodes controlled through current and voltage is a far more successful and more accurate furnace than the induction type, which, as far as I know, is becoming a past issue in the United States in the steel industry on account of the poor operating conditions and especially on account of the power-factor conditions.

One point of the article that did not appeal very much to me was the type of control of the electrodes. I do not see how hydraulic-type control can in any way compare with the type used in modern furnaces built in this country. GEORGE W. QUENTIN,

Duquesne Light Company, Pittsburgh, Pa. Power Sales Engineer.

Limitations of Utility Regulation by Cities

To the Editors of the ELECTRICAL WORLD:

In the news report of my remarks in the July 14 issue you gave an incorrect version of my comment.

I did not say that the regulatory system in Iowa had proved superior to that employed in many states where elaborate commissions have been created. I did say that in cities of sufficient size to warrant the expenditure of the funds necessary to procure expert advice and assistance the practice had been satisfactory, where an honest effort had been made by city councils to fix just rates. I further stated that as to all other cities and towns—that is, those where they were without sufficient funds to employ the necessary advice and assistance—the Iowa system was a failure and, in my opinion, could never be made to give satisfactory results. I also gave a fairly general outline of the difficulties attendant upon the making of rates for companies serving many communities over long-distance transmission lines. W. CHAMBERLAIN,

Vice-President and General Counsel.
United Light & Railways Company, Cedar Rapids, Iowa.

Central Station and Industrial Practice

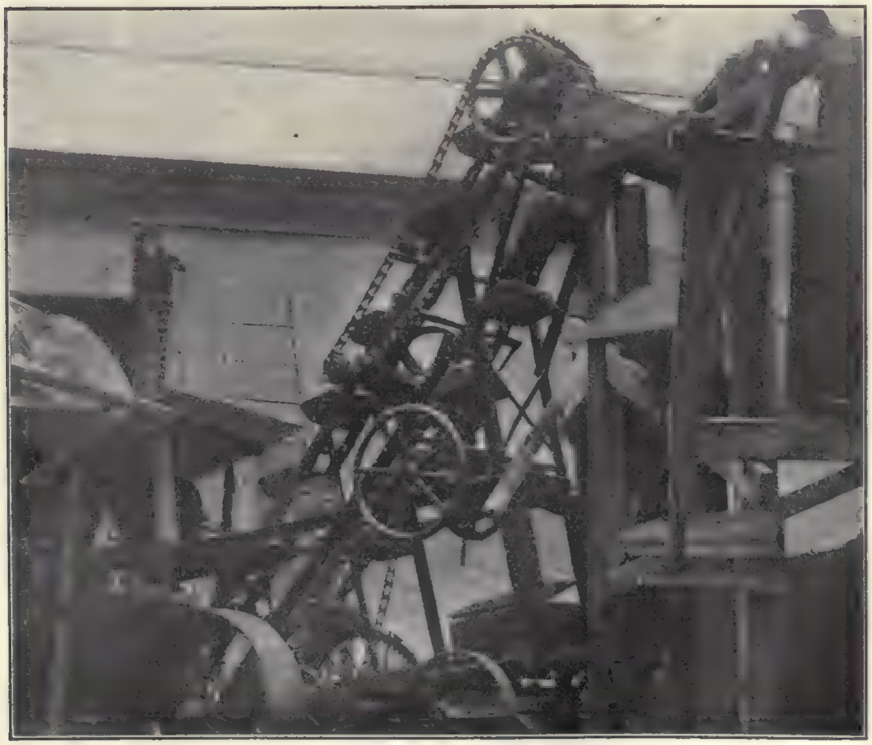
Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Motor-Driven Loader Saves Double Its Operating and Rental Cost

A SAVING of at least five men's labor was made recently in moving 1,200 tons of anthracite coal at the Massachusetts State House, Boston, by the use of a 5-hp. motor-driven loader. The outfit was rented from the Conant Machine Company, Concord Junction, Mass., and the total cost of its operation, including rental and electrical service, was about $170 for the twenty days required to transfer the fuel.

The boiler plant recently was changed over for fuel-oil combustion and the stored coal was turned over to the city of Boston for schoolhouses. The coal was stored in bins in the basement of the State House, and after being shoveled into push-cars and run upon an elevator to the boiler-room floor, it was pushed into a courtyard on a portable track and dumped at the foot of the loader. This raised the coal 12 ft. and deposited it in bins built of boards for the work, from which it fell into 5-ton trucks. About ten men were employed in shoveling into push-cars and taking these to the courtyard, two men attending to the loading. Had the loading been done by hand, about seven men would have been required for the work. The saving effected was about $350, and the maximum day's loading for the entire period was 115 tons.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.



ELECTRIC COAL LOADER SAVED $350 IN TWENTY DAYS

High-Voltage Distribution Costs

Diagrams Show for Certain Specific Conditions of Load and Transmission Distances the Relative Economy Obtained by Using Higher Voltages

AN ECONOMIC study of higher voltage distribution is one of the interesting features that were included in the overhead-systems committee report presented at the recent N. E. L. A. convention in New York. For the purpose of study the distribution system is divided into two essential parts — lines and transformer installations. This particular part of the report was compiled by the sub-committee on higher voltage distribution lines, E. C. Stone, chairman.

In general the cost per kva. of lines decreases as voltage goes up, but that of the transformer installation increases with the higher voltages. For scattered connections on large-capacity installations the cost of the line predominates, so that higher voltages give lower total costs. On the other hand, for many connections close together and relatively small the cost of transformers predominates, making the lower voltages more economical.

In the case of long feeders to load centers around which many small customers are grouped it may be better to use higher voltage for the feeder with step-down transformers to 2,300-volt or 4,000-volt distribution at the feeding point.

It is, of course, the annual cost year in and year out which is of interest. The correct answer therefore involves a knowledge of cost of line and transformer losses under the various conditions and the operating cost of the various types of installations used.

In diagrams presented herewith an attempt has been made to show for certain specific conditions of load and transmission distances the relative economy obtained by using higher voltages. In compiling the curves the following assumptions as to fundamental conditions were made: Annual cost of investment in lines and transformer installations, 15 per cent of first cost; cost of energy delivered to distribution circuit at substation, $0.01 per kilowatt-hour; copper loss in lines and transformers, assumed equal to

those resulting from operation at full load four hours per day.

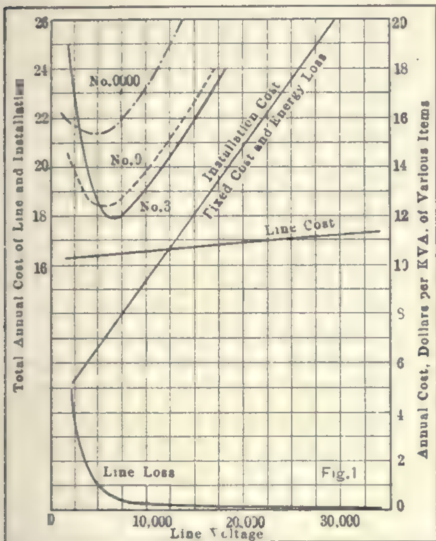
All load is considered as centered at the end of the line. If load is assumed to be uniformly distributed over the entire length of line, the copper losses will be one-third of those computed on the basis of load at the end of the line; or, if the cost of the copper loss is kept constant, full load with the load uniformly distributed can be maintained for twelve hours, or three times the period allowed with the load concentrated at the end of the line.

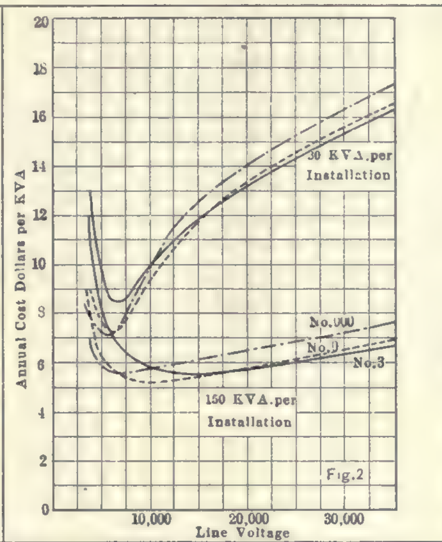
The curves prove very clearly the principles outlined above, thus:

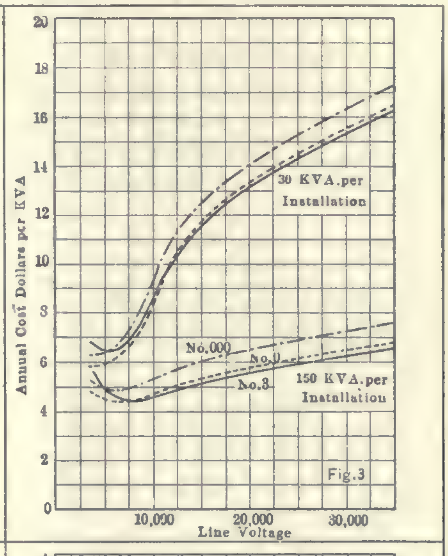
For a load of 1,500 kva., consisting of 300-5 kva., single-phase installations, with 5-mile transmission distance, the most economical voltage is 6,600. (Fig. 1.)

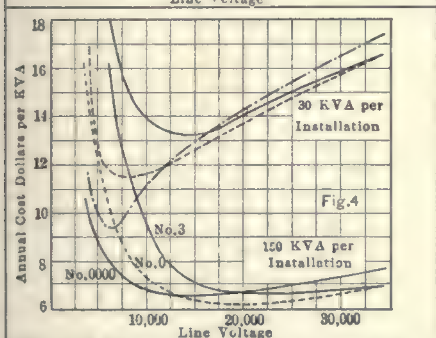
For the same total load and the same transmission distance, made up of fifty installations of 30 kva. installed capacity each, the most economical voltage is around 6,600, and for ten installations of 150 kva. the most economical voltage is around 11,000. (Fig. 2.)

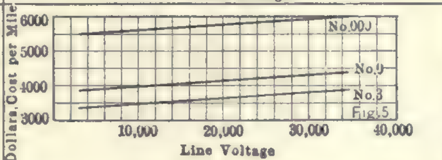
For 750 kva. load, 2½-mile transmission distance, and a corresponding number of the same size of transformer installations, the most economical voltages are lower—4,000 to 6,600—as is to be expected (Fig.



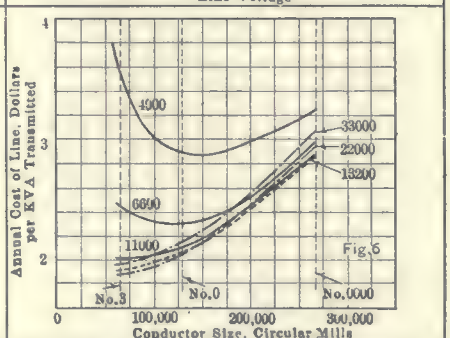


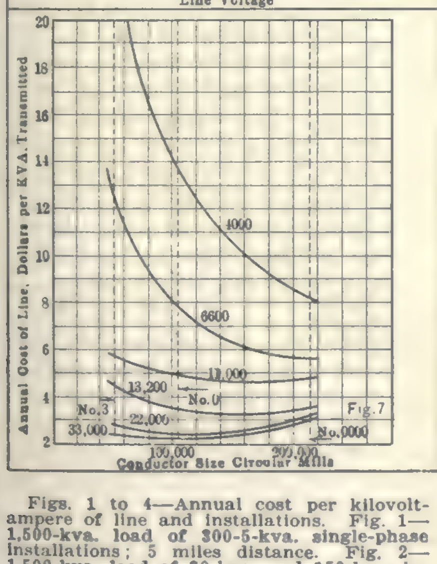


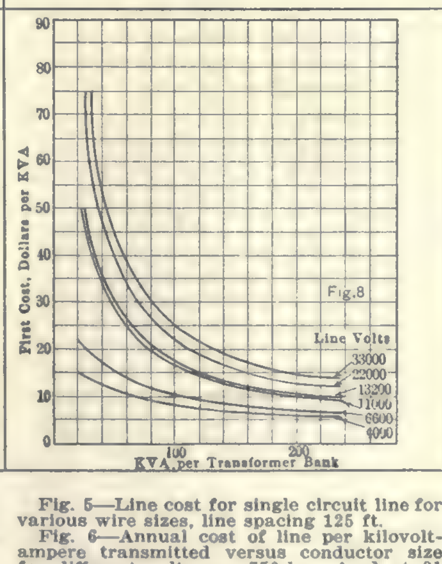


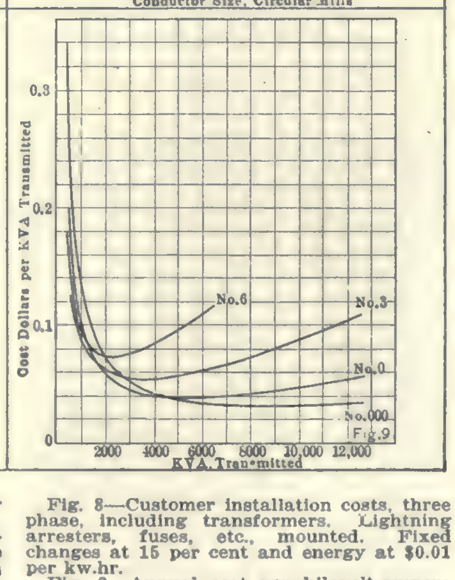


Relative Economy Obtained by Using Higher Voltages and Relations Between Load and Transmission Distances









Figs. 1 to 4—Annual cost per kilovolt-ampere of line and installations. Fig. 1—1,500-kva. load of 300-5-kva. single-phase installations; 5 miles distance. Fig. 2—1,500-kva. load of 30-kva. and 150-kva. installations; 5 miles distance. Fig. 3—750-kva. load of 30 kva. and 150 kva. installations; 2½ miles distance. Fig. 4—3,000 kva. load of 30-kva. and 150-kva. installations; 10 miles distance.

Fig. 5—Line cost for single circuit line for various wire sizes, line spacing 125 ft.

Fig. 6—Annual cost of line per kilovolt-ampere transmitted versus conductor size for different voltages; 750-kva. load at 2½ miles distance.

Fig. 7—Annual cost of line per kilovolt-ampere versus conductor size for different voltages; 3,000-kva. load at 10 miles distance.

Fig. 8—Customer installation costs, three phase, including transformers. Lightning arresters, fuses, etc., mounted. Fixed changes at 15 per cent and energy at $0.01 per kw.hr.

Fig. 9—Annual cost per kilovolt-ampere per 1,000 ft. of transmission line 22,000 volts, 10 equivalent hours. The most economical loads for Nos. 6, 3, 0 and 3/0 wires are 2,000, 3,500, 5,000 and 8,500 kva. respectively.

3); and for a total load of 3,000 kva., with a transmission distance of 10 miles and with a corresponding number of the same size of transformer installations, the equivalent voltages approximate 6,600 and 22,000 respectively. (Fig. 4.)

For the best economy it is, of course, necessary to treat each case on its own merits, as the possible combinations of costs, distance, size of installation, etc., are always infinite.

Typical Calculation

In order that the methods used herewith may be employed in specific cases for determination of the best voltages the following typical calculation is given:

Necessary Data.—Cost of energy, 1 cent per kilowatt-hour delivered to circuit in substation. Load to consist of fifty three-phase installations of 30 kva. each, located at end of line; transmission distance 10 miles. Annual cost, including interest, depreciation, maintenance and operation of line transformer, installations, 15 per cent of first cost. Assumed load is equivalent to four hours at maximum demand each day.

A complete sample calculation is given here for a 30-kva., 22,000-volt installation.

COST OF 30-KVA., 22,000-VOLT INSTALLATION

Transformer Installation Cost:		
Concrete platform		$600.00
Pole structure—two poles		20.00
Labor		20.00
Transformers — three single-phase		735.00
Labor		176.00
Fuses S. & C. 25,000-volt, 50-amp.:		
Fuses	$31.50	
Mountings	63.00	
Clips	6.00	
		100.50
Labor		20.00
Lightning arresters, three Westinghouse type LE		193.00
Labor		30.00
Total		$1,894.50
Per kva.		$63.15

Annual cost, at 15 per cent = 0.15 × $63.15 = $9.47

Transformer Losses:

Iron loss, 220 watts per transformer:
220/1,000 × 8,760 = 1,920 kw.-hr. per transformer.

Copper loss, 210 watts per transformer:
220/1,000 × 4 × 365 = 306 kw.-hr. per transformer.

Total loss:
= 3 (1,920 + 306) × $0.01 = $66.78
Cost per kva. = $2.23.

Line Cost:

Computed equal to $4,150 per mile for No. 1/0 wire.
0.15 × 4,150 = $622.00.
$622/1,500 = $0.415 annual fixed cost per kva. per mile.

Line Energy Loss Cost:

0.785 amp. current due to one customer
$30{,}000/(\sqrt{3} \times 22{,}000) =$ (30 kva.).

$$\frac{3\, I^2 R_t \times 365 \times 4 \times 0.01}{1{,}000} =$$

$0.01494 annual cost per mile of energy due to *only one* customer on line.

If there are fifty customers on the line, the current is fifty times as large, and the I^2R loss is 2,500 times as great; however, the total loss is to be divided between fifty customers, so the loss chargeable to each customer becomes 2,500/50 = 50 times the loss due to the current drawn by only one customer. As a general rule, we may say the total loss chargeable to any one customer (all assumed to be same size) is equal to the number of customers times the loss caused by current drawn by one customer.

50 × $0.01494 = $0.747 total loss.
$0.747/30 = $0.0249 cost of line loss per kva. per mile.

Figs. 5 to 9 give sample cost curves such as should be prepared for a study of this type.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Input-Output Performance of Frequency Changer

An over-all efficiency test of a 25-cycle, 33,000/2,200-volt, 900-kva. substation connected to the transmission lines of the Niagara, Lockport, & Ontario Power Company is outlined below, as conducted by the writer. In order to use purchased energy in conjunction with locally generated 60-cycle energy, the distribution company operates from the secondary of the substation a 25-cycle-to-60-cycle, 2,300-volt, 500-kva. induction motor-generator to run in parallel with water-driver and steam-driven generators in the distribution company's main station.

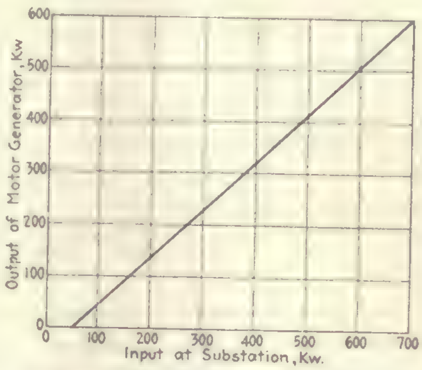


FIG. 1—INPUT-OUTPUT PERFORMANCE OF SUBSTATION

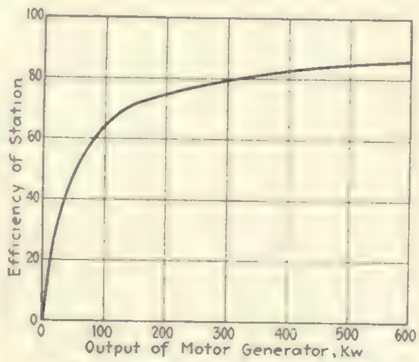


FIG 2—EFFICIENCY OF FREQUENCY-CHANGING EQUIPMENT

It was desired to check the input-output performance of the combined substation and motor-generator to allow a curve to be drawn showing input at the high-tension side of the transformers as the abscissa and output to the station busbars as the ordinate (Fig. 1). The motor-generator field excitation was not measured or taken into account as the only information desired was substation input and machine output.

It was decided to take the data from the power company's watt-hour meter in the substation to measure the input and from the distribution company's switchboard watt-hour meter, which measured the output of the motor-generator.

The data were taken while the motor-generator was running in parallel with the waterwheel generators so that load could be shifted to or from them to obtain the different points on the curve. The method of obtaining the readings was to time the input and output watt-hour meters simultaneously with stop watches, while the operator manipulated the waterwheel governor to throw all load fluctuations on the waterwheel generator, thereby keeping a steady load on the motor-generator. The watt-hour meters were timed for a number of revolutions, so that each reading covered about twenty seconds, giving average power for that length of time.

Readings were taken with the motor-generator running idle to get the zero output point and every 50-kw. or 75-kw. up to the last point obtained, which was an output of a little more than 600-kw.

The result obtained was virtually a straight line from zero output point to the maximum. There is a slight curve downward due to the heat losses which is hardly noticeable. This deviation appears only in the upper part of the curve. The curve as drawn includes all points taken except two, one of which was below the curve and the other above. The amount these two points were off was less than 1 per cent and data taken to check them fell directly on the curve.

Another curve was drawn (Fig. 2) showing input divided by output plotted against output. This is not an actual efficiency curve of the apparatus because excitation is not included, but shows what percentage of input was converted into kilowatts delivered to the busbars of the main station.

WALTER A. CHURCHILL,
Electrical Engineer.
Eastern Massachusetts Electric Company,
Boston, Mass.

Relation of Circuit Breakers to Interconnection

RECENT advances in interconnection have led to an extremely rapid development in oil circuit breakers for heavy duty. Units are now under construction to rupture 1,500,000 kva. at the arc in both high- and low-voltage types, stated H. H. Dewey of the General Electric Company at a recent meeting of the New England System Operators' Club at Schenectady. The analysis of maximum rupturing capacities likely to be needed at different points on an interconnected system is becoming of increasing importance. Mr. Dewey stated that recent studies of New England interconnections showed a total generating capacity of nearly 1,000,000 kva. tied together. If this were all concentrated in one station a short circuit would amount to from 2,000,000 to 2,500,000 kva., but that the natural reactance of the connections limit short circuits in most places to less than 1,000,000 kva. In studies of this kind the short-circuit current rating generally exceeds the generator rating, but reactance saves the day. Too much reactance, however, has a tendency to segregate a system and to throw synchronous apparatus out of step.

The high cost of heavy-duty circuit breakers, some 220,000-volt units, representing an investment of $35,000 each, is due in part to the fact that the industry and interconnection are growing too fast to allow standardization. Designing engineers are studying test data with more thoroughness than ever before. At Schenectady a 27,600-kva. turbo-generator is available for short-circuit tests. The use of the explosion chamber in oil circuit breakers of new design has been so successful in increasing rupturing capacity that the same principle can be applied to many breakers in service to increase their rating without requiring changes in the dimensions of switch cells. This eliminates oil throw, and in the case of the "H-3" type breaker increases the rupturing capacity about 40 per cent, the gain with the "H-6" being 10 per cent and with the "H-9" 30 per cent.

The high cost of modern transmission lines renders it important to operate them at a high load factor. A typical 220,000-volt line costs from $15,000 to $20,000* per mile per circuit, and on a transmission of 150 to 200 miles the total line cost is comparable to the plant investment. This economic situation warrants careful study of circuit-breaker selection, and while operating companies cannot afford to "run wild" over protection, the cost of interruptions must be carefully weighed. Unless a high-voltage arc across a string of insulators is broken with great speed, it may easily involve a steel tower and cause a protracted shutdown. The inherent reactance of water-power generators may be 25 to 30 per cent, compared with 12 to 15 per cent in steam turbo-units, which makes circuit-breaker selection somewhat easier for hydro-electric systems. Under 15,000 to 20,000 amp. the magnetic forces exerted in breakers are not very serious, but in installations it is important to draw up all nuts to prevent loosening on short circuits. In the present switchboard types of breaker a maximum pressure of 60 to 75 lb. per square inch may occur on rupture, and in the type H breakers this may rise to 150 to 200 lb. The explosion chamber permits the breaker to handle a greatly increased current capacity without increase of pressure.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

[*Costs solicited from various sources would indicate that double-circuit 220,000-volt 100,000-kw. transmission lines would cost $25,000 to $65,000 per mile, depending on conditions.—EDS.]

Tractor Moves Heavy Transformers

TRANSPORTING heavy distribution transformers over rough country roads often becomes a problem of considerable magnitude—especially so when the apparatus is filled with oil. To make sure of an absolute means for moving heavy equipment and also to insure continuity of service, the Georgia Railway and Power Company recently built the tractor shown in the accompanying illustration. It was designed by the writer and built in the company's shop of steel I beams to carry a weight up to 35 tons. Ordinarily two 5-ton winch trucks are used for hauling. They furnish enough power to negotiate the hills of the surrounding country. The transformer illustrated is rated at 2,000 kva. at 110,000/38,000 volts. It had a shipping weight of 26.4 tons, and the construction crew of eight men under T. M. Fellers moved it one mile from the railroad.

A. L. SMITH,
Superintendent Tests and Repairs.
Georgia Railway & Power Company,
Atlanta, Ga.

CONSTRUCTION CREW MOVING A 26.4-TON TRANSFORMER ON COMPANY-BUILT TRACTOR

Three-Phase Distribution Transformers Favored

THREE-PHASE versus single-phase distribution transformers, 4,000-volt distribution, radio communication and automatic generating plants were the chief features of the recent meeting of the technical committees of the Pacific Coast Electrical Association.

Many of the companies represented at this meeting favor three-phase distribution transformers and are using them extensively, while others feel that under their peculiar operating conditions the single-phase unit is the most flexible and economical. The principal objection to the three-phase unit seems to be its lack of flexibility for handling combination power, range and lighting loads. The fact that 97 per cent of the distribution transformers manufactured are of the single-phase

type is responsible for the higher cost of the three-phase unit. Until more companies adopt the three-phase transformer which will allow the manufacturers to reach quantity production this difference in price in favor of the single-phase transformer will exist.

FIELD EDITOR ELECTRICAL WORLD.
San Francisco, Cal.

Extracts from an Operating Code*

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

Restoring Service After Interruptions

SERIOUS damage to apparatus, repetition of the interruption and false indication of location of trouble may result in restoration of power to the bus if defective incoming feeders or apparatus or undamaged rotating apparatus be left connected to the bus. It is essential to clear the bus and restore lines and apparatus to service either according to specific order from the load dispatcher or, where a definite program for restoring service without specific orders is in effect, according to that program. Following are detailed instructions for restoring service after an interruption in substations.

Total Interruption

1. Carefully note whether or not any switches have opened automatically and, if so, if they have spilled oil. This rule is of vital importance as a preliminary step to restoring service and the operator must check his first observations by any means that will insure an absolutely correct report to the load dispatcher.

2. Clear the high-tension buses.

3. Report to the load dispatcher. The procedure followed by the load dispatcher will depend upon the reports received from the various stations affected. If no spare apparatus is available and the line oil switch opens without any indication of damage, the load dispatcher may order it back without testing. If spare apparatus can be used or if there is evidence of damage prescribed tests must be made before the line may be put back into service, and in no case should more lines be put back than necessary to carry the load.

4. Watch the pilot lights, put on the first line which comes back, and energize the lines supplying those substations which were being supplied before the interruption.

5. Open sufficient circuits or feeders so that the load will not be excessive when service is restored.

6. (a) In alternating-current substations and direct current substations open a sufficient number of circuits or feeders so that the line on which the service is restored will not be overloaded.

(b) In Edison district substations either of the three following general methods may be employed:

First—Connect all special feeders to a separate bus fed by rotary converters or other units at normal voltage. Connect the remainder of the station load to another bus fed by motor generators or other units at low voltage. If the capacity of the machines on the low voltage bus will permit, raise the voltage to normal and parallel with the normal voltage bus. If the capacity is insufficient, raise the voltage until the machines are loaded. See that the machine capacity connected to the normal voltage bus is at least equal to the difference between the station load and the machine capacity on the low-voltage bus. Connect the low-voltage and normal-voltage buses through circuit breakers or other ties of sufficient capacity.

Second—Connect all special feeders to a separate bus fed by rotary converters or other units at normal voltage. Start, bring up to voltage and connect to a separate bus, which has been cleared, a sufficient number of generating units to carry the street load. Put all the street feeders on this bus simultaneously.

Third—Start a sufficient number of rotary converters, motor generators or generators to carry the entire station load. Adjust their voltages for proper paralleling. Connect them to direct-current bus as nearly simultaneously as possible and immediately adjust the field rheostats for proper load division.

7. Load the station.

Partial Interruption

1. If the interruption to the service is only partial, the procedure to be followed will vary, depending upon the extent of the interruption and the station at which it occurs. In general, follow the procedure outlined for a total interruption as far as may be required by the nature of the interruption. In addition, follow such special instructions as have been issued for the particular station.

If an oil switch on an outgoing feed trips it may be due to either an overload or a ground on one or more phases of the circuit. If no large motors are connected to the circuit the switch may be closed at once. Circuits carrying large motors equipped with no-voltage releases must be left open for a sufficient time to allow all the releases to operate. Observing the ammeters and the ground detectors on closing the oil switch will be a fairly reliable indication of trouble. A relatively slow movement of the ammeters needle across the scale indicates an overload, while a violent movement indicates a ground or short circuit. With circuit interruption on outgoing feeders, the procedure outlined below should be followed:

1. Close the oil switch at the end of the time given on the circuit schedule, observing the ammeters and the ground detectors, noting particularly whether or not the closing of the oil switch causes any change in the ground detector readings.

2. If the circuit trips again, try to determine which phase is defective.

3. Report to the load dispatcher.

4. If the circuit trips the second time and the ammeters do not indicate the defective phase, if ordered by the load dispatcher, open the A phase disconnecting switch and again close the circuit switch.

5. If it trips again, close the A and open the C phase disconnecting switch and again close the circuit switch to see if their phase holds.

6. Report to the load dispatcher, either that the circuit will not hold or on which phase it will hold, as the case may be.

Instructions for Shutting Down Turbo-Generators

WHEN shutting down turbo-generators proper oil pressure should be maintained on the bearings to keep the rotor floating until the unit is actually at rest, the sealing system should be regulated to prevent cold air being drawn in and injuring the heated parts and the operator should listen for rubs or unusual noises within the turbine. It is even more important to admit steam to the seals on shutting down than in starting up, as heated parts of the machine may be seriously damaged by cold air currents being drawn in when the first stage pressure falls below zero gage. Also after closing throttle the globe vacuum valve should be opened and left open so that throttle leaks cannot result in dangerous pressure and temperature conditions in the turbine and condenser.

Following are detailed instructions for shutting down a turbo-generator:

1. After receiving and answering the signal "Stand By" from the switchboard operator regulate the sealing system as the load decreases.

2. Start the auxiliary oil pump by hand to see that it will start properly.

3. After receiving and answering the signal "Stop" from the switchboard operator close the throttle slowly.

4. See that the auxiliary oil pump starts as the machine slows down and that proper pressure is maintained.

5. Shut off the steam seals (and water seals, if installed).

6. Shut down the air pumps and wet pumps.

7. After the machine stops, shut down the circulating pump.

8. Shut off the oil and water supply to the main bearings and oil cooler.

9. Shut down the auxiliary oil pump.

10. Open the vacuum globe valve after the vacuum has been reduced by leakage of air through the seals.

11. See that all admission valves have been opened by the governor.

12. Make a general inspection of the turbine.

*Abstracted from the operating code of the Philadelphia Electric Company.

Electric Trucks Halve Pie Delivery Cost

Remarkable Savings Are Realized by Replacing Gasoline and Horse-Drawn Vehicles—Advantage of Greater Cleanliness—Data on Cost of Operation

BY OTTO J. LANGE

Electric Vehicle Department, Public Service Electric Company, Newark, N. J.

BY CHANGING its gasoline and horse-drawn delivery equipment to electric trucks the Wagner Pastry Company of Newark, N. J., has effected a 50 per cent reduction in its delivery costs. As stated in the ELECTRICAL WORLD of Feb. 10, page 346, this company had placed an order for 177 1-ton Commercial Vehicle trucks equipped with sixty-cell, type 7-A Edison batteries, and advertised to sell at auction its then existing gasoline trucks and horse-drawn wagons. To date sixty-eight of the trucks have been delivered and have been in operation long enough to obtain accurate data on the economies which have been brought about.

Two years ago, when a change in the delivery system was first contemplated, the company had in operation seventy-three gas trucks and ninety horse wagons within a 30 mile radius from its Newark plant. With that equipment it cost 13 cents to deliver $1 worth of pies. The equipment as it now stands consists of sixty-eight electrics, nine gas trucks and only seven horse wagons serving the same territory, and the cost to deliver $1 worth of pies is only 6½ cents. Delivery costs have been reduced by just one-half.

As one electric will easily displace four horses further economies will be realized when the fleet is entirely electrified and enlarged to meet the requirements of increasing business. Excluding the wages of the driver, each horse costs $12 a week for feed, harness, bedding and stabling, and because of the long routes it is possible to work the horses only every other day.

Another distinct advantage that the electrics have is that both gasoline trucks and horses carry an odor that is objectionable in the pie business. In wet weather the reins get wet and make the driver's hands black, and with a gasoline truck there is always more or less dirt and grime and odor from exhaust or escaping gas. Since pies cannot be wrapped it is essential that the drivers have clean hands. As a result of using the electrics many customers have taken occasion to compliment the pastry company on the cleanliness of the drivers and the better psychological effect of the more sanitary delivery.

The Wagner Pastry Company is one of the largest bakers of pies exclusively in the East. It serves about 7,500 customers including stores, railroads, restaurants, hotels, grocers and bakers located in New York City and various New Jersey towns. The delivery routes covered by the trucks total 3,500 miles daily and most of these are completed before noon.

To serve its customers in New York the company maintains a distributing station there which is supplied by two 5-ton trucks each day from the Newark plant, a round-trip distance of 22 miles. Gasoline trucks have been used for this work but probably will be replaced with electrics, as one 5-ton electric truck is now being tried out on this service. The New York deliveries are made entirely by twenty-four 1-ton electric trucks which are maintained at a flat rate of $70 apiece per month in an electric vehicle garage near the company's distributing station. Each of these trucks average between 25 and 30 miles per day.

For the trucks making deliveries

SOME OF SIXTY-EIGHT ONE-TON TRUCKS USED IN PIE DELIVERY. THESE TRUCKS AVERAGE FORTY MILES DAILY

in New Jersey the company has installed a charging outfit in its own garage, consisting of a General Electric-Sprague motor generator set and a Cutler-Hammer switchboard with wiring outlets to seventy charging plugs. The total cost of this equipment, which is capable of charging thirteen vehicles at one time, was $5,900. Power is supplied by the Public Service Electric Company at the low rate for this service of 3 cents per kw.-hr.

Power consumption at the switchboard during the winter months averages 2,000 ky.-hr. daily, but the summer consumption drops to approximately 1,800 kw.-hr. because of better operating conditions for the trucks when the streets are clear of snow and ice. For a 1-ton vehicle during the summer the average draw is 4.5 amp. During the winter months, however, on the city routes this has been around 5 amp. and on some country routes during snowstorms it has gone up to 6.5 amp. Very little trouble has been experienced from stalled trucks during heavy weather, and deliveries have always been completed to the satisfaction of customers.

What difficulty has been had from breakdowns was not due to mechanical or inherent defects of the trucks or their design, but rather to insufficient charging of batteries or failure properly to inspect the condition of batteries and control at regular intervals. Some time after the first trucks were put in service a number were reported out of power while on a delivery route. After an investigation it came to light that batteries were not being flushed at regular intervals nor was the condition of the controllers being examined. This had resulted, first, in failure of the batteries to take a full charge, and second, controller fingers had been burned so as to make poor contacts. This experience worked somewhat as a blessing in disguise for it caused the inauguration of a rigid system of regular inspection and repair.

The average mileage of the trucks operating in New Jersey is 40 miles per day and their total monthly aver- is 58,000.

Each truck makes one trip with 90 to 100 stops per day. They leave the factory in Newark at 3 a.m., and the time of their return varies according to the length of the route, the earliest reaching the garage about 10 a.m. and the latest at noon. The procedure of taking care of the trucks in the garage is as follows: As soon as a vehicle comes in to the garage it is put on the washstand for a thorough cleaning.

Flushing of the batteries, if necessary, is the next operation, the batteries being flushed regularly twice a week. Lubricating of the vehicles occurs daily. Controllers are inspected once each week and the motors every other week.

One man is employed for this work and it is also his duty to spot the trucks in their proper places at the loading platform where the charging plugs are located and the batteries put on charge.

AUCTION OF DELIVERY EQUIPMENT

DON'T FORGET ON DECEMBER 15

WE WILL SELL FOR THE WAGNER PASTRY COMPANY, NEWARK, N. J., AT PUBLIC AUCTION, WITHOUT RESERVE, TO THE HIGHEST BIDDER THEIR ENTIRE DELIVERY OUTFIT OF HORSES, WAGONS, HARNESSES AND GAS AUTOMBILES, ALL IN FIRST CLASS CONDITION, ON ACCOUNT OF THEIR CHANGING TO ELECTRIC TRUCKS, ON FRIDAY, DECEMBER 15, 1922, AT 10 A. M., AT THE COMPANY'S STABLE, VESEY STREET NEWARK, N. J., CONSISTING OF

57 Horses
7 Mules
32 Top Wagons
1 Concord Buggy
2 Double Trucks
14 Sets Single Harness
21 Sets Double Harness
90 Collars
1 Set New Single Harness
1 Horse Swing
1 Oat Crusher
Blankets
Stable Utensils

6 1922 1 Ton Ford Trucks with Bodies
2 1922 1-Ton Ford Truck Chassis
4 1922 ¾-Ton G M C Truck Chassis
3 1922 ¾-Ton G M C Trucks with Bodies
7 2-Ton Pierce-Arrow Trucks with Bodies
These Cars are all in first-class mechanical condition

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For Particulars Phone Market 8792

ONE OF THE RESULTS OF ELECTRIFYING DELIVERIES

The regular engineers, of which there are three who work in eight-hour shifts, take care of the operating of the charging outfit in addition to their work of handling boilers, ice machines and plant maintenance. These men with three helpers, making a total of six, are sufficient to handle all of the work connected with the maintenance and charging of the trucks. They handle nearly all of the ordinary light repairs, but heavy battery work is taken care of by an outside battery concern.

Three men—two mechanics and one battery man—take care of the fleet. The two mechanics are employed to take care of the nine remaining gas trucks and also handle odd jobs around the plant. The three men for the electrics and the two gas truck mechanics with the shop foreman, a total of six, are actively engaged in the garage on the sixty-eight electrics and nine gas trucks.

Two years ago, when the company was operating seventy-three gas trucks, there were seventeen mechanics and the foreman employed solely for their repairs. In other words, each mechanic handled only four or five vehicles.

INVESTMENT, FIXED AND OPERATING EXPENSES OF ONE-TON TRUCK

Investment	
Chassis price	$2,309.13
Battery price	1,595.00
Body	600.00
Freight	30.00
Tax	117.12
Total	$4,651.25
Fixed Expense	
Interest, after ten-year depreciation, 6 per cent	$153.49
License	35.00
Garage, rent, light, heat, power	85.71
Insurance	175.00
Total	$449.20
Operating Expense	
Maintenance and repair	$164.80
Tire cost	154.30
Charging cost	183.00
Battery renewal and repair	191.40
Total	$693.50

For repairs the company allows the following:

1 cent a mile.
$15 every six months for revarnishing.
$125 every five years for painting.

Charging of batteries costs, including labor, 70 cents per charge. The drivers are paid on a salary and commission basis, but only $30 a week is chargeable as drivers' wages.

Figures computed on one of the 1-ton electrics averaging 36 miles per day show a cost per day of $9.60 or 26.66 cents per mile. Deducting the driver's wages, the cost per day is $5.34. This truck makes ninety-five delivery stops per day, so the cost per delivery-stop is 10.10 cents, and since 600 pies are carried per trip, the cost of delivery of one pie is 1.6 cents.

This cost is low, a fact of considerable importance to the company because its delivery costs are about the only big item on which it can save any money.

The accompanying itemized figures give a record of this 1-ton truck for a 305-day year.

Depreciation is based on a total cost of $4,496.95, after the tire value of $154.30 has been subtracted, and amounts to 4.28 cents a mile on a minimum life of 105,000 miles.

Tire cost is based on a life of 10,000 miles and amounts to 1.5 cents per mile.

TOTAL YEARLY EXPENSE FOR A ONE-TON TRUCK

Depreciation	$469.91
Maintenance and repair	164.80
Tire cost	154.30
Charging cost	183.00
Battery renewals and repairs	191.40
Total	$1,163.41
Total fixed expense	449.20
Total driver's wages	1,560.00
Total annual cost	$3,172.61

Battery renewals and maintenance allow for a 40 per cent trade-in value and on the year's performance amounts to 1.74 cents per mile.

On the basis of 10,900 miles for the year, the cost per mile is 28.8 cents.

Duquesne Light Company Offers Premium for Raising Power Factor

A POWER-FACTOR provision designed to encourage customers in the improvement of their power-factor conditions has been included in a revised rate schedule recently put in effect by the Duquesne Light Company of Pittsburgh. The provision offers a premium in the form of additional discounts for the raising of power factor above a certain point and at the same time low power factor is not too severely penalized, as the wholesale light and power rate allows an average lag of 75 per cent from which point the premium or penalty discounts are computed.

The clause as it applies to the wholesale and off-peak service rates reads as follows:

Power Factor.—This rate allows an average lagging power factor of 75 per cent, which corresponds to a ratio of reactive kilovolt-ampere-hours to kilowatt-hours of 88.2 per cent (88.2 points). At the option of either customer or company instruments may be installed to measure the consumption of lagging reactive kilovolt-ampere-hours. The gross bill will then be adjusted according to the record of these meters as follows:

For each reduction of 10 points in the ratio of reactive kilovolt-ampere-hours to kilowatt-hours for any given month, a discount will be allowed on the gross bill computed at the rate of 1 per cent for each such 10 points decrease. (Maximum discount 8.82 per cent.)

For each increase of 10 points in this ratio, a corresponding charge will be added to the gross bill computed at the rate of 1 per cent for each such 10 point increase.

Reactive kilovolt-ampere-hour meters will be ratcheted to record lagging kilovolt-ampere-hours only.

Discounts and penalties for power factor shall not be applied except for periods during which the reactive kilovolt-ampere-hour meters are in service. All costs for the installation of these meters shall be borne by the party exercising the option.

Under the company's special power rate, available to customers using three-phase service exclusively for the manufacture of ice or for refrigeration purposes or for installations having similar characteristics with high load factors, the provision allows an average lagging power factor of 95 per cent, which corresponds to a ratio of reactive kilovolt-ampere-hours to kilowatt-hours of 32.9 per cent. Under this rate the maximum discount for raising the power factor is 3.29 per cent. These provisions are intended, of course, to encourage the installation of synchronous motors for constant load and long-hour use.

Contests Stimulate Employee Interest and Ability

THAT contests in emergency rescue work tend to increase the efficiency of employees, who look forward to them with a great deal of interest and enthusiasm, is shown in the experience of the Dallas Power & Light Company. Last year a rescue contest was staged at the annual picnic of the employees, in which the "victim" was brought down from a pole and the prone pressure method of resuscitation applied in forty-five seconds. This year the winning team performed the same feat in the rescue contest in eight seconds less time. The illustration is unusual in that the "victim" on the third pole is on his way down while the smoke from the flash starting the contest is still visible near the top of the pole at the left. In the transformer-hanging and service-running contest the winning team put up the transformer, including double cross arm, braces, brackets and so forth, and ran the service in seven minutes and twenty four seconds.

Texas Utility Receives Mention in School Textbook

REFERENCE to a public utility company in a school textbook is unusual, but has occurred in a recent geography of Texas written for use in the schools of that state. The book is profusely illustrated, showing the industries, natural features and views of many of the principal towns. Credit is given for the use of many of the photos to individuals or organizations co-operating in the gathering of the illustration material. An even dozen of the photos relating to cities or industries and in three cases to the utility industries of the state are credited to the Texas Power & Light Company. Such credit is illustrative of some of the things involved in community work and building that at first glance appear remote so far as utility problems are affected, but help to tie the utility definitely into matters of common community interest.

Nebraska Rural Lines Practice

AN ANALYSIS of fifteen Nebraska communities served by rural lines shows that the predominating voltages are between 2,300 and 6,600. The accompanying table, which was prepared for the rural lines committee Nebraska section, N. E. L. A. by J. C. Hoge, lists the type of construction used by 784 customers. Although lightning arresters and fuses are in general use, most of the present construction

DALLAS COMPANY EMPLOYEES COMPETE IN RESCUE OF FELLOW-EMPLOYEE SUPPOSEDLY SHOCKED AT TOP OF POLE

CONSTRUCTION DATA ON RURAL LINES IN NEBRASKA

Name of Company	Location	Number of Customers	Ownership of Line	Capital Furnished By	Voltage	Arresters	Fuses	Choke Coils	Switches	Method of Meter Reading
Platte Valley Power Company	Omaha	50	Company	Customer	13,200-6,600	Yes	Yes	No	Yes	Customer reads
Southern Nebraska Power Company	Superior	7	Company	Customer	13,200	Yes	Yes	No	No	Customer reads
Water & Light Company of	Nebraska City	70	Company	Customer	13,200-2,300	Yes	Yes	No	No	Company reads
Blue River Power Company	Seward	150	Company	Customer	2,300	Yes	Yes	No	No	Customer and Company
Western Public Service	Colorado Springs	160	Company	Customer	13,200-6,600-2,300	Yes	Yes	Yes	No	Company reads
McCook Electric Company	McCook	27	Company	Company	11,000	Yes	Yes	No	No	Company reads
O. A. Cooper Company	Humboldt	6	Customer	Customer	2,300	Yes	No	No	No	Company every three months
Callaway Mill & Electric Company	Callaway	6	Company	Company	2,300	Yes	Yes	.....	.....	Company
Humphrey Electric Power Company	Humphrey	6	Company	Company	220	...	...	.....	.....	.....
Van Ackeren Brothers	Cedar Rapids	5			220	...	...	.....	.....	.....
Harvard Electric Company	Harvard	12	Company	Customer	220 DC.	...	...	.....	.....	.....
Albion Electric Light Company	Albion	15	Customer	Customer	2,200	No	Yes	No	No	Company
Jacobs Electric Company	Staplehurst	[illegible]	Customer	Customer	110 near town	.....	.....	.....	.....	Company
Central Power Company	Grand Island	90	Company and Customer	Customer	6,600-2,300	Yes	Yes	Yes	No	Company
Continental Gas & Electric Corporation	Omaha	175	Company	Customer	6,600-2,300	Yes	Yes	No	No	Company
	Total	784								

seems to omit choke coils and air-break switches. In almost all cases the ownership of the lines is in the company's hands, although the financing for the most part was done by customers. In all but two instances the company either reads or checks the customers' meter readings.

Large Model of Residential Fan Demonstrated on St. Louis Streets

A GIANT model of an electric fan was displayed on the streets of St. Louis during the week of June 16. The fan was approximately 6½ ft. high and was operated by a 1-hp. motor supplied with power from a storage battery carried on the truck. The demonstration of this model in operation on the streets attracted a great deal of interest and resulted in many sales.

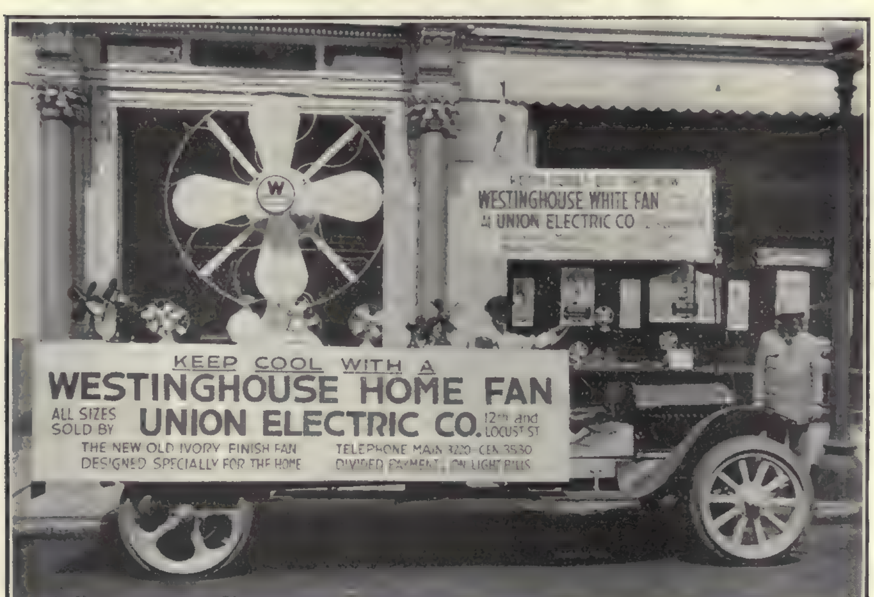
What Other Companies Are Doing

Wausau, Wis.—This city recently closed a most successful electric and food show at which the attendance was exceptionally good. For a city of 20,000 to draw an attendance of 15,000, of which approximately 11,000 were paid admissions, is an enviable record. The show was conducted under the auspices of the *Record-Herald*, but to the Wisconsin Valley Electric Company, and particularly to E. V. Pryor, is due the credit for financing and for managing the electrical features. The exhibition was held five miles from town in a park owned by the electric company. The show was self-supporting, expenses being covered by the sale of booths and the 25-cent admission charge.

Fitchburg, Mass. — The Fitchburg Gas & Electric Light Company has won for a second year and will as a result keep permanently the merchandise sales cup offered to the central station under the management of Charles H. Tenney & Company, Boston, making the best record for the past year in merchandising. The company scored 105⅜ points against 71 scored by the Malden companies, which were second in the competition. F. L. Ball is manager and F. S. Clifford sales manager of the Fitchburg company, Cyrus Barnes being general sales manager of the Tenney organization. Points were computed on the basis of percentage increase of appliance sales over 1921, percentage of gross profit, turnover, sales per meter and larger appliances sold per meter. The judges were A. B. Tenney, D. E. Manson and H. T. Sands.

South Pasadena, Cal.—An electrical contractor of this city recently sent to the Joint Committee for Business Development at N. E. L. A. headquarters in New York for a large quantity of the pamphlets entitled "Electricity in the House." He stated that he thought he could get considerable business by sending one to each person who takes out a permit. The idea seems to be a good one, and since the home builder is almost certain to have his house wired for electricity he should be told "what's what" in an installation.

Birmingham, Ala.—A commendable policy to further public relations has been adopted by the Alabama Power Company in offering five scholarships to boys and girls of the state who are ambitious to go to the state schools and have not the money to attend. Two of the scholarships are to the Alabama Polytechnic Institute at Auburn, two are to the University of Alabama and one is to the Girls' Industrial School and College at Montevallo.



SIX AND ONE HALF FOOT ELECTRIC FAN FOR STREET DEMONSTRATION

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Fuel Oil in a Rhode Island Central Station.—N. STAHL.—The decision of the Narragansett Company to install fuel-oil burning equipment at its South Street generating station is somewhat of an innovation in general stationary power plant practice, and the work done in overcoming the many problems encountered was more or less of a pioneering nature. The undertaking represents one of the largest central stations using fuel oil exclusively, which at present is about 1,000,000 bbl. per year. The story of how the change-over from coal burning to oil burning was successfully accomplished without interrupting service, a general description of the boilers, oil burners, etc., and cost data on the entire oil-burning installation are among the subjects covered. The cost of the entire oil-burning installation was about $17 per rated boiler-horsepower, or $3.70 per kilowatt based on the kilowatt load which the boilers are capable of carrying.—*Electric Journal*, June, 1923.

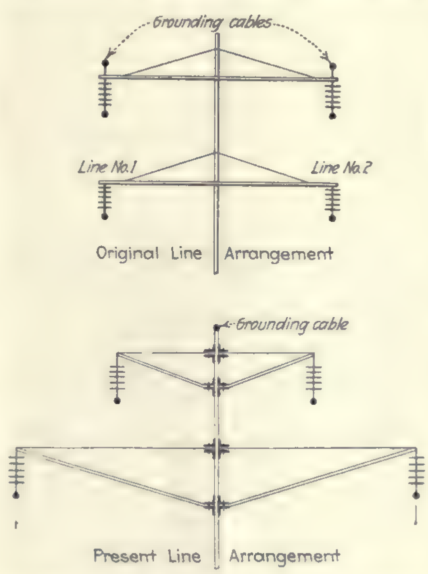
Electrical Applications in Bethlehem Plant of Bethlehem Steel Company.—D. M. PETTY and A. J. STANDING.—Electrically operated equipment is the most important factor in high efficiencies and enormous tonnages that are produced in this steel plant. In the first part of this article the authors describe the power generation and distribution features, while the second part, which will be in the July issue, describes the application of electricity in the manufacturing department of the steel plant. A detailed description is given of all of the generating units, both direct current and alternating current, and is followed by a method of distributing the power throughout the plant.—*Blast Furnace and Steel Plant*, June, 1923.

Pueblo Plant of the Southern Colorado Power Company.—A short description of the 14,600-kw. steam plant at Pueblo. This plant consists of a new 7,500-kw. turbine unit and 7,100-kw. older engine and turbine-driven generators that are called upon for emergency use only. For the new turbine installation, special coal and ash-handling systems have been initiated. The author also considers the evaporator system for make-up water and describes a unique method of driving the circulation water tunnel.—*Power*, June 12, 1923.

Hydro-Electric Developments in Ontario.—F. A. GABY.—A review of the power situation in Ontario, and the principal features of all hydro-electric power plants acquired, constructed and operated by the Ontario Hydro-Electric Commission are the main subjects considered in this paper. The territory under the jurisdiction of this company has a possible water-power development of 6,000,000 hp., of which about 1,300,000 hp. has been developed.—*Canadian Engineer*, June 19, 1923.

Transmission, Substations and Distribution

Experiences with a High-Tension Line in Mountainous Terrain.—O. USBECK.—A double single-phase 80,000-volt line, feeding the electrified main road between Lauban and Königszelt in Silesia, crossing a very mountainous region of extremely severe climatic conditions, has given cause to numerous



RECONSTRUCTED LINE DECREASES TROUBLE CAUSED BY SLEET

breakdowns due mostly to storms and sleet on the wires. The author describes these failures and tries to suggest remedies. Originally one grounding cable and the two wires of one phase, all three in the same vertical plane, were carried on each side of the towers. Irregular sagging of these wires when coated with sleet caused frequent short circuits with melting of the cables. Arranging the wires in three different planes above each other remedied most of these troubles. The grounding cables, instead of protecting the line, caused still more trouble than the main conductors, so that finally only one of them was laid out, spanned between the tops of the towers. A comparison between the original (1914) line and the present line is seen from the accompanying sketches. In some cases the break of the cables caused the complete collapse of the adjacent steel towers. This was due to an unusually heavy deposit of sleet upon the wires, estimated at 4 kg. per meter. The author points out that the new V. D. E. sleet load specifications seem to be many times too low for severe climatic conditions.—*Elektrotechnische Zeitschrift*, June 21, 1923.

Three years of service of the "Anomima per Elettroagricoltura" (A.P.E.) of Bologna.—F. CARNEVALI.—A very interesting report of what this electro-agricultural company has done during its three years of existence. It has at its disposition a network of about 130 km. of transmission lines, and about 3,000,000 lires worth of apparatus; it is able to perform all kinds of farm work at a reasonable rate. The author explains how the company was formed, and how it has developed and tells how the power is generated, furnished, transmitted, transformed, delivered and utilized. He gives many details about the apparatus the company owns. The various costs of the different operations are mentioned.—*Elettrotecnica*, June 5, 1923.

Changing from Two-Phase Four-Wire to Three-Phase Four-Wire Distribution.—A. HUSSEY and R. A. PAINE, JR.—During the last half of this year the Brooklyn Edison Company expects to change approximately 30,000 kva. from two-phase four-wire, 2,400-volt distribution to a three-phase four-wire 2,400/4,150-volt system. This article takes up the general methods that are proposed for doing this work and represents very careful forethought by the company's engineers.—*Electric Journal*, June, 1923.

Three-Phase Auto Transformer Connections.—F. A. DAHLGREN.—A discussion of the relative advantages of various methods available for the connection of three-phase auto-transformers, giving formulas and curves relating to each method.—*Electrician* (England), June 8, 1923.

General Considerations in Grounding the Neutral of power Systems.—H. H. DEWEY.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A.I.E.E. spring convention, May 5, 1923, on page 1020. —*Journal of the A.I.E.E.*, June, 1923.

Generation, Control, Switching and Protection

Selective Relay System of the 66,000-Volt Ring of the Duquesne Light Company.—H. P. SLEEPER.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A.I.E.E. spring convention, May 5, 1923, on page 1027.—*Journal of the A.I.E.E.*, July, 1923.

Power Developments in Japan. — W. W. LEWIS. — The author considers the topography and climate of the country, the power available, the principal uses of power, construction work which follows closely that of American practice and some general statements as to operation and government regulations. Typical distribution practice is outlined with the use of drawings, and several tables give the various

companies operating, where located, output of stations, substations and transmission line voltages.—*General Electric Review*, July 1923.

Units, Measurements and Instruments

Standardized Insulator Tests.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A.I.E.E. spring convention, May 5, 1923, on page 1032.—*Journal of the A.I.E.E.*, July, 1923.

Development in Alternating-Current Instruments.—PAUL MACGAHAN.—One of the most important recent developments in alternating-current instruments is the design of a complete line of instruments operating on the dynamometer principle. In the instruments described, this principle of operation is used with only slight modifications for the production of voltmeters, ammeters, single-phase and polyphase wattmeters, power-factor meters and frequency meters. An ideal condition results from both a manufacturing and application point of view, when practically one mechanism or movement can be used for such a wide variety of purposes, and for all kinds of applications which require the measurement of electrical quantities.—*Electric Journal*, July, 1923.

Motors and Control

Phase Compensator.—J. BECKMANN.—Any synchronous motor may be used advantageously as a phase compensator, particularly in systems with many small motors. From a simple triangle-diagram may be found how much wattless current remains available if the synchronous motor is also called upon to deliver mechanical power. For drives with low starting torque and small load variations, over-excitation may be used to improve the current displacement of the system. Where, beside small motors, a number of large units are operating on the net, a special three-phase exciting machine is advocated, which consists of a direct current armature, driven by a small motor. The brushes upon the commutator of this armature are connected to the collector rings of the main motor. With such a compensator set the power factor of the main motor can be kept at unity even at no-load run of the motor. Connecting diagrams and resulting power-factor curves illustrate the use of these compensators.—*A. E. G. Mitteilungen*, May, 1923.

The Electrical Equipment of a Cotton Mill.—A description is given of one of the mills of the Dunlop Rubber Cotton Mills, Ltd. The mills are entirely electrically driven and consist of large spinning and weaving establishments equipped with up-to-date machinery for the production of cotton cord, fabric, etc., used in the manufacture of cord tires. Energy is received at 10,000 volts and transformed to 400 volts in two substations which will have an ultimate capacity of 16,000 kva. The article is well illustrated.—*Electrical Review* (England), June 8, 1923.

Heat Application and Material Handling

Autogenous Welding.—CARLO BOTTINI.—This article embraces several methods of welding (oxy-acetylene, oxy-hydrogene, pure electrical, and Goldschmidt process) in which two parts of the same metal are joined in a homogeneous manner, the joints being made by the intermingling contacts of the fibers of the material to be welded, so that the finished piece is one of uniform quality and properties throughout. Each method is fully treated and illustrated, and all the various technical characteristics of these welding processes are given.—*Ingegneria*, Vol. II, No. 3.

Effect of Electric Cooking Upon Station Load.—C. HÄSSLER.—A small but prosperous suburb of Stockholm, Sweden, has today, after a five-year propaganda for electric cooking, reached the point where over 20 per cent of its connected houses have a complete electric kitchen. Data and load curves are given in this paper, to show how this extensive electric cooking affects the load demand upon the station. Light and power are separately metered, the latter with double-rate meters, depending upon the time of the day. The average consumption per connection is 190 kw.-hr. for light and 1,750 kw.-hr. for cooking per year. The load for cooking is on the average 323 kw.hr. per person per year or 0.9 kw.-hr. per person per day.—*Elektrotechnische Zeitschrift*, June 7, 1923.

Traction

Regenerative Braking on Single-Phase Locomotives.—The article describes in full detail the latest type of regenerative train braking on 16⅔-cycle single-phase locomotives, as installed on several hilly branches of the Swiss Federal Railways. Connection diagrams, wattmeter records and vectors are used to explain the novel system. On an average 30 per cent of the energy required for the up-hill pull of a train is being returned into the overhead lines on the down grades. While resistance braking can only serve to reduce the train speed to a certain value, the new regenerative system is independent of speed and may bring the train to a complete standstill. The operation of the brake is very simple and eliminates faulty manipulation. So reliable is the new braking that it is regarded as a fully dependable emergency brake in case of trouble on the vacuum braking system.—*Bulletin Oerlikon*, May, 1923.

Steam Accumulator for Railway Power Stations.—K. MAYR.—The extremely fluctuating load of steam power stations supplying electric railroads makes it necessary to either provide such large boilers that their temporary forcing generates sufficient quantities of steam to cope with peak loads, or else a floating storage battery of ample capacity is called upon to cover the fluctuations. Neither of these two common methods is economical. A large boiler operated at only fractional load is inefficient, and losses in a storage battery, including the necessary booster motor-generator, may rise as high as 35 per cent. The recently developed and now perfected Ruth steam accumulator is claimed to be the best solution of this problem with an over-all efficiency far greater than the above-mentioned systems. On an assumed example, a power house of 4,000 kw., with a typical traction load, comparative data are given for operation without and with such an accumulator, which is kept charged with the full pressure boiler steam. The required investment of an adequate steam plant without accumulator is 16.7 per cent higher than that of an equivalent plant with steam storage. A saving of roughly 10 per cent per year on the indirect expenditures may be realized in the station with the accumulator.—*Siemens Zeitschrift*, June, 1923.

The Electric Railways of Iowa.—Iowa has twenty-eight electric railways operating nearly 1,000 passenger cars and more than 3,000 freight and work cars on approximately 1,100 miles of track. A general description is given of each of the railways in this state, with particular attention given to the equipment and freight handling facilities. Power requirements and passenger and freight rates are among other subjects considered.—*Electric Traction*, June, 1923.

Electrophysics, Electrochemistry and Batteries

Permanent Magnets, and the Relation of Their Properties to the Constitution of Magnet Steels.—E. A. WATSON.—The first part of the paper deals with the properties required in a permanent magnet, while the second part deals with the case of magnets which are microscopically not of uniform composition and which contain two principal constituents. Data taken chiefly from modern cobalt steels are given in support of the theories put forward, and some suggestions are made for further research and development work in this connection.—*Journal of the Institution of Electrical Engineers* (England), June, 1923.

Telegraphy, Telephony, Radio and Signals

Advantages of Condensors in Combination with Telephone Transformers.—ARVID HOLMGREN.—The author shows that the introduction of suitable capacities in the primary and secondary circuits of a telephone transformer will improve its characteristics and reduce the damping. A mathematical deduction for commutation of the suitable capacity is given. A transformer of this kind will have a characteristic that is almost independent of the frequency as well as a damping that is practically one half of that of an ordinary transformer without capacities.—*Teknisk Tidskrift* (Swedish), *Elektroteknik*, June 2, 1923.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Niagara Diversion Board Soon to Be Appointed

The Canadian government has agreed to the plan proposed by the United States for the measurement of the diversion from the Niagara River. The measurements are to be made under the supervision of a board to be composed of two members, one to be appointed by the Canadian government and the other by the United States. The American member of the board undoubtedly will be Major P. S. Reinike, the district engineer of the War Department at Buffalo. Canada is expected to appoint William Stewart as its member of the board.

Six Months' Gain in Business Offsets Rate Decrease

In a statement given to the San Francisco press last week by A. F. Hockenbeamer, vice-president and treasurer of the Pacific Gas & Electric Company, the statement is made that increased earning capacity resulting from the rapid growth of the company's business has offset the effect upon gross revenues of the substantial reductions made in both gas and electric rates during the past year. In the first half of 1923 gross revenues increased $290,747 over the same period of 1922. Operating expenses, owing primarily to reduced oil costs resulting from lower price of fuel oil and larger proportion of hydro-electric energy available, decreased $574,013 the first half of the current year, an increase in net income of $864,760 being thus registered. In the six months ended June 30, 1923, sales of electricity increased 57,277,188 kw.-hr., or 11.6 per cent.

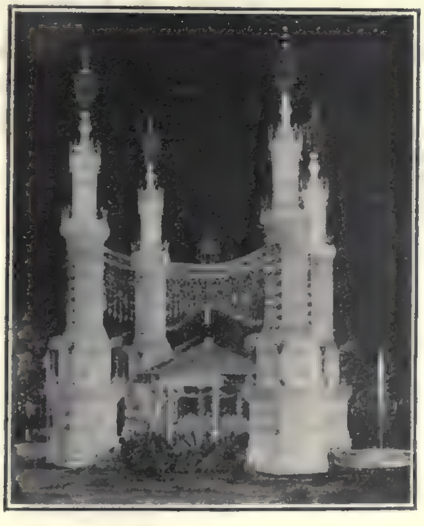
Southern California Edison Plans New Capitalization

A great increase in capital is planned by the Southern California Edison Company. To adjust the financial structure to the growth of the company's business, the stockholders will be asked on Sept. 7 to approve proposals to increase the authorized capital stock from $100,000,000 to $250,000,000, to consist of $125,000,000 common and $125,000,000 preferred; to authorize $250,000,000 of bonded indebtedness, and to approve the execution of a new mortgage to secure the newly authorized bond issue. Stockholders will be offered the privilege of buying the new stock at $100 a share in the ratio of one new share for every ten now held.

The increased authorized capitalization will provide, according to President John B. Miller, a broad and strong foundation for financing through to completion more than 1,000,000 additional horsepower to be installed at the company's Big Creek water power project, together with extensions of its transmission and distributing system, on account of which the expenditures in the next ten years are estimated to amount to approximately $200,000,000.

Tower of Jewels for Cincinnati

A striking and impressive feature of the Cincinnati Fall Festival and Industrial Exposition, to be held at Cincinnati from Aug. 25 to Sept. 5, will be an elaborate display of ornamental lighting in Washington Park. This display was designed by W. D'A. Ryan, director of the General Electric Company Illuminating Engineering Laboratory. There will be a tower with Oriental minarets, 90 ft. high, decorated with "Novagem" jewels. The light from forty 18-in. searchlights will be thrown on these. Twenty other searchlights of the same size will be used.



Display for Cincinnati Festival

General Electric Issues More Bonds for Employees

An additional issue of $2,500,000 of bonds by the General Electric Employees' Securities Corporation, which pay 8 per cent so long as the original holder remains an employee of the General Electric Company, has been announced by President Gerard Swope. The first issue of $5,000,000 of bonds was announced Feb. 8, and the demand of employees so far exceeded the amount available that this second issue has been arranged.

The bonds are 6 per cent fifty-year securities issued in multiples of $10. The company agrees with the holder to pay an additional 2 per cent so long as he remains with the company.

According to a recent report of the comptroller, employees of the General Electric Company have to date acquired nearly $28,000,000 in the company's securities.

Salt River Valley Project Bonds Found Legal

Passing on three disputed points, the Supreme Court of Arizona has sustained the validity of an issue of $1,800,000 in bonds made a few months ago by the Salt River Valley Water Users' Association and sold in March through a Los Angeles firm.

Most of the money will be expended in construction of the Mormon Flat dam in the channel of Salt River, 42 miles east of Phoenix. This structure is to be 160 ft. high, 320 ft. long on top and only 90 ft. in channel width at the bottom, in a narrow box canyon declared ideal for the installation. It will back up less than 100,000 acre-feet of water and is to be used only as a supplemental storage basin for water that may be passed through the Roosevelt Dam for power needs. The agricultural supply hereafter is to be regulated at Mormon Flat instead of the more distant Roosevelt.

Not only will the dam permit installation at Roosevelt of an additional 7,000-hp. generator, bringing the rating of the plant to 20,000 hp., but this gross power will be available continuously, instead of occasionally as at present. A profitable market for the power already is waiting in the mines of central Arizona, for industrial needs around Phoenix and for the pumping of water on the farming areas around Casa Grande and Tucson.

Work on the project has already been started. When the dam shall have been completed it is expected that work will be started on a second and larger structure 10 miles upstream at Horse Mesa. This is to be a power dam, about 235 ft. high and with a large storage basin. No power will be generated at Mormon Flat.

To Deal with Power Export

Question of American Relations to St. Lawrence Development Before Ottawa Government

ACCORDING to articles in the *Financial Post* of Toronto, the Canadian government has not yet decided on a permanent policy regarding the export of power to the United States. Much power is now being exported at Niagara and from the Quebec privately owned systems, but the position of any new company developing power for export would be so insecure that capital could not be interested in the investment of millions in permanent works upon the chance of the government policy being favorable. What would be required would be the assurance of the privilege of export over a term of many years.

With this question is closely bound up the development of water power on the St. Lawrence. It is argued in Canada that the Dominion could obtain a substantial revenue from an export tax on the 4,000,000 hp. that could be developed on the Canadian side of the river. It is recognized that most of the power would go to industries in the United States. Moreover, the control of this power would put Canada in an enviable position to bargain with the United States on coal and the tariff.

On the other hand, if Canada proceeded with the water-power development and sold power in the States, a somewhat difficult situation might be created when Canadian industry expanded to the point where large quantities of the power would be needed in Canada. It might be difficult to divert power from the United States to Canada without causing international ill feeling—such complications, for instance, as the proposed embargo on the export of pulpwood is causing.

PROJECTS AWAIT DECISION

Among projected developments awaiting the decision of the Canadian government on power exportation is that of the Frontier Corporation, controlled in the United States, for which Col. Hugh L. Cooper has submitted definite plans (see ELECTRICAL WORLD, July 28, p. 196). These plans, according to the *Financial Post*, are branded as "propaganda" by officials of the Hydro-Electric Power Commission of Ontario, who oppose private development of the great water powers of the lower province, but among business men of Quebec have created much discussion.

Another contemplated development is concerned in the application of the National Hydro-Electric Company, Ltd., of Montreal for permission to raise the level of the dam at Carillon on the Ottawa River to 133 ft. In 1911 this corporation obtained a license which permitted the development of only a small amount of power. In 1921 this was changed so as to permit the raising of the level of the dam to 94 ft. Since then the demands for power have so increased that the promoters, the Robert group of Montreal, with whom are associated important American capitalists, now need a much higher level.

One of the most important features of the project is that undoubtedly a very large portion of the power developed would be sold in the United States. That big things are contemplated is evident from reports that the expenditure may amount to $30,000,000.

NEW YORKERS VISIT LONG SAULT

A conference in which representatives of chambers of commerce and boards of trade of towns in northern New York, Canadian public men and others were to take part was called to meet in Cornwall, Ontario, on Thursday. It was to be addressed by Charles P. Craig of Duluth, Minn., vice-president of the Great Lakes and St. Lawrence Tidewater Association, and the participants were to proceed to the Long Sault Rapids to listen to an explanation from engineers of the canalization and power projects.

Representative Dempsey Urges Immediate Development

Wallace Dempsey, chairman of the rivers and harbors committee of the United States House of Representatives, conferred with Premier Ferguson of Ontario at Toronto on Tuesday last. Mr. Dempsey is of the opinion there should be immediate development of the St. Lawrence by private interests.

"Canada has intimated to us that she is not ready to go ahead with the development at the present time," said Mr. Dempsey. "That being the case, I think it should be developed privately. Private capital is ready for such an undertaking."

Reclamation and the Colorado River

F. E. Weymouth, chief engineer of the Bureau of Reclamation, Department of the Interior, with his headquarters in Denver, has just returned to that city after a visit to Washington. Mr. Weymouth says that delay on the part of any state in ratifying the Colorado River treaty will not necessarily result in delay in the development of the Colorado River project from a reclamation point of view. He adds that there is no reason why the bringing of water from the western slopes through the Moffat Tunnel, now being bored, should not be carried out successfully, with vast benefits to Denver and surrounding territory, and that the plan is wholly practicable.

Revitalizing N.E.L.A. Commercial Section

Organization Meeting Held at Association Island, N. Y., Determines to Re-enlist Support of Former Chairmen and Frame Convention Program of Inspiring Kind

IN SO far as is possible, the detail work of the National Electric Light Association Commercial Section will be done this year in the committees of the geographic divisions. This policy was definitely announced at the organization meeting of the Commercial Section held on Friday and Saturday of last week at Association Island, Henderson Harbor, N. Y. A determined effort is to be made this year, under the leadership of Chairman N. T. Wilcox, to revitalize the Commercial Section and raise it to a higher standard of usefulness, on a plane with the other sections of the association.

A committee was appointed to devise a method of re-enlisting the support and services of the ex-chairmen of the section, who have for a number of years dropped out year after year and lost interest. Plans were discussed looking to a convention program that would provide something to interest and inspire the executive by bringing men of distinction from outside the industry to talk upon commercial problems in which the central-station company is concerned. "National convention sessions," said Mr. Wilcox, "should be something more than glorified committee meetings. Much of the detail work we have been doing in the national section is better done and discussed in the meetings of the geographic divisions, the national section assisting and reporting to the industry through the *N. E. L. A. Bulletin* and the electrical press." The method by which it is hoped that this result may be accomplished will be reported to the next meeting of the Commercial National Section executive committee, which will be held in New York in September.

The N. E. L. A. wiring committee held its first meeting of the year on the day preceding. Chairman R. S. Hale reported that the standardization of the plug on the appliance end of attachment cords has progressed to the degree where manufacturers have agreed on one type of round prong and one type of flat prong, and only these are now being produced. It now remains to bring about the universal adoption of one of these.

The committee decided to make a study of the "thoroughly grounded neutral" to determine whether if the neutral is made solid throughout and is adequately protected as by conduit and safely grounded at all points, bare wire can be used at a considerable saving in cost.

An appropriation of $2,000 was voted to help finance the cost of establishing a field secretary for the National Fire Protection Association electrical committee, who will work to unify wiring practice throughout the country.

Maryland Utilities Body

Representatives of Fifty-three Companies Meet with State Commission for Organization

TO PERFECT the organization of the Maryland Public Utilities Association, representatives of fifty-three utility companies met with the State Public Service Commission on Thursday, July 26, in the chamber of the House of Delegates at Annapolis.

In his address to the members of the association, Governor Albert C. Ritchie spoke on "Service." He suggested that the association should substitute the name "Service" for "Utilities" in its corporate title so that its very name would bespeak the aims of the officials and employees of the companies composing the association.

Service, said the Governor, meant the realization by officials of public utilities that they are servants of the public or quasi-public officials. Their duties to the public are as high as, and even more intimate than, the duties of public officials duly elected by the people. People today depend so much in the daily routine of their lives upon the water, gas, electricity and railway companies that the service these corporations render must be of the right kind; it should be constant, honest and courteous. The Governor declared that the meeting was one of the most progressive steps the state had taken in years, and he urged upon the representatives present that they take the people more and more into their confidence.

PRESIDENT COBLENTZ' ADDRESS

Emory L. Coblentz, president of the association, who is also the president of the Potomac Public Service Company of Hagerstown and Frederick, Md., accentuated the value of co-operation with the public and showed the pleasure he felt because of the interest aroused. "Through our organization," he said, "every utility in the state may gather lessons which other organizations have learned through hard experience. The Public Service Commission, which really started the move, will have its work lightened when it works with an organization whose sole aim is service. We can now adjust many of our minor troubles, and, what is more important, we may avoid many of them."

Excoriating the "public-be-damned" policy which, he said, unfortunately appeared to be the attitude of a good many public utility companies until recently, Charles M. Cohn, vice-president of the Consolidated Gas, Electric Light & Power Company, Baltimore, spoke of the rapid progress that could be made through co-operation. "The public-be-damned spirit of our forefathers is antique and not wise in our day," Mr. Cohn said. "I have seen this tried. Our lines of business will never run with any smoothness until we have learned a lesson in common courtesy and have forced our employees to follow our example. We cannot successfully disregard our customers' feelings any more than a merchant in a highly competitive business can."

Among other speakers were C. D. Emmons, president United Railway & Electric Company, Baltimore, and president American Electric Railway Association; Labert St. Clair, director advertising section, American Electric Railway Association; George F. Oxley, director of publicity National Electric Light Association, and representatives of the electric light, telephone and gas companies.

Membership dues were determined upon a sliding scale based on the gross earnings of the companies and ranging from $10 to $700.

Permanent headquarters for the organization were chosen at the Engineers' Club, Baltimore. Governor Ritchie entertained the entire delegation at luncheon in the Executive Mansion.

Commonwealth Edison Reduces Rates

Acquiesces Cheerfully in Commission's Desire for a Decrease of 1 Cent in First Step of Tariff—Reductions Also to Be Made by Northern and Central Illinois Companies

ORDERING a reduction in Chicago gas rates, the Illinois Commerce Commission on July 25 announced at the same time changes effecting decreases in the rates for electrical energy in that city and elsewhere in Illinois.

In a preliminary letter addressed to the Commonwealth Edison Company suggesting a lower rate, the commission said: "The commission recognizes that the rates of the Commonwealth Edison Company are appreciably lower than those charged for similar service in practically all comparable cities. Nevertheless, after such consideration as under the circumstances it is able to give to the reports of the company, the commission is of the opinion that the company can make a reduction of substantially 1 cent per kilowatt-hour in its general tariff, which, as it now is in effect, is 9 cents for the first 30 kw.-hr. of maximum demand, 5 cents for the second kilowatt-hour block and 3 cents for the succeeding kilowatt-hours. This reduction may be effected by reducing the first step rate from 9 cents to 8 cents. The reduction in the tariffs will bring a saving to the users of the service of substantially $1,300,000 a year and a like reduction in the income account of the company, and in view of the foregoing the commission is satisfied that such adjusted tariffs will be fair and reasonable. In view of all these facts, the commission therefore directs the filing of tariffs in compliance with the foregoing recommendations."

At the time this letter was received Samuel Insull, president of the company, was in New York. Upon his return to Chicago he wrote the commission as follows:

"Upon my return to the city today I find your letter of the 25th suggesting a reduction of 1 cent per kilowatt-hour in the initial portion of the company's general tariff for electric service. In reply, I beg to say that the company is ready to adopt the suggestion and will immediately file tariffs in accordance therewith, effective as to all bills rendered for meters read on and after Aug. 1, 1923.

"The company appreciates the commission's recognition of the fact that the company was able to go through the world war and the period subsequent thereto without seeking the relief of increased rates and that its rates are appreciably lower than the rates charged for similar service in practically all cities comparable with Chicago.

"It is true, as you state, that the business of the company has shown a marked increase in volume. For instance, during the year 1922 there was an increase in its maximum load of more than 14 per cent over that of the preceding year, and there was also a substantial increase in its output of energy. On the other hand, its operating expenses, including the cost of labor, materials and money, have been high during the past few years, and there has been comparatively little decrease since the peak of prices following the war. Nevertheless, I believe that as a result of the increase in the volume of its business and on account of the increased economy and efficiency in the production and distribution of electricity, the company can safely make the reduction in its rates which the commission suggests. The reduction is in accord with the policy of the company to reduce its rates as rapidly as reductions can be made consistent with good service and with the interest of those who have invested money in its properties."

OTHER RATE REDUCTIONS

Rates for the Public Service Company of Northern Illinois were reduced upon the commission's order. There was a 1-cent cut per kilowatt-hour in the first step rate for the electric light consumers on Schedule A, which will be effective Aug. 1. Then a further reduction of 1 cent per kilowatt-hour for the first step block rate is called for Jan. 1, 1924.

Rates down the state were also changed by order of the commission, the Central Illinois Public Service Company being required to bring its energy rate for the first maximum-demand block step to 13 cents a kilowatt-hour. This will affect about 75,000 consumers in 161 localities.

Tennessee River Projects

Knoxville Power & Light Applies for Two More Sites—Initial Work on Deschutes Plan

THE Knoxville Power & Light Company is anxious to make more comprehensive its proposed development on the Clinch and Powell Rivers and has asked permission of the Federal Power Commission to amend its original application by adding the Coulter Shoals and Marble Bluffs sites to the four sites covered in the original application. The two new sites are on the Tennessee itself, in Blount County.

The Coulter Shoals development is to include the construction of a dam 53 ft. high and 1,200 ft. long, with provisions for locks for navigation and an installed capacity of 48,000 hp. The Marble Bluffs dam is to have a height of 35 ft. and will be 1,400 ft. long. At that point 44,000 hp. is to be developed. This brings the total of the proposed installation on the six sites to 292,000 hp.

The great advantage in adding to the project the two Tennessee River sites is that during high water the load can be carried on the Tennessee River plants. No storage other than that for daily regulation can be had on the Tennessee, but on the Clinch and the Powell run-off can be stored in the large reservoirs that form a part of the proposed development. The situation is such as to permit of the application of exactly the same plan resorted to by the Alabama Power Company on the Tallapoosa and Coosa Rivers.

COLUMBIA VALLEY COMPANY'S PLANS

Reports to the Federal Power Commission indicate that the Columbia Valley Power Company is well advanced in the engineering studies prescribed in its preliminary permit for the development of the Metolius and Pelton sites on the Deschutes River, near Madras, Ore. These engineering investigations have disclosed no unfavorable facts and indicate that very cheap power is likely to be developed. It is the plan of the company to develop the Pelton site first. The Metolius site will necessitate a much larger development, which will not be undertaken until a market has been developed.

Owing to the low cost at which it now is estimated that this power can be furnished, it is expected that the development will have an important bearing on the public utility and industrial situations in Portland and vicinity.

Murder of American Electrical Man in Mexico

Mexican correspondents of newspapers published in El Paso have telegraphed that M. Marion, an American, who managed the electric light and power company at Orizaba, in the State of Vera Cruz, Mexico, was stabbed to death on July 30 by radical workmen on the streets of the town.

Messages say that police, state officers and the military are hunting the assassins. Several other crimes in the past few weeks were committed by the radicals, the correspondents assert.

Coal-Storage Investigation of F. A. E. S. Under Way

The storage-of-coal study undertaken by the Federated American Engineering Societies in co-operation with the United States Coal Commission and the Department of Commerce is now in full swing throughout the country.

Definite organization of the work is announced by the president of the Engineering Federation, Dean Mortimer E. Cooley of the University of Michigan, who states that 107 committees, comprising more than 500 engineers, are actively pursuing the inquiry, the aim of which is to aid in solving the nation's fuel problem, which this winter may become acute. Probably 200,000 engineers, directly or indirectly, are assisting in the coal-storage study, according to Dean Cooley. It is hoped to complete the study by fall.

The chairman of the main committee is W. L. Abbott of Chicago. Additions to the personnel announced recently include R. V. Norris of Wilkes-Barre, Pa. Dean Perley F. Walker of the University of Kansas has been chosen to direct the field organization and is now working in the Central West and the South.

Season Affects Utility Financing

THE low absorbing power of the public during the summer season probably accounts for the reduced volume of new electric light and power issues brought out during the month of July. The total amount of new offerings of bonds and notes of this type of security was only $23,080,000, the lowest total of the year. This lull is not inconsistent with conditions existing last summer, when utility financing showed a tendency to decline during July and August. The largest single issue of the month—in fact, one of the largest pieces of public utility financing during the summer—was $7,192,000 of bonds of the Interstate Public Service Company offered at 91½ and yielding 6.70. It is interesting to note that preferred-stock offerings, which played a conspicuous part in electric light and power public utility financing during the early months of the year, do not appear among July's flotations. Long-term securities continue to predominate, and the rate of return advanced to 6.58, the highest point reached in the current year.

In spite of the seasonal slump electric light and power public utility financing for the seven-month period just ended shows an increase of more than $54,000,000 over the total reached during the same period last year.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN JULY

Name of Company	Amount of Issue	Period Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Jersey Central Power & Light Corp.	$1,250,000	10	Convertible debenture gold bonds	Construction	7	98¼	7.25
Metropolitan Edison Co. (Pa.)	1,000,000	29	First and refunding mortgage gold bonds, series B	Capital expenditures	6	97½	6.20
San Diego Consolidated Gas & Electric Co. (Cal.)	1,438,000	24	First and refunding mortgage gold bonds, series C	Construction	6	98	6.15
Northern States Power Co (Minn.)	3,000,000	18	First and refunding mortgage gold bonds of 1916	To reimburse for expenditures and extensions	6	99½	6.00
Ohio Public Service Co.	500,000	30	First mortgage and refunding gold bonds, series C	Construction and corporate purposes	6	94½	6.40
Virginia-Western Power Co. (Va.)	3,500,000	30	First mortgage sinking-fund gold bonds, series A	To reimburse for retiring bonds, acquiring properties and corporate purposes	6	95	6.33
Penn-Ohio Edison Co.	3,250,000	3½	Gold notes	For acquisition of securities of controlled companies	6½	98	7.15
United Light & Railways Co. (Mich.)	1,000,000	29	First lien and consolidated mortgage gold bonds, series A	To reimburse for additions and improvements	6	96½	6.25
Commonwealth Light & Power Co. (N. Y)	600,000	2	Secured gold notes	Refunding, additions and improvements and other purposes	7	99½	7.25
Eastern Iowa Power Co.	350,000	20	First (closed) mortgage gold bonds	Construction and development	6½	97½	6.75
Interstate Public Service Co. (Ind.)	7,192,000	25	First mortgage and refunding gold bonds, series A	Refunding and corporate uses	6	91½	6.70
Total	$23,080,000						

Interconnection Economics

Fall River District Executives Give Valuable Testimony Before the Massachusetts Commission

THROUGH the construction of the Montaup Electric Company's tidewater power station in the Fall River district of Massachusetts and the interconnection of the central stations at Pawtucket and Woonsocket, R. I., Fall River and Brockton, Mass., it is estimated that an investment of $3,000,000 in plant will be saved, according to testimony before the Massachusetts Department of Public Utilities last week in the capitalization case of the Montaup company. Roy F. Whitney, president Fall River Electric Light Company; M. L. Sperry, vice-president Blackstone Valley Gas & Electric Company, and A. Stuart Pratt of Stone & Webster, Inc., vice-president Edison Electric Illuminating Company of Brockton, set forth the advantages of interconnection and of the co-operative plan by which these companies expect to develop the Montaup plant. S. H. Mildram, for the city of Fall River, opposed the project pending a more extended demonstration of its economic justification, contending that, under an existing contract with the New England Power Company, the Fall River company should seek to increase its capacity through the purchase of additional energy rather than through the building of the Montaup station. H. I. Harriman, president of the New England Power Company, asserted that future hydro-electric developments to serve New England rendered the purchase of additional water power a logical step for the Fall River central station.

President Whitney's Argument

President Whitney reviewed at length the negotiations of the Fall River company with the New England Power Company, concluding that the offered prices of the latter of between 12.5 and 13 mills per kilowatt-hour exceed the estimated cost of production at the proposed Montaup plant. He pointed out that the starting of an electric rate case in Fall River within a few days of the inauguration of a new city administration had resulted in premature publicity for the Montaup plan and that this had caused an overnight rise of $90,000 in the price of the station site under consideration.

Opponents of the Montaup plan wanted to know why the Fall River company did not purchase energy from the new Weymouth plant of the Boston Edison Company, which is seeking maximum efficiency in production. Mr. Whitney replied that the same type of equipment is contemplated for Montaup as for Weymouth and that there is a fuel differential of approximately $1 per ton of coal in favor of Montaup. The demand for power is so great in Fall River, a city of 111 cotton mills, that at present five mills are unable to secure power from the Fall River company, and the provision of new generating facilities is absolutely essential to the growth of the community. Mr. Whitney said that the greater reliability of locally produced power as compared with transmitted power is an important consideration in a city like Fall River, with its 150,000-hp. industrial development. By 1929, if no steps are taken to develop additional plant, the Fall River load of 50,000 kw. will have to be supplied 80 per cent from outside. This year there has been no opportunity to purchase surplus power. In ten years there will be an estimated saving of $2,000,000 to Fall River if the Montaup plant is built and interconnected with the Blackstone Valley, Brockton and Fall River systems.

Mr. Pratt said that interconnection would save a 30,000-kw. unit through utilization of load-factor differences in the systems. The hearing was continued.

Interconnection Idea Is Spreading in Maine

An important interconneetion program has been under consideration lately in Maine by which the systems of the Cumberland County Power & Light Company, Portland; the Central Maine Power Company, Augusta, and the Bangor Railway & Electric Company will be tied together to enable the benefits of this policy to be reaped by more than 80 per cent of the power users of the state. All three of these companies operate extensive hydro-electric plants and lines, and the first two named own valuable auxiliary steam plants. The water-power stations are located on some of the chief watersheds and are in a position to take advantage of the diversities of rainfall and run-off through interconnection. More than $50,000 a year has been saved in operating costs by the interconnection of the plants of the Central Maine system on the Androscoggin and Kennebec Rivers. While details of the plan are not yet fully determined, it is expected that the Cumberland-Central Maine tie line will follow the Portland-Lewiston interurban right-of-way, and that one of the first steps will involve the construction of a switching and substation at West Falmouth at a cost of from $150,000 to $200,000. Fred D. Gordon is general manager of the Cumberland County Company, W. S. Wyman of the Central Maine Company and E. M. Graham of the Bangor Company.

New Hydro-Electric Plant for Keene (N. H.) Utility

Construction has begun of a hydro-electric plant of 2,000 kw. rating near Marlboro, N. H., for the Keene Gas & Electric Company. The plant will be built on Minnewawa Brook and will utilize the run-off of Dublin Lake and Mount Monadnock streams. From a storage dam 60 ft. high and 6,000 ft. above the station water will be delivered to the plant by a wooden-stave penstock, the normal head being 275 ft. Improved storage facilities will benefit the company and local mill owners alike. Energy will be delivered to Keene at 13,000 volts. The Keene company is already connected with the New England Power Company's transmission system, and the new installation is expected to benefit both local service and intercompany requirements. It is hoped to complete the plant by Dec. 1. L. H. Shattuck, Inc., Manchester, N. H., is handling the construction.

Central Connecticut Company Expands

The Central Connecticut Power & Light Company, East Hampton, Conn., has purchased the Essex Light & Power Company of Essex, Conn., and will at once undertake the intensive commercial development of the territory covered by the latter organization, including industrial and residential loads of attractive prospects. Financing will be handled by Bodell & Company, Providence, R. I. The acquisition of the Essex company will increase at once the area and number of customers added to the Central Connecticut system by about 50 per cent, and the combined territories will extend from East Hartford to Long Island Sound. Franklin N. Fernald is vice-president and general manager of the Central Connecticut company.

St. Louis River to Be Developed

Completion of arrangements for the purchase from the Weyerhauser interests of Cloquet, Minn., of additional power properties on the St. Louis River by the American Power & Light Company, which recently acquired the Great Northern Power and the Minnesota Utilities companies, has been announced by W. S. Robertson of the Phoenix Utilities Company, who is in charge of developments in the Duluth district for the American Power & Light Company.

The purchase is part of a project to develop the entire resources of the St. Louis River system into one power-producing and distributing organization. Construction work now under way at Fond du Lac, Wis., will increase the present power capacity of the river from 80,000 hp. to 95,000 hp. within a year, according to Mr. Robertson.

Engineers have estimated that complete development of the system will make possible a total of 130,000 hp. All of this eventually will be made available to Duluth and vicinity, including the Iron Ranges, it is planned.

At the same time, arrangements were made for the acquisition of the power transmission system known as the General Light & Power Company, which serves Cloquet and towns north and south as far as Floodwood and Sandstone. This system will be tied in with the system of the Great Northern Power Company and the Minnesota Utilities Company.

Inductive Trouble on Coast

California Commission Calls Conference on Postal Telegraph Complaint Against Pacific Gas

AS THE result of a complaint filed against the Pacific Gas & Electric Company by the Postal Telegraph Company, which claims that because of the proximity of the power lines of the electric company to its telegraph lines between Sacramento and Suisun the transmission of messages is interfered with, speed of sending messages reduced and its equipment and apparatus destroyed, the California Railroad Commission has called a conference for Aug. 31 of certain state utilities for the purpose of planning for the relocation of the wires which have caused the trouble.

Between Sacramento and Suisun the Pacific Gas & Electric Company has two 60,000-volt transmission lines which parallel the communication circuit of the Postal Telegraph-Cable Company. For a distance of approximately 12 miles the horizontal separation between the power and communication circuits is approximately 25 ft. In order that it might have a complete record of the scope and effect of the inductive interference, the commission has required, over a period of three years, the Postal company to file a record of all cases of interruption to its service and other cases where damage has resulted to its plant. The commission has also required the Pacific company to file reports regarding the cause of interference or abnormal conditions on power lines.

Although the Postal Telegraph-Cable Company is the only communication company involved in this particular proceeding, the Western Union Telegraph Company and the Pacific Telephone & Telegraph Company have circuits in this parallel. Accordingly, the order of the commission provides for a joint conference of all of the utilities operating either power or communication circuits within this particular section.

Better Inspection Urged for New York City

An increase of $250,000 annually in the city budget for a larger squad of more competent electrical inspectors for the Department of Water Supply, Gas and Electricity is being urged by Charles L. Eidlitz, on behalf of the Electrical Board of Trade of Greater New York, of whose board of governors he is chairman. At present there are fifty-seven such inspectors, receiving $1,200 a year each, which Mr. Eidlitz says is decidedly insufficient for experienced men.

He recommended further that hospitals, theaters, motion-picture houses and meeting places be inspected at an early date for fire hazard due to a possibility of defective wiring. While not wishing to create undue alarm, Mr. Eidlitz says, the vast amount of new construction, and more particularly the widespread remodeling of buildings, calls for close supervision by experts of all electrical work done.

"Doing away with the power of the city to issue permits for $1 to any one wishing to have work inspected would stop 50 per cent of defective installations," Mr. Eidlitz asserts. "Where a building has no current, it is possible to work on the premises without a permit at all.

"The Electrical Board of Trade is desirous of having repair work and installing done on a uniform basis throughout the city, only by competent men who have passed technical examinations, the work later to be inspected by high-grade and well-paid men from the city bureau. Under the present system, any wiring poorly done may bring a $50 fine when discovered. A policy of safety first would prevent the unsatisfactory work from being done at all."

Mr. Eidlitz is contemplating placing the matter before Commissioner W. J. Hayes, submitting, along with the suggestions of the electrical group, recommendations along similar lines made by leading contractors and by the Board of Fire Underwriters.

September Meeting of the Great Lakes Division

Future distribution voltage and the trend of steam power-plant design will be some of the topics to be presented at the third annual convention of the Great Lakes Division of the N.E.L.A., to be held in joint meeting with the fifteenth annual convention of the Indiana Electric Light Association at the French Lick Springs Hotel, French Lick, Ind., from Sept. 26 to 29. Although the complete program will not be available before Sept. 1, the subjects up for discussion will include:

Paper, "Mechanical Refrigeration."

Paper, "The Future Distribution Voltage as It Affects Central-Station Companies."

Paper, "The Trend of Steam Power-Plant Design."

Paper, "Practical Methods of Improving Contacts with the Public."

Paper, "Bookkeeping Machines in Connection with Light and Power Customers' Accounts."

Symposium, "How the Industry Can Help Itself." Public Utility Information Committees: Speakers—Illinois, B. J. Mullaney; Wisconsin, Franz Herwig; Michigan, Alfred Fischer; Indiana, John C. Mellett.

"N. E. L. A. Sections' Work Planned for the Administrative Year": Accounting Section, W. A. Jones, chairman; Commercial Section, N. T. Wilcox, chairman; Public Relations Section, H. T. Sands, chairman; Technical Section, H. P. Liversidge, chairman.

Address, "Supplying Rural Districts with Electricity," by a representative of the American Farm Bureau Federation.

Address, "What I Have Derived from the Advanced Accounting Course."

Address. Invitations have been extended to several members of public utilities commissions in the division to address the convention.

An usual, a special one and one-half fare for the round trip from all states in the Central Passenger Association territory is again available. Identification certificates may be obtained from R. V. Prather, Thomas Donahue, Herbert Silvester, and John N. Cadby.

Final Program of National Electrical Credit Men

For the "Silver Jubilee" meeting at the Copley-Plaza Hotel, Boston, on Thursday and Friday of next week of the National Electrical Credit Association, which this year is celebrating its twenty-fifth anniversary, this program has been prepared:

THURSDAY, AUGUST 9, 9:30 A.M.

Address of welcome, Mayor J. M. Curley; response, Albert H. Elliot, secretary Pacific Coast Association; reports and announcements; "Review of the Beginnings of the N. E. C. A." Charles M. Wilkins; "Relation of Credit to Capital Investment," E. W. Shepard, Western Electric Company, discussion led by Joseph C. Belden; address by Paul Hollister, Boston; memorial addresses for deceased presidents: Frank Ridlon, by a Boston member; James Wolff, by Frank M. Pierce, Chicago; John Forman, by C. M. Wilkins, Toronto; John H. Dale, by Robert Edwards, Jr., New York City.

FRIDAY, AUGUST 10, 9:30 A.M.

"How New Lines of Merchandise, Such as Radio, Affect Credit," A. F. Hearl, American Electric Supply Company, Chicago, discussion led by George J. Murphy; "Mercantile Agency Reports—How They Can Be Improved by Merchants' Co-operation," J. S. Thomas, Elliott-Lewis Company, Philadelphia, discussion led by H. D. Clark; address by W. T. G. Harding, governor Federal Reserve Bank, Boston; general discussion of association problems.

On Thursday evening the "Silver Jubilee" banquet will be held, when Governor Cox of Massachusetts and George S. Smith, vice-president of the New England Power Company, will be the principal speakers. Frederick P. Vose, secretary of the association, will be the toastmaster. In the afternoons of Thursday and Friday there will be golf tournaments, sightseeing tours and boat rides, and a "Silver Jubilee" outing on Friday evening to Nantasket Beach will conclude with a sail around Boston Harbor.

Hydro-Electric Development in Brazil

The steady progress of hydro-electric power development in Brazil is reflected in a series of contracts lately undertaken or completed by the Pelton Water Wheel Company, Atlantic Department, for plants in that country. One of the most interesting of these was for two 4,000-hp. units for the new Fagundes power plant of the Cia Braziliera de Energia Electrica, near Rio Janeiro. The installation included turbines, auxiliaries, power-house equipment and penstocks.

These turbines are of the single-discharge, horizontal, reaction type and will operate under an effective head of 365 ft. The design, which was developed throughout by the Pelton company, is known as the single overhung type, as only two bearings support the entire weight of rotating elements of both turbine and generator, all on one shaft. The turbine runner is on one end of the shaft, the direct-connected exciter on the other; the bearings are inside these two, and the generator is between them. This makes, naturally, a compact, simple and efficient design.

Another interesting Brazilian contract recently given the Pelton company will supply power for a new textile mill

project near Pernambuco. This consists of two 400-hp. impulse wheels, to operate under about 360 ft. head, directly connected to General Electric alternators. Current will be generated at 6,600 volts and transmitted over a 4-mile line to the textile mill. The design required unusually sensitive governors, as the maximum speed variation allowable for an ordinary change in load is 5 per cent. This requirement was successfully met by the Pelton design. It was also necessary in both the hydraulic and electric features to make the entire equipment as near "foolproof" as possible, because of the scarcity of skilled labor and the difficulty of getting spare parts or making repairs. The result is that, by a number of devices, control of the entire plant is centralized at the switchboard to a much greater extent than would be necessary in a similar plant in the United States.

The turbines and auxiliaries will be built in the I. P. Morris Department shops of the William Cramp & Sons' Ship & Engine Building Company at Philadelphia, the Pelton company being one of the units of the Cramp organization.

Electrification in Prussia

Three laws authorizing the state to subsidize the electrification of the district along the middle and lower Weser and to acquire an interest in two industrial enterprises operating electric power stations were passed by the Prussian Diet not long ago, according to a report received by the Department of Commerce from William Coffin, American Consul-General at Berlin. The terms of the laws are:

1. The state is authorized to spend 26,000,000,000 marks to electrify the region along the middle and lower Weser, to guarantee to the extent of 26,000,000,000 marks any loans issued by a corporation operating this enterprise, and to disburse 11,400,000,000 marks toward laying state-owned cables and constructing plants which will connect the high-power station at Hanover with the state-owned cables in the region of the upper Weser.

2. The state is authorized to acquire an interest in the Ostpreussenwerk A. G., an electric power station, by the purchase of shares to the extent of 200,000,000 marks, on the understanding that the capital stock shall be increased to 600,000,000 marks; in addition, to grant the enterprise a nonrecallable loan of 750,000,000 marks, to hold at its disposal another 4,250,000,000 marks, and to guarantee, in conjunction with the Reich and the Province of East Prussia, a further issue of 30,000,000,000 marks in bonds.

3. The state is authorized to acquire, to the extent of 250,000,000 marks, an interest in the A. G. Ueberlandwerk Oberschlesien, an electric power station the establishment of which is under consideration, and to undertake to guarantee to the extent of 1,000,000,000 marks any loans issued by the undertaking.

Brief News Notes

South Dakota Plant Sold.—The Union Light & Power Company of Omaha, Neb., has formally taken over the ownership and control of the Boyle Electric Company plant in Clark, S. D. The Omaha company is said to have been striving for some time to secure entrance into Clark. The plant was first offered for sale to the city but the citizens of Clark at a special election decided against purchasing it.

Another Aluminum Cable Line.—A 30-mile, 34,600-volt, seven-strand aluminum cable transmission line is being built by the British Columbia Electric Railway Company to supply power to the Britannia Mining & Smelting Company. The line extends from West Vancouver to Britannia Beach. The highest altitude reached by the line will be 1,400 ft., although the ends will be at sea level.

Injunction Against Development of Klamath Water Power Denied.—Injunction proceedings seeking to prevent the Federal Power Commission from leasing and developing the water power of the Klamath National Forest Reserve in California and Oregon have been dismissed in the District of Columbia Supreme Court. The petition for an injunction was filed on behalf of the Karok or Peh-Tsick Indians, inhabitants of the reserve.

Indiana Commission Starts State-Wide Investigations. — Searching investigation into the affairs of seventy public utilities of Indiana has been ordered by the Public Service Commission, making a total of eighty-five plants now under its scrutiny. Of the seventy additional companies, thirty-eight are privately owned corporations and thirty-two are municipal utility plants. The list includes fifty-three electric companies and two plants providing both water and electric service.

The Isar Works in Bavaria.—One of the largest engineering plants in the world is, a European correspondent of the ELECTRICAL WORLD writes, nearing its completion in Bavaria. The River Isar has received an entirely new bed for a length of 55 km., from Munich to Moosburg. Four generating stations have been built along the new riverbed, which have an annual output of more than 480,000,000 kw.-hr., thus saving no less than 500,000 tons of coal per annum. The Finsing power station will supply 63,000,000 kw.-hr. of electrical energy per annum, and eight turbines and two generators have been installed at that station. At the Aufkirchen power station four turbines will furnish more than 150,000,000 kw.-hr. a year, and at the Etting station four turbines will supply 144,000,000 kw.-hr. At the fourth power station, at Pfrombach, four turbines will furnish 119,000,000 kw.-hr.

Hagerstown's Modern Switching Station.—The Potomac Public Service Company of Hagerstown, Md., which serves Hagerstown, Frederick and other places in Maryland, besides controlling and operating utilities in Winchester, Va., Martinsburg, W. Va., and Chambersburg, Pa., is constructing a "superpower" plant at Williamsport, Md., on the Potomac River, which, when completed, will bring the rating of the company's plants, previously numbered at four steam and four hydro-electric, to approximately 60,000 hp. To give Hagerstown the full benefit of the increased energy soon to be available the company is constructing there a thoroughly modern centralization and switching station, which, the company asserts, will make Hagerstown one of the best served cities in the country.

Buffalo Convention Hall Power Equipment.—Karr Parker, engineering manager of McCarthy Brothers & Ford, Buffalo, announces that his firm is completing the installation of electrical power equipment and facilities in the Broadway Auditorium that will make it the best equipped convention hall in the country from this standpoint. The contract involves a complete system of heavy power wiring with numerous special floor boxes for all kinds of current, with complete switchboard equipment for the Buffalo General Electric Company's high-tension service. The equipment will include a 200-kw. synchronous motor-generator set to supply, besides direct current, 60-cycle, three-phase and single-phase, and 25-cycle, three-phase, 220-volt service. One of the first conventions to use this equipment will be that of the Association of Iron and Steel Electrical Engineers on Sept. 24 to 28. An electrical blast furnace and rolling mill will actually produce steel during this convention.

Los Angeles Improving Its Lighting System.—Extensions to its lighting system now under construction and others for which contracts will be let in a short time will make Los Angeles the best lighted city in the West, according to the city officials who have the matter in hand. The largest contract for ornamental lighting, in Western Avenue between First Street and Los Feliz Boulevard, is nearing completion. This system will connect with the system already installed in Western Avenue between First Street and Wilshire Boulevard. A similar system is being installed in Vermont Avenue from Los Feliz Boulevard to Hollywood Boulevard. An ornamental lighting system in Hollywood Boulevard between Vermont Avenue and Vine Street is to follow and will connect with the lighting system in Hollywood Boulevard between Vermont Avenue and Sanborn Junction. The ornamental system in Washington Street from Main Street to Vermont Avenue is nearing completion, and it is planned to continue this system westwardly to Eighth Avenue.

New Plant Projected for Rome, N. Y.—The Manufacturers' Power Corporation of Rome, N. Y., incorporated for generating electricity and serving the Rome Wire Company, the Rome Brass & Copper Company and the Rome Manufacturing Company, has submitted evidence to Public Service Commissioner Van Voorhis in support of its petition for permission to construct a steam-generating electric plant in Rome and to exercise a city franchise.

Largest Dry Dock to Be Operated by Electricity.—The largest floating dry dock in the world, capable of handling the Leviathan or even greater ships, is under construction at Southampton, England. The dry dock, which will be 960 ft. long and 134 ft. wide, with a lifting capacity of 60,000 tons, will be operated entirely by electricity from a central station ashore. Fourteen electric pumps will eject 80,000 tons of water, the maximum needed to empty the basin, in four hours. Electrical air compressors will drive the pneumatic machinery, electrical capstans will haul in the giant cables to make the ships fast, and electrical traveling cranes will fetch and carry for their repair.

Penn Public Service Asks Permission to Purchase Northwestern Company.—The Penn Public Service Company has asked the Public Service Commission of Pennsylvania to approve its purchase of the Northwestern Electric Service Company of Erie as a link in its plan for extending its power system over a large portion of the state. The Northwestern company serves communities for a distance of more than 50 miles, operating a trolley line from Meadville to Erie, which will be included in the purchase. It will be operated in connection with the Clarion River power plants now in the course of construction and its purchase will be a logical sequence of the acquisition by the Penn Public Service Company of the Erie Lighting Company, the Warren Light & Power Company and the Du Bois Electric & Traction Company.

Huntington Gets More Power.—In order to meet the growing demand for electric power and service of the manufacturing industries in and about Huntington, W. Va., the Consolidated Power & Light Company is building a new 20,000-hp. unit at the Kenova generating station. Recently $1,500,000 in 7 per cent cumulative preferred stock was sold to finance this new plant. The system now owns and operates a modern power plant at Kenova, W. Va., which, upon completion of this new 20,000-hp. unit, will have a generating capacity of 40,000 hp., and with the power plants at Roanoke and Lynchburg, Va., the company will have a total generating capacity of 60,000 hp., of which 6,800 hp. is hydro-electric. The company recently closed a contract at Huntington with the Virginian Power Company for the purchase of additional power on favorable terms, and at Roanoke a satisfactory power purchase contract exists with the Appalachian Power Company.

High Prices Postpone Construction.—Construction of the new $3,000,000 power plant of the Sioux City Gas & Electric Company, which was planned to be started this year and completed for operation during 1924, has been indefinitely postponed, owing to the high prices on material and equipment, and because of the engineers being unable to decide on a suitable site, according to William J. Bertke, general manager of the company. In the meantime several thousands of dollars is being spent in repairs on the old plant pending the construction of the new one, Mr. Bertke explains. Company engineers also are continuing their prospecting for the best possible location for the new plant.

Korean Emperor's 60-Cycle Rotary Converter.—The photograph, taken a short time ago, shows one of the first 60-cycle rotary converters made. It was installed in Seoul, Korea, more

than twenty years ago when the Emperor of that country ordered the city equipped with electric street cars. The converter has a capacity of 120 kw., 550 volts, and both the motor and the exciter are belted. It is in daily operation and is reported to be giving first-class service in every way.

Power Possibilities of Winnipeg River.—Engineering investigations conducted by the Canadian Interior Department have proved the Winnipeg River to rank high among the power rivers on the North American Continent. Its maximum recorded flood is but six times its minimum flow, and in any one year the ratio between highest and lowest flow is very much less. The river traverses but 100 miles between the Manitoba boundary and Lake Winnipeg, and in this short distance there are nine feasible power sites varying in capacity and attractiveness, but all, it is predicted, certain to be developed within twenty-five years. Three of these sites, with a total ultimate capacity of 200,000 continuous horsepower, justifying a commercial installation of 300,000 hp., have already been developed, one by the city of Winnipeg and two by the Winnipeg Electric Railway Company. Plans are now being prepared for a fourth and fifth development.

Associations and Societies

Pennsylvania Electric Association.—This association will hold its annual convention at Bedford Springs, Pa., on Sept. 5-8. The association is the Eastern Geographic Division of the N.E.L.A.

Empire State Gas and Electric Association.—The annual meeting of this association is announced for Oct. 8 and 9 at the Lake Placid Club, Lake Placid, N. Y. The program will deal with matters of particular interest to the executive officers of member companies.

San Francisco Electrical Development League—James R. Strong, president of the Association of Electragists International, was the speaker of the day at the July 23 meeting of the San Francisco Electrical Development League. In his talk Mr. Strong dealt with the advantages of associations and said that vital business facts were being less jealously guarded at the present time, drawing the conclusion that associations were partly responsible for this.

S. E. D. Calls Conference of Local Leagues.—Camp Co-operation III will be held under the auspices of the Society for Electrical Development at Association Island from Sept. 16 to 19. This is the second conference of electrical leagues and groups interested in forming local co-operative organizations. It is hoped to have a good attendance from all sections in order to bring out all viewpoints in the discussion of important questions.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

National Electrical Credit Association—Boston, Aug. 9-10. F. P. Vose, 1347 Marquette Bldg., Chicago.

New England Division, N. E. L. A.—Swampscott, Mass., Sept. 5-8. Miss O. A. Bursiel, 149 Tremont St., Boston.

Conference of Electrical Leagues.—Association Island, Sept. 16-19. Society for Electrical Development, 522 Fifth Ave., New York.

Rocky Mountain Division. N. E. L. A.—Glenwood Springs, Col., Sept. 17-19. O. A. Weller, 900 15th St., Denver.

Association of Edison Illuminating Companies—Dixville Notch, N. H., Sept. 17-21. P. S. Millar, 84th St. and East End Ave., New York.

Michigan Electric Light Association—Grand Rapids, Sept. 18-20. Herbert Silvester, Detroit Edison Co., Ann Arbor.

Illuminating Engineering Society—Lake George, N. Y., Sept. 24-28. S. G. Hibben, 29 West 39th St., New York.

Association of Iron and Steel Electrical Engineers — Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

Indiana Electric Light Association—French Lick Springs, Sept. 26-29. T. Donahue, Northern Indiana Gas & Electric Co., Lafayette, Ind.

American Electrochemical Society—Dayton, Ohio, Sept. 27-29. Colin G. Fink, Columbia University, New York.

American Institute of Electrical Engineers—Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

Association of Electragists International—Washington, Oct. 8-13. Farquson Johnson, 15 West 37th St., New York.

Commission Rulings

Advantages of Adjusted Rates.—In condemning the practice of applying straight rates to gas consumption regardless of the amount consumed the Kansas Public Utilities Commission said recently: "The electrical business is one of the most progressive and most rapidly developing businesses in the whole country. One reason for its success has been the carefully adjusted system used, with the approval of the regulatory commissions, by most of the larger electric light and power companies. They have had schedules of charges fitted to the needs of the different classes of customers and as a result have undertaken intelligently to supply the various classes of their demand. No electric plant of any size, whether privately or municipally owned, has been operated upon the basis of a straight consumption charge of all customers regardless of the amount of their demand. The commission is of the opinion that ultimately the straight rate based wholly upon consumption must be abandoned."

An Explanation of Depreciation.—In sustaining the present rates of the Appalachian Power Company against complaints filed by coal companies, the West Virginia Public Service Commission made these observations on depreciation: "In ascertaining the value of a utility for rate-making purposes by the 'investment-cost' method depreciation does not apply in the same manner as it does in ascertaining the value by the 'reproduction-new-cost' method. If investors skillfully and judiciously locate and construct a plant, operate it economically and maintain it efficiently, they are entitled to have their investment kept intact and undiminished by wear, deterioration or obsolescence unless the amount that the investment may have been diminished has been returned to the investors. . . . If all the units of the plant were of comparatively small cost, the investment could be kept intact and protected by a reasonable annual maintenance expense. Defendant's plant consists of many large and expensive units. When these large units have to be replaced, by reason of wear and deterioration or by reason of obsolescence, the expense of such replacements will be too great to be met by a reasonable annual operating expense. The active life and use of these large units are being consumed by the present patrons of the utility. It is the duty of these patrons to contribute to the defendant company a sufficient amount of revenue to pay operating expense and taxes, to maintain efficiently said plant, to provide a reasonable return upon the present fair value of the plant and to create a fund out of which said large units may be replaced so that the value or corpus of the plant of the investors will not be reduced. If a plant is highly maintained, the amount set aside each year for the reserve fund need not be so large as the amount would be if the plant were not so efficiently maintained. This reserve fund is sometimes designated as a depreciation reserve fund or a retirement fund and often designated as 'depreciation.' This fund is usually created by applying a certain per cent to the rate base of the utility. . . . This fund should be kept under a separate account and the annual contribution to the fund should be invested by the utility so that it would earn a reasonable income each year and the income should be charged to the account so that the account would be accumulative and would be sufficient at all times to meet the necessary replacement charges. This fund should not increase or diminish the rate base of the utility unless the fund or part of it be returned to the investors, and in such case the rate base should be reduced to the extent of the funds returned to the investors."

Recent Court Decisions

Inadequate Voluntary Rates on Different Basis from Inadequate Rates Imposed by Commission.—A situation where the state reduces the former rates of a utility and imposes a new rate upon it pending the completion of its rate-making process is entirely different from that presented in a case where the existing rates claimed by the company to be confiscatory have not been imposed upon it by any act of the commission but have been voluntarily established by the company itself with the approval of the commission, according to a decision of the United States District Court in Cumberland (Tenn.) Telephone & Telegraph Company vs. Railroad and Public Utilities Commission. The court said: "I am of the opinion that where the utility seeks an increase in existing rates that it has itself voluntarily established the state may properly provide for the suspension of such increased rates and the incidental maintenance of the existing rates pending a reasonable time allowed for investigation by the commission as to the reasonableness of the proposed increase, such preservation of the status quo established by the utility itself being merely an incident to the proper exercise by the state, through its commission, of the rate-making process; and that where such delay is not unreasonable, the utility is not entitled, on the ground that the existing rates which it has thus established are confiscatory, to be granted an injunction the effect of which would permit it to increase the rates thus voluntarily established pending the due and proper exercise of the rate-making process." (287 Fed. 406.)*

Tennessee Commission Is Not a Court.—Examining a claim made by the Cumberland Power Company, in appealing against a decision of the Tennessee Railroad and Public Utilities Commission disapproving a contract between the utility company and the city of Lebanon, to the effect that the commission is a judicial body and that hence its decisions can be appealed to the Supreme Court of the state, which has appellate jurisdiction only, that court denied the contention, asserting that a tribunal exercising, as does the commission, commingled legislative, executive and judicial functions cannot be made a court. Hence its actions are not subject to review by the Supreme Court, and the provision of the law providing for appeal to that court is unconstitutional. (249 S. W. 818.)

Nature and Extent of Flowage Rights.—In Glidden vs. Beaverton Power Company the plaintiff sought damages for the flooding of his land caused by the defendant company's dam. The power company claimed flowage rights acquired from the predecessors of both parties in the chain of title. Sustaining a verdict for the defendant, the Supreme Court of Michigan held that the right of flowage or to dam water back above its natural level is in its nature an easement which an owner of full title can reserve when disposing of the fee, or he may retain the fee and deed the right of flowage to others as a perpetual easement. An omission by the riparian owner to make use of such right does not impair his title or confer any right thereto upon another, although the adverse enjoyment of it by another for the prescriptive period may. (193 N. W. 862.)

Admissible Evidence Concerning Ownership of Wire.—Several demurrers taken in Bloom vs. Union Electric Light & Power Company by the defendant, which was held responsible for injury to plaintiff by a falling wire in a public thoroughfare, were overruled by the St. Louis Court of Appeals. The court held that the testimony of a witness who had charge of city-owned wires that none of these was broken and that an open circuit was always made manifest in the office was, although partly based on hearsay, properly admitted as tending to show the company's ownership of the wire, and that this question of ownership was properly submitted to the jury, no evidence having been offered to show that the company did not own the wire. This, the court held, could, if true, have easily been proved by the company's records and the testimony of those of its employees who were on the ground soon after the accident. Direct proof of the company's negligence was unecessary in a case where the doctrine of *res ipsa loquitur* (the thing speaks for itself) was applicable. (251 S. W. 411.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Charles O'B. Murphy Resigns

Charles O'Brien Murphy resigned from the offices of vice-president and general manager of the Merchants' Heat & Light Company, Indianapolis, and from the same offices in all the Brewer utility companies in Indiana on Aug. 1. In announcing his resignation Mr. Murphy said his reasons were purely personal and that his relations with the Brewer companies and their managements had been very pleasant. He plans to spend a short time in resting from the arduous work of the last few years in organizing and merging utility companies in Indiana for the Brewer interests.

These interests have been for several months engaged in merging smaller electric utilities into a few large corporations. Originally the plan was to have one large company, the Indiana Electric Corporation. When the city of Indianapolis and other city governments affected by the proposed merger opposed the plan and appealed to the courts, after the Public Service Commission had approved the plan, the merger scheme was changed somewhat, and several of the companies have been merged into two or three new organizations. The Indiana Electric Corporation plan eventually was sustained by the courts, and the corporation is proceeding with the erection of the power plant on the Wabash River in Vigo County.

Besides being the vice-president and general manager of the Merchants' Heat & Light Company and hence the local operating head of the company, Mr. Murphy has held the same office in the Central Indiana Power Company, the holding company of the Brewer Indiana utilities, and in addition has been the vice-president and general manager of the Indiana Electric Corporation, the Wabash Valley Electric Company, the Northern Indiana Power Company, the Putnam Electric Company and the Cayuga Electric Company. A detailed account of his early career appeared in the April 7 issue of the ELECTRICAL WORLD. His successor has not been selected.

Prof. Royal D. Sloan, who has served as assistant professor of electrical engineering at Yale University during the past year, has been appointed associate professor of electrical engineering at the State College of Washington at Pullman. Professor Sloan is a graduate of the University of Montana and was employed two years with the General Electric Company and later with the Montana Power Company on the Thompson Falls development. During the war he entered the service of the navy and was in charge of the electrical equipment of the battleship New Mexico with the rank of junior lieutenant. Before going to Yale Professor Sloan had been associate professor of electrical engineering at the Montana State College for a number of years.

Owen D. Young, chairman of the board of directors of the Radio Corporation of America and of the General Electric Company, who sailed for Europe on the Paris about a month ago to attend the meeting of the Consortium of International Radio Corporations, returned to this country on Wednesday, Aug. 1, on the White Star liner Majestic.

N. H. Coit has resigned his position as superintendent of the Auburn plant of the Western Public Service Company, Auburn, Neb., to assume the duties of assistant to H. G. Harvey, commercial manager of the Pennsylvania Edison Company, Easton, Pa. The Edison company is one of the important links in the Pennsylvania-New Jersey power system controlled and operated by the W. S. Barstow Management Association, Inc.

W. A. Kitchen of the electrical engineering department of the Oklahoma Gas & Electric Company has recently been placed in charge of all electrical engineering matters pertaining to transmission and distribution. Three years ago Mr. Kitchen became associated with the company at Oklahoma City and subsequently was transferred to Sapulpa as chief dispatcher. Later he returned to Oklahoma City in the electrical engineering department.

Lincoln E. McRae, field manager of the securities department of the Central Maine Power Company, Augusta, Me., has been appointed sales manager of that department, succeeding A. S. Brown, who has resigned to become associated with Percy H. Whiting. Mr. Whiting recently severed his connection with the Central Maine Power Company to head the customer-ownership division of the securities department of Henry L. Doherty & Company, New York. James H. Record has been appointed field manager to succeed Mr. McRae.

J. H. Crossley of the Metropolitan-Vickers Electrical Company, Manchester, England, was lately in the United States studying industrial electric heating developments for the purpose of promoting that application of electricity in England, where it is employed less extensively than in this country. After electrifying a number of producer-gas ovens in the main plant of the Metropolitan-Vickers Company, to be used for demonstration and test purposes as well as for the regular manufacturing processes of the company, he will deliver lectures on the advantages of electrical heating in the various industrial centers of England. Mr. Crossley was sent to this country in 1921 by the Metropolitan-Vickers company to make a number of special investigations. In January, 1923, he was instructed to begin an intensive study of electric heating, and he spent four months investigating the methods of manufacture of industrial heating apparatus in the shops of the Westinghouse company and the methods of operation of this apparatus in factories in various parts of the country. Mr. Crossley sailed for England on July 13.

Obituary

Herbert S. Pope, president of the Barnes-Pope Electric Company, a Boston contractor-dealer house, died at Boston July 23 from a self-inflicted bullet wound. It is believed that despondency caused by ill health was the cause.

Harry T. Woodfill, general superintendent of the Greensburg (Ind.) Gas & Electric Company for the last twenty years, died recently at his home in that city. Mr. Woodfill, who was sixty years of age, had been in poor health for several years. He was born in Greensburg in 1863 and was educated in the city schools. For more than forty years he had been prominently identified with the business interests of his native city and at the time of his death was a director of the Greensburg National Bank.

John A. McCampbell, for the last eighteen years a member of the Stone & Webster organization, died recently. Mr. McCampbell, who was born in Knoxville, Tenn., in 1873, entered the employ of Pepper & Register, engineers and electric railway contractors at Philadelphia, in 1892, and remained with them until 1898. Then he became associated with the South Shore & Boston Street Railway and subsequently with the Massachusetts Electric Company as chief engineer of power stations at East Braintree and Quincy Point. In 1901 and 1902 he was chief engineer of power stations for the Houghton County Street Railway at Hancock, Mich., and was connected with several other utilities until he became identified with Stone & Webster on Dec. 1, 1906. He instituted betterment operation in power plants at Houston, Dallas, El Paso, Fort Worth, Key West, Jacksonville, Seattle and Bellingham and also supervised the installation of mechanical equipment in a large steam plant on the Niagara River which Stone & Webster were building for the Buffalo General Electric Company. After leaving Buffalo he became general superintendent on the construction of a 100,000-kw. plant for the Philadelphia Electric Company.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

The Jobber and the Contractor—A Problem—II

The Contractor's Value as a Customer—How Price Sirens Demoralize Him—His Strength in Specialized Functions—Breaking Faith With Trade

By W. R. Herstein
Vice-President Wesco Supply Company, Memphis, Tenn.

As I stated in the preceding paper, the result of my twenty years experience in selling the contractor leads me to believe that he is not only the jobber's legitimate customer, but that he is the jobber's golden opportunity. The great bulk of his purchases are made in quantities that afford the jobber a real profit. He does not become syndicated, consequently his defection in a quantity large enough to be harmful is not possible. His credit is frequently poor, but his number is so large that responsibility is spread over many units and individual losses are comparatively small. As a rule, he does his own buying, and efficient salesmanship brings better results, where service and quality count, than with professional purchasing agents. Finally, he is responsive to proper treatment, and a community of interest, once established, renders future relations easy to maintain and productive of exceptionally profitable business.

Present Weaknesses

As against these virtues which I am extolling, it must not be concealed that the contractor has characteristics which are not so admirable. The contractor's environment tends to make him suspicious, sullen and resentful. In any group of men, large or small, we will nearly always find at least one member who is willing to turn to his own profit a situation requiring the good faith of the entire number to make it work to the mutual advantage of the complete group. Hence we find that in a situation involving the co-operation of jobber and dealer, a single member of the latter class will sometimes take his own share of the benefits, but will not contribute his pro rata of effort or good faith in return.

Perhaps the most serious criticism of the contractor, however, may be leveled at his shortsighted cupidity, which frequently impels him to sacrifice his jobber friends and jeopardize a highly advantageous situation by yielding to small price concessions from suppliers who are uninterested in him except for the immediate moment, and entirely indifferent to his welfare, the solution of his problems and his continued success in business.

Another criticism of the contractor is his too frequent neglect of his credit standing in the industry. His habit of saddling his financial burden upon the jobber is notorious, though in justice it must be said that the jobber not infrequently invites and encourages this shortcoming. When the contractor finally learns that collecting is as important a feature of his business as buying and selling, relations between himself and his jobber become vastly more cordial.

I once heard a prominent physician remark that the tendency of his profession was toward self-destruction, because the efforts of its members to prevent disease would presently leave no patients to cure. The electrical jobber, in his relations with the contractor, stands in like case, to a considerable extent, in that so far as his effort to improve the contractor's condition is successful, just so far does he render the contractor independent of jobber connections. It is in many individual instances of this character that what I have just termed his "shortsighted cupidity" comes into full play.

The business of the successful contractor is eagerly sought, not only by legitimate jobbers, half-baked jobbers and manufacturers' agents, but by manufacturers themselves, and the contractor who has money in bank and adequate storage facilities sometimes forgets the jobbers who permitted and helped him to acquire these. Not all contractors are of this type, but it takes strong business morality to resist the temptation of a lower price, even for an inferior brand, and particularly to withstand the desire to obtain prestige by being able to announce that he "buys direct from the factory." Indeed, these instances have the effect of a boomerang upon the jobber when his customer decides to add small-scale jobbing to his contracting business. It is generally conceded in the industry, and loudly demanded by the contractor, that a jobber shall not be also a contractor, but we do not hear so much about the converse of the maximum, namely, that a contractor shall not also attempt to do a jobbing business, and it seems that the example of a contractor continuing to contract, and at the same time to expand into jobbing, is quite a fashionable paradox in his own circles.

Specialized Functions

There is but one answer to this, and I think that we jobbers as a class should insist upon it firmly, loudly and continuously. The answer is so old that it has become almost hackneyed by use, but the very fact of its age renders it the more respectable, and the fact of its long usage shows that it stands that test. What I have in mind is this: that the production, distribution and practical application of electrical materials, particularly wiring devices, have developed into specialized functions. The industry is so vast that there is ample opportunity for the participants in any one function to expand profitably their entire energies in their chosen specialty; that an attempt to encroach upon the function of another will not only lead to chaos in the industry,

but to financial disaster to the offender, by reason of his abandonment of the function in which he is a specialist, and his entrance upon a career in which he is but an amateur.

In plain English, we, as jobbers, should take our cue from the contractor himself, and, just as he has proclaimed that a jobber must not be a contractor, we should respond that neither must a contractor be a jobber. True, we have no very adequate means of enforcing this dictum, but public opinion and industry opinion is a powerful weapon, and opinion may sometimes be created or influenced by a very small body of men if they are actuated by a logical proposition and a singleness of purpose.

THE MATTER OF KEEPING FAITH

When the contractor places price above quality and service, he strikes at the foundations of the edifice upon which our industry is built. The very first stone in the foundation of this structure is good faith—faith not only in the manufacturer, the jobber, the dealer and the customer, but faith in competitors as well. If the contractor desires relief from vicious competition, so also does the jobber. If the contractor desires our help in solving his problems, we need his as well, and the way to help us does not lie along the lines of compelling us to sell goods below cost. It does not lie along the lines of destroying faith in our own competitors by making misleading statements and false claims to our salesmen. It does not lie in compelling us to abandon the function of service, which alone justifies our existence, and forcing us to seek business through the mediums of cheap prices and worthless material.

The very fact that an electrical contractor, through success, becomes a leader in his community and a power in the industry should, if he is a real man, impel him to use his opportunity in a constructive way, and he is not doing this when he plays our salesmen one against the other; when he plays manufacturer against jobber, and when, for his own selfish purposes, he contributes to the breaking up of the code of ethics which started him on the road to prosperity.

GOLDEN RULE APPLIED

Surely it should not be necessary to point out to such a man the fact that in endeavoring to induce a jobber to disregard a well-recognized market price he loses far more than he gains. He should realize that a jobber who is untrue to his manufacturer will also be untrue to his customer. A jobber who breaks faith with his competitors will hardly keep faith with his trade. A jobber who is confessedly crooked in one phase of a transaction is unsafe to trust in any other phase. If the contractor in question succeeds in securing what he is led to believe is a "cut price," what assurance has he that his competitor is not securing even lower prices from that very jobber?

It is said that to grazing animals the grass on the other side of the fence always looks greenest, but let's remember that we are men, not cattle, and that we know the fallacy of the belief. Being men, we know where our opportunity lies; we know the line of endeavor for which we are specially fitted by temperament or training; we know that whatever success may crown our own efforts will be multiplied in collaboration with others, and in seeking this collaboration we would do well to bear in mind always the admonition: "Whatsoever ye would that men should do to you, do ye so to them."

A Way to Qualify New Products*

Trial Installation Under Special Supervision Is Going to Meet the Complaint That the National Electrical Code Blocks New Products

BY DANA PIERCE
Chairman Electrical Committee, N. F. P. A.

THE National Electrical Code in its twenty-five to thirty years' history has been a progressive evolution, a development with many changes. As the industry grew, with new methods, new materials and new experience, these developments have found their places in the rules and regulations of the code. If one compares the early code with the present one simply as to number of pages, the size of the book itself indicates the increase in the subjects, methods and materials dealt with.

I think I am correct in stating that no other set of engineering standards in the world can equal the National Electrical Code in its long, widespread and general use and application. It is well to bear this in mind. The code has in fact been a registry of the developing industry, of American practice viewed from the standpoint of safety.

Code rules have not anticipated development or inventions. They have not dealt with possible but rather with actual conditions, recording how existing, known methods and materials should be employed. The National Electrical Code is not wholly based on abstract principles or theory, but quite as much upon practical experience. It therefore probably contains some inconsistencies, at least from the theorist's viewpoint. It can be correctly appreciated only by remembering its history, its purposes and the sources of its growth, but, think of it as one will its service has been very great.

WHO IT REPRESENTS

This is what the National Electrical Code is. Its faults are recognized by its friends as well as by its opponents, and a constant, determined effort is made to improve it by obtaining the best opinions from every available source.

The electrical committee of the National Protection Association, whose function it is to develop the code, is composed of experienced men, many of whom have long been associated with this work. It includes representatives not only of insurance interests but also of all the large electrical organizations. These latter are the American Institute of Electrical Engineers, American Electric Railway Association, National Electric Light Association, Associated Manufacturers of Electrical Supplies, Electric Power Club, Association of Electragists (the contractors' organization), Electrical Supply Jobbers' Association, Associated Edison Illuminating Companies and the Bureau of Standards of the federal government. The representatives of all these have for years taken an active part in the successive revisions of the code and are doing so still.

NEW PRODUCTS BLOCKED

I have said that the code rests on practice as well as upon theory. It has been said that under the code no

*Being a statement presented recently at a public hearing in New York before the sub-committee on new developments, N. F. P. A.

new development could be recognized or approved till it had been tried and no such new development could be tried until it had been approved. The electrical press has had complaints that the code thus operates to hold back development of new inventions and practice.

The committee on new developments, which has recently been established as a sub-committee of the electrical committee, is an attempt—or call it, if you choose, an experiment—on the part of the electrical committee to break this circle of "no use till it is approved and no approval till it is used." We are trying with the same conscientiousness that has made the code to deal fairly with this situation, to be fair to the newcomer who is eager to introduce a new product or method and fair to the older men and methods. We wish to meet reasonable development in the industry with reasonable code rules, to serve the electrical industry in an orderly manner.

A Method of Trial

The purpose of the public hearing recently held to discuss two new electrical materials recommended for trial installation under special supervision, and, indeed, the purpose of the committee on new developments itself is not to revise the National Electrical Code. Rather we are trying to give the man with a new idea a reasonable and safe chance to prove his case in actual practice. The committee on new developments affords a means for this, instead of sending him to beg from one inspection department, municipal or underwriters', to another for a local exception which will allow him and them to gain the needed experience by actual trial.

Which is the better method for the electrical industry, for the inspection departments and for the general public— an orderly consideration of a new product by this committee, leading to a recommendation for trial installations, or an uncontrolled haphazard campaign by the manufacturers for special dispensations by local authorities? We present in the spirit of this meeting the record and experience of our electrical committee in doing the safe, reasonable, decent thing by the electrical industry and the public, and on the occasion of this first hearing of this sort it was considered proper to state clearly the intent of the committee on new developments, the reasons for its creation and the sincerity of its purpose.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

DESPITE a seasonal recession in demand, business is again active in Eastern manufacturing and jobbing circles. Prices are unstable in the wiring-device field, and sockets and switches showed marked weakness Monday on quotations out of factory sources. In apparatus bids firm prices are reported, owing to the upward pressure of labor costs and a none too plentiful supply of steel.

Deliveries are lengthening on armored cable for parkway lighting service to ten or fifteen weeks on current quotations, with some prospect of further diminution of supply this fall. Rubber-covered wire in New York City was reduced 3 per cent Tuesday, July 31. Distributors are advising early placement of orders for this class of material against fall demands.

Motor sales are running well ahead of last year, although some reduction in current requirements has made itself felt recently. Rigid conduit is short in Boston in the 3-in. and 1½-in. sizes. General business in the East is fairly good, with a dull money market, reasonably good credit situation and some curtailment in the textile industry. The telephone strike on the New England system, which did not include Connecticut, failed completely last week and was declared off. Operators with good records are being taken back as openings in the service permit, but with loss of seniority privileges broadly speaking.

Excellent Outlook for Motors; Trend to Individual Drives

SALES of electric motors are running far ahead of last year's record, according to leading American producers, although at present there is a reduced demand for this class of apparatus as compared with a few weeks ago. Plant facilities are measuring well up to requirements and some surplus capacity may be said to exist, taking the motor manufacturing industry as a whole. During the spring the demand in some quarters approximated 75 per cent above last year's figures. The motor price situation is firm at present, following a 5 per cent advance early last month. Leading makers emphasize the probable influence of the anticipated eight-hour day in the steel industry as a factor tending to hold motor prices firm or to stiffen them later, and labor costs continue high in motor factory work.

The market is most encouraging for individual-drive motors, and in electric railway shops and other establishments long inured to group driving there is a decided trend toward unit powering of tools which makes for increased sales of motor and control apparatus. In new laboratories as well as in mills electric drives are taken for granted by designers. Sales of motors for industrial tractor and truck service are improving.

Delinquent Electrical Accounts Were Fewer in June

ACCORDING to the June reports of the National Electrical Credit Association, the number of delinquent accounts for the five sections reporting recorded a slight drop over the report of May, 1923. For the Central Division there were twenty-eight fewer accounts in June than in May, although the average amount increased $3.80.

The New York territory reports a reduction of nine accounts with a lower value of $118 in June as compared with $156 in May, 1923. The Philadelphia territory in June had an average value of $108.28 as compared with $117.33 for May, 1923, although the number of accounts for this period jumped from 225 to 227. The Pacific Coast, which has been running very low in number of delinquent accounts, jumped from twenty in May, 1923, to fifty-two, increasing an average value of $145.70 to $266.80 during the same period. The complete report is as follows:

DELINQUENT ACCOUNTS IN JUNE

Branch and Month	Number of Delinquent Accounts Reported	Total Amount	Average Amount
Central Division:			
May, 1922....	746	$84,048.53	$112 66
May, 1923....	749	95,984.35	128 15
June, 1922....	727	87,643.24	120 55
June, 1923....	721	95,133.51	131.95
New York:			
May, 1922....	440	58,401.00	133.00
May, 1923....	437	68,228.[illegible]	156.00
June, 1922....	479	69,303.00	145 00
June, 1923....	428	50,758.00	118.00
Philadelphia:			
May, 1922....	236	22,175.[illegible]	93.97
May, 1923....	225	26,399.32	117.33
June, 1922....	207	22,401.[illegible]	108.22
June, 1923....	227	24,580.53	108.28
New England:			
May, 1922 ...	108	7,908.93	63.97
May, 1923....	29	3,464.08	119.45
June, 1922....	81	10,152.24	126.57
June, 1923....	29	2,325.95	80.20
Pacific Coast			
May, 1922....	24	2,133.[illegible]	88.99
May, 1923....	20	2,910.69	145.70
June, 1922....	18	2,353.13	130 75
June, 1923....	52	13,873.41	266 80

Porcelain Insulator Deliveries Running at Two to Five Months

AS A RESULT of the widespread electrical power developments, the porcelain insulator manufacturers are now operating under such heavy demand schedules that their deliveries are delayed from two to five months, depending upon the type of equipment.

The only reason to account for this situation seems to be the overwhelming increase in demand for insulators which had been occasioned by power expansions of the past year.

This is true because no shortage of raw materials seems to exist and the labor market is quiet, outside of the usual tendency for the men working in the kilns to seek outside employment during the summer. But on the whole this labor factor is not very serious since it is a customary occurrence every year. So the only evident solution seems to lie in trying to increase the production of a line of goods which by its own inherent characteristics cannot be materially hastened without serious results. This is so because the time for testing and ageing of insulators does not allow hurried work. Accordingly the larger insulator organizations are now planning for the construction of new kilns. But since most of these kilns will not be ready until the first of the year no relief seems to be offered during the fall months.

Most of the present deliveries are going to new installations rather than for replacements. Although various companies report different figures, the relative percentage of insulators sold for new installations as compared with those for old ones ranges between 50 and 70. As to the location of the most active business, manufacturers say that while buying has been following the power developments throughout the United States, the activity along both the Atlantic and the Pacific coast has been the most pronounced.

The present price situation is one which has remained stable since early spring. Indications are that it will remain so, since manufacturers will try to maintain prices by increasing production to the point where it will meet the price advances of raw materials and labor, rather than change insulator prices.

Cautious Buying Continues in Pacific Coast Territory

UNCERTAINTY of the future is shown in cautious buying in the Pacific Coast Territory. Prices have dropped after a month or so of uneasy equilibrium which followed the sharp advances of the earlier part of the year. Schedule socket material for both construction and retail trade has decreased about 15 per cent. Household material sales have improved and radio business has increased considerably because of interesting public events which have required better broadcasting. The standardization of radio equipment is pointed by the slower movement of parts and insulating material from which amateurs made up their sets. A feature of present contracting and dealer business is the activity of the large interior cities such as Sacramento, Stockton and Fresno. A total of 52 delinquent accounts were reported in June compared with 18 in June, 1922.

Chicago Business Slowing Up; Expect Lower Material Prices

THE spirit of caution which has been prevalent during the first part of the month has recently been intensified by the drop of commodity prices and the moderate recession in building activity. The jobbers, while not drawing a pessimistic conclusion from the present economic conditions, are foregoing possible profits in the interest of maintaining a stronger cash position. They are retrenching to a certain extent, curtailing purchases, expecting lower prices on raw materials. While this attitude is a trifle overdrawn, the weak condition of the stock market has caused a pessimistic viewpoint to be formed by some of those who assume that movements of stock in themselves portend movements of business. The present strengthening of the stock market, while not great, together with the relatively easy condition of the money market, should shortly remove this idea.

No important price announcements were made this week. Wiring devices were reduced 5 per cent, while the demand is slow. Conduit price is firm, with the stocks depleted. Pole-line hardware and high-tension equipment sales remain good, due to utility purchasing. The pole situation has not changed, nor are there indications that the present shortage will be relieved for some time to come. Appliance sales have picked up somewhat. Washing machines in particular are going well. The cool weather in this vicinity curtailed the sale of fans to some extent, resulting in cancellations to the manufacturers. Building activity declined this week, although for this section the month compares favorably with the same month last year.

June Electrical Exports Drop $1,597,185 from Year Ago

TOTAL exports of electrical machinery, apparatus and appurtenances for June were $5,678,267, a decrease of $1,597,185 from June, 1922, when the total amounted to $7,275,452. In May, 1923, total electrical exports amounted to $5,396,943. The accompanying figures are supplied by the Bureau of Foreign and Domestic Commerce:

ELECTRICAL EXPORTS FOR JUNE, 1923, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

Articles	Value June 1922	Value June 1923
Turbines	$238,545	$3,550
Generators:		
Direct-current:		
Under 500 kw	52,925	79,420
500 kw. and over	19,005	85,018
Alternating current:		
Under 2,000 kva	17,070	13,926
2,000 kva. and over	4,220	49,030
Accessories and parts for generators	385,584	31,449
Self-contained lighting outfits	31,138	76,164
Batteries:		
Primary	127,468	118,056
Storage	149,808	203,250
Transforming and converting apparatus:		
Transformers—		
Power	952,473	265,755
Other	60,760	119,242
Rectifiers, condensers, double-current and motor generators, dynamotors, synchronous and other converters	351,868	71,671
Transmission and distribution apparatus:		
Switchboard panels, except telephone	368,291	89,635
Switches and circuit breakers above 10 amp	127,967	172,530
Fuse and fuse blocks	14,620	21,547
Meters and measuring instruments:		
Watt-hour and other measuring instruments	58,286	44,761
Volt, watt and ampere meters, and other recording, indicating and testing apparatus	84,194	66,034
Lightning arresters, choke coils, reactors and other protective devices	185,246	59,051
Motors, starters and controllers:		
Motors under 1 hp	64,214	158,921
Stationary motors, 1 to 200 hp	157,096	264,944
Stationary motors, over 200 hp	99,268	50,563
Railway motors	....	42,146
Elctric locomotives:		
Railway	4,856	129,492
Mining and industrial	74,483	19,573
Other motors	52,678	26,882
Rheostats, controllers and other starting and controlling equipment	86,103	153,417
Accessories and parts for motors	122,249	98,093
Electrical-Appliances, etc:		
Electric fans	$93,742	$43,196
Electric lamps:		
Incandescent—		
Carbon-filament	1,494	4,771
Metal-filament	80,198	120,926
Other electric lamps	10,430	14,175
Flashlights	19,702	47,303
Searchlights and projectors	5,430	14,562
Motor-driven household devices	64,561	100,036
Domestic heating and cooking devices	36,186	115,031
Industrial electric furnaces and ovens	48,094	18,776
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	41,933	109,944
Signal and communication devices:		
Radio and wireless apparatus	547,364	223,589
Telegraph apparatus	18,468	28,500
Magneto telephones	*	12,678
Other telephones	420,940	20,170
Magneto switchboards	*	6,017
Other telephone switchboards	*	10,842
Railway signals, switches and attachments	54,735	36,045
Bells, buzzers, annunciators and alarms	5,819	9,405
Other electrical apparatus and appurtenances:		
Spark plugs, magnetos and other ignition apparatus	102,765	181,850
Insulating material	70,413	113,656
Metal conduit, outlet and switch boxes	26,912	27,085
Sockets, receptacles and lighting switches	42,027	123,869
Other wiring supplies and fixtures	119,848	165,371
Otherelectrical apparatus	753,643	613,208
Globes and shades for lighting fixtures	39,491	38,332
Electrical glassware, except for lighting	7,775	12,087
Electrical porcelain	163,712	164,920
Electrical carbons, carbon brushes and electrodes	116,421	196,494
Insulated wire and cable (iron or steel)	42,768	47,365
Other manufactures of aluminum	140,031	94,261
Copper:		
Bare wire	162,161	174,411
Insulated wire and cable	147,974	275,272
Total electrical machinery, apparatus and appurtenances	$7,275,452	$5,678,267

*Not separately stated prior to Jan. 1, 1923.

New England Collections Running at Fair Rate

IN RESPONSE to careful supervision of accounts, New England collections in jobbing circles appear to be maintaining their earlier good record of the year. Money is plentiful and relatively easy, and the volume of business is so much above that of a year ago that underlying conditions are favorable to continued prosperity in well-conducted establishments rendering first-class service to the industry.

Railroad earnings are much improved, and collections from these and from electric utilities appear to be highly satisfactory. Industrial plant conditions are more uneven, the cotton textile mills having rather spotty business. The building industry is very active in comparison with most recent years, and while some difficulties are apparent in contractor-dealer accounts, jobbers are not giving evidence of any marked anxiety. Relations with the banks are apparently excellent.

The Metal Market

FEW sales of importance were made in last week's metal market. Electrical manufacturers continued to take even but medium lots of lead and copper at the level of 14.62½ cents, but hardly touched the small lots, which sold at 14.75 cents.

NEW YORK METAL MARKET PRICES

	July 24, 1923 Cents per Pound	Aug. 1, 1923 Cents per Pound
Copper, electrolytic.	14.75	14.62½ to 14.75
Lead, Am. S. & R. price	6.00	6.25
Antimony	6.75	7.00 to 7.25
Nickel, ingot	27.00 to 32.00	27.00 to 32.00
Zinc, spot	6.10	6.10
Tin, Straits	38.08	39.00
Aluminum, 98 to 99 per cent	26.00 to 27.00	26.00 to 27.00

No action in the lead market was seen last week, although there was a fair demand from the dealers. The large producers were not anxious sellers and in no mood to sell to other than their regular customers. The orders, although numerous, were mostly from small consumers and were, in general, for August shipment. Dealers and speculative interests feel that lead is likely to approach 7 cents again. The demand in the Middle West has kept particularly strong and the market seems bare of supplies. Even the large consumers complain that they are unable to buy lead at the St. Louis prices that have been quoted by the metal papers recently.

Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Kerr Turbine Reorganization

The Kerr Turbine Company, Wellsville, N. Y., has just undergone a reorganization through the acquisition of practically all its common stock by new interests. Paul B. Hanks, the former president, having disposed of his holdings, has resigned and has been succeeded by W. T. Hamilton, Pittsburgh.

Ample capital for expansion has been put into the business of a sufficient amount to take care of all the present and future requirements, enabling the company to take care of any volume of business that may be developed in its line of manufacture.

Form New Engineering Firm

Ralph B. Coleman, his brother and several others have formed the Coleman Engineering Company, which will do business at 104 North Minnesota Avenue, Sioux Falls, S. D. R. B. Coleman has had over thirty-five years experience and his brother thirty years as electrical salesmen. The firm will handle boilers, generators, transformers, motors, high line apparatus, oil-gas engines and steam engines, waterwheels and governors. They will also figure on the construction of complete power plants.

Baltimore Electrical Supply to Open Branch in Florida

In order to more properly handle the electrical supply business of the extreme South and insure quick deliveries of material to its customers, the Baltimore Electrical Supply Company, with headquarters at 307 North Calvert Street, Baltimore, will open a branch store at 17 Ocean Street, Jacksonville, Fla., in August. This branch will be an entirely separate corporation, however, and will be called the Jacksonville Electrical Supply Company, Inc., of Florida.

The officers of the new firm are W. J. Flannery, president; J. J. Smith, secretary and treasurer, and Oscar A. Flannery, sales manager. The premises of the Jacksonville branch will contain about 6,000 sq.ft. of floor space, with warehouses in the rear of the main building, carrying a stock of approximately $35,000 to $40,000, representing through the Florida territory the Arrow Electric Company, the Rome Wire Company, "Colonial" lamps, "Red Seal" dry batteries and a general line of high grade electrical supplies, in order to insure shipment the same day an order is received. This supply house will cover the entire state of Florida and the southern parts of Georgia.

Hoover Company Holds Third International Convention

The third international convention of the Hoover Company, North Canton, Ohio, manufacturer of electrical cleaners, was held last month. Salesmen from all over the United States Canada and Great Britain attended.

In the morning a parade was held by the company. The floats and programs, accompanying the parade, were instructive and entertaining. Every department of the company in the parade was dressed in uniforms of various makes. All carried toy rubber balloons, and as the march came to a close at a park, each department tied its balloons together, fastened its slogan to them and let them go up.

S. Morgan Smith Awarded Order for Two 2,000-Hp. Waterwheels

The Holyoke Water Power Company, Holyoke, Mass., has awarded to the S. Morgan Smith Company, York, Pa., a contract for two 2,000-hp. waterwheels, to be installed at the new plant under construction at an overflow near the Whiting Paper Company. The wheels will be attached to generators feeding into the switchboard at the power company's main plant. It is estimated the installation will save 18,000 tons of coal yearly.

Using Novelty Containers for National X-Ray Reflectors

For focusing attention toward its new line of reflectors for 50-watt lamps, the National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, is sending out each unit in a carload container around which is pasted numbers to represent dice. Three new lines have been added, whose diameter vary from 4½ to 5½ in. Two of the reflectors are for lighting display cases and commercial exhibits, while the other unit was designed for drop cord bench lighting work.

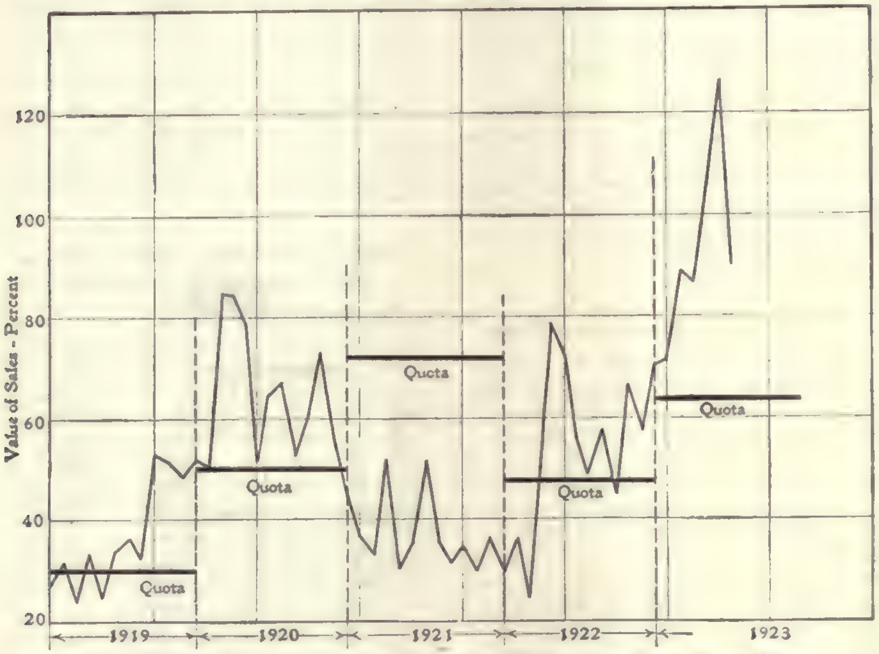
Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.0337	$0.034	$0.0276
Cold finished shafting, per lb.	0.0428	0.042	0.0355
Brass rods, per lb.	0.1825	0.1850	0.1650
Solder (half and half), per lb.	0.276	0.2862	0.21
Cotton waste, per lb.	0.1231	0.1231	0.101
Washers, cast iron (½-in.), per 100 lb.	4.66	4.66	3.83
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.08	3.08	3.11
Machine oil, per gal.	0.349	0.349	0.36
Belting, leather, medium, off list	37%	42½%	46⅔%
Machine bolts, up to 1-in. x 30-in., off list	44¼%	44¼%	53⅓%

Electrical Engineers Equipment Sales Highest in May, 1923

Some indication of the present activity in the high-tension field may be found in the accompanying chart, obtained from the Electrical Engineers Equipment Company, 710 West Madison Street, Chicago. This chart, ranging over a period of four years, gives the value of sales expressed in percentages as against the quota established for those years.

In analyzing these sales it is interesting to note that during both the years 1919 and 1920 this quota was exceeded. However, the 1921 quota was defined on the basis of business obtained in 1922. Naturally, when business conditions became abnormal in that year, there also occurred a slump in power developments. The return of good business may be taken from the figures in 1922, which overexceeded the quota established, thereby showing rapid advances during the latter part of that year and running into 1923. The peak load for sales of this organization happened in May, 1923, when that month exceeded the quota by 60 per cent. This chart was furnished through the courtesy of R. T. Calloway, sales manager of this organization.



THE INCREASE IN HIGH-TENSION BUSINESS DURING THE PAST FOUR YEARS FOR ONE COMPANY

Allis-Chalmers Sales Billed in Second Quarter Were $6,082,070

The Allis-Chalmers Manufacturing Company, Milwaukee, on July 30 reported sales billed of $6,082,070 in the three months ended June 30, against $4,778,863 in the same period last year.

Net profits for the period were $628,418.24, after expenses and taxes, equal to $1.30 a share on the common stock after allowing for preferred dividends. In the same period last year net profits were $299,796, equal to 4 cents a share on the outstanding common stock.

For the first six months of 1923 sales billed aggregated $11,303,762, against $9,450,465 in the first half of 1922. Net profits were $1,097,108, against $578,529, equal to $1.99 a share on the common stock in the first half of this year.

Habirshaw Reorganization Body Outlines Company's Position

The committee on reorganization of the Habirshaw Electric Company and its affiliated organizations has sent a letter to creditors outlining the probable financial position of the company upon completion of the proposed reorganization.

The letter shows that total claims filed against the company approximate $6,472,589. In its statement the committee says it is advised that the statement of claims includes only those filed against one company and does not include claims filed against one or more of the other companies based on indorsement or guaranty of the same obligation.

"Based upon information obtained by the committee from the receivers," says the letter, "it is estimated that, after giving effect to the new financing contemplated by the plan, the balance sheet of the new company as of June 2, 1923, would be substantially as follows:

"Current assets, $2,115,506; plant, $2,500,000, and reels and lags, $213,415; total assets, $4,829,415. Liabilities, reels and lags, $275,274; preferred stock, $1,500,000, and common stock, $3,054,141. Total liabilities, $4,829,415." The current assets include $724,804 cash, $398,657 notes and accounts receivable, $3,180 other current assets, and $988,865 value of inventory.

"On the basis of the above estimated balance sheet," says the letter, "the book value of the common stock of the new company would be about $100 per share.

"The committee is advised by the receivers that since Jan. 1, 1923, the business conducted by the receivers has resulted in an average operating profit of about $80,000 a month, exclusive of depreciation, interest on investment, etc. The committee is also advised by the receivers that a large element of the above profit was due to favorable contracts which expire Oct. 1, 1923, and that since June 2, 1923, a 10 per cent reduction in the price of wire has been established which will lessen future earnings considerably."

Orders for New "Orangeburg" System Expected to Reach $500,000

Orders for the new "Orangeburg" underflow duct system, manufactured by the Fibre Conduit Company and sold through the Johns-Manville Company, are expected to reach $500,000 by January, 1924. Some of the recent large orders for this company include the new buildings of the City Savings Institution, Albany, N. Y., at a cost of $6,000; the National Life & Accident Company, Nashville, Tenn., $2,500; the Southern New England Telephone Company, New Haven, Conn., $2,500; the New York Telephone Company, New York City, $4,000; the Lincoln Life Insurance Company, Fort Wayne, Ind., $3,500; the Greenwich Savings Bank, New York, N. Y., $7,500, and the First National Bank, Boston, Mass., $4,500.

Valentine-Clark Moves Main Office to St. Paul

The main office of the Valentine-Clark Company, including the accounting department, has been moved to the yard at 2516 Doswell Avenue, St. Paul. The move has been made to facilitate the handling of business by concentrating the pole yarding, treating and the business of selling at one point. The post office address remains Minneapolis, and a special wire from Minneapolis to the yards and office has been provided for the handling of all telegrams and long-distance calls.

G. E. and Westinghouse Are Awarded $950,000 Cahokia Turbine Orders

Orders for two turbines to be installed in the second section of the new Cahokia station of the Union Electric Light & Power Company, St. Louis, have been awarded to the General Electric Company and the Westinghouse Electric & Manufacturing Company by McClellan & Junkersfeld, Inc, The combined order amounts to about $950,000 and comprises 65,000 kva.

General Electric will build the 30,000-kva. unit for April, 1924, delivery, and Westinghouse the 35,000-kva. unit for delivery in April, 1925. Both turbines will be constructed for 300 lb. of steam pressure at the throttle and will be arranged for bleeding steam for feed-water heating. Westinghouse will construct the "Bauman" type, which is

single-flow, at 1,800 r.p.m., and General Electric its standard type, with several detailed improvements, also at 1,800 r.p.m.

According to information received early this week from McClellan & Junkersfeld, Inc., contracts for boiler equipment will not be awarded until November. Steel orders have been awarded to the Fort Pitt Bridge Works and other pile orders to the Raymond Concrete Pile Company. Construction using these materials will start this month. It was pointed out by the engineering firm that owing to the fact that it is necessary to have the Cahokia Station completed as soon as possible in order to serve the increasing demand for light and power in the St. Louis territory, these contracts for the second section were awarded before the first section was finished.

Master Electric Ships Largest Motor Order from Dayton, Ohio

"Business is good"—this message was proclaimed in Dayton, Ohio, recently when the Master Electric Company paraded its trucks through that city carrying the largest shipment of motors that ever left Dayton in a single day. The shipment, which was hauled on six huge trucks, was part of large orders placed by manufacturers of water systems, refrigerating plants, compressors and other labor-saving devices.

Officials of Master Electric say orders for 1923 have been the largest in the company's history. Three times as much business is being done at this time as during the same period of last year and all indications point to a continuation of this production basis.

Simplex Order for 107 Ranges

One hundred and seven Simplex cabinet-type electric ranges are to be installed in the Huntington Apartments, now being erected in San Francisco at California and Taylor Streets. Each range will have a capacity of 7.7 kw. The intallation was sold by "Doc" Libbey, Western sales representative of the Simplex Electric Heating Company. The Huntington Apartment will be the largest apartment-house building in San Francisco.

Plan Consumption 100,000,000 lb. Copper at New Wire Plant

The Brenner-Mosley-Mervis Company has been organized to produce copper rods and drawn copper wire in Chicago. With a paid-in capitalization of $600,000 the organization has acquired an 8-acre track of land on South Kedzie Avenue adjoining the sanitary canal. The first unit of the contemplated plant now under construction will have a frontage on Kedzie Avenue of 116 ft. and a depth of 388 ft.

Production plans call for a consumption of 100,000,000 lb. of copper annually, with an energy consumption of 4,000 hp. One purpose of launching this new company was to relieve customers of the added freight costs and delays accruing from Eastern and more distant markets.

Nathan P. Brenner will head this new company, besides serving as the head of the American Insulated Wire & Cable Company. The vice-presidents will be W. J. Mosley and George T. Mosley. N. D. Brenner, Jr., and Mayer B. Mervis, both of the American Insulated Wire & Cable Company, will be respectively the treasurer and secretary of this new organization. These five men will also comprise the directorate of the new organization.

Green Equipment Appointment

The Green Equipment Corporation, 53 West Jackson Boulevard, Chicago, manufacturer of commutator undercutting tools, commutator stones and cements, announces the appointment of Thomas H. Endicott as vice-president and general manager. Mr. Endicott is well known in industrial circles because of his former contact with the trade as sales engineers for the Crocker-Wheeler Company and later as sales manager for the metal-cutting department of the E. C. Atkins Company. Recently he organized a company to serve as engineering consultant to industrials, with headquarters in Indianapolis.

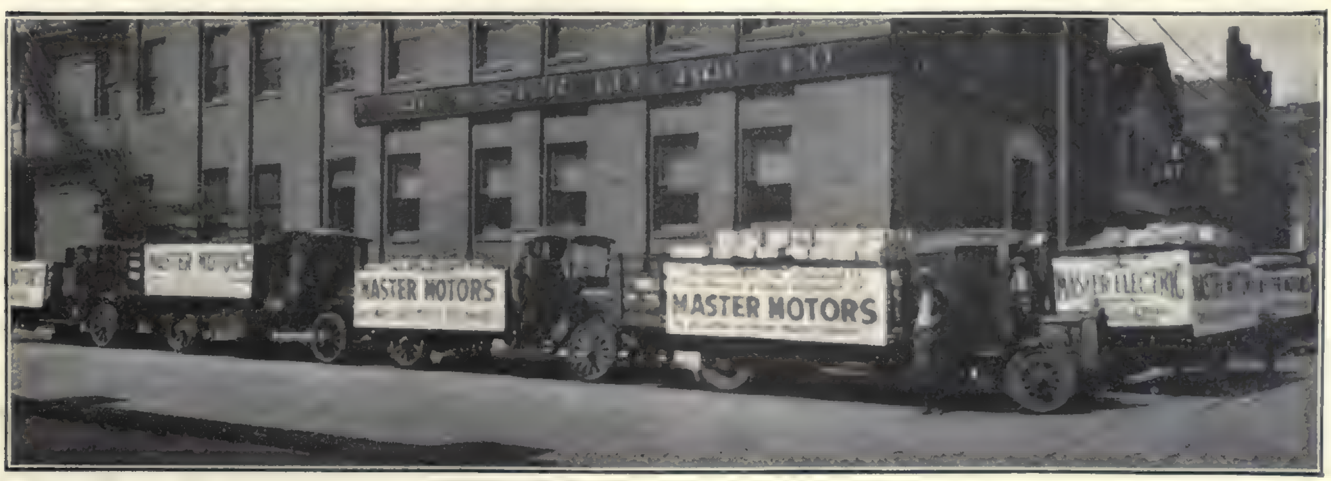
The Packard Electric Company, Dana Avenue, Warren, Ohio, is completing plans and will soon take bids for the construction of a three-story and basement addition to its plant, 85 ft. x 200 ft. The company is also planning for the construction of a one-story warehouse and distributing building 45 ft. x 200 ft., on an adjoining site.

The Western Electric Company has leased the three-story factory of the John H. Meyer Company, 708-720 Frelinghuysen Avenue, Newark, N. J., heretofore devoted to the manufacture of tire fabrics, for the establishment of a new plant for the manufacture of its regular line of telephone apparatus, etc. The company will take possession about Sept. 1 and will commence the installation of necessary equipment. It is purposed to provide facilities for the employment of about 750 operatives and to inaugurate work early in October. It is said that the company has acquired the structure for the establishment of an organization prior to the occupancy of its new plant on the Kearny Meadows, Kearny, N. J., estimated to cost more than $5,000,000, and on which excavations have just been commenced. Ultimately the new Newark plant will be consolidated with the Kearny works.

The Memco Engineering & Manufacturing Company, 24 Vanderbilt Avenue, Brooklyn, N. Y., manufacturer of electrical equipment, has leased a building at Hamilton and Freeman Avenues, Long Island City, and will occupy the plant at an early date for a new works.

The Arrow Electric Company, Hartford, Conn., has arranged for an increase in capital stock from $1,600,000 to $3,000,000 for general expansion.

The Electrical Alloy Company, Morristown, N. J., manufacturer of electrical wire, etc., has commenced operations at its new rolling mill, recently completed, 60 ft. x 125 ft., consisting of motor-driven rolls, electric furnace and auxiliary equipment. The new mill will be used for the rolling of special alloys in bar and ribbon shapes for use at the wire works of the company on Ridgedale Avenue.



SIX TRUCK LOADS OF MOTORS READY TO BE SHIPPED FROM DAYTON, OHIO, TO LABOR-SAVING DEVICE MANUFACTURERS

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Nagoya, Japan (No. 7,287), of electrical display signs and advertising signs.

Purchase is desired in Leksand, Sweden (No. 7,347), of a power transformer, 6,300/800-volt, three-phase, and mercury-arc rectifiers.

An agency is desired in Damascus, Syria (No. 7,336), for wiring supplies and fixtures.

Purchase is desired in Santo Domingo, Dominican Republic (No. 7,323), of a complete cold-storage plant.

An agency is desired in Turin, Italy (No. 7,333), for refrigerating plants, especially those of small type.

AUTOMATIC TELEPHONES FOR MEXICO CITY, MEXICO—The Department of Communications and Public Works, Commerce Reports states, has granted one of the telephone companies in Mexico City permission to change its present system to that of automatic telephones.

EXTENSIONS TO THE TEGUCIGALPA, HONDURAS ELECTRIC PLANT PROPOSED—Plans for the installation of additional hydroelectric units to serve the city of Tegucigalpa are being considered, according to Consul Robert L. Keiser, of that district. No definite arrangements for the proposed work have been completed.

PROPOSED ELECTRIC PLANTS FOR EAST AFRICA.—The East African Power & Lighting Company has applied for licenses to establish electric generating plants at Mombasa, near Thika, at Eldoret and Nakuru, Kenya Colony.

PROPOSED ELECTRIC PLANT FOR AOSTA, ITALY — The Società Anonima Termoelettrica Ligure Piemontese has been organized at Milan, Italy, for the purpose of securing a concession to build an 18,000-kw. steam-driven electric generating station at La Thurle, Aosta.

AUTOMATIC TELEPHONES IN THE NETHERLANDS.—Developments in the telephone field, according to *Commerce Reports*, indicate the adoption of a complete automatic system in all the principal cities of the Netherlands in the near future. The telephone system in the larger cities of the country, and in fact in all cities and towns with few exceptions, are owned and operated by the national government as a supplement to its mail and telegraph services, or by the municipalities under concession from the national government.

New Apparatus and Publications

CONNECTORS.—Dossert & Company, 242 West Forty-first Street, New York City, have issued new price sheets covering all types and sizes of "Dossert" connectors.

FILTERS AND GREASE EXTRACTORS.—The Elliott Company, Jeannette, Pa., has issued catalog R-1, which describes and illustrates the "Lagonda" filters and grease extractors.

EXTENSION TRANSFORMER.—Bulletin No. 2,025, issued by the Pittsburgh Transformer Company, Pittsburgh, Pa., describes its new "Pittsburgh" farm-line extension transformer.

ELECTRIC DRILLS.—The Temco Electric Motor Company, Leipsic, Ohio, has recently added two new models to its "Temco" line of drills, known as model "D" and model "K." The former can be used for making ¼-in. holes or smaller, and the latter for ⅜-in. holes.

CENTRIFUGAL PUMP.—The De Laval Steam Turbine Company, Trenton, N. J., is distributing catalog H, entitled "Multi-stage Series Pumps" in which it describes a new style of centrifugal pump called a "Series Pump," manufactured by the company. These pumps are made with two or three stages.

STOKERS.—The McClave-Brooks Company, Scranton, Pa., has developed a new mechanical stoker for all grades of bituminous coal and lignite. A hopper-feed hand stoker for burning all grades of bituminuos fuel, screenings, slack, coke and lignite has also been designed by the company.

SPLICES AND TAPES. — The Okonite Company, Passaic, N. J., has issued a booklet entitled "Splices and Tapes," in which it describes its splicing compound and adhesive tapes and also gives instructions for making a perfect splice or joint.

ELECTRIC DRILL BENCH STAND.—The Standard Electric Tool Company, Cincinnati, is placing on the market an improved electric drill bench stand for use in connection with electric portable hand drills.

MOTOR STARTING SWITCHES. — The Trumbull Electric Manufacturing Company, Plainville, Conn., is distributing bulletin No. 4 covering its new motor starting switches with overload relay and under voltage release coil.

ELECTRIC WELDER.—The Todd Shipyards Corporation, 25 Broadway, New York City, has brought out a new electric welding machine, known as the "Todd" twin-pole electric welder.

ELECTRICAL SUPPLIES. — The Steel City Electric Company, Pittsburgh, Pa., is distributing catalog No. 34, covering its complete line of electrical products.

New Incorporations

THE HUTCHINSON (MINN.) LIGHTING & MANUFACTURING COMPANY has been incorporated with a capital stock of $50,000 by I. B. Jorgenson, C. R. Zickrick, P. P. Pendergast and H. C. Schluter.

THE WOLVERINE POWER COMPANY, Edenville, Mich., has been incorporated to build four hydro-electric plants on the Tittabawassee and Tobacco Rivers, the output to be utilized by the Consumers' Power Company, Jackson. The officers are: Frank I. Nixon, Edenville, Mich., president, and William C. Manning, Detroit, vice-president.

THE WEST VIRGINIA TRANSMISSION COMPANY, Martinsburg, W. Va., has been incorporated by Cleveland M. Seibert, Charles R. Beall and Clarence E. Martin. The company proposes to erect a transmission line from the new power plant at Williamsport, Md., to Cumberland, Md., to connect with the system of the American Water Works & Electric Company.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

PATTEN, ME.—The Merrill Mill Company contemplates rebuilding its electric plant and woodworking mill, recently damaged by fire, with loss of about $75,000.

PORTLAND, ME.—Plans are under consideration for the linking up of all the power systems of Maine from Bangor to the New Hampshire line. The project will include the electric lines of the Central Maine Power Company, the Cumberland County Power & Light Company and the Bangor Railway & Light Company.

EAST BRAINTREE, MASS.—The East Braintree Bleacheries, Inc., will build a power house at its mill on Adams Street.

MEDFORD, MASS. — Plans are under consideration by the Council for the installation of an ornamental lighting system on Salem, Main and High Streets.

MIDDLEBORO, MASS.—Bids for the proposed municipal power house at Muttock for the municipal electric system have been rejected by the Selectmen. New bids, it is understood, will be asked for.

WAKEFIELD, MASS.—A site has been acquired on Water Street for the new substation of the municipal electric system. Preliminary work will soon be started on laying the underground conduits between the Water Street site and Stoneham for cables for the distribution of high-tension current.

PROVIDENCE, R. I.—The Narragansett Electric Light Company plans to build a four-story substation on Elm Street.

ESSEX, CONN.—The property of the Essex Light & Power Company has been acquired by the Central Connecticut Power & Light Company, East Hampton. Plans for the amalgamation of the two companies include the raising of the dam of the latter company in the Salmon River at Leesville from 18 ft. to 78 ft., at a cost of about $500,000.

Middle Atlantic States

BUFFALO, N. Y.—The New York Central Railroad Company will build an addition to the transformer station at its shops on Bailey Avenue.

BUFFALO, N. Y.—Plans for the proposed municipal market building to be erected on Elk Street by the Department of Parks and Public Buildings provide for a refrigerating plant.

CHELSEA, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 23 for the installation of an automatic telephone system in the United States Veterans' Hospital, Chelsea. For details see Searchlight Section.

ELLENBURGH, N. Y.—The Public Service Commission has granted Norman I. White permission to erect a transmission line from his electric plant on Big Chazy River through the town of Moers and a distributing system in the towns of Altona and Ellenburgh under franchises granted by the Town Boards.

GLENS FALLS, N. Y. — The Moreau Manufacturing Company is planning to build a hydroelectric plant on Sherman Island, to cost about $1,000,000.

MEDINA, N. Y.—The Clark-Allis Vinegar Company plans to rebuild its power house, cold-storage plant and factory, recently damaged by fire, causing a loss of about $50,000.

NEW YORK, N. Y. — Electric power equipment will be installed in the new ice and refrigerating plant to be established by the United Refrigeration & Terminals Company at the former brewing plant of the Bernheimer & Schwartz Co., Amsterdam Avenue, between Lawrence and 128th Streets.

NORTH TONAWANDA, N. Y. — The Tonawanda Power Company contemplates the erection of a transmission line on the Lockport Road, from Ward Road to Military Road, for commercial service in this section.

WEST SAND LAKE, N. Y. — The Wynantskill Hydro-Electric Company has applied to the Public Service Commission for permission to issue bonds for improvements to its system, including the installation of new equipment in its generating plant. A street-lighting system will be established consisting of thirty-four lamps in District No. 1 and 103 lamps in District No. 2.

BLOOMSBURY, N. J.—The New Jersey Power & Light Company, Dover, will build a local substation. A transmission line will be erected to Stewartsville.

EDINBURG, N. J.—The Electric Light & Power Company of Hightstown plans to erect a transmission line and install a local system for commercial service.

HADDONFIELD, N. J.—Bids will be received by the Board of Commissioners of the borough of Haddonfield until Aug. 16 for the construction of a sanitary sewer system, including an electrically operated sewage-pumping station. Remington & Vosbury, 601 Market Street, Camden, are engineers.

TRENTON, N. J.—The Trenton & Mercer County Traction Company plans extensions to its power plant, including the installation of additional machinery, to cost about $500,000.

GLENIRON, PA.—The Gleniron Power & Tool Company, recently organized, plans to install an electric system for local commercial service.

HARRISBURG, PA. — Bids will be received by Berkey H. Boyd, secretary of the Department of Property and Supplies, Capitol Building, Harrisburg, until Aug. 23 for completing the new South office building in Capitol Park, as follows: Contract No. 4—heating and ventilating; Contract No. 5—electrical work; Contract 6—plumbing and drainage; Contract No. 7—vacuum cleaning system; Contract No. 8—drinking-water refrigeration system, and Contract No. 9—electric elevators and lifts. Arnold W. Brunner, 101 Park Avenue, New York City, is architect.

HAZLETON, PA. — The Pennsylvania Power & Light Company plans to install a street-lighting system at Park View, near Hazleton.

LANCASTER, PA.—Electrically operated

pumping machinery will be installed in connection with a proposed sewerage system, to cost about $1,000,000, which has been ordered by the State Board of Health.

LEBANON, PA.—The Metropolitan Edison Company is negotiating for the purchase of the property of the Weimer Electric Light & Power Company. Extensions will be made in the transmission system.

LEIGHTON, PA.—The Leighton Water Company contemplates improvements to its plant, including the installation of electrically operated pumping machinery. The cost is estimated at about $40,000.

LEWISTOWN, PA. — The Pennsylvania Wire Glass Company, Pennsylvania Building, Philadelphia, plans to construct a power house in connection with its proposed local plant, to cost about $250,000.

PHILADELPHIA, PA.—The Ford Motor Company, Highland Park, Mich., plans to construct a power house in connection with its proposed assembling plant at Sixty-third Street, Gibson and Eastwick Avenues, to cost about $1,000,000.

WILMINGTON, DEL. — Electric power equipment will be installed at the proposed ice-manufacturing and cold storage plant of the Holstein-Harvey Terminal, Inc., to be located at French and Water Streets, to cost about $500,000.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company will build an addition at its plant on Kloman Street, to cost $100,000.

CUMBERLAND, MD.—The Baltimore & Ohio Railroad Company plans to install electric and steam power equipment at its tie-treating and wood-preserving plant at Green Spring, to cost about $115,000.

BACHMAN, W. VA. — The Cataract Smokeless Coal Company, recently organized, is planning to equip its coal properties in this section with electrically-operated machinery.

CABIN CREEK JUNCTION, W. VA.—Plans are being prepared by the Virginia Power Company, Charleston, for improvements to its local plant, including the construction of a coal-storage basin, extension to power plant, etc.

CHELYAN, W. VA.—The capital stock of the Chelyan Electric, Water & Ice Company has been increased from $25,000 to $50,000.

MONTGOMERY, W. VA. — The State Supreme Court has issued a peremptory writ instructing the Montgomery Water & Light Improvement Company to make improvements to its plant and mains as ordered by the Public Service Commission.

PRUNTYTOWN, W. VA.—Bids will be received by the State Board of Control, Charleston, until Sept. 28 for construction of school building at the West Virginia Industrial School for Boys at Pruntytown, including electric wiring, conduit system, intercommunicating telephone system, heating system, etc. R. A. Gillis, Fairmont, is architect.

WELLSBURG, W. VA.—Bids will be received by the City Water Board until Aug. 15 for furnishing and installing a 2,000,000-gal. motor-driven centrifugal low-lift pump and a 2,000,000-gal. motor-driven centrifugal high-lift pump with all necessary appurtenances. Hudson & Myron, Wabash Building, Pittsburgh, Pa., are engineers.

MARTINSVILLE, VA.—The Town Council has entered into an agreement with the Appalachian Power Company, Bluefield, W. Va., whereby the company will extend its transmission line to furnish electricity in Martinsville, to be distributed by the municipal system.

PORTSMOUTH, VA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 14, for three motors, controllers and spare parts. (Schedule 1137.)

RADFORD, VA.—J. P. McConnell and Harold C. Tyler plan to construct a power house in connection with the establishment of a local stone quarrying and crushing plant.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 7 for fire protection equipment in the United States Treasury Annex No. 2, Washington, D. C. For details see Searchlight Section.

North Central States

DETROIT, MICH.—The Père Marquette Railroad Company plans to construct a power house at its shops on West Jefferson Street, to cost about $30,000.

GRAND RAPIDS, MICH. — Work will soon begin on rebuilding the power plant of the Valley City Milling Company on Michigan Street between the Grand Trunk depot and Hotel Rowe. Considerable new equipment will be required. The plant supplies electricity for lighting and heating the Hotel Rowe.

ITHACA, MICH.—The Consumers' Power Company, Jackson, has been granted a franchise in Ithaca, to construct a transmission line and install a local system.

LANSING, MICH.—Plans are under consideration by the Durant Motors, Inc., to double the output of its power plant.

COLUMBUS, OHIO.—Bids will be received by the Board of Commissioners of Franklin County, Columbus, until Aug. 20 for repairs and alterations to the electric wiring and the piping in the tunnel in the Franklin County Children's Home.

HOPKINSVILLE, KY.—Work has started on improvements to the power plant of the Kentucky-Tennessee Light & Power Company. The cost is estimated at $300,000. A. J. Nott, assistant engineer of the J. G. White Management Corporation, 43 Exchange Place New York City, is in charge of construction.

INDIANAPOLIS, IND.—The Merchants Heat & Light Company will issue $95,000 in bonds, and $148,000 in capital stock, part of the proceeds to be used for extensions and improvements.

CHICAGO, ILL. — The Commonwealth Edison Company plans to build a machine shop at Fisk and Twenty-second Streets, to cost about $225,000.

BEAVER DAM, WIS. — Extensive improvements are contemplated by the Wisconsin Power, Heat & Light Company to its local system, to include a new switchboard, new feeder regulators, etc., to cost about $8,000.

MOUNT HOREB, WIS.—The Darlington (Wis.) Electric Company is negotiating for the purchase of the property of the Mount Horeb Heat, Light & Power Company. Improvements are contemplated to the system.

STEVENS POINT, WIS.—The Wisconsin Valley Electric Company is considering the erection of a transmission line to serve the towns of Auburndale, Vesper, Sherry and Junction City.

WATERTOWN, WIS. — The Council is considering extending the street-lighting system to the outskirts of the town.

AUSTIN MINN.—The installation of an ornamental lighting system in the downtown district has been authorized by the voters.

HIBBING, MINN. — Arrangements are being made by the Phoenix Power Company (recently incorporated) for the erection of a transmission line between Hibbing and Thomson which will supply electricity in many localities in the range district.

TAOPI, MINN.—The voters have authorized an issue of $5,000 in electric light bonds.

VILLISCA, IOWA.—Plans are under way for the construction of a municipal electric plant, to cost about $75,000.

KANSAS CITY, MO.—The Kansas City Power & Light Company will erect a building at Pennsylvania Avenue and Twenty-fifth Street for general operating service, to cost about $125,000.

REPUBLIC, MO.—Jared R. Woodfill, Jr., Aurora, has applied for a franchise to supply electricity for lamps and motors in Republic.

ENDERLIN, N. D.—The Midwest Power Company contemplates extensions to its transmission lines.

HUDSON, S. D.—The local electric light plant was recently damaged by fire. Horace Waldorf is superintendent.

PRESHO, S. D.—The purchase of electrical equipment, including oil engines, electric generators, exciters and switchboard, for the Water Department, it is reported, has been authorized.

ATKINSON, NEB. — The plant of the Atkinson Milling & Light Company was recently damaged by fire.

FREMONT, NEB.—Bonds to the amount of $90,000 have been authorized by the voters of Dodge County for establishing an electric lighting and power distribution system.

SUPERIOR, NEB. — Arrangements are being made by the Southern Nebraska Power Company to acquire the hydro-electric plants at Oak and Hebron and the steam-power plant at Clay Center. Extensions and improvements will be made to the systems.

LAWRENCE, KAN.—The Kansas Electric Power Company has applied to the Public Utilities Commission for permission to extend its transmission line along the Leavenworth, Bonner Springs and White Church Road in Wyandotte County.

SALINA, KAN.—The City Council is considering the installation of electrically-operated pumping machinery in connection with the new sewage disposal works. C. A. Haskins, Finance Building, Kansas City, Mo., is engineer.

TOPEKA, KAN. — The Topeka Edison Company has acquired a water-power site on the Kaw River, near Tecumseh, 6 miles from the city, on which it will build a steam-driven electric plant, with an initial capacity of 15,000 kw., to cost about $2,500,000.

Southern States

RALEIGH, N. C.—The North State Power Company is planning to erect a 22,000-volt, three-phase transmission line to connect its Furquay Springs and Lillington generating stations.

SYLVA, N. C.—Plans are under consideration for the construction of a power plant at the Cullohwee Normal and Industrial School. The equipment will include boilers, engines, generators, switchboards, etc. H. A. Underwood, Raleigh, is engineer.

WAYNESVILLE, N. C.—The Southland Hardwood Lumber Company, recently organized, contemplates the construction of a power house in connection with its proposed local plant.

ANDREWS, S. C.—Bids will be received by the city of Andrews until Aug. 22 for water mains, reservoir, filter and transmission lines, to cost about $70,000. The Ryan Engineering Company, Columbia, is engineer.

COLUMBIA, S. C.—A company is being organized by T. C. Williams and G. A. Guignard to construct and operate two hydro-electric plants with combined capacity of about 200,000 hp., to cost about $1,000,000, with transmission system. One plant will be located on the Salude River, near Columbia, and the other on the Santee-Cooper Canal, Berkeley County.

NINETY-SIX, S. C. — The Ninety-Six Lumber Company contemplates rebuilding its power house and mill recently damaged by fire, causing a loss of about $100,000.

BUSHNELL, FLA.—Bonds to the amount of $15,000 have been authorized for improvements to the electric light plant.

ORANGE PARK, FLA. — Arrangements have been made by the City Commission whereby the Jacksonville municipal electric plant will supply electricity in Orange Park.

WEST PALM BEACH, FLA.—The Southern Utilities Company contemplates installing new electrical machinery, including a 500-hp. boiler.

BRISTOL, TENN.—The City Council has authorized surveys made of the power site on the Holstein River for the proposed municipal hydro-electric plant.

KNOXVILLE, TENN.—Plans are under consideration for the construction of a new power plant on the campus of the University of Tennessee to furnish light, heat and power for all the University buildings. An appropriation of $115,000 has been made for the work.

LAWRENCEBURG, TENN.—An election will soon be held to vote on the proposal to issue $80,000 in bonds for the construction of another dam and power plant on Shoal Creek, between the present dam and power plant.

MARTIN, TENN.—The installation of an ornamental lighting system is under consideration.

GREENVILLE, ALA. — The Alabama Power Company is planning to extend its high-tension transmission lines to Greenville. The company is also negotiating for the purchase of the local electric plant.

MONTGOMERY, ALA. — The Alabama Power Company, which recently took over the electric and gas plants in Montgomery, has offered to install an ornamental lighting system in the business district, providing the merchants will make arrangements for same and for future maintenance.

PRATTVILLE, ALA. — The Alabama Power Company has acquired the local electric distributing system, owned by the Autauga Oil & Fertilizer Company.

MERIDIAN, MISS.—The Lockard Brick Works plan to rebuild their power house and plant, recently damaged by fire, causing a loss of about $60,000.

PINE BLUFFS, ARK.—The installation of electrically-operated pumping machinery in connection with improvements to the municipal waterworks is under consideration. Ford Bennett, Citizens' Bank Building, is engineer.

NEW ORLEANS, LA.—The Algiers Public Service Company contemplates extensions and improvements. The company has recently increased its capital from $250,000 to $500,000.

MONROE, LA.—The Union Power Company, Shreveport, recently organized, plans to construct a power house in connection with its proposed carbon-black manufacturing plant, to cost about $1,000,000.

NEW ORLEANS, LA.—A petition has been presented to the City Commission by the residents of Ursuline Avenue asking for the installation of an ornamental lighting system on that thoroughfare.

AMARILLO, TEX. — Plans are under consideration for the installation of electrically operated pumping machinery in connection with improvements to the waterworks system, to cost about $1,700,000.

BRONTE, TEX.—F. E. Brown and C. C. Holden, recently granted a franchise, are planning to install an electric plant and system.

DALLAS, TEX.—The Gulberson Corporation, manufacturer of oil-well machinery, etc., will install electric power equipment in connection with its proposed plant addition, to cost about $500,000.

EDGEWOOD, TEX. — Bonds have been voted for $55,000 for the installation of a municipal electric lighting plant and waterworks system.

FORT WORTH, TEX.—Plans, it is reported, are being prepared for the installation of 400 new street lamps.

FORT WORTH, TEX.—Extensions and improvements are contemplated by the Northern Texas Traction Company involving an expenditure of about $400,000.

LAREDO, TEX.—The Laredo Electric & Railway Company is contemplating the erection of a boiler house.

MERCEDES, TEX.—An election will be held Aug. 4 to vote on the proposal to issue $150,000 for a municipal electric light plant and waterworks.

SAN ANTONIO, TEX.—The Valley Electric & Ice Company is aking for bids for the construction of a new power house.

SANGER, TEX.—Bonds to the amount of $17,500 have been voted for the installation of a municipal electric light plant. E. L. Dalton, 1915½ Main Street, Dallas, is engineer.

SOUR LAKE, TEX.—The Western Public Service Company contemplates extensions and improvements, including the installation of additional equipment.

Pacific and Mountain States

SEATTLE, WASH.—The Municipal Power Department has acquired property at Third Avenue and Madison Street, on which it will erect a substation.

SEATTLE, WASH.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 21 for transformers, motor-generator sets and telephone terminal, for use at the Puget Sound Navy Yard. (Schedule 1142.)

TENINO, WASH. — The Puget Sound Power & Light Company will build a transmission line to a point near Olympia for connection with the system of the North Coast Power Company, recently acquired. A local substation will be built.

VANCOUVER, WASH. — Work has started by William Wills, Thompson Building, Seattle, general contractor, on the construction of the power house at the local State School for the Deaf. All sub-contracts in connection with the plant will be handled by the state.

BEND, ORE.—The Bend Water, Light & Power Company contemplates the construction of a hydro-electric power plant on the Tumalo Creek, with an initial installation of 5,000 hp.

PORTLAND, ORE.—Plans are being prepared by W. J. Morris, Spaulding Building, for the establishment of a lumber town, 4 miles east of Oakridge, for G. H. Kelly, Spaulding Building. The project will include an electrically driven sawmill, planing mill, dry kiln, an 8-mile main logging railroad, machine shop, 200 houses, etc., to cost about $2,000,000.

LOS ANGELES, CAL. — Electric power equipment will be installed in the new ice-manufacturing and cold-storage plant to be erected by the Federal Refrigerating Company at Downey Road and District Avenue, to cost about $1,500,000. Frank D. Chase, Inc., is engineer.

OAKLAND, CAL.—The Pacific Gas & Electric Company is planning to erect a new substation in the Lake district on Twenty-first Street, between Grove Street and Telegraph Avenue. The new building will be a temporary structure. A permanent building, to cost $280,000, will be erected in the near future.

SAN FRANCISCO, CAL. — Plans are under consideration by the Down Town Association for the installation of a lighting system on highways leading from the city.

STOCKTON, CAL.—Steps are being taken for the installation of an ornamental lighting system on Miner Avenue between North El Dorado and California Streets. W. B. Hogan is city engineer.

BOISE, IDAHO. — The Federal Power Commission has granted the Unity Gold Mines Company permission to build a diversion dam on Elk Creek, a power house and a transmission line, 9½ miles long, in Idaho and Valley Counties, Idaho.

BOISE, IDAHO. — The Federal Power Commission has granted the Idaho Power Company a fifty-year license covering its transmission and distribution system, consisting of twenty-nine transmission lines throughout the Snake River Basin in southern Idaho and Oregon, aggregating 420 miles in length.

Canada

NORTH BAY, ONT.—The purchase of three generators for the substation at Gormonville, Man., is under consideration by the Hydro-Electric Commission of Ontario, North Bay.

TIMMINS, ONT. — Contract has been awarded by the Hollinger Consolidated Gold Mines Company for the construction of a new dam and power house on the Abitibi River to William Arrol, Ltd., St. Catharines, Ontario, and London, England. The proposed plant will have an output of 25,000 hp., of which 20,000 hp. will be delivered to the mines of the Hollinger company and 2,000 hp. will be for the use of the municipalities in the immediate neighborhood of the plant.

TORONTO, ONT.—Plans are being prepared by the Hydro-Electric Power Commission of Ontario, Toronto, for erecting a transmission line from St. Jacobs to Linwood, to cost about $26,000; also to erect 15 miles of distributing line to Sombra and Port Lambton, to cost about $48,000.

ASBESTOS, QUE.—Johns-Manville, Inc., New York, N. Y., contemplates the construction of a power house in connection with its proposed asbestos goods plant, to cost about $350,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued July 10, 1923)

1,461,571. Control System; E. F. W. Alexanderson, Schenectady, N. Y. App. filed March 23, 1920. System for securing maximum output of motor.

1,461,575 and 1,461,576. Ship Propulsion System; F. H. Clough, Hillmorton, near Rugby, England. App. filed Jan. 29, 1921. Adjustable speed for propelling motors.

1,461,634. Rheostat and the Like; E. R. Stoekle, Milwaukee, Wis. App. filed July 31, 1922. Electron tube filament rheostat.

1,461,645. Automatic Telegraph System; G. R. Benjamin, Jersey City, N. J. App. filed Nov. 4, 1916. For loop operation.

1,461,661. Electrolyzing Apparatus for the Manufacture of Oxygen and Hydrogen; G. F. Jaubert, Paris, France. App. filed April 4, 1922. Uses nickel electrodes.

(Issued July 17, 1923)

15,653 (reissue). Lightning Arrester; C. T. Allcutt, Wilkinsburg, Pa. App. filed Sept. 1, 1917. For communication lines.

1,461,750 to 1,461,753. Conductor Support; H. P. Chandler, Mansfield, Ohio. App. filed Sept. 5, 1922. Clamping ear for trolley wires.

1,461,754. Transmitting and Receiving Apparatus for Wireless Telegraphy; G. H. Clark, Brooklyn, N. Y. App. filed March 3, 1921. Increased speed of signal transmission.

1,461,779. Holding Device; S. S. Matthes, Mansfield, Ohio. App. filed May 27, 1922. Clamping device for trolley wires.

1,461,780. Support for Electric Conductors; S. S. Matthes, Mansfield, Ohio. App. filed Nov. 23, 1922. Crossover for trolley wires.

1,461,781. Current Collector and Sleet Remover; S. S. Matthes, Mansfield, Ohio. App. filed March 26, 1923. For trolley poles.

1,461,783. Secret Communication System; R. D. Parker and B. P. Hamilton, Brooklyn, N. Y. App. filed Dec. 27, 1919. Constant frequency voltage impressed on voice frequencies.

1,461,790. Maximum Voltage Indicator; M. Sultzer, Brooklyn, N. Y. App. filed May 31, 1919. Apparatus to detect induced current in telephone line.

1,461,811 and 1,461,812. Conductor Support; A. C. Wood, Mansfield, Ohio. App. filed Dec. 30, 1922. Ear for clamping grooved wire to supporting insulator.

1,461,813. Safety Support for Current Collectors; A. C. Wood, Mansfield, Ohio. App. filed Jan. 27, 1923. Pole prevented from rising vertically when it leaves wire.

1,461,830. Electrical Indicating Device; R. S. O'Neil, London, England. App. filed March 1, 1920. Apparatus for signaling the position of ship's helm.

1,461,840. Apparatus for Humidifying Air; L. E. Vignon, Tarare, France. App. filed March 28, 1922. Humidifying air in weaving mills, etc., by means of electric heater.

1,461,852. Driving Arrangement for Ships; A. T. Kasley, Essington, Pa. App. filed March 29, 1921. Method of changing from Diesel to electric drive.

1,461,862 and 1,461,863. Manufacture of Electric Furnace Linings; W. R. Clark, Bridgeport, Conn. App. filed Aug. 6, 1917. For induction furnace.

1,461,875. Thermostatic Control; J. E. Harvey, Milton, Mass. App. filed May 23, 1921. For electric iron.

1,461,921. Electric Gas Lamp; A. Lederer, Vienna, Austria. App. filed May 16, 1914. Electrode of an alkali metal potassium.

1,461,939. Wire Cart; E. R. Sager, United States Army. App. filed Sept. 4, 1920. For stringing telephone lines at battle front.

1,461,980. Automatic Telephone System; M. L. Nelson, Chicago, Ill. App. filed June 30, 1919. For party lines in rural districts.

1,461,988. Pantograph; R. B. Spikes, San Francisco, Cal. App. filed Nov. 27, 1922. Method of controlling pressure between pantograph and wire.

1,461,996. Electric Starter; C. C. Andersen, Salt Lake City, Utah. App. filed May 3, 1922. For automobiles.

1,462,012. Radiator Thermostat; A. I. Kaplon, Brunswick, Md. App. filed July 2, 1920. Light on radiator cap in conjunction with motormeter indicates when engine temperature is too high.

1,462,026. Protective Device; W. T. Booth, East Orange, N. J. App. filed Nov. 3, 1917. Fuse and lightning arrester combined into one unit for Forest Reserve telephone lines.

1,462,031. Neutral Position Safety Control; W. E. Day, San Francisco, Cal. App. filed June 30, 1919. For elevators mechanically operated.

1,462,032. Machine and Method for Winding Electrical Coils; H. C. Egerton, Passaic, N. J. App. filed Dec. 29, 1920.

1,462,035. Treatment of Magnetic Material; W. Fondiller, New York, N. Y. App. filed Aug. 10, 1920. Securing uniformity in the permeability to signaling currents of magnetic materials.

1,462,038. Modulating System; R. V. L. Hartley, South Orange, N. J. App. filed Dec. 30, 1916. For transmitting pure modulated wave.

1,462,047. Crossbar Line Switch; J. N. Reynolds, Greenwich, Conn. App. filed Oct. 14, 1920. Selector panel for automatic telephone system.

1,462,052. Process for Obtaining Nitric Acid by Means of the Electric Arc in a Closed Cycle; W. Siebert, Laufenburg, Switzerland. App. filed May 13, 1922.

1,462,053. Electrical Testing System; H. M. Stoller, New York, N. Y. App. filed Nov. 13, 1920. Locating faults in telephone lines.

1,462,057. Switching Mechanism for Vacuum Tubes and the Like; P. I. Wold, East Orange, N. J. App. filed Sept. 27, 1920. Automatic substitution of new tube into circuit when old tube has deteriorated a certain amount.

1,462,085. Non-Interference Signal Device; L. Degen, Berkeley, Cal. App. filed Aug. 23, 1920. Sending two or more fire alarms over same wires.

1,462,111. Magnetic Separator; A. F. Jobke, Pittsburgh, Pa. App. filed April 24, 1918.

1,462,124. Cut-Out Box; A. L. Pierce, Wallington, Conn. App. filed April 16, 1920.

1,462,129. Electromagnet; E. B. Thurston, Toledo, Ohio. App. filed Sept. 30, 1921. Electromagnetic brake.

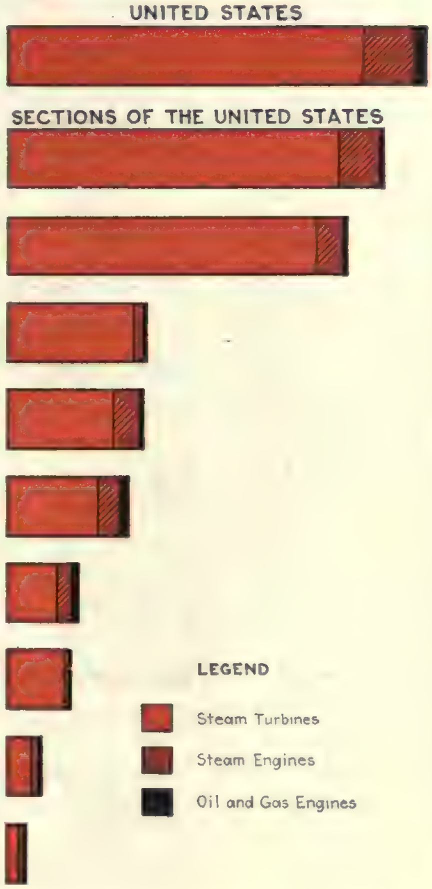
Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

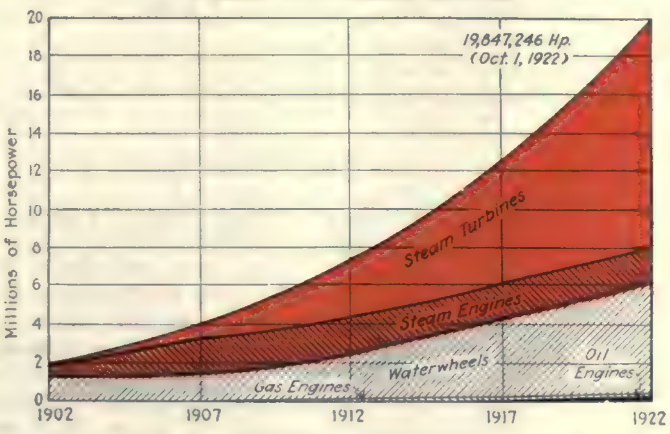
The Steam Turbine Predominates as a Prime Mover in Fuel-Electric Central Generating Plants

(Data as of Oct. 1, 1922)

UNITED STATES 13,702,719 Hp.	Steam Turbines	11,710,615 Hp.
	Steam Engines	1,758,025 Hp.
	Gas Engines	92,902 Hp.
	Oil Engines	141,177 Hp.
EAST NORTH CENTRAL 3,973,417 Hp.	Steam Turbines	3,507,745 Hp.
	Steam Engines	439,564 Hp.
	Gas Engines	13,380 Hp.
	Oil Engines	12,728 Hp.
MIDDLE ATLANTIC 3,575,960 Hp.	Steam Turbines	3,250,020 Hp.
	Steam Engines	307,151 Hp.
	Gas Engines	15,205 Hp.
	Oil Engines	3,584 Hp.
NEW ENGLAND 1,454,024 Hp.	Steam Turbines	1,334,144 Hp.
	Steam Engines	116,682 Hp.
	Gas Engines	1,185 Hp.
	Oil Engines	2,014 Hp.
SOUTH ATLANTIC 1,428,018 Hp.	Steam Turbines	1,130,548 Hp.
	Steam Engines	275,166 Hp.
	Gas Engines	16,232 Hp.
	Oil Engines	6,072 Hp.
WEST NORTH CENTRAL 1,288,970 Hp.	Steam Turbines	966,852 Hp.
	Steam Engines	244,397 Hp.
	Gas Engines	27,410 Hp.
	Oil Engines	50,311 Hp.
WEST SOUTH CENTRAL 749,877 Hp.	Steam Turbines	513,343 Hp.
	Steam Engines	172,212 Hp.
	Gas Engines	15,659 Hp.
	Oil Engines	48,663 Hp.
PACIFIC 676,804 Hp.	Steam Turbines	613,203 Hp.
	Steam Engines	59,014 Hp.
	Gas Engines	1,322 Hp.
	Oil Engines	3,265 Hp.
EAST SOUTH CENTRAL 346,356 Hp.	Steam Turbines	354,824 Hp.
	Steam Engines	85,868 Hp.
	Gas Engines	660 Hp.
	Oil Engines	5,004 Hp.
MOUNTAIN 209,292 Hp.	Steam Turbines	139,936 Hp.
	Steam Engines	57,971 Hp.
	Gas Engines	1,849 Hp.
	Oil Engines	9,536 Hp.



About 68 Per Cent of the Prime Movers in Central Generating Plants are Steam Driven



The Steam Turbine—a Symbol of Progress

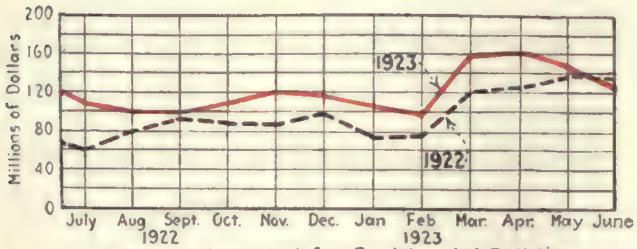
"Is man a child of hope? Do generations press on generations, without progress made?"

ONE of the outstanding characteristics of American industrial activity is the unremitting search for better ways of doing things that have been done well, or for applications of forces which can accomplish greater things than in the past. The question of increased efficiency is applied both to the personnel and to the adaptation of natural forces to the work to be done. Methods of operation which in themselves display a high degree of efficiency must give way before new and better ways of accomplishing the desired results.

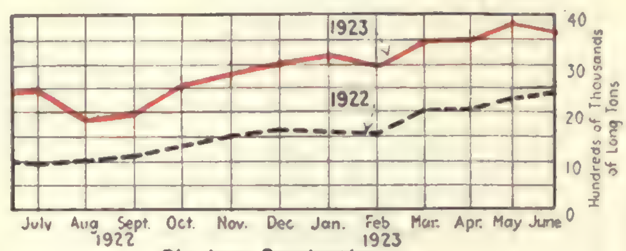
In the rapid ascendency of the steam turbine in central-station generating plants is to be found a clean-cut example of a more efficient method of applying the same force of nature to turn the same or greater "wheels of industry." Trends in power plant engineering practice are marked by distinct and almost abrupt changes. About twenty years ago reciprocating steam-engine-driven units had reached their practicable limit, 7,500 kw. Up to that time few if any turbines of ratings greater than 500 kw. had been designed. So long as ratings remained comparatively small and steam pressures and temperatures reasonably low, if there was any choice in prime movers it was probably in favor of the steam engine. As soon as sizes went above 5,000 kw. the turbine began to have decided advantages. The practical limitation placed on the steam-engine size caused a reaching out for some means of overcoming this barrier, and in 1902 the epoch-making turbine of 2,000 kw. rating was installed at Hartford, Conn. Since that time the use of the steam turbine in central-station generating plants has been rapid, until on Oct. 1, 1922, the steam turbines installed totaled 8,782,961 kw., as against 1,758,025 hp. for steam engines. During the past five years the steam turbine rating has increased 74 per cent, whereas the rating of installed steam engines has increased only 3.3 per cent.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those using these statistics would credit the ELECTRICAL WORLD.

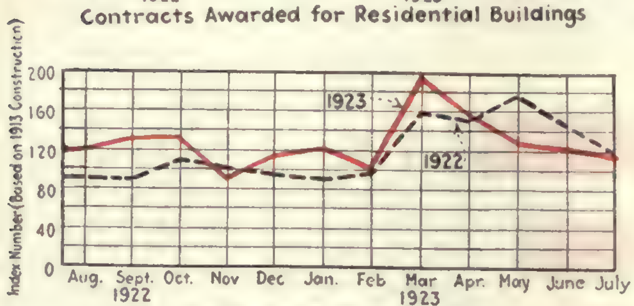
How the Primary Industries Are Trending



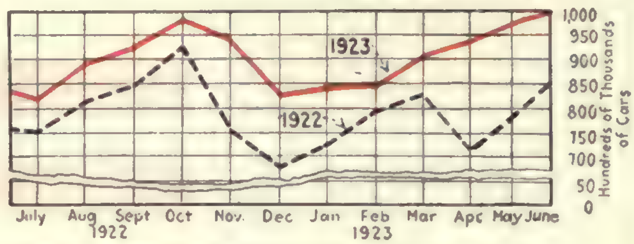
Contracts Awarded for Residential Buildings



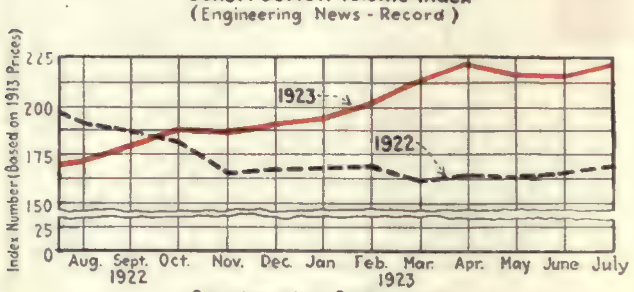
Pig-Iron Production



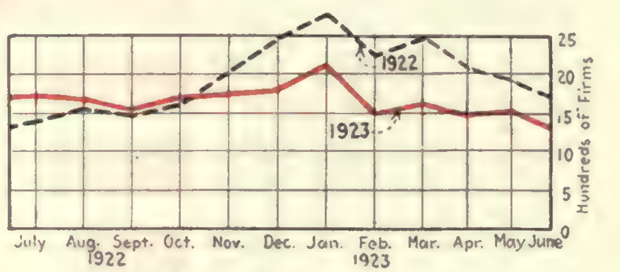
Construction Volume Index
(Engineering News-Record)



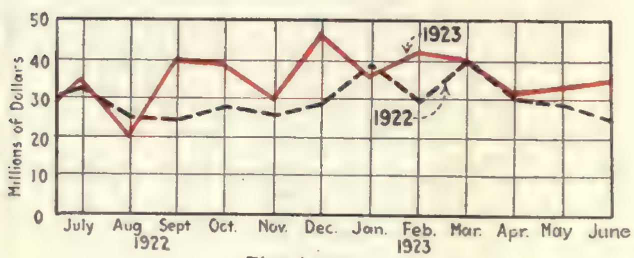
Total Average Weekly Freight-Car Loadings



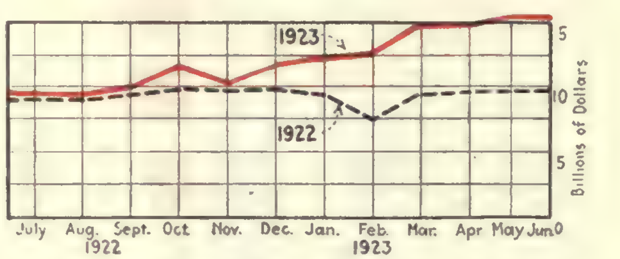
Construction Cost Index
(Engineering News-Record)



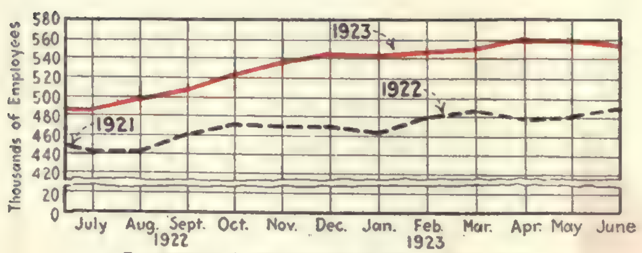
Business Failures



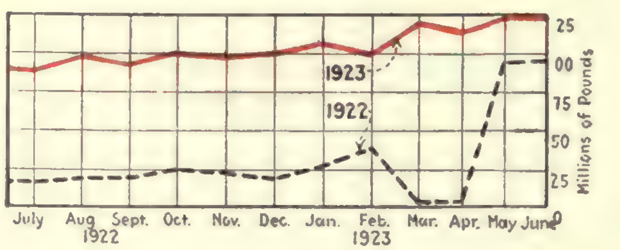
Fire Losses



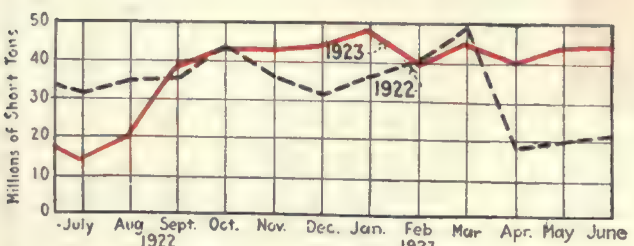
Bank Clearings
(Outside of New York City)



Employees in Factories of New York State



Copper Production



Bituminous Coal Production

Summer Business Bright

PRODUCTION has been well above normal since last November, and after seven months of continual and unusual activity only a few plants have shut down for a brief period, or have slowed up operations in order that they may make necessary repairs, take account of stock and permit employees to have a short vacation. This can be reasonably termed a seasonal movement.

Electrical World

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W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

Volume 82 — New York, Saturday, August 11, 1923 — *Number* 6

Warren G. Harding

A WAVE of sadness has swept over the nation on account of the death of President Harding. We mourn his loss as an executive and as a man and confidently await the verdict of history on his presidential achievements. The great harmonizer came into office in troubled times, when men and nations were bitter and despondent and rent with contending interests. President Harding courageously fought to bring worldwide harmony and friendship out of this chaos. In domestic affairs he created a new common-sense business and professional atmosphere in national administration practices which has already made possible real accomplishment in stabilizing a nation badly shaken by internal and external dissension.

Kindly, courteously and calmly he gave his ear, his thought and his time to all who sought his counsel, and he sacrificed his life in service to his country and in an attempt to bring relief and succor to a sorely disorganized world.

Not a genius, not an outstanding warrior or statesman, conservative and sane rather than spectacular, he represented the best type of American—the type that serves for the good of the nation with modesty, industry, kindliness and a recognition of the value of human relations.

The electrical industry joins the nation in its tribute to the departed who served so wisely, so sincerely and so well.

Sydney Richard Inch

An exceptionally capable central-station executive and a well-trained engineer who has grown up with hydro-electric development in the West.

SYDNEY R. INCH, vice-president and general manager of the Utah Power & Light Company, is a well-trained engineer, a hard worker of great aggressiveness, and possesses a remarkable ability, founded on natural executive capacity plus engineering training, to grasp quickly any situation that may arise.

Mr. Inch was born in Taunton, England, in 1879, where he received his general education, after which he went to London for his technical training at Finsbury Technical College. Before coming to the United States in 1900, at the age of twenty-two, he had gained practical experience in English central-station work at Taunton and in the manufacture of storage batteries with the Lithonode Electric Storage Company of London. Upon his arrival in America he was employed by the Montana Power Transmission Company, one of the predecessors of the present Montana Power Company, and became an operator at the first hydro-electric power plant furnishing power to Butte, Mont. In this way Mr. Inch became identified with one of the earliest hydro-electric power developments in the Intermountain region. After working his way up through various positions with the Montana Power Transmission Company and the Butte Electric & Power Company, another predecessor of the Montana Power Company, he went to Missoula, Mont., where he became the manager of a group of public utilities owned by the late Senator W. A. Clark.

In 1912 Mr. Inch became general superintendent of the Utah Power & Light Company, with headquarters in Salt Lake City. In 1915 he was made operating manager of the company and in 1918 became its vice-president and general manager. He is also vice-president of the Utah Light & Traction Company and the Western Colorado Power & Light Company, both of which are subsidiaries of the Utah Power & Light Company. The former company operates the street-railway system in Salt Lake City, and the latter furnishes light and power service to a considerable portion of southwestern Colorado. These allied companies form one of the largest public utility systems in the West. Under the able management of Mr. Inch they have been a constructive force in the upbuilding of the Intermountain territory in which they operate.

Editorial Comment

Electrical World, August 11, 1923

Volume 82

Number 6

Vice-President in Charge of Sales and Public Relations

TO VITALIZE the sales efforts of a central-station company, to give impetus to public relations work and to tie these two things together in a manner at once effective and sufficiently dignified to insure respect from the public is a move as important as any that the company can make. In these columns a few weeks ago it was suggested that a "vice-president in charge of sales"—to include also public relations work—is one effective way to indicate publicly, as well as within the company, that these activities are, as they deserve to be, on an equal plane with engineering and finance.

Comments received from many central-station executives on this expression of opinion give evidence that there is wide approval of the idea, though only in scattered places has it been put into practice. But elsewhere in this issue the Pacific Gas & Electric Company's plan of organization of such a combined department headed by a vice-president is related. Two vice-presidents have headed the sales and public relations departments—there has been sufficient dignity for them, it seems. But, following the death of one of the industry's grand old men—John A. Britton—one of these vice-presidents, F. A. Leach, was made general manager, succeeding Mr. Britton. The company then made an excellent move—recognizing the growing interdependence of commercial activity and public relations work—by combining the two departments under one vice-president, R. E. Fisher, "in charge of sales and public relations." Mr. Fisher's plan of organization will surely be of interest to all central-station executives. Naturally, any plan is good only so far as it provides a program for men to follow. On the other hand, men trying to work without a plan are likely to end nowhere. The accomplishments of the newly created combined department will be watched with interest.

Adequate Meter Testing Essential, but Not Necessarily Expensive

NO REASONABLE operating company would expect meters to be shipped thousands of miles, handled four or five times, and yet be accurate on either a 25-watt or a 1,000-watt load, and run on as little power as is used by a flashlight. It would seem, however, that some operating companies are not reasonable, judging from the number that install meters without a pre-service test after receiving them from the manufacturer. Of course, small plants cannot keep a man busy testing meters, but every plant can have a carefully handled test meter and can afford the time necessary to check and inspect each meter in the shop or soon after is is installed and to give periodical tests thereafter. The right way is to put meter work in the hands of a man with technical knowledge, but in small stations where this may now be impossible a meterman can at least follow the instructions issued by manufacturers. It is possible to train any one who is willing to study a little to become a good routine meter test man. With a knowledge of meter testing and meter connections as a basis, a young man who wants to learn will find many interesting problems which will gradually lead him on to further study of electrical engineering.

It cannot be too often repeated that the meter department should have proper facilities for doing its work. Too many metermen have only a bench in some dark corner of the plant, where all kinds of junk accumulate. The surroundings always have an influence on the kind of work a man does, and a wise company will locate and equip its meter department with this in view.

Relative Merits of Different-Type Waterwheels

ONE of the notable advances of the past decade has been the evolution of the hydraulic turbine to a point which not many years ago seemed a sheer impossibility. From time to time there have been gains in efficiency and particularly the attainment of high capacity and speed of rotation without sacrificing other qualities. For some time there has been a notable drift of practice toward the use of reaction turbines at very high heads in lieu of the ordinary impulse wheel, which with all its virtues of simplicity and endurance has never reached the pitch of efficiency touched by the turbine. More recently installations have been made of combined impulse reaction turbines which open another epoch in hydro-electric power development.

With three types of waterwheels now available for use instead of only the two which formerly divided the field of application rather definitely and without question, the situation as to where each type is most effective and desirable becomes more confusing. No longer is there a definite line of demarcation between the respective fields, but each type is to a considerable extent invading the field of the adjacent one. A decision on a type for a given installation is not so easy, and it appears that it would facilitate the proper application of the various types of waterwheels if manufacturers would unite in compiling data that will give prospective users a yardstick for comparison. In addition the prospective user wants to know how the different types of units stand up in service. This information can be obtained if there is a free, frank exchange of experience on how well efficiency is maintained over a period of time, how subject each type of wheel is to erosion, how accessible the parts are to repair, and so forth.

To be more specific, the following information should be tabulated: Permissible ranges of speed for different types of waterwheels at different heads and ratings, the probable efficiencies under these conditions at half, three-quarter and full rating and 25 per cent overload;

relative cost of wheels for different conditions, amount of auxiliary equipment required for each type, comparative foundation costs for each type, relative size of wheels of each type for different conditions, relative maintenance expenses for each type, ease of inspection, and simplicity of construction and control. These are merely suggestions. Perhaps other factors are more important in a relative comparison, but information on only the subjects named would be more helpful than the meager data now available.

Pole Specifications Will Be Governed by the Available Supply of Poles

JUST what the available pole supplies are and how they can be used to the best advantage are questions to which the American Engineering Standards Committee cannot fail to give a great deal of attention in its forthcoming work on wooden-pole specifications. In working out these specifications it must be remembered that the committee is dealing with a product manufactured by nature. It is therefore specifying the best use of what is available and not the quality of a product subject to control in manufacturing processes.

Three principal woods are commonly considered for use. The chestnut is the best known in the Eastern market, where it is most largely produced. The chestnut blight, which has created so much havoc in the last eight or ten years, is commonly supposed to mean an early end to the supply. Actually there is a considerable quantity of chestnut poles dribbling into the market, which raises a question whether the supply is as nearly exhausted as has been thought. The next source is the Northern and Western cedar. It is commonly thought to be the largest available supply in the country, though Northern white cedar in the longer lengths is hard to get. The third supply is the treated Southern yellow pine. Among the woods used locally in various parts of the country because they are handy and cheap are the fir and tamarack of the Pacific Northwest, the juniper, and to some extent the cypress of the South. These four varieties, like the Southern yellow pine, are all short-lived when untreated, and there are few data available to show just what effect on their usefulness treatment might have.

The available supplies of all kinds of woods which can be used ought to be the first matter investigated as it will be impossible for the sectional committee to handle the specification problem intelligently until the real supply is known. As an example of what must be considered, the practice in producing Western cedar poles seems to be that of cleaning up each timber tract as the production crews reach the tracts. The wood is a slow grower and will not replace itself in a reasonable length of time. The method of production yields a large number of short poles that can be sold only to small telephone companies or worked into fence posts or possibly pulp wood. This supply introduces a real production and cost problem into the cedar-pole industry. The Southern yellow pine—or, rather, the various woods so classed—is a rapid grower. Some producers of these poles say that they can go to a tract, take what they want and in a few years repeat the process. Such a situation may have a decided bearing on specifications that the Standards Committee will ultimately recommend, and the facts on available supply and reproduction possibilities on all kinds of usable timber ought all to be in hand before the committee work proceeds too far. Undoubtedly most of the data are available from timber resource reports and need only to be put together in usable form.

Electric Melting of Brass Deserves Wider Adoption

UNDER the stimulus exerted by the Great War, the electric melting of brass, both in large and in small quantities, has been brought to a high degree of efficiency. Yet thousands of small fuel-heated brass foundries are still operating throughout this country. To convert them to modern methods will necessitate much missionary and educational work on the part of power-sales solicitors, but the results will be well worth the effort.

The advantages of electric melting of brass, as outlined in a recently issued statement by the United States Bureau of Mines, should be of considerable assistance to the advocates of "doing it electrically"—this statement coming as it does from a competent and impartial organization.

With proper safeguards, no hesitancy need be felt regarding the desirability of the load; moreover, it is not objectionable from the point of view of other consumers of electrical energy.

A Story of Local Trade Relations

HERE is an incident that points the finger at a situation that demands and certainly deserves some serious thought on the part of central-station chief executives:

One of the editors of the ELECTRICAL WORLD not long ago talked for an hour or so one afternoon with a prominent electrical contractor in a Middle Western city. This young man had inherited a business—a struggling, debt-weighted contracting business which included a fixture department and an appliance store —and without experience and against heavy handicaps had built it up in a short time into a prosperous enterprise.

In doing this he naturally established himself in a position of some prominence in the electrical circles of his city. He had became one of the three largest contractors in town. He was doing a large fixture business. But his appliance store had not kept pace. "The central station," he said, "is selling on such terms that it amounts to unfair competition and there is no use trying to push appliances on such a basis."

"How long since you have talked to the general manager of the lighting company about this?" he was asked.

"Why, I have never talked to him about it," was the answer.

"Well, how long since you have seen him?"

"As a matter of fact I have never met him."

The situation was sufficiently interesting to follow up. The editor dropped in upon the G. M. of the power company, the local chief executive, whom he had long known. "How much do you know about this fellow Blank, the contractor?" he asked.

"Well, really," said the G. M., "I don't know very much about him at all. I understand he does good work and is making money."

He listened to the story of what this local man had achieved. He was intensely interested—enthusiastic.

"By George," he said, "I'll go and see that fellow. He's done a great job."

"How long since you've been in his store?" came the question.

"Well, do you know," he said, "I'm ashamed to say it. but I never have been in it."

And when he heard why this contractor had been afraid to expand his appliance department he was surprised. "Why, I'll go around to see him right away," he said, "and straighten all that out. I'll carry his easy-payment account for him if he wants me to."

The time this contractor needed the guidance and backing of the central station most was in the early period of struggle. He might have gone to the G. M. and told him so. But a man hates to call for help. If the utility man had felt his full responsibility, however, he himself would have called upon the other in the beginning, offered to help, learned his problem, stiffened his back with a show of friendly interest, and the appliance store would have grown and prospered also, to the material benefit of the utility.

This general manager is an enlightened executive, interested and successful in public relations. But he had overlooked the fact that the local electrical trade relations are one of the prime influences in building popularity and good will. Friendly, prosperous contractors are an invaluable asset to the utility.

Worth-While Methods in Transmission-Line Design

OBSERVATIONS over a large part of the country indicate that rule-of-thumb methods in transmission-line design are more widely used than engineering knowledge of the subject justifies. While careful attention has come to be given to the determination of sizes of conductors and to the design of steel towers, the location of structures is still very largely a matter of guesswork even on lines with steel supports. And yet, on this one operation more than on any other perhaps depend the stability of a line, its operating life and its maintenance expense. By careful attention to location it is possible to avoid or at least mitigate the unbalanced strains that lower stability, decrease life and increase maintenance cost.

Elsewhere in this issue is outlined a happy compromise between rule-of-thumb and academic methods that was followed by the Kansas Gas & Electric Company in the construction of a 132-kv. double-circuit steel-tower line. The template method which was used in structure location is not new, but comparatively few engineers seem to be familiar with it. Intelligently used, it means that the structures can be placed where there will be a minimum strain upon them. The use of the cold template insures against "uplift" on structures in cold weather due to locations too low or improperly selected. The most important requirement in using the hot and cold templates is an accurately determined profile.

The attention given angles on the Kansas line calls attention to another element in transmission-line design that too often receives insufficient consideration. Angles cannot be totally eliminated, but they can be reduced in value and the unbalanced strains incident to angle construction lessened. This reduction can be made to mean longer structure life and smaller maintenance costs. It means also that less expensive structures can be used at angle points. In steel-tower construction this has a big significance in dollars and cents.

Although the Kansas story is based on steel-tower lines, the design methods used are equally applicable to wooden-pole construction and will yield the same advantages there in cost, life and line maintenance expense.

Cable Charge and Discharge

PROBLEMS of insulation are very much to the fore these days. More than ever it is being realized that insulation is the limiting element in all high-voltage equipment, and that in spite of years of experiment and development and of new and improved insulating materials, little is known as to the laws governing the performance of these materials.

Within the last year or two several notable contributions to our knowledge of the nature of dielectric breakdown have appeared. The National Research Council is actively supporting a committee on insulation, recently described in these columns, and the program of the recent annual convention of the A. I. E. E. contained several notable papers in this field. Of these, that by Dr. Steinmetz on cable charge and discharge deals with the subject of dielectric absorption, one of the most obscure, least known, and perhaps the most important of all insulation phenomena, certainly as regards high-voltage cables and machinery. It causes the time lag in the soaking in of charge under continuous voltage.

The initial values of absorption current are very large, and these large values persist over intervals of time quite large compared with the period of a commercial alternating cycle. Consequently Dr. Steinmetz's conclusion that the power component of the charging current of a cable under alternating voltage is equal to the initial value of the absorption current makes a direct appeal to common sense. This paper is an excellent example of its author's remarkable facility in presenting obscure electrical phenomena in terms of quantities and method of analysis which may be readily understood by the engineer. Starting with the assumption that a dielectric is made up of a very high resistance in series with a capacity, an assumption which has often been made, the analytical development is carried much further and reaches the conclusion that the charge and discharge curves have one principal exponential term, accompanied by one or more additional terms of relatively much smaller magnitudes.

The conclusions coincide admirably with observations on cables in operation. Dr. Steinmetz's analysis will go far toward helping the active engineer to form a mental picture, in terms of every-day quantities, of what is going on in a dielectric. It must be remembered, however, that these every-day quantities are not actually present in dielectrics, and the picture that he draws will scarcely be sufficient to guide us in our efforts to improve and control insulation through a better knowledge of its nature. This can only come by separate study of the various components entering commercial insulation and of their behavior in combination, with the aid of the rapidly expanding field of electrophysics and the light that it is throwing on the structure of the atom and the nature of electric conduction and dielectric displacement.

From Addresses by

Calvin Coolidge

INDUSTRY, thrift, character are not conferred by act or resolve. Government cannot relieve from toil. It can provide no substitute for the rewards of service.

* *

Ultimately, property rights and personal rights are the same thing.

* *

We have reached the age of invention, of commerce, of great industrial enterprise. It is often referred to as selfish and materialistic. Our economic system has been attacked from above and from below. But the short answer lies in the teachings of history. The hope of a Watt or an Edison lay in the men who chipped flint to perfection. . . . The hope of tomorrow lies in the development of the instruments of today. The prospect of advance lies in maintaining those conditions which have stimulated invention and industry and commerce. The only road to a more progressive age lies in perfecting the instrumentalities of this age.

* *

Where commerce has flourished there civilization has increased. It is only when the exchange of products begins that development follows.

* *

It is only a figure of poetry that "wealth accumulates and men decay." Where wealth has accumulated, there the arts and sciences have flourished, there education has been diffused, and of contemplation liberty has been born.

* *

Let us dismiss the general indictment that has all too long hung over business enterprise. While we continue to condemn, unsparingly, selfishness and greed and all trafficking in the natural rights of man, let us not forget to respect thrift and industry and enterprise. Let us look to the service rather than to the reward. Then shall we see in our industrial army, from the most exalted captain to the humblest soldier in the ranks, a purpose worthy to minister to the highest needs of man and to fulfill the hope of a fairer day.

* *

We have had many attempts at regulation of industrial activity by law. Some of it has proceeded on the theory that if those who enjoyed material prosperity used it for wrong purposes, such prosperity should be limited or abolished. That is as sound as it would be to abolish writing to prevent forgery.

* *

There is just one condition on which men can secure employment and a living, nourishing, profitable wage for whatever they contribute to the enterprise, be it labor or capital, and that condition is that someone make a profit by it. That is the sound basis for the distribution of wealth and the only one. It cannot be done by law, it cannot be done by public ownership, it cannot be done by socialism. When you deny the right to a profit you deny the right of a reward to thrift and industry.

* *

The discontent in modern industry is the result of a too narrow outlook. A more liberal culture will reveal the importance and nobility of the work of the world, whether in war or peace.

* *

Taxes must be measured by the ability to meet them out of surplus income. Industry must expand or fail. It must show a surplus after all payments of wages, taxes and returns to investors. Conscription can call once, then all is over.

* *

. . . The day when it is the duty of all Americans to work will remain forever. . . . It is not money that the nation or the world needs today, but the products of labor.

Design Methods Used in Building a Kansas Transmission System

Plan Followed in Erection of Towers on 132-Kv. Line of the Kansas Gas & Electric Company—Description of Types of Towers Used—Design of Angle Construction

TO GET away from the use of small generating stations and obtain the best results in the operation of its property, the Kansas Gas & Electric Company has constructed a steel-tower transmission line connecting the two portions of its system. It runs between the Midian substation just east of El Dorado in the westerly group to a point near Neosha in the easterly group, where a new steam-electric generating plant is being constructed. This will give the system two large and efficient steam plants, the other being the one at Wichita now in operation. The groups are interconnected with transmission lines, largely of 60-kv. rating, though some lower voltages are still in use.

Some of the design and construction methods used in the installation of this steel-tower line, which will operate at 132 kv., 60-cycle, three-phase, will be described in this article.

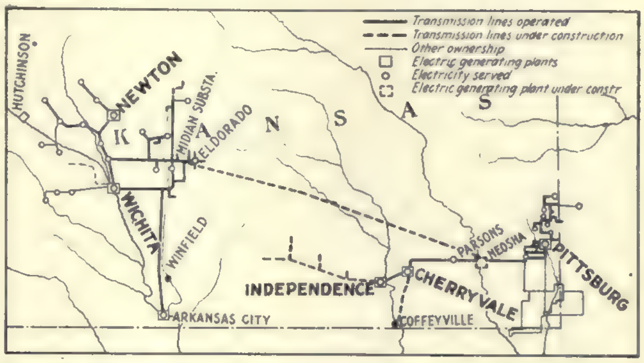


FIG. 1—TWO PORTIONS OF KANSAS GAS & ELECTRIC COMPANY'S SYSTEM TIED TOGETHER BY 132,000-VOLT LINE

Considerations Involved in Design

The first consideration in the design of this line was to ascertain the shortest feasible route. Every mile of line that can be eliminated means so much less labor and material in original construction and a proportionately less expense in maintenance, operation and line losses. The preliminary location was picked by airplane, the reconnaissance being carried out in one day by E. C. Curtis, the chief engineer for the company. It was found

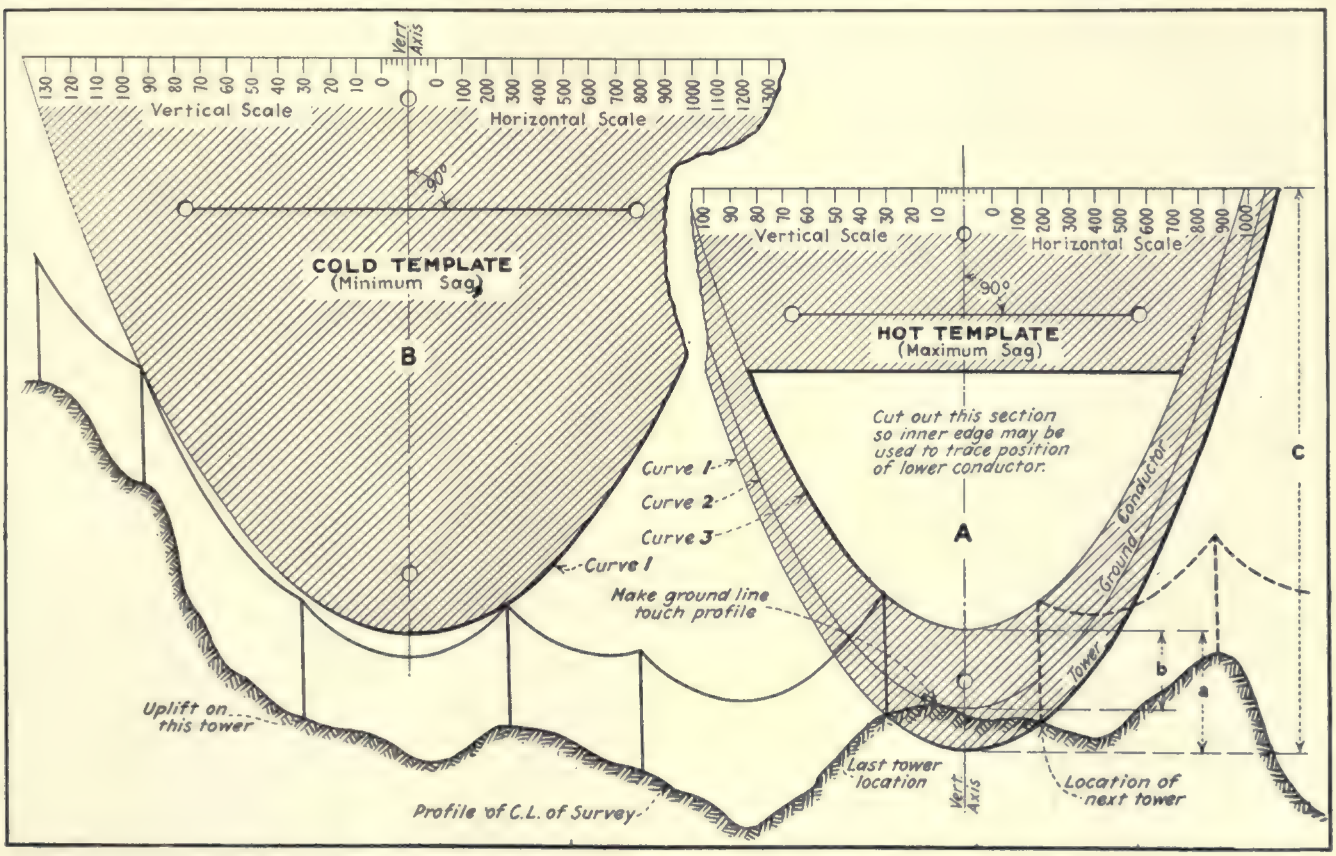


FIG. 2—HOT AND COLD SAG TEMPLATES AND METHOD OF USING

Dimension *a* is the height above ground of the point of conductor support. Dimension *b* is the minimum clearance of the lowest line conductor from the surface of the ground. Dimension *c* can be made to suit the user. Both templates are made of clear, double-thick celluloid. The "hot" template is used to locate the structures on the profile drawing. The "cold" template is used to check the location of structures under low-temperature condition This method of using them is indicated.

that flying at a height of approximately 1,000 ft. would allow the observer to gain a clear idea of the country, which is generally flat, for a distance of approximately 2½ miles on either side of the line of flight, or a strip 5 miles wide. With maps of the territory available and arranged for quick taking of notes, a strip of 5 miles was reconnoitered on the trip from the flying field at Wichita to the eastern end of the line and another strip of 5 miles on the return trip. This was done in one day. If the reconnaissance had been carried out in the ordinary way, at least ten days to two weeks would have been required to accomplish the same results. It was possible for the observer to make sufficient notes on the character of the country to allow the selection of an approximate route so that surveys could be arranged for. The line was finally located as shown in Fig. 1. While it is impossible on so small a map to show the angles in 110 miles of line, the illustration gives a fair idea of the location, the angles being slight and the whole line being as straight as possible. The greatest angle is less than 20 deg.

The second consideration was the location of structures so that they would be subjected to the least possible strain under the climatic conditions that they must withstand. To this end the elimination of angles was sought so far as it was practicable. Where it was impossible to eliminate an angle steps were taken to reduce it to a minimum. Careful attention was given to the location of towers to avoid unbalanced strains or to reduce them, where they could not be eliminated, to the least possible amount of unbalance. The method employed in the location of these structures was as follows:

A survey was made which included a transit line, a level line and the side slopes on the upper side of the line at points where the slope was sufficient to cut down the ground clearance of the outside conductors to too low a value. This survey also included all the property lines of land crossed, ties to bench marks and obstructions such as existing utility lines, railways, buildings and other things that must be considered in laying out and securing the right-of-way for the line.

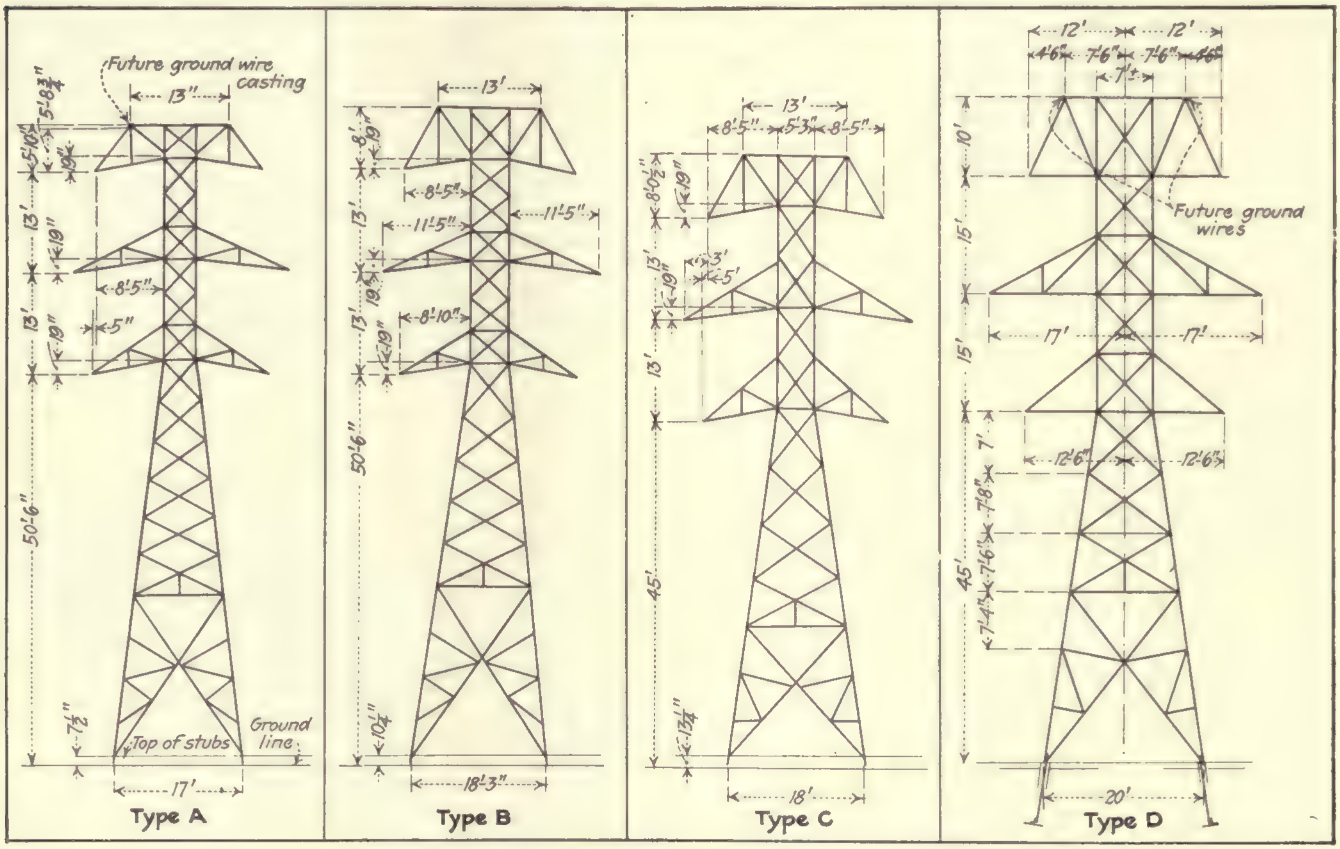


FIG. 3—FOUR TYPES OF TOWERS AND PRINCIPAL DIMENSIONS

Type A is used for tangent construction only. A normal span of 850 ft. is employed on this line. The assumed conditions of loading for design purposes include a range of temperature from 20 deg. below zero to 120 deg. above zero. F. and an ice load of ½ in. with 8 lb. wind pressure. The type A tower specifications call for test loads as follows: A horizontal, longitudinal or transverse pull of 15,000 lb. applied at the elevation of the middle cross-arm; two horizontal longitudinal pulls of 4,000 lb. each applied simultaneously and in either direction at any two insulator supports, or one pull of 6,000 lb. applied at either ground cable support, or one pull of 4,500 lb. applied at any one cross-arm; three vertical loads applied simultaneously, two of 3,500 lb. at each of any two insulator supports, and one of 4,500 lb. at either ground-wire cable support.

Type B tower is used on small angles, the maximum being 8 deg. and for a maximum span of 1,400 ft. where longer than normal line spans are used. The test loads on this tower are: A horizontal, longitudinal or transverse pull of 30,000 lb. applied at the elevation of the middle cross-arm; three horizontal, longitudinal pulls of 5,100 lb. each applied simultaneously and in either direction at any three insulator supports, or two pulls of 7,300 lb. applied at the ground wire supports, or one pull of 7,500 lb. applied at any one cross-arm; four vertical loads applied simultaneously, three of 7,000 lb. at each of any three insulator supports and one of 7,000 lb. applied at either ground wire-cable support.

When the transposition cross-arm is used on this tower in place of the standard middle cross-arm the horizontal pulls must be reduced to 3,000 lb. and the vertical loads to 4,500 lb.

Type C tower is used for intermediate angles not over 45 deg. The test loads consist of a horizontal longitudinal or transverse pull of 60,000 lb. at the elevation of the middle cross-arm, two horizontal pulls of 12,500 lb. each applied simultaneously and in either direction at any two insulator supports, or two similar pulls of 15,000 lb. each applied at the ground cable supports and three vertical loads applied simultaneously, of 15,000 lb. at each of any three insulator supports, and 15,000 lb. at either ground-wire support.

Type D tower is the heaviest and is used for dead-ends and would have been used for angles greater than 45 deg. had there been any. The test loads are: One horizontal, longitudinal or transverse pull of 110,000 lb. applied at the center of the gravity of the insulator supports; three horizontal, longitudinal pulls of 15,000 lb. each applied at any three insulator supports in either direction, or two similar loads of 15,000 lb. each applied at the ground-wire supports; eight vertical loads of 15,000 lb. each applied simultaneously at the six conductor and two ground-wire supports.

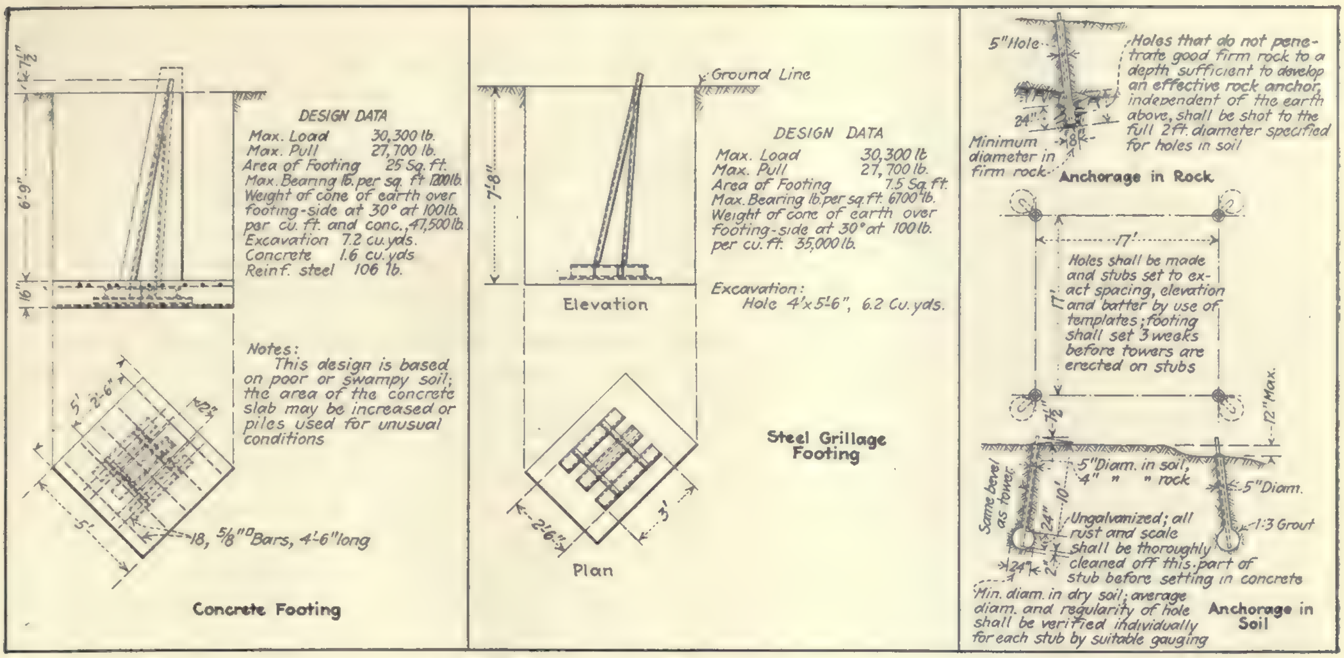


FIG. 4—GRILLAGE AND CONCRETE TOWER FOOTINGS AND METHODS OF ANCHORAGE
The footings are for Type A towers only. Those for other towers are heavier.

All these data were plotted to a horizontal scale of 400 ft. to the inch and a vertical scale of 40 ft. to the inch.

This arrangement of scales permitted reproducing nearly 2 miles of line on a sheet 20 in. x 26 in. in size, which is about as large as can be handled conveniently in construction work, either office or field. For the actual layout of tower locations a template* like that shown in Fig. 2 was used. Both hot and cold sag curves are illustrated with their method of use.

SAGS MUST BE CONSIDERED

In passing it should be noted that stadia methods of taking levels will not do in this class of work, particularly when changes in ground levels are pronounced. Structures are located with the template as shown. One pole on a side slope has been so located that under low-temperature conditions the sag of the conductor will naturally come above the top of the pole and serious uplift strains will be incurred. Two remedies are available, to move the structure until it meets the curve or to increase the height of the structure. Which method will be adopted in any case depends on the conditions to be met. In general it is desirable both from the standpoint of expense and good operation to avoid the use of higher structures. It is well to note that this method of locating transmission line structures is just as useful with wooden as with steel structures and that the same care in locating and protecting wooden structures from unnecessary strains is necessary.

Four types of towers are used on the line. The general design is shown in an accompanying illustration. All are designed to carry six 266,800-circ.-mil steel-core aluminum conductors having a maximum tension of 6,470 lb., and two $\frac{3}{8}$-in. stranded high-strength galvanized-steel ground conductors. The latter have not been installed, though provision is made for them if they are needed in the future.

*See article by J. S. Viche, ELECTRICAL WORLD, June 15, 1911, page 1556.

The unit stresses used in the design of the towers are: Tension, 30,000 lb. per square inch; compression, $30{,}000 - 100\,l/r$; bolt shear, 25,000 lb. per square inch; bearing, 50,000 lb. per square inch.

The type A and B towers support the upper end of the lower insulator strings at a height of 50 ft. 6 in. above the ground, while the type C and D towers support these insulators at 45 ft. above the ground line. The clearance of the conductors from the towers with an insulator string 5 ft. 6 in. in length and a conductor swing of 45 deg. is 4 ft. and at 60 deg. is not less than 3 ft. 6 in. The type of tower footings used on the majority of the towers is shown in one of the accompanying illustrations. Both concrete and grillage are provided for use as conditions make essential. Concrete footings were, of course, used on the heavily loaded type C and D towers in all places. Another type of footing, known as the Malone footing, was used on the east end of the line. This was described in the ELECTRICAL WORLD for March 3, 1923, page 524. One footing is shown which is formed by first boring a hole 4 in. or 5 in. in diameter to the required depth and then exploding a charge of dynamite at the bottom of the hole to form the chamber into which concrete is poured after the stub is set in place. The advantages of this form of anchorage are a reduction in cost and the small disturbance caused in the fields in which the towers are set. This is particularly important when fields are already planted or crops growing.

INSULATOR ASSEMBLIES

Four types of insulator assembly are used. The straight suspension string is of course most extensively employed. It has ten 10-in. disk units. The dead-end assembly is made up of two strings of eleven units in parallel to gain mechanical strength. The semi-tension assembly is used at crossings over railways and other points where dead-end insulators might otherwise be required. This assembly has all the advantage of a dead-end assembly, though it is subjected normally to the same strains as the suspension

assembly. When broken conductors or the release of strain on the conductors on one side of the assembly occurs, it will swing into a tension position and take tension strains until the line is restored to normal. Another type of assembly is used to replace the semi-tension insulator. It is a suspension assembly with two strings in parallel and equipped with dead-end clamps. The assembly normally hangs as a suspension assembly, but in case of accident to the line causing a broken conductor or the release of strain on one side, it swings to a tension position and becomes a tension insulator until the line is restored to normal. The advantage of this assembly over the semi-tension is ease of adjustment in tying in the conductors. The semi-tension assembly is difficult to adjust at this time, while the double suspension assembly may be tied in as easily as the ordinary suspension. The advantage of either of these assemblies over tension insulators is that they are not constantly under heavy strain. This is an advantage both in the maintenance of insulators and the line structures.

Angle Construction

Although angles are expensive and an undesirable form of construction, they cannot be avoided, and the best that can be done is to exercise extreme care in line location to make them as small as possible. When this has been done the selection of towers for such angles as remain must be made. In the case under notice the accompanying chart was used. It was made up to fit the conditions imposed by the use of the three aluminum conductors and two steel ground wires on this line. The upper part of the chart shows the data and method used in the checking of insulator swings on the angle towers. This detail is important as a lack of attention to it may result in too small a clearance from the supporting structure and subsequent operating troubles due to flashovers to the tower, or it may require the use of more expensive structures than should be necessary. With the ordinary attachment of the insulator to the structure there would be cases in which it would be necessary to adopt rather expensive measures to keep this clearance when other conditions require nothing in the way of structure adjustments. For this reason an extension bracket is used with the suspension assembly on the type B towers. This merely brings the insulator farther out from the tower, and as shown in the shaded area at the left side of the lower half of the chart an insulator swing of 8 deg. maximum on the type B tower can be used as against a maximum of about 1 deg. on the type A tower. The jumper ofttimes becomes a problem on some of the angles, and to keep it rigid and prevent swinging into the tower an angle iron jumper guide is employed where necessary.

The lower half of the chart shows the angle and span limit for each of the four types of towers. It will be noted that this is given in terms of average spans and horizontal angles. The meaning of the term "span" as used is shown at the upper right-hand corner.

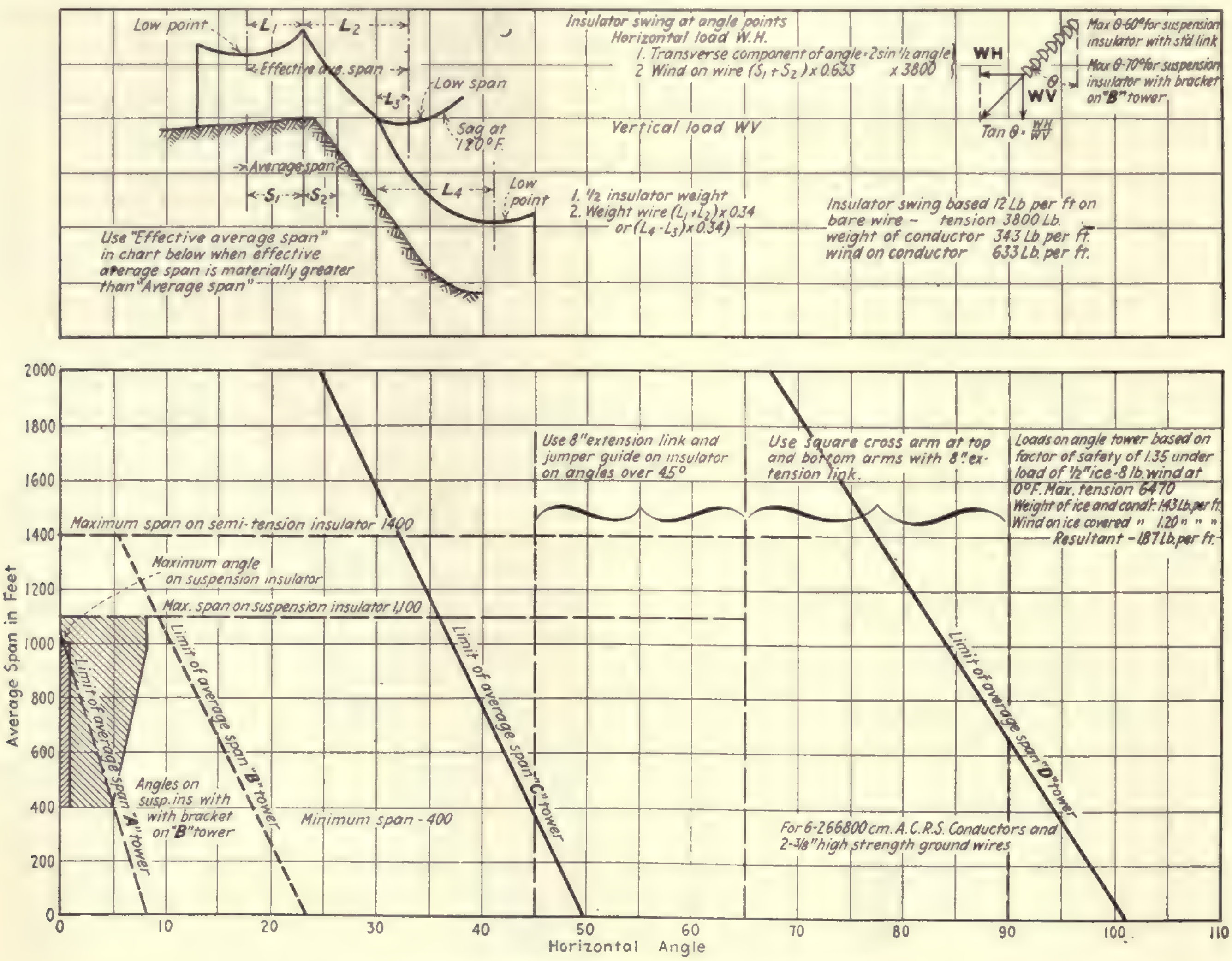


FIG. 5—CHART USED TO DETERMINE ANGLE CONSTRUCTION

President of A. I. E. E. Says Engineers Should

Make Facts Public

Engineers Should Shoulder Civic Responsibilities
Research Should Be Encouraged
Technical Standards Should Be Maintained

By **L. W. W. Morrow**
Associate Editor "Electrical World"

Harris J. Ryan
President A.I.E.E.

"ELECTRICAL methods are as necessary to our civilization as the nervous system is to the human body, and electrical engineers must shoulder greater and greater civic responsibilities for the benefit of the nation," said Harris J. Ryan, the new president of the American Institute of Electrical Engineers, in response to a query regarding the duty of engineers to participate more actively in national affairs. "The truth always overcomes the false, according to the records of history, and this is a significant and reassuring fact in my opinion, for it at last inexorably corrects the world's blunders and determines the world's ideals. But truth usually conquers only through fighting, and the engineers can expedite the victory because they are armed with the requisite skill and knowledge to deal with modern conditions.

"The truth about engineering matters affecting the national welfare must be disseminated to the public by engineers. There is a real obligation resting upon them to present engineering and economic facts, and they must abandon their inherent dislike of publicity and publicity methods. And as 'all generous minds have a horror of facts,' the engineers must learn how to express them in a style that will be welcomed by the public and will prevent the charlatans and opportunists leading the public astray.

"In my opinion, the proper organized outlet for this type of civic activity is through the Council of the Federated American Engineering Societies. It should speak for all engineers and must be single-tracked in its work to accomplish results, although composed of multiple-tracked elements consisting of the best and most experienced minds to be found in the profession of engineering."

In the words quoted President Ryan's vision and all-pervading humanity spoke clearly and convincingly sentiments and ideals that will find a ready response in the minds and hearts of his brother engineers. This humanitarian outlook is a measure of the man who will guide the Institute during the coming year. He is an indefatigable, creative and deep-thinking engineer possessing the true simplicity of strength and a deep and earnest element of sunshine and joyfulness. With sincerity shining in his countenance, he seems to be made for friendship, and his genial, open and sympathetic personality inspires admiration, love and respect.

"I have been informing myself about the activities of the Institute and am impressed and astonished by the great amount of good work it is doing and the many fields in which it is making its influence felt," continued Professor Ryan. "It is inspiring and stimulating to find this great body of more than 17,000 electrical men united in their efforts to advance the art and unanimous in their recognition of the value of scientific accomplishments. Only in our country can such a democratic organization exist with specialists, operating engineers, electrical business men and engineering students closely co-operating and working toward a common goal. It seems to me that American idealism is afforded an outlet through membership in this engineering organization which unselfishly labors to make engineering contributions for the benefit of mankind and recognizes and exalts technical proficiency. There is a feeling of personal pleasure and satisfaction derived from membership in a fellowship of this character which has such tremendous potentiality for beneficial accomplishments and expresses the standards and opinions of the profession.

The Engineers Should Serve

"And there seem to be many ways in which the engineers through the Institute can render service to each other and to the nation. The practical aspects of electrical engineering have reached a stage where they encroach upon the domain of research, and as a result it is encouraging and stimulating to find operating engineers vitally interested in the work of specialists and research workers because this condition makes for mutual understanding and rapid progress. Much can be done to interpret and apply the work of the specialists and research workers, because they usually talk in words and deal with mathematical tools difficult to comprehend by engineers having less mastery of technology. And every opportunity should be afforded the specialists for developing the art, and the encouragement of the rank and file of the members should stimulate them to renewed activity.

"In the field of education the Institute can be of service in maintaining technical standards. The de-

mand at present in the commercial world is for engineers to enter into business and executive positions, and this has been influential in decreasing the technical courses and increasing the other contents in many college curricula. All types of men are needed in industry and should be trained in the colleges, but in my opinion the art of electrical engineering has advanced so rapidly and become so extensive that the technical standards of the schools should be raised and research proficiency encouraged and rewarded. There is great hope of permanent and tangible progress in our civilization through new engineering contributions and methods which can be produced by numbers of skilled engineers and research workers, and this fact must not be forgotten by the industry or by the schools when dealing with the expediencies of the moment as reflected by the demands of industry."

Keep Breadth in the Institute

The interviewer was now sufficiently at ease to risk a leading question: "How does it feel to be president of the Institute and what do you consider the scope of its activities?"

"I was surprised that the Institute honored me with the presidency and feel humble yet enthusiastic about the task before me. Fortunately, my able predecessors have builded wisely and well and have generously and kindly done everything possible to perfect the organization and make my task easy. I have been studying the status and activities of the Institute for several weeks and have much work to do yet before I can speak with authority, but my personal feeling is that the Institute should be the capstone and all-inclusive organization in the theoretical aspects of electrical engineering. It must encourage the development of sections and promote and co-operate with the work of allied societies in the field of electrical engineering. But it should not narrow its technical scope or field of endeavor, and should embrace all electrical engineers for the purpose of advancing the art. The offshoot and allied societies have very important work to do, and they satisfy the necessity for engineers in specialized fields to discuss many details and all matters of current theory and practice. But the Institute should also present and discuss 'quality' material of fundamental and permanent character on all the theoretical phases of electrical engineering. This, in my opinion, will make for unity in the electrical profession, enhance its standing and more adequately recognize and reward the engineers who have contributed to the advancement of the art." Here President Ryan again emphasized the fact that he expressed his personal opinion.

Act as Research Consultants

"Professor Ryan, you have contributed greatly to the art through your research activities. In what way can the Institute encourage or do research work?" asked the interviewer.

"Research is a vital element in engineering progress," replied Professor Ryan. "It is not an easy thing to define or to accomplish and requires money and facilities for experimentation impossible for the Institute to furnish. But the Institute has available the most talented personnel in the profession, and through its technical committees can do much to further and encourage research work. The ground must be spaded and the problems defined by other agencies than the Institute, but once the data are assembled and the problems defined, it would seem feasible for the Institute committees to help in the solutions either directly or in consultation with those more responsible. Theoretical investigations involving analytical and mathematical studies by specialists could be made by the Institute committees, and they could co-operate and advise with workers actively engaged in the experimental investigations needed for the solution of other types of problems.

"Since the Institute committees are composed of impartial and carefully selected specialists in the several fields of endeavor—men who cannot be excelled in technical proficiency—I believe they could be extremely valuable as research consultants. How much of this kind of activity is carried on by the committees I do not know," said President Ryan in concluding the interview, "but to me it seems to offer very pertinent opportunities for services and achievements of the greatest importance to the profession."

Electrical engineers can feel honored in having at their head a man who can think so constructively and broadly on subjects so vital to the Institute and the profession. These are the sentiments of a level-headed, constructive organizer and thinker and yet they are the expressions of a man who is world-renowned for his technical contributions to the art. Specialist, educator, engineer and executive are all apposite characterizations of Harris J. Ryan, and these attainments make him a worthy torchbearer of the electrical profession. Yet the most distinct impression left with the interviewer was that these were incidental attributes of a great and courteous man who possessed an unusually sympathetic and inspiring personality.

Radio in France

THE use of wireless by private persons in France is already attaining considerable proportions, although not to nearly the same degree as in the United States. Private wireless sets for receiving broadcasted messages from Eiffel Tower and other near-by stations are advertised for sale. Any private person can own a wireless receiving set, but wireless sending outfits are only authorized by special license from the French government. An annual fee of 10 francs is charged by the French postal authorities to all owners of wireless receiving sets.

Broadcasting is carried out in the Paris region by the Eiffel Tower, the Société Française Radio Electrique and the Superior School of the Postal Telegraph and Telephone Services of the French government. The length of wave used by the Eiffel Tower is 2,600 meters, the principal items broadcasted being weather reports, stock exchange news and a radio concert every evening. The length of wave used by the Société Française Radio Electrique is 1,780 meters, the society broadcasting two radio concerts, one in the afternoon and the other in the evening. The Superior School broadcasts on a wave of 450 meters, its program including educational subjects and an evening concert. The Eiffel Tower service is government-owned and is sent out for the general public benefit. The Société Française Radio Electrique obtains its remuneration by the sale of special "Radiola" receiving sets adapted to the broadcasting system used. The Superior School service is likewise free of charge and carried out in the interests of education and experiment. The French military authorities are starting a trial system of broadcasting on a 45-meter wave.

Peoria's Automatic Substations

How Regulation Is Improved and Relief Afforded to Overloaded Pole Lines of 2,300-Volt Distribution Circuits Leaving Generating Station—Two 3,000-Kw. Autcmatic Substations Cost $53,392

By C. R. BUSH

Electrical Engineer Central Illinois Light Company, Peoria, Ill.

AS A RESULT of the rapid increase in lighting demand at Peoria the Central Illinois Light Company installed three automatic alternating-current substations during October and November, 1922. The old transmission system consisted of single phase 2,300-volt, 200-kw. two-wire primary feeders all radiating from the Liberty Street generating station on the river bank in the heart of the city. These circuits gradually became overloaded to such an extent that, regardless of the voltage regulators operating at maximum boost and carrying double their rated capacity, the voltage drop at the ends of the feeders was excessive; but owing to the development of the tungsten lamp, complaints of low voltage were not so pronounced as they might have been under the old conditions with carbon lamps.

LOAD DEVELOPMENT STUDIED

In order to determine what steps should be taken to relieve the situation, to provide capacity for future growth and yet install a system which could be readily expanded, a detailed study of load conditions was made covering the entire city divided into equal sections. From the feeder readings covering the five years 1916-1921 it was determined that the average yearly increase in load was 13 per cent.

Two solutions to the problem presented were then studied. The first was to change existing single-phase circuits to four-wire, three-phase circuits by doubling two circuits as far as possible and by adding additional copper wherever necessary, thereby making the equivalent of three circuits out of two existing circuits. This would involve the reconnection of all the generators and a complete change-over at the station from three-phase delta to three-phase star, or the installation of a bank of auto-transformers of sufficient capacity to feed the lighting load. This scheme involved many difficulties in making the change-over, and as it provided additional capacity for only two or three years, it was finally abandoned.

SUBSTATIONS AT DUCT ENDS

It was then decided to install three substations—one (Glendale) a mile north of the generating station, an exact duplicate (Lincoln), one mile south, and a smaller substation at Peoria Heights. Both the Lincoln and the Glendale substation were installed at the extremity of an existing underground duct system and were supplied by a 13,200 volt, three-phase underground cable loop. One No. 2/0 three-phase, three-conductor, 13,200-volt, 3,300-kw. cable feeds each substation, with a similar tie cable between the substations. This loop is protected by automatic breakers and inverse-time overload relays in such a manner that any one of the three sections is isolated in case of trouble without interrupting service. These substations were also erected in close proximity to what the study of the load showed to be the most heavily loaded sections, considering both present and future conditions.

The capacity of the substations was determined partly

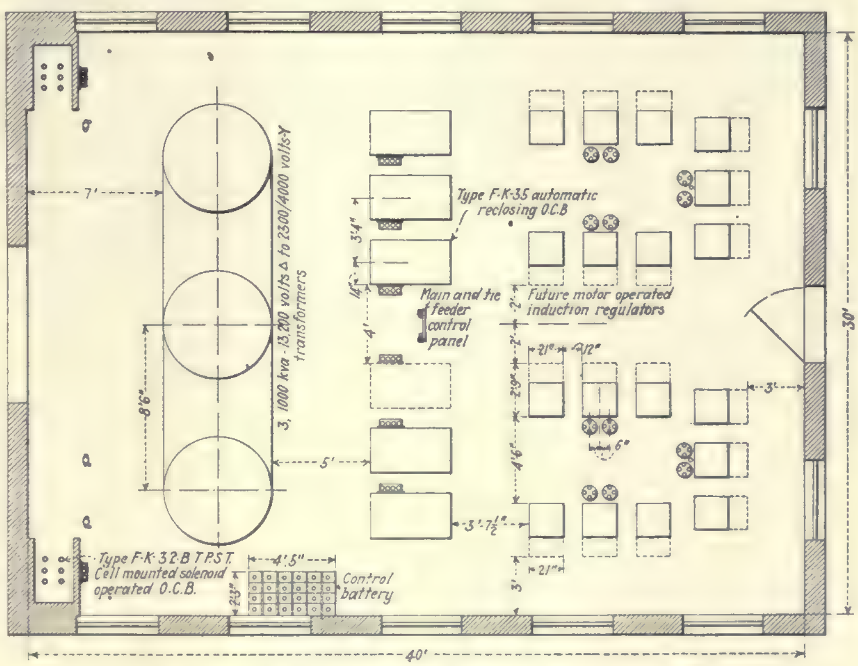


FIG. 1—AUTOMATIC SUBSTATION LAYOUT WHICH IS CHARACTERISTIC OF PEORIA INSTALLATIONS

by the size of existing ducts through which the feeder cables were carried and partly by the distance it would be necessary to carry load when the substation was operating at capacity. This was determined by assuming that the most heavily loaded section had reached its ultimate capacity and that adjacent sections would ultimately develop the same load.

When these substations finally become loaded, the plan is to install a second loop around the city, possibly a mile farther out, supplying another row of substations. This system not only allows for unlimited expansion of the company's service, but will ultimately result in short feeders radiating from each substation and in giving good regulation.

EQUIPMENT COMPLETELY HOUSED

Each substation consists of a brick and concrete fireproof structure having a floor area of 30 ft. x 40 ft.,

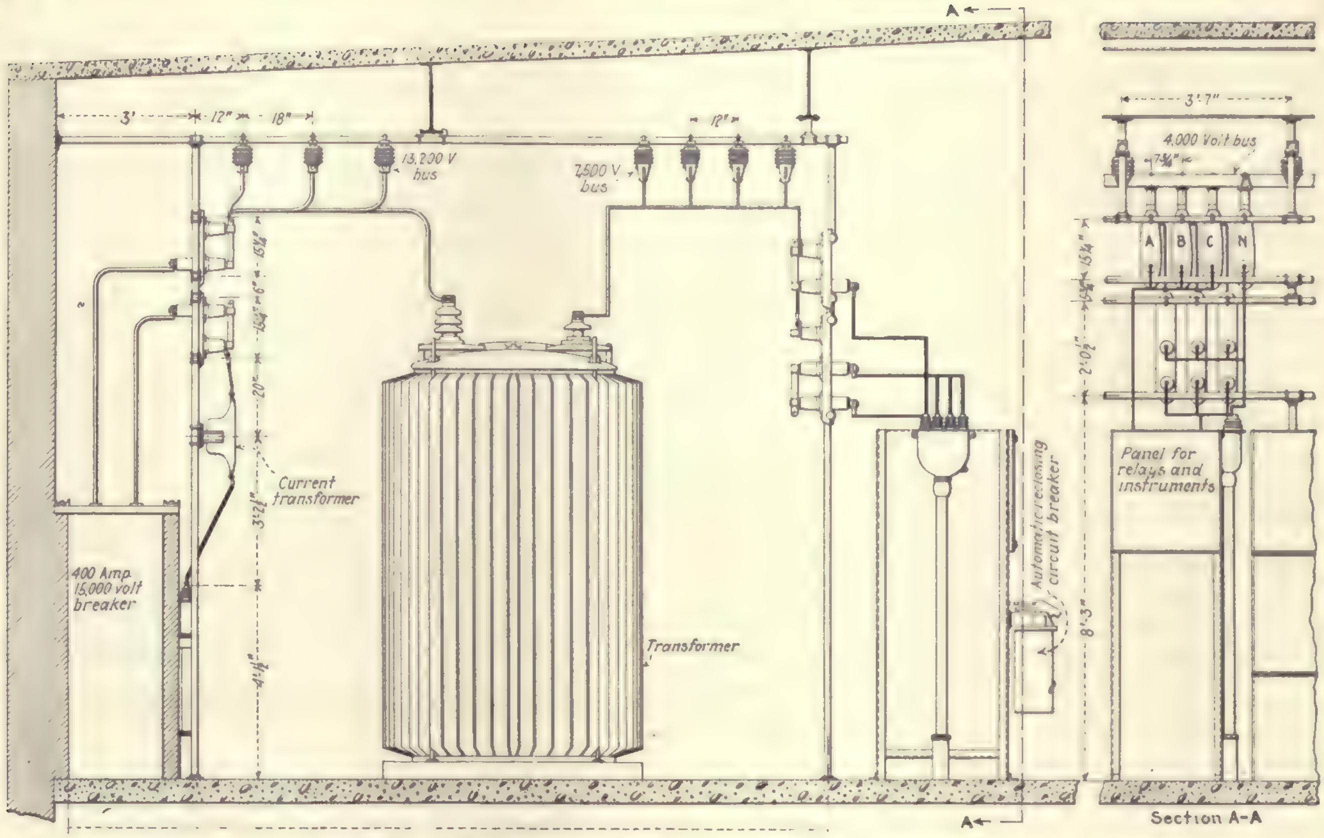


FIG. 2, A AND B—"DISCONNECTS" ARE ARRANGED SO THAT ANY FEEDER BREAKER MAY BE SHUNTED OUT OF SERVICE FOR INSPECTION AND REPAIR

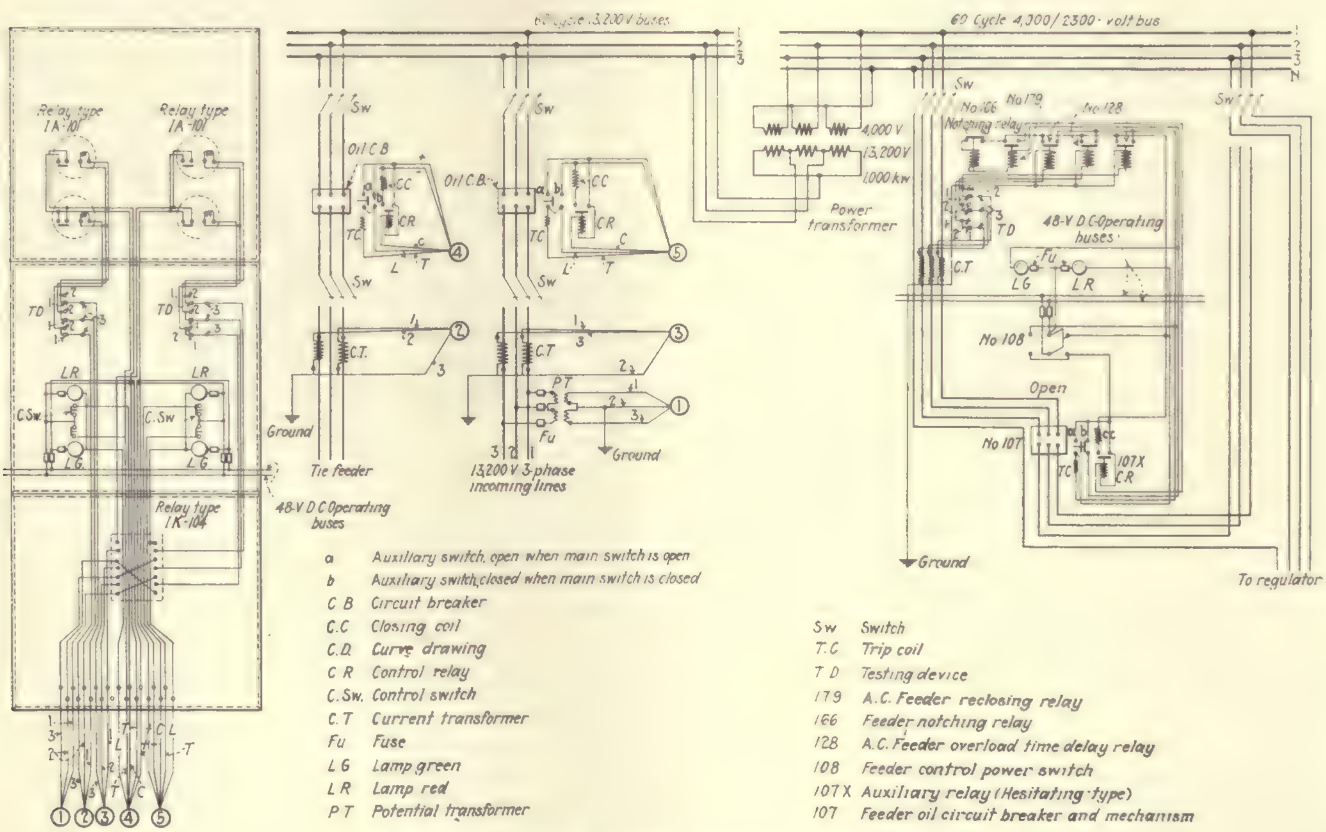


FIG. 3—CONNECTIONS OF AUTOMATIC RECLOSING EQUIPMENT

Each station houses three 1,000-kva., 13,200 (delta) 4,000-2,300-volt (star) single-phase self-cooled transformers feeding 4,000-2,300-volt buses with provisions for six three-phase, four-wire feeders. Provision is made for future installations of voltag regulators.

housing three 1,000-kva., 13,200 (delta)- 2,300/4,000 volt-star, single-phase self-cooled transformers, buses and switching equipment. These transformers feed a 2,300/4,000-volt bus from which provision has been made for taking six three-phase, four-wire feeders. Glendale substation has five circuits at the present time, while Lincoln has three. Provision has also been made for the future installation of voltage regulators. Transformer temperatures are registered on an external indicator, giving a direct check on load conditions. Louvers in the roof and walls of the substations allow a control of the indoor temperature. With closed louvers the transformers operated during January at between 45 deg. and 50 deg. C.

Feeder connections are made to the bus through an arrangement of single-blade, single-throw, and double-blade, double-throw disconnecting switches in such a manner that the oil circuit breaker protecting the feeder may be shunted out of the circuit for inspection and repairs while the feeder is connected directly to the bus during this operation. Inspections of breakers are made only during fair weather. If trouble should develop during this period, the automatic breakers on the incoming 13,200-volt feeders would still afford protection, although interrupting the entire substation load.

Storage Battery Recloses Breaker

Each feeder panel consists of a type FK-35 400-amp., 7,500-volt solenoid-operated oil circuit breaker operated by means of three overload relays, one circuit-breaker-reclosing relay and one notching relay. Energy for operating this breaker is obtained from a 48-volt storage battery. Provision for charging this control battery is taken care of by a 6-amp. Tungar rectifier. The battery is placed on charge at a low rate for twenty-four hours every three weeks, but oftener if necessary, this being determined by the number of feeder-breaker operations which have occurred.

Weekly inspections of these substations are made, the inspector being required to make a thorough examination of all equipment at such times. Among his duties are the examination of connections and switches for signs of heating, addition of distilled water to the control battery where needed, testing the gravity of each cell and testing of all relays on reclosing units.

Breakers Reclose Within Set Time

If a ground or short circuit develops on a feeder, the overload relays function, thereby opening the breaker. After a predetermined interval, about thirty seconds, the contacts of the reclosing relay close, thereby closing the breaker. If the short circuit still persists, the breaker again opens and is again reclosed. Then if the short circuit still continues, the breaker opens a third time, but the contacts of the notching relay open and the breaker remains open until the notching relay is reset by hand, thus starting the cycle over again.

However, if the breaker opens once, but is reclosed and remains closed for a definite period of from two to three minutes, the notching relay returns to its original position and is ready to start on a new cycle. Thus a series of short circuits or overloads coming in at intervals of a few minutes will be cleared and the breaker closed without manual attention. The breaker may be operated manually by means of the double-throw switch No. 108, which causes the breaker to trip in one position while the automatic feature functions when in the other position.

Sequence of Operation

The control functions as follows:

1. An overload occurs on the line.
2. Overload relay No. 128 trips the circuit breaker.
3. Circuit breaker opens, auxiliary switch *b* on circuit breaker closes, energizing reclosing relay and notching relay.

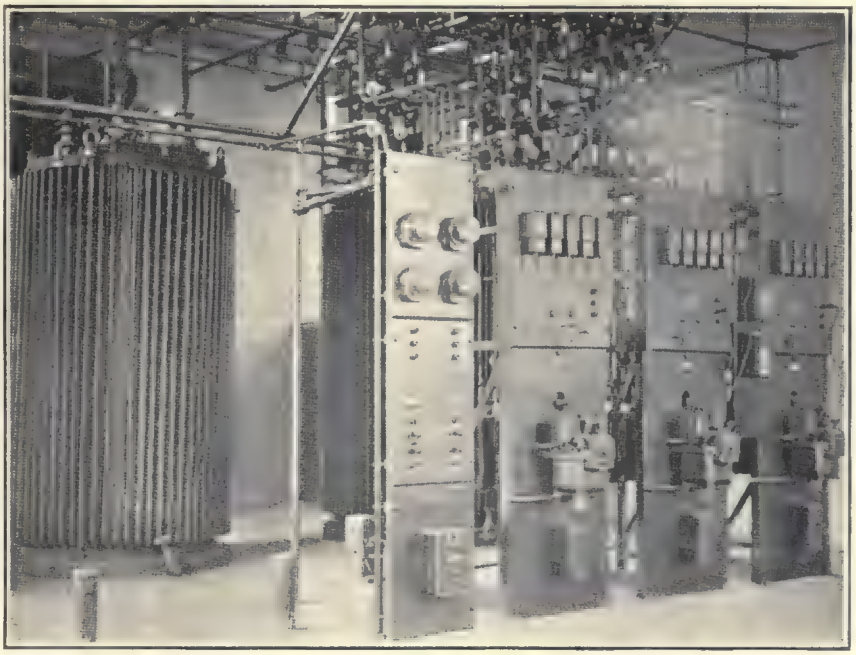


FIG. 4—AUTOMATIC RECLOSING SWITCHING EQUIPMENT AT LINCOLN SUBSTATION

4. Notching relay No. 166 advances one step instantly.
5. Reclosing relay No. 179 operates within definite time, permitting solenoid control relay on circuit breaker to be energized, causing circuit breaker to close.
6. Circuit breaker closes, auxiliary switch *b* on circuit breaker opens and auxiliary switch *a* closes, connecting trip coil and red lights.
7. Relay No. 179 opens and control relay on breaker opens.
8. Notching relay No. 166 starts to reset and will do so if breaker does not open within a predetermined time. The second opening of the breaker causes the relay to notch the second step, but the relay contacts are not opened. With the third relay breaker opening, the relay notches to the third step, thereby opening the contacts, which locks the apparatus out; but if the breaker had remained closed after the first or second step, the relay would have returned to its original position ready for a fresh sequence of relay and breaker operation.

Peoria Heights substation is about 4 miles north of the main station and is supplied with 13,200-volt, three-phase power from a tap on one of the transmission lines. This substation has a capacity of 300 kw. and is connected the same as the Glendale and Lincoln substations, two three-phase, four-wire feeders leaving the substation to serve outlying light and power consumers in Peoria Heights. The reclosing device on this breaker is motor-actuated, taking power from a 110-volt transformer connected through line cut-outs to

Generator and Prime-Mover Equipment of the Central Stations of the United States as of Oct. 1, 1922

States and Sections	Operating Companies			Electric Generators							Prime Movers					Water Wheels and Water Turbines	Boilers
							Private Plants		Municipal Plants		Total	Steam Engines	Steam Turbines	Gas Engines	Oil Engines		
	Total	Private	Municipal	Total Rating Kva.	A.C. Rating Kva.	D.C. Rating Kw.	A.C. Kva.	D.C. Kw.	A.C. Kva.	D.C. Kw.	Rating, Hp.	Rating, Hp.	Rating, Kw.	Rating, Hp.	Rating, Hp.	Rating, Hp.	Rating, Hp.
United States	5,974	3,955	2,019	17,715,484	17,293,551	421,933	16,379,603	403,313	913,948	28,620	19,847,246	1,758,025	8,782,961	92,902	141,177	6,144,527	4,235,455
New England	391	328	63	1,732,813	1,697,524	35,289	1,664,810	35,289	32,714	0	2,004,610	116,682	1,000,608	1,185	2,014	550,585	304,200
Middle Atlantic	664	557	107	3,886,599	3,849,274	37,325	3,796,147	36,105	53,127	1,220	447,604	307,151	2,437,515	15,205	3,584	900,081	990,545
South Atlantic	700	418	282	2,237,421	2,195,541	41,880	2,088,001	40,881	107,540	999	2,465,613	275,166	847,911	16,232	6,072	1,037,595	443,683
East North Central	1,257	802	455	4,263,955	4,117,993	145,962	3,821,674	137,854	296,319	8,108	4,535,599	439,564	2,630,809	13,380	12,728	562,182	1,183,916
West North Central	1,460	767	693	1,472,553	1,406,903	65,650	1,262,604	63,688	144,299	11,962	1,697,983	244,397	725,139	27,410	50,311	409,013	496,627
East South Central	370	232	138	600,034	580,928	19,106	544,380	17,510	36,548	1,596	592,284	85,868	191,118	660	5,004	245,928	203,348
West South Central	588	414	174	662,652	624,834	37,818	575,136	36,998	49,698	820	757,963	172,212	385,007	15,659	48,663	8,086	273,779
Mountain	308	248	60	951,499	938,574	12,925	922,508	12,655	16,066	270	1,107,846	57,971	104,952	1,849	9,536	898,554	118,410
Pacific	236	189	47	1,907,958	1,881,980	25,978	1,704,343	22,333	177,637	3,645	2,209,307	59,014	459,902	1,322	3,265	1,532,503	220,947
NEW ENGLAND																	
Maine	78	73	5	142,129	134,719	7,410	133,257	7,410	1,462	0	151,725	12,573	11,987	125	150	122,894	14,140
New Hampshire	57	54	3	79,121	75,328	3,793	73,878	3,793	1,450	0	92,179	11,950	33,499	760	450	34,354	18,537
Vermont	63	51	12	123,335	121,550	1,785	115,560	1,785	5,990	0	155,587	7,820	9,475	0	9	135,125	10,432
Massachusetts	135	98	37	914,561	900,300	14,061	877,238	14,061	23,062	0	1,092,352	72,679	603,747	300	280	214,097	157,422
Rhode Island	12	10	2	215,425	212,475	2,950	212,475	2,950	0	0	232,862	2,820	170,818	0	0	2,285	28,163
Connecticut	46	42	4	258,442	253,152	5,290	252,402	5,290	750	0	279,904	8,840	171,082	0	1,125	41,830	75,506
MIDDLE ATLANTIC																	
New York	356	309	47	1,985,117	1,973,825	11,292	1,939,752	11,292	34,073	0	2,381,479	115,175	1,127,220	3,790	1,864	757,690	450,335
New Jersey	61	46	15	348,467	346,966	1,501	342,792	1,476	4,174	25	369,636	97,261	201,665	1,115	1,100	1,273	135,909
Pennsylvania	247	202	45	1,553,015	1,528,483	24,532	1,513,603	23,337	14,880	1,195	1,724,926	94,715	1,108,630	10,300	620	141,118	404,301
SOUTH ATLANTIC																	
Delaware	15	9	6	35,287	32,342	2,945	31,225	2,585	1,117	360	38,863	5,885	24,580	25	30	150	14,135
Maryland	47	37	10	278,834	272,512	6,322	266,822	6,170	5,690	152	290,776	44,532	181,590	660	95	3,369	77,021
District of Columbia	3	3	0	91,850	87,000	4,850	87,000	4,850	0	0	99,600	6,800	69,600	0	0	0	26,850
Virginia	96	74	22	243,216	234,643	8,573	218,847	8,473	15,796	100	278,335	12,926	162,130	272	530	48,434	64,157
West Virginia	71	64	7	449,612	441,005	8,607	440,265	8,607	740	0	427,739	116,476	195,233	10,530	20	40,402	86,157
North Carolina	139	76	63	177,909	175,714	2,195	155,697	2,195	20,017	0	210,529	22,288	47,823	200	865	123,412	47,356
South Carolina	81	51	30	453,873	451,378	2,495	432,795	2,455	18,583	40	541,137	8,820	51,240	3,000	562	460,435	24,467
Georgia	161	56	105	392,140	388,897	3,243	370,516	3,231	18,381	12	478,862	40,528	62,543	200	350	354,393	72,561
Florida	87	48	39	114,700	112,050	2,650	84,834	2,315	27,216	335	99,772	16,911	53,172	1,345	3,620	7,000	30,979
EAST NORTH CENTRAL																	
Ohio	281	169	112	1,278,441	1,240,155	38,286	1,154,123	34,616	86,032	3,670	1,377,284	110,256	925,967	5,323	3,255	24,094	365,139
Indiana	216	140	76	425,638	402,998	22,640	337,570	21,253	65,428	1,387	426,693	58,058	266,144	705	1,805	11,266	178,784
Illinois	287	196	91	1,210,241	1,157,806	52,435	1,102,121	51,034	55,685	1,401	1,302,820	150,484	824,017	1,340	2,492	49,815	359,888
Michigan	199	113	86	812,028	803,743	8,285	732,666	7,273	71,077	1,012	857,218	51,197	433,555	847	2,634	224,467	151,212
Wisconsin	274	184	90	537,607	513,291	24,316	495,194	23,678	18,097	638	571,585	69,569	181,326	5,165	2,542	252,540	128,893
WEST NORTH CENTRAL																	
Minnesota	220	103	117	349,162	325,794	23,368	301,915	21,087	23,879	2,281	415,084	41,099	133,426	3,342	2,732	190,010	88,254
Iowa	225	129	96	352,112	333,341	18,771	317,869	15,355	15,472	3,416	370,857	65,803	102,451	1,440	4,010	163,003	109,158
Missouri	241	169	72	435,230	422,564	12,666	404,340	12,401	18,224	265	496,748	44,234	309,719	3,500	6,435	29,620	135,273
North Dakota*	129	99	30	27,062	19,806	7,256	18,061	5,839	1,745	1,417	34,481	21,178	6,467	2,620	2,060	0	22,949
South Dakota	117	73	44	39,320	37,340	1,980	32,345	793	4,995	1,187	48,527	11,680	14,418	6,511	7,282	3,830	20,215
Nebraska	265	113	152	120,088	113,596	6,492	103,986	3,687	19,610	2,805	139,472	27,496	64,922	2,009	10,097	13,307	52,661
Kansas	263	81	182	149,579	144,462	5,117	84,088	4,526	60,374	591	192,814	32,907	93,736	7,988	17,695	9,243	68,117
EAST SOUTH CENTRAL																	
Kentucky	113	91	22	127,220	121,553	5,667	115,072	5,202	6,481	465	78,386	23,567	38,583	610	2,320	445	50,363
Tennessee	98	67	31	208,420	203,355	5,065	194,400	4,287	8,955	778	206,383	18,125	44,585	25	400	128,386	55,118
Alabama	68	33	35	215,633	210,246	5,387	204,682	5,331	5,564	56	253,378	26,022	82,664	0	40	117,097	69,825
Mississippi	91	41	50	48,761	45,774	2,987	30,226	2,690	15,548	297	54,138	18,154	25,286	25	2,244	0	28,042
WEST SOUTH CENTRAL																	
Arkansas	89	68	21	79,824	74,042	5,782	68,151	5,732	5,891	50	71,619	27,612	28,910	660	1,600	3,200	43,716
Louisiana	73	36	37	97,798	80,064	17,734	65,279	17,104	14,785	630	118,980	32,907	58,517	740	7,310	0	35,300
Oklahoma	149	61	88	136,267	131,892	4,375	110,870	4,250	21,022	125	163,071	50,899	70,259	5,923	11,062	1,508	68,292
Texas	277	249	28	348,763	338,836	9,927	330,836	9,912	8,000	15	404,293	60,794	227,321	8,336	28,691	3,378	126,471
MOUNTAIN STATES																	
Montana	57	52	5	410,051	408,975	1,076	406,923	1,076	2,052	0	483,647	10,509	2,467	195	1,068	468,579	11,188
Idaho	43	30	13	165,423	164,928	495	162,336	350	2,592	145	213,600	2,725	1,200	40	20	209,215	2,990
Wyoming	38	30	8	32,890	32,033	857	30,139	857	1,894	0	33,439	8,980	14,915	840	1,762	1,970	15,834
Colorado	61	53	8	153,029	143,612	9,417	138,705	9,367	4,907	50	166,403	20,209	50,392	270	275	78,460	50,925
New Mexico	27	23	4	12,469	11,764	705	10,131	705	1,633	0	13,250	5,685	3,800	0	1,840	658	7,806
Arizona	31	28	3	64,230	63,930	300	63,880	300	50	0	67,265	9,485	17,978	22	4,171	29,616	20,891
Utah	36	18	18	99,902	99,827	75	96,889	0	2,938	75	114,906	63	12,800	0	0	97,776	7,276
Nevada	15	14	1	13,505	13,505	0	13,505	0	0	0	15,344	315	1,400	482	400	12,280	1,500
PACIFIC																	
Washington	97	81	16	426,038	412,671	13,367	318,956	9,867	93,715	3,500	350,188	16,009	66,469	40	230	245,284	48,222
Oregon	56	43	13	180,417	171,733	8,684	167,436	8,539	4,297	145	230,917	12,730	61,938	142	585	134,876	29,901
California	83	65	18	1,301,503	1,297,576	3,927	1,217,951	3,927	79,625	0	1,628,201	30,275	331,495	1,140	2,450	1,152,343	142,824

the low-tension side of the main bank of transformers, which are mounted outdoors.

The total cost of the Glendale substation, now supplying five feeders, was $28,322.40, which is divided into $3,000 for land, $6,000 for building and $19,322.40 for electrical equipment installed. The cost of the Lincoln substation, supplying three circuits, was $3,500 for land, $5,800 for the building and $15,670 for electrical equipment. Peoria Heights substation cost $5,695.38, which is divided into $5,195.38 for electric equipment and building and $500 for land.

The specific advantages gained by this change-over are as follows: The same load is now carried by the two 13,200-volt, three-phase underground cables as was handled by the former nine single-phase circuits. This has resulted in relieving the pole lines from the generating station of eighteen runs of No. 1/0 wire. Voltage regulation at feeder ends has also improved since the feeders have been shortened and owing also to the increase in voltage from 2,300 to 4,000. Service to outlying three-phase power consumers is now better provided by carrying the substation three-phase feeder out from the Peoria Heights substation direct to the consumers. This has allowed a shortening of the regular three-phase feeders, thereby giving an improved voltage regulation. Another advantage in installing automatic substations was that the expense of station operators was eliminated.

Central-Station Generator Ratings Total 17,715,484 Kva.

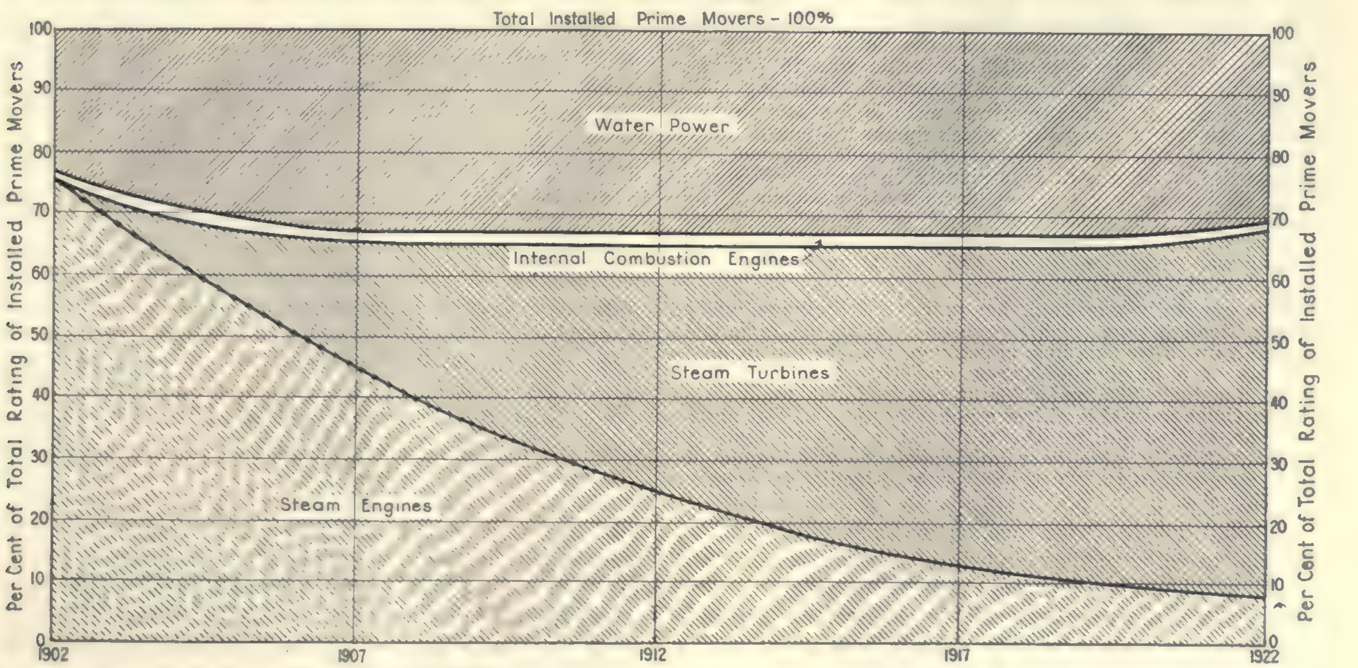
On Oct. 1, 1922, there Were 5,974 Generating and Transmission Systems in the United States, of Which 66.3 per Cent Were Privately Operated

A TABULATION based upon equipment reports as published in the 1923 edition of the McGraw Central Station Directory indicates that on Oct. 1, 1922, there were a total of 5,974 central-station systems operating in the United States. Of this number 3,955, or 66.3 per cent, were commercial or privately owned, and 2,019, or 33.7 per cent, were operated by municipalities. The West North Central States reported the largest number of systems with 1,460, of which 693, or 47.5 per cent, were municipally operated. The three other central sections and the South Atlantic States also reported high percentages of municipally operated systems. In the Northeastern and Mountain-Pacific sections the municipal systems were of much less importance in so far as number of unit systems was concerned.

The combined rating of the generators installed in the central generating plants of the country is given as 17,715,484 kva., of which 17,293,551 kva., or 97.6 per cent, represents the rating of alternating-current generators and 421,933 kw., or 2.4 per cent, is the rating of direct-current generators. The commercial or privately operated plants reported 16,782,916 kva., or 94.7 per cent, of the total generator rating. Although the three Pacific States reported the lowest number of municipal systems of any section, yet three of these systems are of such size as to bring the total generator rating of municipal plants in this section to a figure second only to the municipal systems in the East North Central States.

As indicated in the accompanying table, the prime movers in the central generating plants total 19,847,246 hp. The relative importance of the various types of prime movers is clearly indicated in the diagram below. It will be noticed that the percentage relation between steam-driven and water-driven prime movers has remained almost stationary for the past fifteen years, with a slight increase in favor of steam during the last five-year period. The total rating of internal-combustion engines as compared to the total prime-mover rating has also remained almost stationary, about 1.5 per cent of the total. The total boiler rating is given as 4,235,455 hp.

The Pacific States lead in the rating of waterwheels and water turbines with 1,532,503 hp., followed by the South Atlantic States with 1,037,595 hp. The total for the country of 6,144,527 hp. is 1,867,254 hp., or 43.4 per cent, above the total waterwheel and water-turbine installation as reported by the 1917 Census.



WITH THE ADVENT OF GENERATORS ABOVE 5,000 KW. THE STEAM TURBINE BECAME A NECESSITY IN CENTRAL GENERATING PLANTS

Accuracy Test for Transformers

Direct-Current Component Upsets Ratio—Error in Measuring Initial Peak—Not Accurate for Transient Measurements

IN CONNECTION with tests for determining mechanical strength and thermal limitations of common types of voltage transformers, the Pennsylvania Power & Light Company and the Consolidated Gas, Electric Light & Power Company tested the accuracy of the instruments during the short-circuit period. The other test results are given in the ELECTRICAL WORLD for July 28 and J. E. Allen of the Pennsylvania Water & Power Company has submitted the data for the accuracy tests given in this article.

TESTS FOR RATIO BREAKDOWN AT HIGH CURRENTS

Two types of transformers, namely FB-2,000/5 and D21-300/5, were tested for accuracy during short circuit. The observations follow:

FB-2.000/5.—Three tests were made on the transformer at effective currents of 18,300, 25,400 and 29,400 amp. (tests 236-238). The secondary loading was made on a 0.1-ohm shunt. Previous to test 236 the transformer was demagnetized by passing full-load current through the secondary with the primary open and gradually reducing the current to zero. The primary and secondary currents were measured with shunts in connection with the oscillograph.

The results of the three tests were quite interesting. In the first test No. 236 (oscillogram, Fig. 10) the primary had a large direct-current component (displacement 1.55). It was noted that the secondary current during the transient period did not have the same general characteristics as the primary current, and the ratio was much higher during this period than for the symmetrical period of the short circuit. For the first half cycle the ratio was as much as 54 per cent too high, but gradually it became lower until it reached a final value of 8.5 per cent too high after about 8 cycles. The secondary current, after being displaced downward in the first half cycle, became displaced upward in the following 4 or 5 cycles, after which time it again became symmetrical.

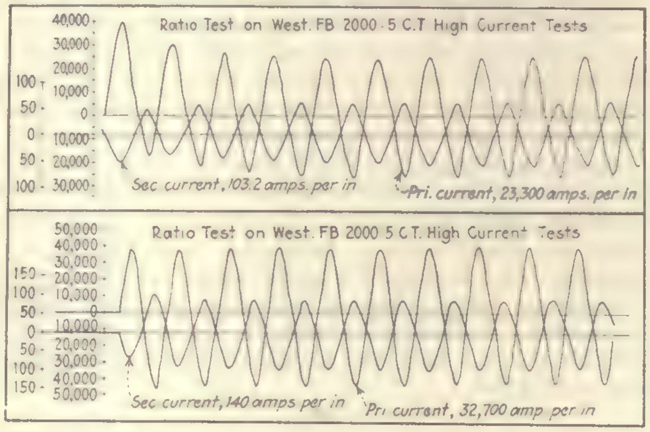
In contrast with the above test were the results of the two following tests, Nos. 237 and 238 (oscillogram, Fig. 11), in which there was virtually no direct-current component in the primary current of either test and in which the ratio did not vary after the first half cycle. The ratio, however, becomes higher at the higher currents. Thus, in test 237, at 25,400 effective amperes, the ratio was 10.5 per cent too high, and in test 238 the ratio was 16 per cent too high.

The results of the above three tests indicated that it is the direct-current component which upsets the ratio. However, even after the direct-current component has disappeared the ratio still is seriously in error. Measurement of the ratio after the above tests at normal load showed that the nominal ratio of the transformer was correct within 1 per cent, thus indicating that the transformer was in good condition and that the errors in ratio are inherent for this type.

It is generally admitted, however, that in transformers of the through type, such as the one tested, the ratio does not hold up so well as in a transformer where the primary consists of a number of turns, and therefore the errors given for tests 237 and 238, at overloads at twelve and fifteen times normal load, were not unexpected. But errors such as existed during the transient period of test 236 would naturally give very misleading results, especially if it were desired to measure currents immediately or after 3 or 5 cycles.

In addition to the above ratio tests, it is also of interest to refer to the previous tests made on the D-21 for thermal and mechanical failure, in which the secondary current was measured for each test. The oscillograms (tests 218 and 229) clearly indicated that in the first half cycle the ratio breakdown is much worse than for the succeeding cycles. However, the overload in these tests was eighty and a hundred times full load respectively, which accounts for the non-sinusoidal secondary wave.

But even the tests on the FB type have the same characteristics in the first half cycle. All of the foregoing tests, then, would indicate that current transformers are subject to considerable error in measuring the initial peak especially when it is displaced. The fact is further confirmed in comparing the initial displacement on the oscillograms when using a current transformer with the initial displacement when using a shunt when measuring currents of approximately the



AT TOP—TEST 236 ON FB-2,000/5, SHOWING DISPLACEMENT OF PRIMARY. AT BOTTOM—TESTS ON FB-2,000/5, SHOWING NO DISPLACEMENT OF PRIMARY

same magnitude. In the former case, when using the current transformer, out of a total number of 190 tests displacements of 45 to 50 per cent were obtained only six times, and the highest was only 50 per cent. In the latter case, when using a shunt for measurement, out of a total number of thirty-one tests, displacements of 50 per cent and over were obtained in seven tests, and the highest was 95 per cent.

A CURIOUS DISPLACEMENT OCCURRED

There is another phenomenon on which the tests have thrown some further light. This is the characteristic found in a great number of oscillograms of having the initial half cycle displaced on one side and the succeeding cycles displaced on the opposite side but gradually becoming symmetrical in 4 to 6 cycles. There was some doubt as to whether the phenomenon was due to the furnace transformer or the current transformer used for measuring. Later, when using the shunt for measurement, the same displacement occurred, thus indicating that the furnace transformer was the cause in this case. However, in test No. 236 the phenomenon again occurs in the secondary current when the primary current measured with a shunt does not show it. From these few tests it would seem that the phenomenon noted is due to both the furnace transformer and the current transformer.

The ratio tests clearly point out the possibility of serious error when using current transformers for measuring transient phenomena. The error seems to be most pronounced in the first half cycle. The three tests on the *FB* type would seem to indicate that the direct-current component, when it exists, produces additional sources of error.

Amsteg Station in Switzerland

New Power House for Use on the Gotthard Electrification—Details of the Design of the Station and of the Transmission Systems

By HENRY L. GEISSEL
Thoune, Switzerland

ABOUT two years after electric traffic on the Gotthard Railway had been begun by utilizing the energy generated at the Ritom power station on the Italian side of the Gotthard tunnel, the Amsteg power station on the German side of the tunnel was put in operation. These two large power stations will, on their final completion within a few years, co-operate in such a way that the Amsteg power station alone will supply the energy in the summer during the high-water period of the Reuss River—a wild mountain stream—while the Ritom power station will remain idle and its incoming water be stored in the Lake of Ritom. During the winter the Ritom power station will supply from its storage lake the energy otherwise not available on account of the low water level of the Reuss. By means of this co-operation of the Amsteg and Ritom power stations and the smaller substation at Göschenen, at the entrance of the Gotthard tunnel, an average production of 32,000 hp. throughout the whole year will be available. The storage reservoir of the Lake of Ritom and that of the Pfaffensprung—to which reference will be made later on—also fully compensate for the load fluctuations so perceptible in railway operation. The group of power stations on the Gotthard will be able to feed the 525-km. lines of the Swiss Federal Railways even then, when the present traffic should be surpassed by about 50 per cent.

The Amsteg power station utilizes the fall of the Reuss, extending from the Pfaffensprung to the village of Amsteg, the water being caught in the very narrow gorge of the Pfaffensprung. By means of an arch-shaped dam a day compensating and clearing basin with storage of 200,000 cu.m. has been created. In order to draw off the high water and to reduce the accumulation of rubble in the storage reservoir, the Reuss River has been diverted by a tunnel 280 m. long at the upper part of the reservoir. The water flows from the storage reservoir through a pressure gallery 7.5 km. long on the right side of the valley into a reservoir entirely blasted out of the rock, into which the water of the Kärstelenbach is also conducted through an open gallery. Connected with this reservoir, the object of which is to compensate for pressure changes, is the pressure line. On emerging from the mountain it passes through a special chamber equipped with automatically closing throttles, in case of the pipe bursting, and leading to the central station. Along this pipe line an electric cable railway has been constructed.

DETAILS OF STATION

The station consists of a machinery house with adjoining buildings for pipes and check valves for the distribution of the running water to the turbines; a building for the 150-volt switching equipment with switchboards, transformer room, workshops and the 60,000-volt switching installations, rooms for the transformation of electrical energy for the lighting and heating purposes of the station, and three dwelling houses with fourteen apartments for the engineer's staff. Rooms for officers are in a separate building.

In the machinery room space is available for six

DATA ON RATING AND EQUIPMENT OF AMSTEG POWER STATION

Capacity

	Horsepower from Turbine
(a) Amsteg power station, utilizing the water powers of the Reuss, Fellibach, Kärstelenbach and Etzlibach:	
Winter—minimum, twenty-four hours	10,000
Winter—average (November to April)	17,000
Summer—average (May to October)	32,000
Summer peak load at first installation with four single-phase generators	54,000
Summer peak load at ultimate installation with six single-phase generators	80,000
(b) Group of Amsteg, Göschenen and Ritom power stations:	
Average capacity for whole year	32,000
Peak load of Ritom power station	50,000
At ultimate installation	73,000

Gallery for Reuss Diversion

Length, m.	280
Cross-section, sq.m.	21.2
Fall, per cent.	3

Pressure Line

Length, m.	450
Number of traces when completed	3
Clear diameter of pipe at top, mm.	1,800
Clear diameter of pipe at bottom, mm.	1,600
(Installation: Upper part riveted, lower part annealed, reinforced by steel rings at the bottom.)	

Pressure Gallery

	Horsepower
Length, m.	7,535
Cross-section, sq.m.	6.45
Fall, per cent.	1.5
Pressure, fluctuating with water level in compensating reservoir, m. (water column)	20 to 35

Water Storage at Pfaffensprung.

Capacity of compensating reservoir, cu.m.	200,000
Length of dam at crown, m.	35
Greatest height of dam, m.	32
Volume of dam, cu.m.	200

Generators

(1) Single-phase alternating current:	
Number at first installation	4
Number at final installation	6
Continuous capacity of each generator, kw.	7,500
Power factor, per cent.	75
Maximum rating ($1\frac{1}{3}$ hours) kw.	9,500
Voltage	15,000
Frequency	$16\frac{2}{3}$
Revolutions per minute	333
Weight of generator, tons	250
(2) Three-phase alternating current:	
Number (for the present)	1
Continuous capacity, kw.	9,100
Power factor, per cent.	70
Maximum rating (half hour), kw.	9,100
Voltage	8,600
Frequency	50
Revolutions per minute	300
Weight of generator, tons	125

Turbines

	Horsepower
Number at first installation	5
Number at final installation	6
Capacity of each turbine, hp.	13,600
Average net fall, m.	275
Amount of water at full load, cu. m. per. sec.	4.73
Revolutions per minute:	
(a) Of the single-phase generators	333
(b) Of the three-phase generators	300
Wheels per turbine	2
Nozzles per shaft	1
Weight of turbine, tons	93

Transformers

Number at first installation	4
Number at final installation	6
Continuous power of each transformer, kw.	7,500
Power factor, per cent.	75
Maximum rating ($1\frac{1}{3}$ hours), kw.	9,000
Transformation ratio, volts	15,000 to 60,000
Frequency	$16\frac{2}{3}$
Weight of transformer with oil, tons	49

Branch Lines

For direct feeding of traction:	
Four copper conductors, each, sq.mm.	100
Voltage	15,000
Transmission lines:	
To the south, four cables, each, sq.mm.	135
Pressure between conductor and earth, volts	30,000
Pressure between conductor and conductor, volts	60,000
To the north, eight copper conductors, each, sq.mm.	95
Voltage	60,000

groups of machines. Five of them are now installed. An electric traveling crane of 100 tons serves for mounting and dismounting machinery. Each turbine has two Pelton waterwheels supplying 13,600 hp. at 333 r.p.m. and 275 m. head. The waste water of each turbine flows through a canal provided with water-measuring overflow weir and is conducted through a collecting tunnel into the Reuss River.

Four turbines are coupled to single-phase generators for a maximum capacity of 9,500 kw. each with a power factor of 0.75, each corresponding to 1,268 kva. at 1,500 volts and $16\frac{2}{3}$ cycles. One turbine drives a three-phase

ONE OF THE SIX 10,000-KVA., 15,000/60,000-VOLT TRANSFORMERS

Two Pelton wheels with a combined rating of 13,600 hp. drive each generator.

generator of 9,100 kw. continuous capacity with a power factor of 0.70, corresponding to 13,000 kva. at 8,600 volts and 50 cycles. The three-phase current is conducted to the works of the Swiss Power Transmission Company, where it is transformed in a special transformer station to 50,000 volts (ultimately 78,000 volts) and then transmitted to the distribution lines of several electric plants. The Amsteg power station will, however, supply this three-phase current for industrial purposes only for the time during which it is not required for railway traction.

The single-phase current is transmitted by cable from the generators to the building housing the 15,000-volt switching apparatus. The smaller part of the energy goes into the overhead wire at 15,000 volts, the larger part by cable into the transformers in order to be transformed to 60,000 volts. For economically favorable energy transmission at great distances the tension is raised to 60,000 volts and transmitted by special lines to the substations, the principal feeding points, where it is again reduced to 15,000 volts for feeding the trolley wires.

In the Amsteg power station there is room for the installation of six transformers each of 10,000 kva. capacity, with transmission at from 15,000 volts to 60,000 volts, and the proper oil-cooling installations and settling ponds. Four transformers are now installed. The transmission line to the south consists of four underground copper cables of 133 sq.mm. cross-section, leading by way of the Göschenen substation to the Ritom power station and farther down to the Giornico substation. To the north runs an overhead transmission line on steel poles. It comprises eight copper conduits of 95 sq.mm. cross-section for the transmission of single-phase current at 60,000 volts to the Steinen substation and three aluminum conduits of 191 sq.mm. cross-section for three-phase current of 50,000 volts (ultimately 78,000 volts) for transmission, as mentioned, by the Swiss Power Transmission Company.

The completion of the Amsteg power station required 800,000 man-days, 180 tons of explosives and 150,000 tons of cement. Construction up to the present time has involved an expenditure of 44,000,000 francs and, when ultimately completed, a total of 50,000,000 francs, or about $10,000,000, will be reached.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Underground Transmission at 150,000 Volts

To the Editors of the ELECTRICAL WORLD:

I was very much interested in the comments of William Del Mar, appearing in your issue of May 12. However, there is one point on which it would appear that Mr. Del Mar has not quite got my idea. It is where he says: "All the advantages of the scheme would not be lost if ordinary triplex cables were used, as its essence is to place conductors between which the diametric voltages are imposed in different cables and thus split the insulation into separate elements."

I have thought a good deal on the question of endeavoring to use ordinary triplex cables, and though I might agree with him that all of the advantages of my proposed scheme would not be lost, yet I think that the great bulk of them would thus disappear.

What I contend is that the employment of thin concentric insulations with intersheaths charged at controlled potentials effects an enormous reduction in the duty performed and the space occupied.

It may help both Mr. Del Mar and other readers of the ELECTRICAL WORLD who may be interested if they refer to an article which I recently contributed to the *Electrical Review* (London) for April 27 and May 4. In this article not only have I pointed out the advantages *per se* of intersheaths, but in particular I have compared an ordinary triplex cable worked in the ordinary way with an intersheath cable. From this it may be seen that considerable effort will have to be expended to get the three conductors into the one cable and to insulate them individually from one another and from earth. Furthermore, a great amount of space is required. If the same space is utilized to introduce intersheaths on a single-core cable, a tremendous gain is effected at once.

Another point of the greatest importance is that it is practically impossible, with a reasonable diameter of cable, to use an ordinary triplex cable, working at, say, 50,000 volts, with more copper than, say, 0.15 sq.in. per phase, because the maximum potential gradient runs up to a dangerous figure if a greater cross-section be attempted.

There is also another factor which greatly favors the employment of an intersheathed single-core cable, namely, that the whole of the waste heat due to three phases is liberated in a single cable of the triplex type, whereas only that due to one phase is liberated in the cable of the type I am proposing.

On the question of "complication" may I be allowed to say that all I do is to convert three-phase into six-phase for transmission and to step it down again at the receiving end? The first part of this operation is continuously employed in rotary converters.

There is another point of considerable importance about which I may have something to say at a future date, and that is the fact that I am able to utilize the intersheaths to pass "power" current at a voltage greatly in excess of the voltage employable in even the highest-worked triplex cables.

I appreciate the recognition which Mr. Del Mar has given my investigation by pointing out that under my proposals 150,000 volts can be transmitted with an insulation which would normally correspond to only 45,000 volts.

A. M. TAYLOR.

Erdington, Birmingham, England.

Aberdeen (Wash.) Property Not Sold

To the Editors of the ELECTRICAL WORLD:

Our attention has been called to an article in the ELECTRICAL WORLD of July 14, page 95, captioned "Another Gap to Be Bridged," containing the following: "The company has acquired the light and power system at Aberdeen, Wash., and construction work is in progress to connect Olympia and the Aberdeen plant through Montesano over the Olympia Highway." This is to advise you that the Federal Light & Traction Company is the owner of the Grays Harbor Railway & Light Company at Aberdeen. This property has not been sold and is not in the market.

E. H. LONSDALE,
Secretary to the President.

Federal Light & Traction Company,
New York, N. Y.

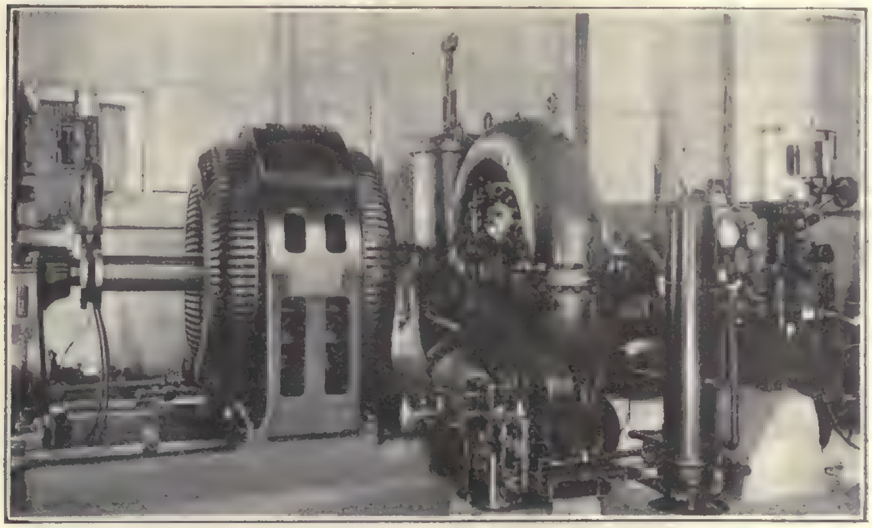
Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Suitable Rubber Seal Rings for Water Turbines

THE design of suitable seal rings for large-capacity, high-head hydraulic turbines presented a new problem when units of this class made their advent, particularly where the water contains silt or other abrasive particles and where, on account of high heads, the water leakage around the turbine runner is more than ordinarily serious. For the past year a large manufacturer of hydraulic turbines has been experimenting with rubber seal rings. slight eccentric movement on account of the necessary clearance within the main steady bearings.

After encouraging results with rubber seal rings, experiments were made to determine the best quality, thickness and hardness for them. Rings now being made embodying the results of these trials are of a thickness that leaves no free clearance between the moving and stationary parts, and the hardness used is about that of a good automobile-tire casing. Under these conditions it is asserted there is absolutely no danger of seizure, no leakage, and



KAWEAH POWER PLANT NO. 2 OF SOUTHERN CALIFORNIA EDISON COMPANY, WHERE USE OF RUBBER SEAL RINGS HAS INCREASED EFFICIENCY

The results have been highly successful, and it is now believed that the seal-ring problem has been solved, thus removing this barrier to the further development of high-speed, large-capacity hydraulic turbines.

In the experiment and study directed toward finding something better in the construction of turbine seal rings the ideal sought was a design and construction which would avoid (1) leakage between stationary and rotating parts, (2) wear between parts, (3) danger of seizure between rotating and stationary parts, or danger that a shutdown might be caused by the assembly of the turbine runner slightly out of the exact center, or even having a the wear after almost a year's operation under adverse conditions has been negligible. The danger of damage to the interior of the turbine from the rubbing of steel rings between the rotating and stationary seal-ring surfaces, is entirely eliminated.

At the Kaweah power house No. 2 of the Southern California Edison Company rubber seal rings have enabled the plant to develop more power under the same hydraulic conditions than ever before and with better operating characteristics. Credit for the success of experiments with rubber seal rings is due Ely C. Hutchinson, general manager and chief engineer of the Pelton Water Wheel Company, who conducted them in co-operation with the author and H. L. Doolittle of the Southern California Edison Company and C. O. Poole and F. O. Dolson of the Southern Sierras Power Company. H. W. DENNIS,

Construction Engineer.
Southern California Edison Company,
Los Angeles, Cal.

Remote Control of Switches with Few Wires

ON EXTENSIVE transmission systems, especially networks, there are usually advantageous points at which to install sectionalizing circuit breakers which must be opened or closed promptly on certain occasions but where such occasions are not so frequent as to justify a local attendant. For such conditions a remote-control system has been developed by one operating company which it believes will give all the assurance of operating and indicating operations that is had with the usual station-control system. It requires only two wires plus one wire for each switch operated. Furthermore, the wires may be of steel and of any length. No. 8 iron wire is used on several installations involving circuit breakers which are two or three miles from the control station.

In general, the system is only a modification of the ordinary control system used in stations. Two of the control wires are connected with positive and negative control buses at the control station and circuit-breaker installation, the control bus at the circuit-breaker installation being connected to the control storage battery. Charging of the battery is accomplished over the iron wires connecting the control buses by a motor-generator set at the control station. The losses incurred in the iron wire with a charging current of approximately 5 amp. the user believes, will be justified by the advantages of the system.

As shown by the accompanying diagram, there is one additional iron-wire control circuit for each circuit breaker controlled. At the control station this is connected through the control switches and pilot lamps to the positive and negative buses,

while at the circuit-breaker end it is connected through a hesitating relay, closing relay, tripping relay and pallet switch to the positive and negative buses.

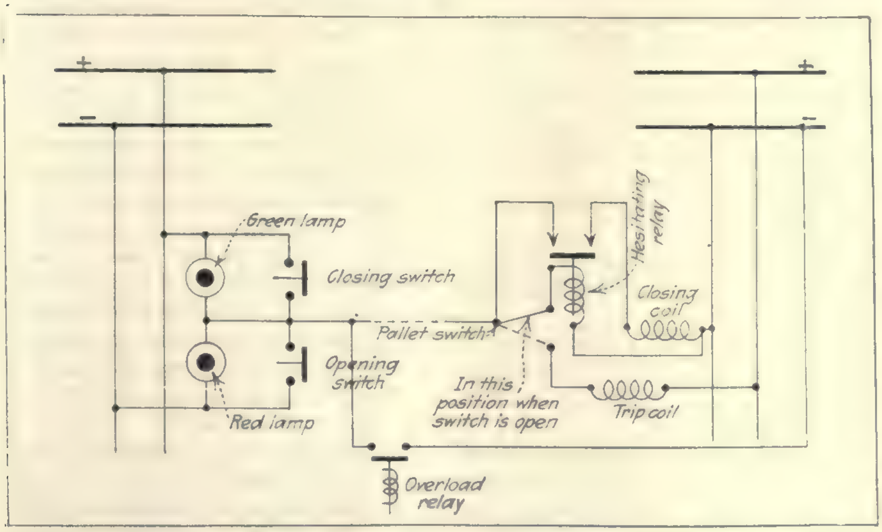
By connecting this wire to the positive or negative buses respectively by means of the control switch the circuit-breaker may be opened or closed. When the operation is performed the pallet switch at the circuit-breaker, which is actuated by the physical operation of the breaker, will connect this control line to the positive or negative bus, thereby lighting the red or green signal lamp as the case may be.

This scheme has made it feasible to install line-sectionalizing switches at strategic points even though they do not justify a local attendant.

There are some disadvantages to the schene, however. For example, if a short circuit should occur on the green lamp it would close the breaker when the breaker is open. If a short circuit should occur on the red lamp when the breaker is closed it would trip the breaker. This could be remedied by providing a resistance of about 350 ohms in each of the lamp circuits.

If the circuit breaker is automatic and equipped with an overload relay the overload relay would have to be connected to the negative and the other side to the common connection with control switch. If there is a dead short during a period when the circuit breaker is open and when it is attempted to close the oil circuit breaker by means of the closing control switch the overload relay would at once attempt to close and cause a short circuit. This would no doubt destroy the relay.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.



SIMPLE CONTROL EQUIPMENT OPERATES OIL SWITCHES AT A DISTANCE

EQUIPMENT FOR PHOTOGRAPHING ILLUMINATED DIALS IN SPEED TEST FOR DETERMINING RETARDATION OF ROTATING MACHINES

Left—Two successive photographs of dials made in a retardation speed test. Right—Camera is used to photograph dial in making retardation speed test on synchronous motor. The test was made by the Oregon company on a 1,060-hp., 400-r.p.m., $33\frac{1}{3}$-cycle, three-phase, 10,000-volt synchronous motor.

Core Loss by Retardation Method

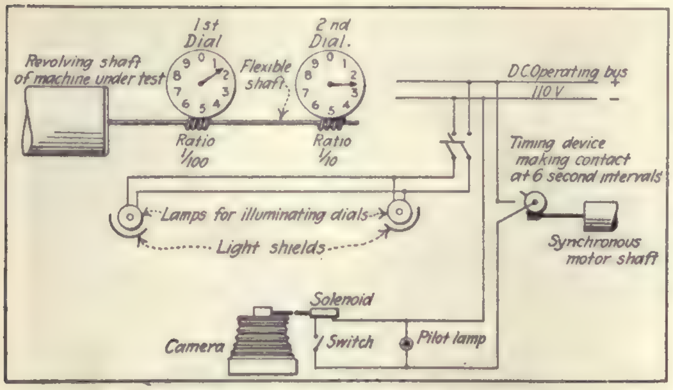
Practical Description of Equipment, Operating Features and Advantages, Followed by Theoretical Analysis

IT IS often found necessary in central-station operation to make efficiency tests on large generators or motors. The determination of friction, windage and core loss is always necessary in making such a test. On the test floor of the factory these losses are measured by the motor-drive method. Out in the plant, however, the motor-drive method can seldom be used for lack of a suitable motor and other requirements. In such places the retardation method for determining losses is more often used and has proved very satisfactory.

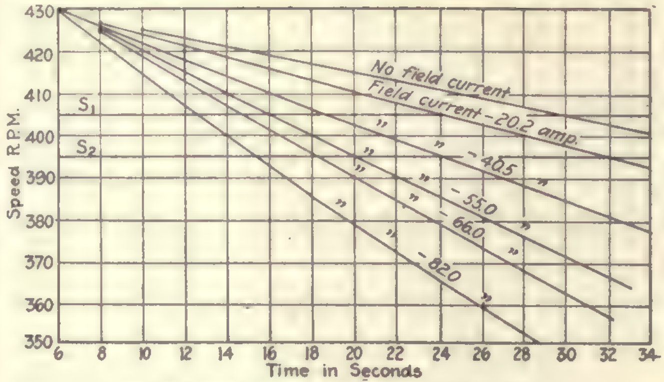
The accompanying illustration shows an unusual photographic method devised by the writer, for determining the rate of retardation of a rotating machine. This method eliminates the personal equation and the possibility of error when the successive speed readings are taken in the usual way. Ordinarily in such tests one man is required to call time, at regular intervals, one to read a tachometer and another to record the readings. This method has four sources of error, inaccuracy of the tachometer and the mistakes of the observers and the recorder.

The photometric method consists of photographing at regular predetermined intervals two dials the hands of which are connected to the rotating object through reduction gears. The camera is operated at an exposure of about 0.01. The first dial is divided into ten parts and connected to the shaft through a gear ratio of one to one hundred. Therefore ten revolutions of the shaft move the hand on the first dial one division. The second dial is also divided into ten parts, but each part is again divided into ten subdivisions. The hand of this dial is connected to the shaft through a gear ratio of one to ten. It follows, then, that one revolution of the shaft moves the hand of the second dial one main division and one-tenth revolution of the shaft moves the hand one of the subdivisions.

The reading of one exposure is subtracted from the reading of the one immediately following. The difference is the number of revolutions the rotating shaft has made during the time interval selected. If this number be divided by the number of seconds in the interval and multiplied by sixty, the result will be the



SCHEMATIC DIAGRAM FOR APPARATUS



RETARDATION CURVES PLOTTED FROM DATA

average speed in revolutions per minute of the rotating element. If several successive exposures are taken, the average speed for each succeeding interval can be accurately determined. The data thus obtained should be plotted in the same manner as the speed and the time periods described below in order to get the retardation curves. The camera shutter was operated by a small solenoid which was energized through a contact-making device that closed the circuit every six seconds. This device was attached to a synchronous motor operating on the system. A period of six seconds was selected so that the multiplying constant of the difference between the dial readings would be 60 ÷ 6, or 10. Therefore, if the second dial is read to the nearest subdivision, the difference in the readings of successive exposures will give the average speed in r.p.m. for that period. The general scheme and wiring diagram for the apparatus is shown herewith.

Procedure Outlined for Making Photometric Test

In making a test the operation is as follows: Place a roll of film in the camera and see that the timing device is working, which will be indicated by the pilot lamp. Bring the machine up to the speed required and then light the large lamps to illuminate the dial. Wait about four seconds after the pilot lamp flashes, then open the source of power to the machine under test and at the same time close the switch in the solenoid circuit. After each click of the solenoid advance the film in the camera for the succeeding exposure. This advance can easily be made in three seconds. An automatic device could be attached, however, to advance the film either by steps or continuously. This scheme eliminates all personal error and gives almost perfect results. Two pictures of the dial taken from a strip of negatives made on a six-exposure film in an actual test on a large synchronous motor are shown.

The determination of core loss by the retardation method consists chiefly in determining the rate of retardation and applying the data obtained in the common energy formulas for moving bodies. First of all the machine to be tested is brought up to a speed higher than normal by means of the local power supply, then disconnected from that supply and allowed to drift down, the speed being read at intervals of five or ten seconds. Several of such observations are taken, including one without field excitation for windage and friction determination and another with definite field current. With field excitation the losses are a combination of windage, friction and core loss. A series of retardation curves can be plotted from the speed-time observations with time as abscissas and r.p.m. as ordinates. Following is a review of the conventional formulas that were used in these tests:

Symbols used in energy formulas:

M = mass.

W = weight.

G = 32.2 ft. per second; then $W = MG$.

V = linear velocity (at radius of gyration).

ω = angular velocity (radians per second).

S = speed in revolutions per minute.

r = radius of gyration in feet.

Wr^2 — moment of inertia in pounds feet square.

Kinetic energy of a moving body $= \frac{1}{2} MV^2 = WV/2G$. With rotating bodies $V = r\omega$ and the kinetic energy $= W (r\omega)^2/2G$.

Application: The energy consumed in retarding from one angular velocity to another—where that is from ω_1 to ω_2—is equal to $(W\ (r\omega_1)^2)/2G$—$(W\ (r\omega_2)^2)/2G = \omega r^2/2G\ (\omega_1^2 - \omega_2^2)$, where $\omega = 2\Pi S/60$.

Then the total energy lost =

$$\frac{Wr^2}{2G}\left[\left(\frac{\pi S_1}{30}\right)^2 - \left(\frac{\pi S_2}{30}\right)^2\right]$$

$= 0.00017\ Wr^2\ (S_1^2 - S_2^2)$ ft.-lb.

It follows then that the average rate at which energy is lost at a given (normal) speed which is midway between two selected speeds S_1 and S_2 will be equal to the total energy lost divided by the time in seconds required for the revolving element to retard from the speed S_1 to the speed S_2. This time will be represented by $(T_2 - T_1)$. Then E (rate of energy lost) =

$$0.00017\ Wr^2\left(\frac{S_1^2 - S_2^2}{T_2 - T_1}\right) \text{ ft.-lb. per sec.}$$

If the loss is expressed in kilowatts:

$$\text{Kw.} = \frac{746}{550 \times 1000} \times 0.00017\ Wr^2 \left(\frac{S_1^2 - S_2^2}{T_2 - T_1}\right) = \frac{2{,}306}{10^{10}} \times \frac{Wr^2\ (S_1^2 - S_2^2)}{T_2 - T_1}.$$

D. W. Proebstel,
Assistant Engineer.
Portland Railway, Light & Power Company,
Portland, Ore.

Corona-Proof Wire Used by Long Island Company

ORDINARY rubber insulation, whether of the code or the 30 per cent Hevea grade, deteriorates rapidly when the wire carries high-voltage current unless it is covered with a lead sheath. This is because conductors raised to a sufficiently high potential are surrounded by an electrical discharge—luminous in the dark if the voltage is high enough—called corona, which takes place whether the conductor is insulated or not. Corona generates ozone from the oxygen in the air, and ozone very rapidly oxidizes rubber insulation, causing it to crack open, especially on the outside of bends.

Although corona discharge takes place at quite low voltages, it does not attain harmful intensity under about 2,000 volts and usually re-

mains invisible up to much higher voltages.

If the rubber-insulated conductor is covered with a lead sheath, either the ozone generated by the corona is kept from contact with the rubber or it does not occur at all, if the sheath is grounded, so that these cables may be used for transmission voltages.

There are some classes of service, however, for which it is desirable to use rubber-insulated, non-leaded conductors for currents at which corona is formed. For instance, the New York & Queens Electric Light & Power Company has a difficult outside distribution problem on account of the number of shade trees in its territory. It is impossible to use weatherproof wire on account of the leakage which would take place in the trees, and it is unsatisfactory to use spans of insulated wire, or tree wire, on account of the damage from chafing against branches. Lead-covered cables suspended from messengers were tried, but these were found to be very unsatisfactory on account of the difficulty of making taps for transformers and branches.

The engineers of the lighting company therefore decided to use on the 2,300/4,000-volt grounded Y system rubber-insulated and braided wires run through rings attached to a messenger. Of course, several wires can be run through a single set of rings, and the ease with which connections can be made to transformers and branches makes this construction economical.

The promising scheme was no sooner put into effect, however, than the rubber-insulated wires began to fail because of the action of corona. Consequently a tree wire insulated with a special rubber compound which is not affected by the ozone from corona was tried. It is covered with a special saturated braid. This wire, which is made by the Kerite Insulated Wire & Cable Company, has been subjected to the most searching tests, which have shown conclusively that it is proof against the destructive effects of corona, and it has given satisfactory service in actual use. A similar cable has been submitted to the New York & Queens Electric Light & Power Company which has withstood its laboratory tests, but none has been in service.

There are other uses to which corona-proof wire can be put, such as the wiring of industrial plants for 2,300 volts or higher.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Cost of Meters in 1922 for New England

DATA from the construction sheets of a New England central-station company are given in the accompanying table covering the cost of various sizes of electric meters purchased and shipped from the factory to the utility stockroom during 1922, but not including the cost of installation. A few current transformers are also in the shipments.

METER PRICES FOR A NEW ENGLAND CENTRAL STATION

Items	Number of Units	Totals*	Per Unit
5-amp., 110-volt, 60-cycle	3,488	$30,502	$8.75
10-amp., 110-volt, 60-cycle	42	432	10.50
15-amp., 110-volt, 60-cycle	18	229	12.73
150-amp., 110-volt, 60-cycle	1	68	68.00
5-amp., 220-volt, 60-cycle	120	1,084	9.06
10-amp., 220-volt, 60-cycle	40	416	10.40
15-amp., 220-volt, 60-cycle	32	372	11.60
25-amp., 220-volt, 60-cycle	8	114	14.25
50-amp., 220-volt, 60-cycle	6	114	19.00
75-amp., 220-volt, 60-cycle	2	44	22.00
300-amp., 220-volt, 60-cycle	1	91	91.00
5-amp., 550-volt	19	686	36.20
10-amp., 550-volt	10	376	37.60
25-amp., 550-volt	14	583	41.50
50-amp., 550-volt	13	607	46.60
75-amp., 550-volt	2	98	49.00
Potential elements	4	230	57.50
25/125-volt, 8/160-amp. current, transformers	2	374	187.00
3,000-amp. current transformers	2	138	69.00
Freight and express	.....	293	.....

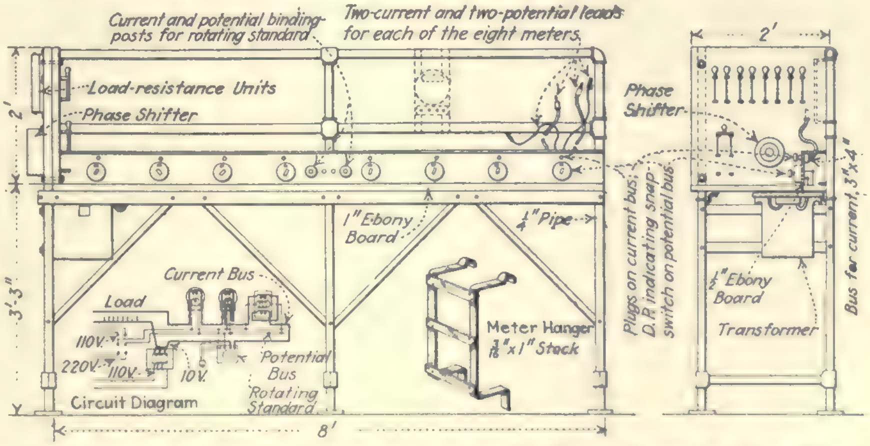
* To nearest dollar.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Building an Inexpensive Meter-Test Board

FOR meter testing the San Antonio (Tex.) Public Service Company built the alternating-current test bench shown herewith for $190, including both labor and material. This figure does not include the cost of the phase shifter, but it does contain the expense of a smaller direct-current board 4 ft. long. This bench for testing two-wire, three-wire and polyphase meters was built to connect eight meters in the circuit with the rotating standard so that after the meters have been tested for light, full and 50 per cent power-factor loads, they can be run until 1 kw.-hr. has been registered on the dials, thus checking the register. All the meters are connected in the circuit, then the current plug is removed and the potential switch turned on the meter to receive the individual tests. After each meter is tested in turn, all the current plugs are removed, the potential switches turned on and the eight meters run simultaneously to check the register.

The bench operates on the phantom-load principle, and to furnish the current a condemned 2-kw. lighting transformer was rewound to transform 110 volts to 10 volts for the current circuit. The potential circuit is on separate buses, and either 110 volts or 220 volts is obtained by means of a double-throw switch. The transformer is hung beneath the top board while the resistance units for the load are mounted back of the switch panel, making the bench entirely self-contained. The ebony-board top is supported on an 2-in. x 2-in. angle iron with $\frac{3}{8}$-in. stud bolts which do not go through to the surface, leaving the top smooth and entirely insulated from the frame.



TEST BOARD FOR TESTING LIGHT METERS EASILY CONSTRUCTED OF 1½-IN. PIPE

The meters are hung from the frame by means of separate racks which can be shifted when necessary to give room for adjustment. A portable light is suspended from the frame to throw light on the meter. Compressed air was made available for cleaning the meters.

HENRY T. POWELL,
Distribution Department.
San Antonio Public Service Company,
San Antonio, Tex.

Using Barriers During Reconstruction Work

REPLACEMENT of existing equipment without interrupting service often makes it necessary to install temporary switching equipment or requires work to be done in close proximity to live buses and cables. In spite of the many possible bus layouts in temporary switchboards, it is impossible to avoid working in the near vicinity of live equipment, and therefore it is important that guards should be erected wherever there is any likelihood of the operating forces getting in dangerous proximity to it.

These barriers may be built of iron fences or of wood, depending upon the extent of the temporary construction. Inadequately supported guards are very likely to be pushed over into the live equipment with disastrous results. Where the work must be done very close to live conductors, the guard should be made without openings and the men cautioned by signs or otherwise not to bore holes or pass their materials through the guards. Wherever it is necessary to employ carpenters who are inexperienced in working around live equipment, they should be watched continuously by competent electrical men, after being cautioned beforehand as to the dangerous nature of the work.

All cracks and knotholes in this type of barrier should be covered to prevent the chance of pushing wires through them. The lumber going into the construction of each guard should be well seasoned. Care should also be taken that no nails project through the board too close to large buses. This type of barrier is for especially dangerous places, but for less hazardous places, where the danger arises mainly in passing by live equipment, open guards or fences will serve the purpose. These should be made fairly solid but need not be fastened to the floor.

While the wood barriers erected around oil switches, transformers, regulators, busbars, disconnecting switches and the like constitute a considerable fire hazard, it is possible to go too far in guarding for electrical safety, thereby minimizing one hazard by unduly increasing another. Experience and judgment alone will indicate where to draw the line between over guarding and not enough.

N. L. DEVENDORF,
Personnel Department.
Consumers' Power Company,
Jackson, Mich.

Extracts from an Operating Code*

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

Restoring Interrupted Lines in Generating Stations

REDUCING the time of interruption to a minimum is the most important requirement when outgoing feeders trip in a generating station. This result can be obtained only by correctly analyzing the cause of trouble. Accurate information must be furnished the load dispatcher by the operators of all stations in which disturbances of any kind have been noticed. The first method outlined below will consume more time, but it is safer as any damaged apparatus will be detected before it can cause a repetition of the trouble. This method, however, is not necessary where accurate information has permitted the proper segregation of trouble.

Partial Interruption

Loss of a number of lines, small in comparison to the total number on the bus.

1. Carefully note if any switches have opened automatically and if they have spilled any oil.
2. Report to the load dispatcher. The load dispatcher will order the lines to be tried back or to be given a high-tension test.
3. If the test indicates no trouble, restore service to the lines on order of the load dispatcher.

Total Interruption

Interruption involving all or nearly all of the lines in a station or on one bus.

1. Carefully note if any switches have opened automatically.
2. Clear the bus.
3. Carefully note if the switches which have opened automatically have spilled any oil.
4. Report to the load dispatcher. The load dispatcher will order one of two procedures:

First—(a) Reconnect all lines to the dead bus.

(b) Connect to this bus an alternator operating at full speed but with no field.

(c) Cut in all field resistance and close the generator field break switches, at the same time observing the line ammeters. The current in any undamaged line will be negligible, while defective lines will be indicated by deflection of the ammeter needle.

(d) Disconnect all defective lines.

(e) Bring the voltage up to normal, observing the line ammeters during the process.

(f) Report the results of the test to the load dispatcher and follow his instructions in restoring service.

Second—(a) Energize the bus at normal voltage.

(b) Try back each line in succession, or as many of them as are ordered by the load dispatcher.

(c) Report to the load dispatcher the results of the trial and follow his instructions in restoring service.

Making Overspeed Test on Turbo-Generators

AT REGULAR specified intervals tests should be made to determine whether or not the overspeed device in a turbine is in satisfactory operating condition. In testing, the governor should be blocked in some manner, preferably by closing the oil supply to the governor. The machine is then controlled only by the throttle and the speed may be increased above normal as desired. Overspeed tests should be made under the personal supervision of the shift superintendant. Detailed instructions for making the overspeed test follow:

1. Bring the turbine up to speed with field on the generator.
2. See that the machine comes up to normal speed and remains there under control of the governor.
3. Close the throttle, and when the speed of the machine has dropped below normal close the oil-supply line for the hydraulic cylinder of the governor. The machine is now not under control of the governor.
4. Open the throttle and allow the machine to accelerate slowly until the automatic overspeed device operates and note the speed and frequency at which the automatic overspeed device operates.
5. Do not relinquish hand control of the machine until it is certain that the throttle has entirely closed under the action of the automatic overspeed device, as indicated by immediate decrease in speed and in first-stage pressure.
6. After the throttle valve has operated properly under the action of the automatic overspeed device, operate the hand wheel to the closed position and reset the throttle trip.
7. If the automatic overspeed device does not operate, do not allow the turbine to increase in speed more than 12 per cent. Trip the throttle by hand before the speed increases above this limit.
8. At completion of the test open the oil supply line to the governor.

*Abstracted from the operating code of the Philadelphia Electric Company.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

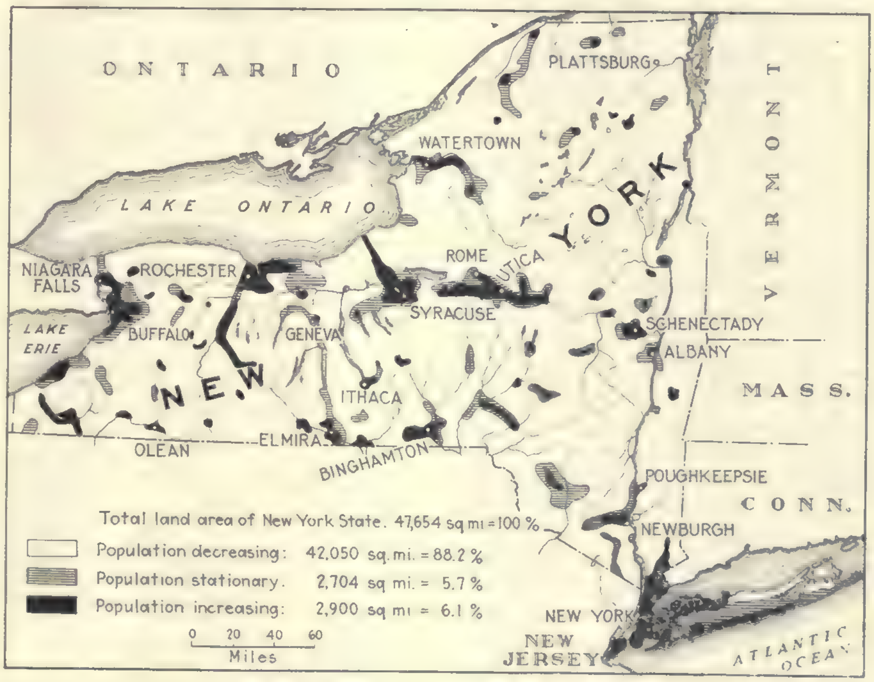
Rural Service as a Help to Stem Cityward Migration

By William M. Carpenter
Engineer Empire State Gas & Electric Association, New York, N. Y.

THE amazing growth of the larger cities at the expense of the rural districts creates a condition of considerable significance to central-station companies. The fact that such a trend has existed has long been commented on, bewailed or rejoiced in according to the personal point of view of the investigator. To the electric plant in the city it means further development and extension; to the distributing company in the country it points out a field, still for the most part untouched, where, with favorable service and an equitable rate structure, the electric industry can be a real benefactor to the country.

The tabular comparison between the figures for the census of 1920 and those for 1910 shows how acute this situation has become in New York State. The trend of the population is graphically shown on the map, upon which the heavily shaded area represents the territory where the population is decreasing, the lightly shaded area that where the population is stationary and the unshaded part that where the population is increasing. With the exception of the vicinity of New York City and the territory immediately east of Rochester, every increase in population represents the results of industrial development. Upon 88 per cent of the area of the state the people are leaving to crowd into the cities, representing only 6 per cent of the total area, and the remaining 6 per cent is barely holding its own. While the map shows the tendencies in 1920, the reports of the Department of Agriculture and of the various farm bureaus all show that the cityward movement has actually accelerated since that date, and as the result of the present limitations upon immigration this tendency may be expected to increase still further.

Unless we are willing to face the possibilities of the recasting of our entire industrial structure, it will soon become the obligation of the community to check to the best of its ability the depletion not only of the rural districts but also of the smaller towns, and to stem in some way the tide of cityward migration. Rural life must be made as attractive as possible, even if it is made so at some expense to the urban communities, and this offers to the electric companies a real opportunity, not only as a matter of duty to the people, but also as an actual business proposition. The dearth of help—of the hired man and of the hired girl—which is one of the principal sources of dissatisfaction with farm life can to a large extent be offset as it has been in the city—by the installation of electrical appliances and by the increased use of electricity. That this has proved to be effective in the villages can be seen from the fact that of the 494 incorporated villages of the state 387 are served by electricity and 107 are not. Of those served, 65 per cent show a gain in inhabitants during the preceding decade and 35 per cent a loss, while of those not so served 86 per cent report a decrease in population and 14 per cent a slight increase.



TREND OF POPULATION IN NEW YORK

Although it does not appear to be either economical or advisable for the farmer to use electric service for larger power purposes (such as

RURAL AND URBAN POPULATION OF NEW YORK STATE—1910 AND 1920

	1910	1920	Change	Per Cent
Cities of more than 10,000 inhabitants	6,771,142	8,103,046	+ 1,331,904	+19.7
Towns of from 2,500 to 10,000 inhabitants	414,352	486,798	+ 72,446	+17.5
Villages of less than 2,500 inhabitants	352,294	346,877	— 5,417	— 1.5
Rural territory	1,575,826	1,448,506	— 127,320	— 8.1
Total—New York State	9,113,614	10,385,227	+ 1,271,613	+14.0

wood sawing, ensilage cutting or feed grinding), where the gasoline tractor can be more advantageously employed, nevertheless there still remains an attractive field for power for pumping, for milking machines and for various small utility motors. In making electricity available for lighting and for household appliances a move of the greatest economic importance is made by bringing into rural territory the comforts and conveniences now available to the city man.

This, however, only can be made possible at prices which, while properly related to the farmers' deflated and still shrinking purse, will at the same time at least allow the electrical distributor to "break even." The ways and means for making extensions into country districts must be developed so as neither to become an unjust burden upon the users of the service nor to entail discrepancies in the charges in the same neighborhood.

During the past year the subject of equitable rates for rural service has received a great deal of attention. It may confidently be hoped that the various agencies now undertaking a study of this problem will soon arrive at an equitable basis for the construction and operation of rural lines and that before long real relief in this manner will be available everywhere for the farm population.

Pacific Gas & Electric Gives Vice-President Charge of Public Relations and Sales

ONE of the most progressive and significant steps in the constructive organization of central-station commercial departments was taken recently by the Pacific Gas & Electric Company, when R. E. Fisher was made vice-president in charge of public relations and sales. These two departments had previously been under the direction of two vice-presidents, F. A. Leach having public relations and Mr. Fisher sales. Mr. Leach was recently made vice-president and general manager, and subsequently the two departments were combined and placed under the direct supervision of one vice-president, Mr. Fisher.

In assuming the duties of this new office Mr. Fisher formed an organization that is of particular interest in its assignment of duties to various departments. The functions and responsibilities of these departments are clearly outlined in the following general order from the office of the vice-president in charge of public relations and sales:

SALES ORDER NO. 1

The assistant to vice-president in charge of public relations and sales, which position is hereby created, will act as general assistant to the vice-president in charge in the handling of all matters for which this department is responsible. He will specialize in the interpretation to division managers of all general orders and rules and regulations of the company, will have charge of informal complaints before the Railroad Commission and will undertake such special assignments as the vice-president in charge may from time to time direct.

Sales Department.—This department will be under the supervision of the sales manager, who will have general control, under the direction of the vice-president in charge, of all matters respecting sales of electrical energy and appliances, gas and appliances, water within municipal boundaries, steam and all other sales not definitely allocated elsewhere. This department will be divided as follows:

Electric Sales: The manager of electric sales will report to the sales manager and will be responsible for the development of methods for increasing the sales of electrical energy and appliances and for the securing of new electric business.

Gas Sales: The manager of gas sales will report to the sales manager and will be responsible for the development of methods for increasing the sales of gas and appliances and for the securing of new gas business.

Commercial Department.—The manager of the commercial department will report to the vice-president in charge and will have charge of the interpretation of rate schedules and rules and regulations relating thereto, adjustment of disputes with consumers and submission of recommendations to the vice-president in charge for approval of such adjustments, renewals of contracts and preparation of contract and sales forms (in conjunction with the law department). He will pass upon the commercial and sales details of all new business estimates and have general control of all commercial details, and in collaboration with the assistant to the vice-president in charge and with the heads of the several departments will co-ordinate the procedure of all departments of this office to promote efficient operation and prompt handling of all business, and undertake such special assignments as may be given him from time to time by the vice-president in charge.

Publicity Department.—The manager of the publicity department will report to the vice-president in charge and will have charge and control of all publicity and advertising in all divisions of the company. He will collaborate with the sales manager in the preparation of all sales publicity and advertising. Division managers will refer to this department for approval any advertisement or publicity which they may desire to place in any publication in their territories.

Bureau of Public Relations.—The manager of the bureau of public relations will collaborate with the manager of sales in the carrying out of the sales service program; he will act as the personal representative of the vice-president in charge in the handling of special adjustments and in contact with organizations and associations, and will undertake such special assignments as may be made by the vice-president in charge.

Is This Weakness Common in Selling Electric Appliances?

THE following story is told and vouched for by the commercial manager of a central-station company having a dozen or more district offices where electric merchandise is displayed and sold. He says that it was an isolated case and does not indicate a general condition, but it does point out that if the central stations are going to profit from this business they must be real merchandisers and employ real salesmen. Here is the story:

Recently Neil C. Hurley of the Hurley Machine Company dropped in to see one of the central-station company's district managers. The manager was out, so Mr. Hurley found a chair near the washing-machine display and sat down to wait for him.

This display consisted of two washing machines and an ironer. It occupied a very prominent place near the door where every one entering or leaving would be sure to see it, but although dozens of people passed in while Mr. Hurley sat there, no one stopped to look at the machines or appeared to be at all interested.

When the manager returned Mr. Hurley found that they had not sold a washing machine for more than two weeks, that in that time they had discovered only two or three live "prospects," and that the only effort they made to get business was through newspaper advertising and the "floor display."

Mr. Hurley then told him of his experience watching the people walk past the floor display and asked him why he did not have his sales force talk washers and ironers to every customer that came in. His point was that, no matter what a woman came into the office for—even if only to pay a lighting bill—her attention should be called to the home laundry machines. In other words, the floor display in itself would not make the sales; it was necessary for the company to get the value out of that

floor space by bringing its customers over to the machines and giving them a little demonstration and sales talk.

The result of the conversation was a meeting of the office employees at which the entire matter was thoroughly covered, and each man and woman was instructed to keep a careful record of the people who were interested so that they could be followed up.

The plan went into effect the next morning, and when a check-up was made at the close of business that day it was found that two washers and one ironer had been sold and that they had obtained six live "prospects" for washers and four for ironers.

The point of the story is obvious. A display in itself, no matter how good it may be, will not make sales. To make the sales and get the live leads which can be developed into sales by proper "follow-up" methods, the customers' attention must be called to the appliances on display.

Progress of Customer-Ownership in Last Eight Years

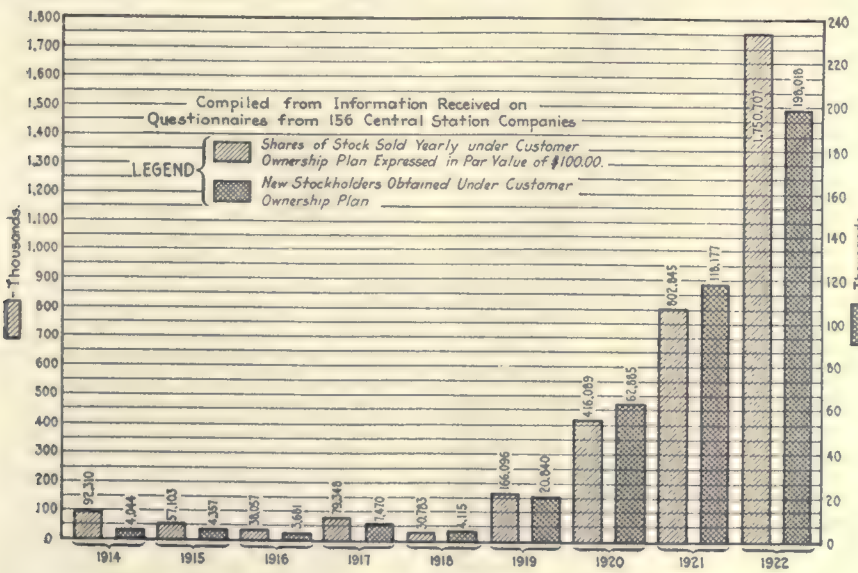
DATA compiled by the customer-ownership committee of the National Electric Light Association from answers to 156 questionnaires received from central-station companies indicate the phenomenal progress in the movement to make the customer a partner in the utility business. The accompanying diagram shows graphically the yearly number of shares, expressed in $100 par value, that have been sold to customers from 1914 to 1922. It also shows the number of new stockholders obtained under the plan during the same period. A summary of the data showing the total population served, number of customers and customer-owners, the average cost of selling per share and so on is given in the accompanying tabulation.

The value of customer ownership to the industry becomes fully apparent when it is remembered that state ownership of the water powers in California was recently defeated by a vote of 700,000 against and only a little more than 200,000 in its favor. That state had 100,000 customer stockholders, each of whom was believed to control seven voters who favored the utilities.

SUMMARY OF INFORMATION FROM 156 ELECTRIC LIGHT AND POWER COMPANIES

Total population of territory served	40,899,096
Total number of customers.	7,698,313
Gross earnings of combined companies reporting	$555,553,901.47
New stockholders obtained from customer-ownership plan	426,495
Shares of stock sold under customer-ownership plan (stated in par value of $100 per share)	3,449,185
Percentage of sales on deferred-payment plan (average)	32.5
Percentage of stockholders obtained through customer-ownership plan, to customers	5.5
*Average cost of selling per share as reported by seventy-five companies	$4.39
Ratio of stockholders to population	1.95
Shares sold to customers, 780,438; employees, 150,511; others, 125,491 (only fifty-eight companies reported on this item).	

*In report of average cost of selling, the lowest was 5 cents per share, which included postage and printing circular letter. The largest amount was $9.64 per share, including commission, advertising, transportation, general office expenses and salaries.



SHARES OF STOCK SOLD AND SHAREHOLDERS OBTAINED YEARLY UNDER CUSTOMER-OWNERSHIP PLANS

What Other Companies Are Doing

Bennington, Vt. — The physics class of the local high school recently received instructions regarding electric meters. A representative of the Twin State Gas & Electric Company explained the construction and operation of meters and showed how they are read and the monthly bills determined. Some testing instruments were loaned to the school, and during its study of electricity the cost of operation of different appliances was calculated.

Wisconsin. — Elgin Club, on Geneva Lake, is endeavoring to have all of its summer residents use electricity for cooking and water heating, thus eliminating fire hazards. Electric service is furnished by the Southern Wisconsin Electric Company.

Rockland, N. Y. — In two and a half months the sales crews of the appliance department of the Rockland Light & Power Company have sold more than $20,000 worth of appliances. Vacuum cleaners have been installed in 260 homes, and in doing this a record has been made for cleaner sales in New York State, according to Cyrus Barnes, general sales manager of Charles H. Tenney & Company, Boston, Mass., operators of this property. One hundred dollars in bonuses and prizes have been distributed among these outside men. T. Scott Saylor is sales manager of the Rockland company.

Anderson, Ind. — The Traction Light & Power Company is now merchandising electrical appliances through the services of a salesman who travels between the various towns on the traction system. He carries several grips of appliances, including toasters, curling irons, grills and so forth, some of which he leaves at the interurban stations as a display. The remaining appliances he uses for a house-to-house campaign. By means of the interurban service, any of the larger appliances, such as a washing machine or vacuum cleaner, can be delivered from the main office within four hours whenever a group of prospective customers desires an actual demonstration of such an appliance. After the salesman leaves that territory the local agent handles the other calls.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Hydro-Electric Development and Steam Equipment

Municipal Power Plant at Lansing, Mich.—O. E. BULKELEY.—This plant, operated by a board of commissioners, has an initial installation of 25,000 kw., with an ultimate capacity of not less than 40,000 kw. Following are some of the interesting features of the plant: Steam supplied to turbines at 275 lb. pressure and 200 deg. superheat, six 15,000-sq.ft. V-type boilers each fired by sixteen retort underfeed stokers, forced draft supplied by independent motor-driven fans, centralized boiler-control system, heat balance maintained by house turbines and steam extraction, evaporators for distillation of feed-water make-up and the location of all steam and other headers below the operating floor. The plant is designed for maximum accessibility and daylight illumination.—*Power*, June 19, 1923.

The Manchester (England) Electricity Supply.—The New Barton generating station of the Corporation of Manchester contains three 27,500-kw. turbo-alternators, each capable of a maximum output of 31,200 kw. for short periods. The operating steam pressure of the main sets is 350 lb., the temperature 700 deg. F. and the speed 1,500 r.p.m., with a vacuum of 29.1 in. at full load and a 30-in. barometer. The station auxiliary supply, control room, switch house, boiler room and coal-handling facilities are discussed in detail.—*Electrical Review (England)*, June 22, 1923.

Furnace Construction for Power Stations.—O. K. LIENTZ.—The author discusses the problems to be met in modern furnace design, factors to be considered in the design of a furnace and actual tests.—*National Engineer*, July, 1923.

Generation, Control, Switching and Protection

Overvoltages, Overloads and Conditions of Effective Resonance in the Practical Use of the Petersen Reactor.—A. INCONTRI. — The author, after treating mathematically with many numerical examples overvoltages, overloads and conditions of effective resonance in the Petersen reactor, draws the following conclusions: The Petersen reactor—very good in its theoretical simplicity—is not diminished in value when practically applied. It is necessary only to figure out with great care the value of the normal capacity of each wire to ground. The dissonance of the reactor is automatic, so that a previous determination of it is not necessary. While designing a reactor it is of great importance to take into account the reactances of the transformers and of the transmission line. Finally, the author believes that owing to the continuous growth of the transmission installations, and consequently of the quantity of energy which can freely circulate through the short circuits, it is not unsafe to foresee a limit beyond which the Petersen reactor, properly proportioned, will become indispensable. — *Elettrotecnica*, June 15, 1923.

Water Resistances.—H. MAN.—For testing generators in the field or at the manufacturers' very frequently a water resistance is used to dispose of electric power. In a large container of wood or cement a stationary and a movable metal plate are inserted, which form electrodes between which the water acts as an ohmic resistance. The paper gives valuable hints as to the best arrangement of such resistors and tabulates dimensions and data for twelve different water boxes with a capacity of from 900 kw. to 21,000 kw. A current density of 11 amp. per square decimeter should not be exceeded because the water temperature should stay below 70 deg. C. Above this temperature the water becomes disturbed, resulting in an unsteady resistance. The specific resistance of the water used has a very great influence upon the electrode size and distance.—*A. E. G. Mitteilungen*, June, 1923.

Transmission, Substations and Distribution

Tacoma-Seattle Power Exchange Line. — R. E. TOWNE. — An interesting and valuable application of the large-capacity regulating transformer will be made shortly. It will be placed in service in the Pacific Northwest and will constitute an important link in the transmission tie line joining the municipal power systems of Tacoma and Seattle. The apparatus will be used to connect a 57,000-volt Y system to a 50,000-volt delta system. It consists of a 15,000-kva. three-phase transformer with taps by means of which, in conjunction with an induction regulator, large variations can be obtained in the transformer ratio. — *Electric Journal*, June, 1923.

Experimental Determination of Short-Circuit Currents in Electric Power Networks.—O. R. SCHURIG.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. midwinter convention, Feb. 24, 1923, on page 438.—*Journal of the A. I. E. E.*, June, 1923.

Summary of High-Tension Underground Transmission Practice and Development.—G. B. SHANKLIN.—After discussing the advancement made in the art and giving data concerning three-conductor and single-conductor cables installed in America, the author compares the development with that in Europe. He then compares the relative merits of three-conductor and single-conductor cables and discusses joints, dielectric strength, internal ionization in the table and heating of cables of various types and cross-section.—*General Electric Review*, July, 1923.

Units, Measurements and Instruments

Optical Methods for Measuring Oil Film in Bearings. — V. VIEWEG. — The use of a suitable lubricant in its bearings is of vital importance to the performance and the economical operation of a rotating machine. At standstill the metal of the shaft touches directly the metal of the bearing. During the starting period the shaft is rolled slightly upward and forward and has a more or less pronounced unsteady radial motion. The exact determination of the position of the shaft in relation to the bearing during the start and the run of a machine is therefore a very essential means by which to judge the suitability of a lubricant or to compare two different oils. Both methods described by the author can be used in the field and neither is a strict laboratory measurement. Both give results with an accuracy of within 0.00004 in. The first method is suitable only for end bearings and measures the displacement of a point on the center of the shaft with a microscope. The second method, suitable for any part of the shaft, measures by means of optical aberration the rise or fall of the shaft and records the amount of it upon a slowly moved photographic plate. The paper should be of considerable interest to manufacturers of electric machines and oil refiners.—*Wissenschaftliche Abhandlungen der Physikalisch-Technischen Reichsanstalt*, Vol. VI, No. 2, 1923.

Transformer Testing Equipment.—E. LIENHARD.—A modern transformer testing department is described in detail. Provisions are made to test small and large capacity transformers of the self-cooled, water-cooled or air-blast types, a dark room is available for corona observations, and a special high-potential and impulse-voltage apparatus are installed. A total generator capacity of 725 kva., comprising three machines, and in addition feeders supplying 1,500 kva. at 16⅔ to 50 cycles. give the necessary testing power. A large high-voltage and low-voltage line selector permits supplying any desired testing current to any particular place within the department. Of interest are portable testing tables, which are brought next to the tested machine, and which contain, ready wired, the necessary apparatus and instruments for the usual iron loss, copper loss, ratio, impedance, etc., tests on transformers. The high-potential room contains one transformer for 225,000 volts and one for 500,000 volts. A 500-mm. sphere

spark gap measures the breakdown voltage. A large oil basin is let into the floor of the high-potential room, in which core and coils of the tested transformer or high-voltage leads are immersed during the test.—*Brown-Boveri Mitteilungen*, June and July, 1923.

Illumination

Lighting Art Galleries. — A. L. POWELL, A. S. TURNER and H. A. COOK. —The layout, with a general description, of the simulated daylight illumination of the Grand Central Art Gallery, New York City, is explained in this article. Care was taken to provide a system of lighting that would present the art subjects just as the artist conceived them. Elimination of shadows, clarity of intricate detail and apparent absence of the feeling of light are the features of this lighting system.—*Electrical Record*, July, 1923.

Motors and Control

Electric Drive for Sectional Paper Machines.—O. C. CORDES.—The necessity for using the same machine for various grades of paper, together with the inherent characteristics of the manufacture of paper, produces three fundamental requirements for the control of these motors, namely: The relative speeds of the motors for any given adjustment must be constant, the relative speeds must be adjustable over a small range, and the speeds of all the motors must be adjustable simultaneously over a wide range without affecting the relative speeds. A control system is described in which the first requirement is met by the use of a master rotary contactor in conjunction with a rotary contactor on each section. The second requirement is met by a speed changer between each section rotary contactor and the motor whose speed it regulates, and the third by adjusting the voltage impressed on all the section motors and the motor driving the master rotary contactor. A very detailed description of the control system is given. — *Electric Journal*, July, 1923.

Winding Induction Motors.—A. M. DUDLEY.—The author tells what distribution and chord factors are and how they are derived in the application of winding stators of induction motors. —*Industrial Engineer*, July, 1923.

Heat Applications and Material Handling

Electric Heating.—E. ZUELEMANN.—A paper giving a survey of modern uses of electric power for industrial heating purposes, dealing in a general descriptive way with a great variety of such devices in connection with which electric generation of heat has been introduced to advantage. Particularly wherever surplus hydro-electric power is available, electric heating results in coal saving, which is of great economic value. Electric steam boilers and hot-water house-heating plants have been developed during the last few years to great perfection. Electric heating units supersede gas and steam on presses and rollers. Welding machines, rivet heaters and forging presses have been successfully electrified. Electric furnaces are so widely used today and are of such varied design that they are only mentioned. Very recently electrically heated driers have been introduced in textile mills.—*Zeitschrift des Vereines Deutscher Ingenieure*, June 23, 1923.

Material-Handling Facilities.—G. A. VAN BRUNT.—The material-handling scheme that forms an integral part of production processes is an important factor in securing continuous maximum output at minimum cost. The author describes the layout that controls the flow of production in the works of the Bates Expanded Steel Truss Company. A material-handling plant based on the use of electric hoists, chain conveyors and rollers, was devised before the production equipment was put in place. —*Industrial Engineer*, July, 1923.

Electrophysics, Electrochemistry and Batteries

Improvement in Electrolytic Silver Refining.—A. H. W. CLEAVE.—A circular electrolytic cell for refining silver is described which is 36 in. in diameter and which rotates at a peripheral speed of 40 ft. per minute. The current density varies from 75 amp. to 150 amp. per square foot. The electrolyte is placed in the annular space between the outer and inner walls of the cell. By means of a specially designed cathode and multiple grouping of the anodes, the current causes the deposited silver to adhere loosely to the cathode, so that it may be easily removed. The cell is capable of an output of 40.3 ounces per hour or more than twice as much as the older type of cells.—*Engineering and Mining Journal-Press*, July 7, 1923.

Storage Battery Cars on the Canadian National.—E. B. WALKER. — Five storage-battery cars have been used on the Canadian railways between Trenton, Ont., and Belleville with marked success. Power used is from but 2½ kw.-hr. to 3 kw.-hr. per car-mile (30-ton car) at the alternating-current side of the charging set. The company has found that the nickel-iron battery stands the rough usage and gives longer life in battery-car service than does the lead battery. However, the longer life of the nickel-iron battery is partially offset by the lower price and high efficiency of the lead battery.—*Railway Electrical Engineer*, June, 1923.

Traction

Austrian Express Locomotives. — B. V. NES.—Two of the new Austrian express locomotives for the mountainous Tyrolean branch are now in operation and five more are expected to be delivered within the next ten months. The engines are for 15,000-volt, single-phase, 16⅔-cycle current and are of the class 1-C + C-1. In a main transformer of 1,730 kva. output, equipped with eighteen taps of about 70 volts each, a special double-brush step switch permits a sparkless increase of the motor voltage from zero to a maximum of 1,330 volts. The transformer is oil-cooled with cooling coils arranged on the outside of the engine cab. The main oil switch has a ten-point break and two initial resistance contacts. Its rupturing capacity is given as over 100,000 kva. A total absence of contractors and straight-resistance braking are the two main reasons for the exceedingly simple, positive and reliable control mechanism of this locomotive. Four twelve-pole compensated series motors, with resistance connections between armature winding and commutator, each of an hour rating of 441 kw. at 640 r.p.m., drive in couples two blind shafts, which in turn are connected with horizontal rods to three drivers each. The motors are designed for 530 volts each, operated two in series. They are forced-air-cooled, with the air passing a special filter before being blown through the windings. This has greatly reduced the insulating difficulties, as an analysis of the incoming dust-laden air has shown that the solid impurities consist of 52 per cent iron, 10 per cent carbon and 4½ per cent copper. Two large pantograph current collectors for the open road and two small collectors for the tunnels have been provided on the engine roof. An elaborate electro-pneumatic interlocking system prevents access to any high-voltage apparatus as long as it is alive. Compressor motors, vacuum-pump motors and train-heating devices are all served from the transformer.—*Elektrotechnik und Maschinenbau*, June 24, 1923.

Electric Braking as Applied to Mine Locomotives. — E. J. GEALY. — The author describes the application of electric braking controller to mine locomotives. The greatest field is for the gathering type of locomotive. The transposition from motors to generators is explained.—*Coal Age*, July 5, 1923.

Telegraphy, Telephony, Radio and Signals

Electric Oscillation in Three-Phase Overhead Distribution Lines.—S. BEKKU.—Experiments with electromagnetically induced electromotive force on a communication line by a neighboring power line with ground return show that the coefficient of mutual induction is far greater than the value calculated by the principle of electric image. The author has developed a theory without the assumption of the proportionality of coefficient of mutual induction. He does not consider the potential difference along the earth's surface, which is somewhat contradictory to the supposition of finite conductivity of earth crust. In this respect the theory developed is to a certain extent semi-empirical, and its validity must be checked with the experimental results performed on the actual transmission line. — *Research Publication No.* 120 *of the Electrotechnical Laboratory, Tokyo, Japan.*

New Books

Reviews of the Latest Contributions to Technical, Industrial and Commercial Literature of Particular Interest to Members of the Electrical Industry

Radio—Télégraphie, Téléphonie, Concert

By E. Reynaud-Bonin. Paris: Gauthier-Villars et Cie. 176 pages, illustrated.

This 176-page pamphlet is a sort of glorified index of the subject. The author has selected too much subject matter to be covered in pamphlet form and has sacrificed clearness to brevity in order to make it all-inclusive. Much of the matter is presented in outline form, almost as if whole chapters of a complete text on radio had been condensed to a few pages. This criticism applies to other books that have recently appeared. They do not give the reader a clearer insight into or a better understanding of the subject.

The preface dedicates the pamphlet to the amateur, but the amateur who can read it with understanding does not need to. The first chapter is brief and historical, an arbitrary collection of names and dates of little value. Further on general statements are made which are true only under certain conditions. The conditions are not generally stated.

The discussion on receiver circuits, detectors and amplifiers is very good. The circuit diagrams of vacuum-tube sets are unnecessarily awkward. It is unlikely that an amateur will understand the operation of the circuit shown in Fig. 65 from the explanation on page 86. Pages 100 to 110 cover briefly the service channels in France and her colonies and are of interest to the French amateurs. This matter is well presented. The chapter on the theory and practice of radio telephony will not be readily understood by beginners. In a "Conclusion" the author generalizes on the present and future usefulness and possibilities of radio.

H. M. TURNER.

The Engineering Index

Volume 21. By the American Society of Mechanical Engineers. New York: J. J. Little & Ives Company. 675 pages.

Approximately thirteen hundred periodicals, reports and other publications regularly received during the year by the Engineering Society, New York, have been reviewed for the purposes of this volume, and from six hundred of these the articles to be indexed have been selected. About 20 per cent of these periodicals are printed in Great Britain and her possessions and approximately 30 per cent are representative publications of Belgium, France, Germany, Italy, Spain, South America and other foreign countries.

The book indexes not only the 1922 periodicals received during the calendar year, but also 1921 publications which came in too late to be reviewed in the 1921 index and all late 1922 publications received previous to February, 1923. The book contains a larger number of references than ever before, but by virtue of conciseness its size has not been unduly increased.

Photostatic copies of articles indexed may be secured from the Engineering Society Library, 29 West Thirty-ninth Street, New York, at a charge of approximately 25 cents per page.

The Electrical Handling of Materials

Vol. IV. Machinery and Methods. By H. H. Broughton. London: Benn Bros., Ltd. 315 pages, illustrated.

A comprehensive volume on electrical and mechanical equipment for handling materials economically. Many examples are culled from practice throughout the world to illustrate the status of the art. Elevators and conveyors, belt conveyors, automatic feeders, skip hoists, bulk materials, grain handling, the handling and storage of coal, ore and similar materials, and the handling of foodstuffs and general merchandise are treated in chapters which are detailed, thorough and well illustrated. The book is a real handbook on material handling and is well edited and printed. Costs and installation details add to its value, and there seem to be no gaps in the descriptions of existing apparatus or methods in this line of activity.

German, British and American Standards Compared

By Friedrich Nettel. Berlin: Julius Springer.

This pamphlet of forty-two pages gives a concise and accurate comparison of the more important standards of Germany, Great Britain and the United States relating to rotating machines (except railway motors) and transformers. It is printed in English. The standards compared are the following:

Germany—V. D. E. 1923 Rules.

Great Britain—(1) British Engineering Standards Committee, (a) No. 72, 1917; (b) No. 168, 1923 (Industrial Motors). (2) Beama Rules, 1920.

U. S. A.—1922 Standards A. I. E. E.

The statement of U. S. A. standards is misleading in a few instances because only A. I. E. E. standards have been included. Standard machine and transformer voltages, for example, adopted by the N. E. L. A. and Power Club are not referred to and it would appear that the United States has no standard voltages.

The subject matter of the several standards has been necessarily condensed, but considering the small size of the publication the contents are surprisingly complete. The rules of the three countries are arranged side by side in parallel columns so that comparisons can be very readily made. This compilation should be of interest and value to engineers interested in the preparation of standards and to the much larger group interested in the sale of electrical machinery and transformers abroad.

F. D. NEWBURY.

Atoms

By Jean Perrin. Translated by Hammick. New York: D. Van Nostrand Company. 225 pages.

Those who are interested in the semi-speculative realms of atomic structure will find this book valuable. It is notable for its good style and for the clear explanations of the phenomena described. The layman can read it with intelligence and the specialist with profit. It deals with chemistry and the atomic theory, molecular agitation, emulsions, Brownian movements, fluctuations, light and quanta, the atom of electricity and the genesis and destruction of atoms.

Inductive and intuitive reasoners are working on the details of the doctrine of atomic structure, and the tendency is toward the theory that all matter is infinitely discontinuous with a continuous ether. A fluid in equilibrium is merely an illusion and a snare for the unwise. The quanta open new vistas for applying Planck and Einstein conceptions to the universe about us, and the author outlines many methods of application. The book is well printed and should be well received.

Books Received

A Symbol of Safety. By Harry Chase Brearley. New York: Doubleday, Page & Company. 290 pages, illustrated.

Ausgleichsrechnung. By V. Happach. Leipzig and Berlin: B. G. Zeubner. 74 pages, illustrated.

Absolute Measurements in Electricity and Magnetism. By Andrew Gray. London: Macmillan & Company, Ltd. 837 pages, illustrated.

A Manual of Artificial Respiration. By Capt. G. R. G. Fisher. Boston: The Stratford Company. 80 pages, illustrated.

The Electric Furnace for Iron and Steel. By Alfred Stansfield. New York: McGraw-Hill Book Company, Inc. 453 pages, illustrated.

Wissenschaftliche Abhandlungen der Physikalisch-Technischen Reichsanstalt. By fourteen authors. Berlin: Julius Springer. 124 pages, illustrated.

L'Eclairage. By E. Darmois. Paris: Gauthier-Villars et Cie. 276 pages, illustrated.

Radiotélégraphie et Radiotéléphonie. By G. Malgorn. Paris: Gauthier-Villars et Cie. 227 pages, illustrated.

Grundzüge der Starkstromtechnik für Unterricht und Praxis. By Dr.-Ing. K. Hoerner. Berlin: Julius Springer. 257 pages, illustrated.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Plans for World Power Conference

Water-Power Development and the Application of Power to Industry to Be Considered Internationally in London Next Year—Twelve Countries Already Co-operating

THE world power conference which is scheduled to be held in London next year under the presidency of the Earl of Derby is fast taking form. National committees have already been organized in Canada, France, Italy, Belgium, Switzerland, Norway, Sweden, Holland, Denmark, Poland, Czechoslovakia and the United States, and the chairman of the Canadian committee, J. B. Challies, and the chairman of the committee from the United States, O. C. Merrill, are expected to arrive in London early in August to help map out the program.

In view of the fact that many of the delegates attending the conference will be interested primarily in water power, the central organization in London has formed a special section devoted to water power, with its own secretary and advisory sub-committee. The secretary of the water-power section is C. M. Norrie.

The program thus far outlined with regard to water power provides for national reviews of the water-power situation in all of the great water-power countries of the world. In these reviews will be treated the attitude of governments toward water-power development, with a summary of legislative policy affecting state control and private enterprise. In addition it is planned to give a historical review of the progressive utilization of water-power resources, statistical data on powers developed and undeveloped, questions of finance, potentialities of water power with reference to national welfare and the productive possibilities of the future.

Many Papers to Be Prepared

Technical papers have been solicited covering generating conditions and economy, recent practice in the design and layout of the civil engineering features of water-power schemes, and recent practice in the design, manufacture and operation of hydraulic pipe lines, machinery and electrical equipment. In the transmission and distribution of hydro-electric energy papers will be provided covering the general economic principles, recent practice in the design and operation of transformers and switches, high-tension lines and distribution systems for rural and industrial districts, and the application of hydro-electric energy, particularly with reference to systems of administration and to industrial and transportation service.

It is the intention that all papers shall be printed and circulated well in advance of the date of the conference so as to obtain the maximum amount of discussion of them. The council of the British Electrical and Allied Manufacturers' Association in arranging the final program is said to have the co-operation of the Admiralty, the War Office, the Air Ministry, the Department of Scientific and Industrial Research, the National Physical Laboratory, the Institution of Civil Engineers, the Institution of Mechanical Engineers, the Institution of Electrical Engineers, the Society of Chemical Industry, the Federation of British Industries, the Cable Makers' Association, the British Engineers' Association, the British Empire Producers' Organization, the Industrial Fatigue Research Board and other British bodies.

Henry Ford to Electrify His D., T. & I. Railroad

It has just been announced that contracts aggregating $1,000,000 have been awarded to the Westinghouse Electric & Manufacturing Company for the construction of electrical equipment, including locomotives, for the Detroit, Toledo & Ironton, Henry Ford's railroad. Preparation for the electrification of the first unit of the line is under way.

New equipment at the River Rouge power house will furnish the motive power for this unit. At this power house the original capacity is being doubled. The present generating system, consisting of two 12,500-kva. turbo-generators, is being replaced by eight turbo-generators each rated at 30,000 kva. The steel work on three of the stacks is completed, and one of the turbines is near completion. A voltage of 22,000, single-phase, will be carried on the trolley with a transmission voltage of 150,000.

Besides this addition at the River Rouge plant, the new plan calls for the building of locomotives, the construction of 13½ miles of double track between the River Rouge plant and the Flat Rock yards, and many minor changes.

The new electric locomotives for the Detroit, Toledo & Ironton for freight service will weigh 360 tons. They will have a normal capacity of 4,000 hp. and will be capable of producing 5,000 hp. for an hour. They will have sixteen driving axles and will develop 108,000 lb. drawbar pull at 25 miles an hour. Their maximum speed will be 45 miles an hour.

Philadelphia and Camden Are Interconnected Electrically

Difficult engineering obstacles were surmounted in almost record-breaking time by the Public Service Production Company in connecting the Philadelphia Electric Company's Delaware station with the Public Service Electric Company's system in Camden, N. J., to assure a substantial electric auxiliary service in the southern part of New Jersey. The job was completed in eight weeks and the line is now in operation.

The work necessitated the laying of three cables under the Delaware River. Two of these are 350,000-circ.mil cables and extend from the Delaware station of the Philadelphia company to the Atlantic Avenue substation of Public Service company. Each has a capacity of 12,000 kva. and is 16,600 ft. long. The third cable is of smaller dimensions.

Permission from the government to install the cables was contingent on the digging of a trench, 5 ft. to 15 ft. deep, in the riverbed, in which the cables were laid. In the channel this trench is 45 ft. below mean water level. The cables were mounted on barges, and each represented three wound reels.

Wyoming Legislature Passes Bill on Water Rights

At a special session of the Wyoming State Legislature during the month of July the House and Senate passed unanimously a bill concerning "water rights" which is approved by Governor Ross, the bill being in line with the Governor's wishes and one of the reasons for the calling of a special session of the lawmakers.

Claiming that Wyoming is the "watershed of the continent," that rivers originating in Wyoming find their way to the Gulf of Mexico, Gulf of California and Puget Sound, the law thus enacted instructs the Governor

of Wyoming to communicate to the Governors of the other interested states and to the federal government Wyoming's proposal for the creation of a state and federal water commission. The commission would consist of representatives of all the states involved and a representative of the United States. The commission would have authority to enter into agreements concerning the waters of all streams rising in the State of Wyoming and draw up a treaty definitely settling all disputes for all time.

Commission Engineers Against Louisville

Give Preference to Central-Station Company's Application in Falls of Ohio Conflict—Property Owners Enjoin Dothan (Ala.) Project—Pigeon River Development

As FORESHADOWED in the ELECTRICAL WORLD, a recommendation will be submitted to the Federal Power Commission by its engineering staff that the application of the city of Louisville for a preliminary permit to develop a hydro-electric project on the Ohio River near that city be disapproved and that the application of the Louisville Hydro-Electric Company, a Byllesby subsidiary, covering the same site be granted. The conflicting applications regarding this proposed development have been before the commission a little more than a year. A letter setting forth the views of the staff has been sent the city officials and a copy directed to the company. Under the procedure of the commission the city will have a month to make reply before the recommendation is placed formally before the commission.

In their letter the members of the engineering staff set forth that the project cannot be developed except with auxiliary power of approximately equivalent capacity, 75,000 hp. to 100,000 hp., and that the Louisville Gas & Electric Company now has its steam development to serve that purpose, while the city's proposal to develop auxiliary power on the Green River would be an unjustifiable duplication of facilities for which the consumer would have to pay. It is further contended that for reasons of economy the hydro-electric plant and the steam plant should be controlled and operated by the same concern.

If the city were able and willing to take over the properties of the Louisville Gas & Electric Company, including its distribution system, then it would be clearly entitled to the preference for municipalities set forth in the water-power act. To build a hydro-electric plant and take over the properties of the private company would involve $25,000,000 to $30,000,000 and for the city to get authority to bond itself to this extent it would be necessary first to obtain an amendment to the constitution of the State of Kentucky, with consequent great delay even if this could be accomplished.

It is further asserted by the engineers that the power project is feasible only as an adjunct to navigation development in the Ohio River and that this navigation development must be started within the next year, since it is part of the remaining gap in the provision of 9-ft. navigation in the Ohio from Pittsburgh down. Speed in settling the question, therefore, is essential so that the permittee can work out with the War Department the best project for power and navigation at the proposed site.

The city has the legal authority to regulate rates and therefore can protect itself, the commission's engineers further point out. The proposed hydro-electric development amounts to only 20 per cent of the properties of the existing power company, and whenever the city is able and ready to condemn and take over these other properties, it can also condemn and take over the hydro-electric development. The rejection of the city's application does not therefore deprive the municipality of the right to go into the power business whenever it is ready to do so.

CHOCTAWHATCHEE PROJECT ENJOINED

A preliminary injunction has, on the petition of property owners, been issued to prevent the city of Dothan, Ala., from proceeding with construction of a proposed power dam in the Choctawhatchee River for which a license was issued by the Federal Power Commission in August, 1922. The petitioners appear to be convinced that the project is not a good investment for the municipality, a bond election having been carried, it is claimed, by a preponderance of non-property-holding voters.

The outcome of this litigation will be watched with interest. Since in many cases it is believed that municipal improvements involving bond issues and special taxes are voted by non-property holders, the decision is expected to set an important precedent. The proposed installation by the municipality was small, 6,000 hp., and it was intended to use all of this in the city proper and not attempt to distribute electricity over any wide region.

BIG PIGEON DEVELOPMENT

The Chief of Engineers, U. S. A., has reported to the Federal Power Commission that the proposed hydro-electric development on the Big Pigeon River in North Carolina, close to the Tennessee line, for which a declaration of intention was filed by C. Boice several months ago, will affect interstate navigation and that therefore the federal government should take jurisdiction.

A study of the project and of the stream, it is stated by the Chief of Engineers, indicates that if the applicant will submit his application for a license accompanied by complete plans, the project probably can be passed on and the conditions to be inserted in the license decided upon without waiting for completion of the survey of the upper Tennessee River and its tributaries which is now being carried out by the district engineer at Chattanooga. This suggestion means that a delay of several months can be avoided with respect to this project if the applicant, as expected, now proceeds to file his formal application.

The contemplated development is an important one, involving an initial installation of 50,000 hp., while the ultimate output may reach as high as 150,000 hp. The power will be used for industrial purposes principally, but also will be made available for service both in Asheville and in Knoxville. The application is one of several submitted in the last few months involving large hydro-electric developments in east Tennessee and in North Carolina. The interests which are supporting Mr. Boice in this proposal have not been disclosed but will be made known when the formal application for a preliminary permit is filed with the commission.

Two Insull Properties to Consolidate

The stockholders of the Central Illinois Public Service Company and the Middle West Power Company will vote on Aug. 30 on a plan to consolidate the companies to permit more favorable financing. The proposed new company will have $10,000,000 of 6 per cent cumulative preferred stock ($100 par), 100,000 shares 6 per cent preferred non-par stock and 200,000 shares of non-par common. Exchange will be made on a share-for-share basis.

Both companies are Insull properties and subsidiaries of the Middle West Utilities Company. The Middle West Power Company was incorporated last year and has a plant under construction at Grand Tower, Ill.

Union Gas & Electric's Plans

The Union Gas & Electric Company of Cincinnati, Ohio, is steadily working on expansion plans. Negotiations are reported under way for the purchase of the Hamilton Utilities Company of Hamilton and also of the Ohio Gas & Electric Company of Middletown, which supplies Middletown, Franklin, Springboro, Medina, Leetonia and Lisbon with electricity and gas. Polk Laffoon, vice-president of the Union Gas & Electric Company, has announced that a physical inspection of the properties of the two companies has been made by the Union Gas & Electric officials with the end announced in view. Announcement of the amalgamation is expected soon.

Industrial Standardization

Unofficial International Conference Is Held in Switzerland for Exchange of Ideas

An unofficial conference of the secretaries of various standardizing organizations was held early in July at Zurich, Switzerland. This was the second conference of its kind held, the first conference having taken place in London in April, 1921. At that conference the secretaries of seven standardizing organizations were present, whereas at the Zurich conference secretaries from thirteen different countries were present. These included representatives from Austria, Belgium, Canada, Czechoslovakia, France, Germany, Great Britain, Holland, Italy, Norway, Sweden, Switzerland and the United States.

The conference, which lasted from July 3 to July 6, was given over to a discussion of the practical application of standards in the various countries and of the extent to which international collaboration is possible. There is a marked difference in industrial standardization and in the method of its application in the various countries involved. In Great Britain and in the United States the standardizing body is an industrial organization seeking government support, while in France, for example, the standardizing body is a government institution.

Reports were made by the various secretaries on progress in the different countries, and the American representative, Dr. Paul G. Agnew, was supported in his resolution that in order to help the cause of standardization ideas cannot be exchanged too soon. Possessing no executive authority, the recommendations made by the secretaries as a whole will have to be placed before the executives of the respective national organizations. Progress has been made, however, toward closer international collaboration between secretaries and toward international amity on questions of standards. Mr. Zollinger, secretary of the Swiss committee, acted as chairman of the conference, and C. le Maistre of Great Britain acted as vice-chairman.

Christiania Visitor Tells of Farm Service in Norway

"The Norwegian farmers are becoming electrical manufacturers on their own account," said E. A. Brofos, managing director of the Western Electric Norsk Aktieselskap, Christiania, Norway, who arrived in New York this week on a short business trip. "The cost of electrical energy is very low, as it is generated by water power, and so the great concern of the country people is to procure electrical appliances. Many are even making their own heaters. They get hold of clay drain pipes, then wind resistance wire around them, and make crude but efficient electric heaters. With these they heat their homes and barns.

"The importance of electricity in the lives of the Scandinavian people is increasing steadily," continued Mr. Brofos. "This will be noticed in passing through the sparsely settled parts of Norway, where one invariably finds even the cottages of the poorer people connected with electric wires. Both Norway and Sweden have now a large number of hydro-electric plants. These are connected in two main systems to supply these countries, and a project is under way to connect these two power systems into one great system which will supply both countries and then to run a cable from Norway across the North Sea to furnish power to Denmark, where there is little water power. The cable connecting these two countries will be the longest high-tension submarine cable in the world.

"Electricity is also used extensively by the large electrochemical works which extract nitrogen from the air in making saltpeter. A hydro-electric plant rated at 300,000 hp. has been built by one of these firms. The plant was erected in a valley where there were no houses. Within three years there had sprung up around this plant a city of 20,000 inhabitants, with churches, schools and motion pictures."

Tennessee Electric Power's Earnings Increase

Net earnings of the Tennessee Electric Power Company at the close of its first year of operation on June 30 showed a balance of $658,211, after payment of interest on first preferred stock and depreciation, according to the report made public last week. These earnings, said the statement, are equivalent to $13.01 a share on the second preferred stock and $2.29 a share on the common. Items in the income statement for the twelve months ended June 30 include: Gross income, $8,631,900; net after taxes, $3,867,275, and surplus, $1,331,027.

"Within the past year," the statement added, "the movement of Northern textile mills to raw material centers in the South has assumed new importance, owing to more economical and generally more favorable manufacturing conditions. This movement has further stimulated industrial activities, the Tennessee Electric Power Company having generated during the first six months of 1923 a total of 229,181,000 kw.-hr., compared with 164,797,000 kw.-hr. in the same period of 1922, or an increase of 39 per cent. The number of customers on June 30 was 54,447."

President Harding Opening Electrically Equipped Replica of Payne's Boyhood Dwelling

National Photo

Among the last official acts of President Harding before he left Washington on the Western tour from which he was never to return was the opening of a replica of the boyhood home of John Howard Payne, author of "Home, Sweet Home," which differed, however, from its prototype in possessing a very full equipment of electrical household conveniences. This home was on exhibition during June, and it will in the future, on a permanent site, be used by the Department of Agriculture for demonstrations in home economics. To the left of the late President are Secretary of War Weeks, Mrs. Harding and Commander Andrews, U. S. N. The lady on his right is Miss Lida Hafford, director of the General Federation of Women's Clubs, to whom it fell to present Mr. Harding with the key of the model electrical home.

New Jeffersonville Plant

Middle West Utilities Plans to Link Its Indianapolis and Kentucky Properties

HARRY REID, president of the Interstate Public Service Company, announced at Indianapolis last week that it is probable work will start before the end of the year on a superpower steam plant on the Ohio River just east of Jeffersonville, Ind. This plant will be erected at a cost of considerably more than $3,000,000 and will be consolidated with several important hydroelectric and steam plants in Kentucky and southern Indiana to supply electrical energy, including service to the most important traction lines in that section. These related electrical projects are said to involve a total expenditure of at least $12,000,000. They are being promoted by the Interstate Public Service Company, the Kentucky Hydro-Electric Company and the Kentucky Utilities Company, all of which are subsidiaries of the Middle West Utilities Company of Chicago. The site of the new power plant, which comprises 105 acres, will be directly across the river from the new gas station of the Louisville Gas & Electric Company.

Louisville Energy to Be Replaced

The end of the sale of Louisville-made electric power in New Albany and Jeffersonville will result from the construction of the new plant. The North Side cities, though supplied with electricity for power and lighting through a subsidiary of the Interstate Public Service Company at the present time, are dependent upon the Louisville utility for their energy. Upon the completion of the new plant there will be no longer any need to purchase this power.

The Kentucky Utilities Company will complete in 1924 a 30,000-kva. steam plant 4 miles from Pineville, Ky., on the Cumberland River, and the Kentucky Hydro-Electric Company is to build a 260-ft. dam 2 miles from the mouth of the Dix River, where 20,000 kva. will be developed. The Kentucky Utilities Company has under construction a 66,000-volt transmission line, capable of being raised to 132,000 volts, for the distance of 95 miles between the Cumberland and Dix Rivers. The Kentucky Hydro-Electric Company will in turn construct a 66,000-volt line to Lexington in order to dispose of its output and from that point will extend the line to a point on the Ohio River near Louisville.

The Interstate Public Service Company now has two power lines from Louisville to Indianapolis, one from Jeffersonville to Bedford and Seymour and the other by way of its traction route to Franklin, Edinburg, Columbus, Seymour and Jeffersonville. These lines will eventually be connected with the Jeffersonville plant so that it will be possible to transmit energy as far north as Indianapolis.

The two transmission lines of the Kentucky Hydro-Electric Company, from Dix River to Lexington and thence to Louisville, will cost, with the plant, approximately $6,000,000. Mr. Reid, who is president of the two Kentucky companies as well as the Indianapolis company, is enthusiastic about the proposed unification of these plants, which will make for the greatest possible economy of operation.

Illinois Power Buys Missouri System

The Illinois Power & Light Corporation has purchased the Missouri Utilities Company of Mexico, according to an announcement made by E. R. Locke, vice-president, and Wiley F. Corl, general manager of the latter company. The Missouri company serves seventeen other towns in Audrain, Montgomery, Callaway and Boone Counties. The Illinois Power & Light Corporation is the combination of the McKinley and the Studebaker public utilities interests which became effective during the spring. It is also understood that the organization has acquired the Moberly Electric Light & Power Company, the Adair County Light & Power Company of Kirksville and the Boonville Light, Heat & Power Company from W. A. Baehr & Company. The acquisition of these properties will bring closer electrical union between the western and eastern parts of the state, since the Illinois property at Perry distributes energy taken from the Keokuk Dam and is but 25 miles from Vandalia, the eastern terminus of the Missouri utilities lines. With the western terminus of the Missouri utilities at Clark, 8 miles from Higbee, and the eastern terminus of the Kansas City Power & Light Company at Armstrong, about 12 miles west of Higbee, a transmission line of 25 miles between Perry and Vandalia could establish direct connections from Kansas City to Hannibal with extensions into Kansas and Illinois and through Keokuk into Iowa.

Combined Fire and Safety Code Contemplated

The American Engineering Standards Committee announces the appointment of a committee to arrange for a conference to decide whether it would be advisable to draw up a combined fire and safety code and to outline the procedure and policies to be followed at the conference. At present two separate codes are in force—the National Electrical Code, which prescribes methods of wiring, fixture and machine installation with respect to fire hazard, and the National Electrical Safety Code, which deals primarily with personal hazards. Since both provide guides for materials and methods of electrical construction, it is clear that either co-ordination or combination of the codes is a desideratum. The proposed conference will not be called until after October.

Denver Forging Ahead

Five-Million-Dollar Program of the Doherty Company Is Being Pushed to Completion

AN IMPROVEMENT program calling for an expenditure of more than $5,000,000 is now under way by the Denver Gas & Electric Light Company and other subsidiaries of Henry L. Doherty & Company operating in Colorado. A large portion of this amount covers the initial installation of the new 20,000-kw. generating plant near Valmont, Col., a project announced several months ago and on which work is actively proceeding.

The finished station at this point will include additional equipment to double the primary generating capacity. With the required transmission system, the total cost is estimated close to $12,000,000. This amount, however, does not include the expenditures which are now being made by the Denver Gas & Electric Light Company for bettering distribution service within the city of Denver.

Already three automatic rural substations have been cut in to accommodate the companies serving the towns of Golden, Arvada, Littleton, Englewood and Fort Logan. Another automatic substation, to be known as the "North Sub" but located at Thirty-ninth and Columbine Streets, East Denver, is expected to be in operation by Jan. 1, according to D. C. McClure, electrical superintendent of the company, under whose direction the various improvements are being made. When completed it will cost about $100,000 and will complete about one-half of the industrial-belt distributing system. Later, it is understood, another substation will be erected to complete the system.

Enlargement of the original Denver power house, now known as the "Barker Sub," at Twenty-first and Wewatta Streets, is being accomplished at a cost in excess of $100,000. Growth of the company's load in the business section of the city has necessitated this addition. A similar amount is being spent on new transmission lines within the city. The unprecedented building program in Denver during the past year, especially in outlying residence sections, has necessitated numerous extensions, and to serve those districts adequately the company has been engaged most of the summer in the installation of the new pole lines.

Connecting the Lakeside Plant

In connection with the Denver transmission system plans for bringing in the lines from the new Lakeside plant are being developed. Steel-core aluminum cables mounted on steel towers will be used for transmitting energy at 90,000 volts to the Denver terminal substation, where it will be cut down to 22,000 volts for distribution to the other substations. The outdoor terminal substations will be at the West Denver generating plant, which probably will be shut down for all other purposes after the new north plant is ready.

New Employment Plan

Co-operative Method Worked Out by the Secretaries of the Four Major Engineering Bodies

A NEW "co-operative employment plan" for the benefit of members of the four major national engineering associations has been prepared by the secretaries of these bodies acting as a committee to solve the problems formulated in the report of a previous joint committee of the four societies which, under the chairmanship of W. I. Slichter, professor of electrical engineering at Columbia University, had submitted a report to the governing bodies on March 17 last. The secretaries' report has been accepted by these governing bodies, and the plan recommended will go into operation by Sept. 1.

This plan provides for the continuance of free service to a limited extent, principally by the free publication of announcements of available men in the respective journals of the four societies and by the personal efforts of the secretaries, but sets up in addition a national employment service that will be partly supported by those directly benefited. To accomplish this the societies are to underwrite the joint employment bureau already existing in the sum of $16,000, prorated according to the placements made last year, but they need actually appropriate only one-half of this sum, the expectation being that the other half will be derived from fees to be charged those obtaining employment through the aid of the bureau. The arrangement works out as follows:

	Placements Last Year	Appropriation Asked	Amount to be Underwritten
A. S. M. E.	1,150	$4,130	$8,260
A. S. C. E.	505	1,815	3,630
A. I. E. E.	450	1,635	3,270
A. I. M. and M. E.	120	420	840
Total	2,225	$8,000	$16,000

The maintenance charge to be made to those registering with the bureau beginning Sept. 1 next will be on the following basis for the first year, with such adjustments later as may be deemed necessary: For all situations procured paying $2,000 or less a year, $10; for situations paying in excess of $2,000, $10 plus 1 per cent on the amount of salary above $2,000. Thus for a situation paying $2,500 the fee would be $15, for a situation paying $5,000 the fee would be $40, and so on. An annual gross income of $30,000 from this source is estimated. Any surplus is to be used for extending the service to other cities.

Registration of available men is restricted to members of the four societies, at least until the plan shall have proved to be satisfactory and financially sound. Later it may be extended to include members of all organizations exchanging courtesies with the major societies and members of affiliated student engineering organizations. The publication of "Positions Available" in the respective journals of the societies will be discontinued, and in its stead there will be substituted an employment bulletin to be sent out at suitable intervals only to those who are properly registered.

It was shown in the report of Professor Slichter's committee that 61 per cent of electrical engineers, 52 per cent of mechanical engineers, 48 per cent of civil engineers and 31 per cent of mining and metallurgical engineers using the old employment service had obtained situations. Still better results are hoped for under the new plan.

World's Northernmost Railroad Now Electrified

The Ofoten railroad in Norway was formally reopened to traffic on July 10 after electrification. This road, which was originally operated by steam after its completion in 1902, is 26 miles long and runs between the seaport of Narvik and the Swedish border. Its location between north latitudes 68 and 69 makes it the most northerly railroad in the world. It is standard-gage, with a maximum grade of 17.3 per mile and a high altitude of 1,700 ft. above sea level. Electrification is expected to increase the rate of speed about 70 per cent and the capacity of the railroad in proportion. The chief freight is iron ore from the vast deposit in Swedish Noorland. In 1920 2,400,000 tons of this ore was hauled.

The electricity for operating the road comes from the water-power plant at Porjus, Sweden. The transmission line is about 125 miles in length and the voltage is 80,000, the highest yet used in Norway. At two substations along the line this voltage is reduced to 16,000 and fed to the locomotives. Nine of these will replace the sixteen steam locomotives previously used. This is the fourth electric railroad in Norway, where, because of the immense water powers and the lack of coal, it is only a question of time when all the lines will be operated by electricity.

Lighting the Air Mail Path

Thirty-five High-Power Searchlamps Will Illuminate the Dark Zone of 800 Miles

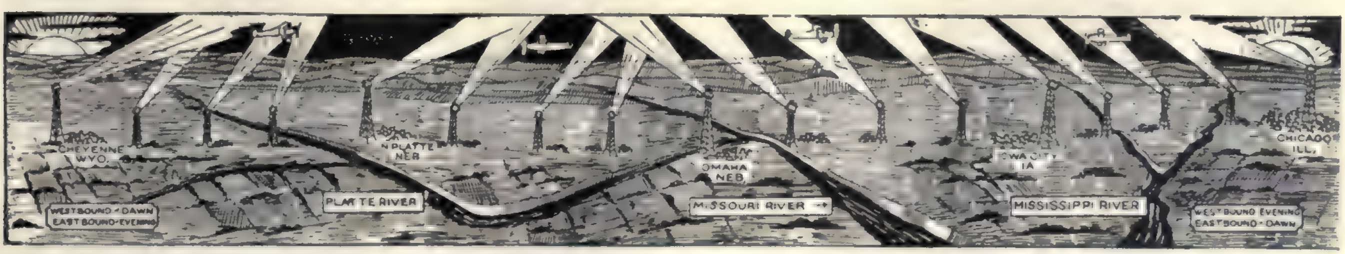
A UNIQUE system of high-power searchlight beacons to illuminate the pathway of airplanes will mark the inauguration of the first United States Air Mail Service, scheduled to start about Aug. 15. A total of 1,800,000,000 cp. in thirty-five arc and incandescent type searchlamps, just installed by the General Electric Company, will light the dark zone of the transcontinental route beginning at Chicago and extending to Cheyenne, Wyo. At the eastern edge of this zone a beacon of 325,000,000 cp. has been stationed, and at the western boundary, 800 miles away, a unit of like intensity has been installed. Between these are three others of similar size at points where permanent landing fields are being laid out—Iowa City, Omaha and North Platte. At lesser intervals of about 25 miles thirty 5,300,000-cp. incandescent searchlamps have been installed.

The large-type lamps, marking the beginning and end of the "darkness zone" and the landing fields, are mounted on steel-frame towers 60 ft. high or on suitable buildings if available. Geared motors of ½ hp. will keep the big lights revolving in a circular path, and ⅛-hp. motors will keep the smaller lights in motion. It is estimated that the big lights will be visible a distance of 50 miles and the smaller ones for 30 miles. Thirty-six-inch projectors will be used for the big lights and 18-in. projectors for the smaller ones.

CENTRAL-STATION SERVICE

Power will be supplied for the big lamps in the larger cities from central-station service. Where such power is not available, particularly for the smaller lamps scattered along the route, power will be furnished from gasoline-engine-driven generator sets at 30 volts direct current by means of units rated at about 1½ kw.

The detailed lighting of the landing fields themselves has been laid out by the Post Office Department with the following objectives in view: definition of field limits, lighting of obstructions, indication of landing levels, illumination of landing stages, definition of the taxi strip, indication of wind direction and force, beacon (orientation) lighting-field identification markings and emergency lighting.



LIGHTING THE PATH OF THE UNITED STATES MAILS FROM CHICAGO TO CHEYENNE

Appointments Made on A. I. E. E. Committees

At the first meeting of the board of directors of the American Institute of Electrical Engineers for the administrative year beginning Aug. 1, 1923, held in New York on Thursday, Aug. 2, President Ryan announced the following appointments as chairmen of committees:

STANDING COMMITTEES

Board of Examiners—H. H. Norris, New York.
Code of Principles of Professional Conduct—John W. Lieb, New York.
Co-ordination of Institute Activities—W. I. Slichter, New York.
Edison Medal—Edward D. Adams, New York.
Executive—Harris J. Ryan, Stanford University, Cal.
Finance—G. L. Knight, Brooklyn, N. Y.
Headquarters—E. B. Craft, New York.
Law—H. H. Barnes, Jr., New York.
Meetings and Papers—L. W. W. Morrow, New York.
Membership—M. E. Skinner, Pittsburgh.
Publication—Donald McNicol, New York.
Public Policy—H. W. Buck, New York.
Research—J. B. Whitehead, Baltimore.
Safety Codes—H. B. Gear, Chicago.
Sections—A. W. Berresford, Milwaukee.
Student Branches — C. E. Magnusson, Seattle.
Standards—H. S. Osborne, New York.

TECHNICAL COMMITTEES

Educational—W. E. Wickenden, New York.
Electrical Machinery — H. M. Hobart, Schenectady, N. Y.
Electrochemistry and Electrometallurgy—J. L. Yardley, Pittsburgh.
Electrophysics—F. W. Peek, Jr., Pittsfield, Mass.
Industrial and Domestic Power—H. D. James, Pittsburgh.
Instruments and Measurements — G. A. Sawin, Pittsburgh.
Iron and Steel Industry—F. B. Crosby, Worcester, Mass.
Lighting and Illumination—G. H. Stickney, Harrison, N. J.
Marine—G. A. Pierce, Jr., Philadelphia.
Mines—F. L. Stone, Schenectady, N. Y.
Power Stations—Nicholas Stahl, Providence.
Protective Devices — H. R. Woodrow, Brooklyn, N. Y.
Telegraphy and Telephony—O. B. Blackwell, New York.
Transmission and Distribution — F. G. Baum, San Francisco.

In accordance with the bylaws of the Edison medal committee, the board of directors confirmed the appointment by President Ryan of new members of this committee for terms of five years each as follows: C. C. Chesney, Pittsfield, Mass.; Robert A. Millikan, Pasadena, Cal., and M. I. Pupin, New York. The board also elected three of its members as members of the Edison medal committee for terms of two years each, namely, H. M. Hobart, Schenectady, N. Y.; Frank B. Jewett, New York, and W. K. Vanderpoel, Newark, N. J.

Appointments in New England Division, N. E. L. A.

The following chairmen of sections have been appointed within the New England Geographic Division of the National Electric Light Association for the coming year: Accounting Section, Franklin L. Hall, Providence; Technical Section, A. H. Sweetnam, Boston (vice-chairman, J. P. McKearin, Springfield); Commercial Section, E. S. Hamblen, Franklin, Mass.; Public Relations Section, E. L. Milliken, Woonsocket, R. I. Committee heads who have accepted appointment are: Prime movers, A. L. Nelson, Boston; electrical apparatus, H. A. Stanley, Fall River; meters, H. L. Thomson, Hartford; inductive co-ordination, James A. Vahey, Boston; underground distribution, L. R. Hicks, Boston; merchandising bureau, L. A. Fiorani, Franklin, Mass.; wiring, R. S. Hale, Boston; new business, H. J. Walton, Malden, Mass.; lighting, J. Daniels, Boston; contact, H. B. Gilmore, Boston; accident prevention, F. W. Randall, Portsmouth, N. H.; taxation, Bowen Tufts, Boston; employees' relations with the public, A. B. Lisle, Providence; relations with bankers, T. C. Fales, Boston; women's public information bureau, Miss G. M. Thibodeau, Malden.

Brief News Notes

Kansas City Company Acquires Sweet Springs Plant.—Authority to purchase the Sweet Springs (Mo.) electric light plant has been granted the Kansas City Power & Light Company, which will construct a 33,000-volt transmission line from Blackburn to Sweet Springs.

Dates Set for Scranton's Electrical Show.—The week of Nov. 5-10 has been set as the date of the electrical show for northeastern Pennsylvania, which, as already announced, is to be held at Scranton, with many educational features and exhibits from manufacturers and dealers.

Geological Survey Will Map Colorado River.—The United States Geological Survey began on Aug. 1 the surveying and mapping of a 300-mile stretch of the Colorado River to aid in developing the waters of the 1,500-mile stream for irrigation and power and to lessen danger from floods in the Imperial Valley. This 300-mile stretch, officials of the Interior Department state, includes the ruggedest and most dangerous parts of the Grand Canyon, which has not yet been surveyed in any detail.

Wisconsin Community to Abandon Municipal Plant.—The Norwalk (Wis.) Village Council has decided to sell its municipal electric light and power plant and obtain energy from the Wisconsin-Minnesota Light & Power Company. This resolution is awaiting the Railroad Commission's approval. If this is obtained, a special election will be held to approve the Council's action. A three-phase line from Norwalk to Cashton to connect with the main 66,000-volt transmission line of the Wisconsin-Minnesota company is planned.

Idaho Power Company Seeks Higher Rates.—An application for an increase in power rates has been made to the Idaho Public Utilities Commission by the Idaho Power Company, which bases its claim on the valuation fixed by the commission in 1919 together with additions made up to Dec. 31, 1922. The company's valuation is in excess of $17,000,000. Any increase is being fought by the Idaho Power Users' Association. The company has filed a new set of rates which it wishes to become effective Oct. 1. The state commission has ruled that this tariff cannot become effective until Oct. 20. Further hearings on the rate increase will be held Sept. 10.

Canadian Utility Companies to Merge.—At a joint meeting of the directors of the Quebec Railway, Light, Heat & Power Company and the directors of the Quebec Power Company it was unanimously decided by the directors of the former company to advise the shareholders of the Quebec Railway company to accept an alliance with the Quebec Power Company on a basis which will reduce the common stock of the first-named company from $10,000,000 to $2,500,000.

Work Begun on Four-Mile Tunnel.—Driving of the 20,000-ft. tunnel of the Pacific Gas & Electric Company that is to carry water to the Pit River power house No. 3 was started July 22. Work started on the eastern portal. Two separate tunnels are to be drilled out of the rock and the ends of these will be cemented together in order to deliver water at an effective head of 300 ft. Four working faces will be used by the crews driving the tunnels. Four miles up stream from the power house a dam 110 ft. high will be erected, which will back up the river for a distance of 9 miles. The lake thus formed will be about a mile and a half wide at its widest part.

Texas Property Sold.—The Western Public Service Company, with district branch office in Navasota, announces the purchase of the Calvert (Tex.) Water, Ice & Electric Company. The properties just purchased include the water, light and ice plant at Hearns, Tex., and the water, light and ice plant at Calvert, with a transmission line from Calvert to Bremond and the lighting system in Bremond. The owners announce that transmission lines will be built from Calvert and Hearne to other towns in central Texas. The Western Public Service Company is a Colorado corporation with home offices in Colorado Springs. It owns and operates a large number of utility properties in Texas.

Revival of a Coosa River Project.—The People's Hydro-Electric Company of Birmingham, Ala., with $30,000 capital stock, proposes development of an average of 40,000 hp. at Lock 2 on the Coosa River, which is the northernmost power site on that stream. It is 20 miles south of Gadsden and near Greenspoint, Ala. The cost is figured at from $2,000,000 to $5,000,000. Roswell C. Cobb is president of the company, which has applied to the Public Service Commission for authority to build the dam. Application will also be made to the Federal Power Commission. The People's Hydro-Electric Company was chartered in 1914 and took over the

interests of the Coosa River Electric Power Company, which had secured the dam site as far back as 1907.

Montana and Washington Power Companies to Be Interconnected.—Construction of a 110,000-volt transmission line between Burke and Wallace, Idaho, a distance of 7 miles, to be completed late next fall, has been announced by the Washington Water Power Company. This connecting line will link the system of the Montana Power Company with the system of the Washington Water Power Company. The connection will complete the last step in providing an interconnected transmission line from Billings, Mont., to Seattle, Wash., a distance of 650 miles as the crow flies. An outdoor substation will be built at Wallace.

One-Pair Telephone Cable Has Made Seven Simultaneous Conversations Possible.—Making seven conversations flow where but one flowed before is the engineering achievement credited to telephone engineers, who have just finished laying a one-pair submarine telephone cable between Catalina Island, off the southern California coast, and the mainland, 25 miles away. An interesting feature of the one-pair cable is that the seven conversations are carried on simultaneously over a single strand of copper wire in the center of the cable, a system of varied frequencies similar to that used in radio telephony making this possible. This cable has superseded the commercial radio link previously operated between Catalina and the mainland.

J. G. White Corporation to Administer Staten Island Company. — The Richmond Light & Railroad Company, which served Staten Island (forming the Borough of Richmond, New York City) with light and power as well as electric railway service, has been taken out of the hands of a receiver, in which it has been for more than three years, and turned over to the J. G. White Management Corporation for administration. The lighting business will be separated from the railway business and carried on by the newly organized Staten Island Edison Corporation, which will finance both lighting and railroad properties. According to a statement made by J. H. Pardee, president of the J. G. White Management Corporation, the properties are entirely solvent and with new capital behind them the outlook is bright.

Los Angeles' Power Bureau's Plans Are Blocked Again.—For the fifth time the Public Service Commission of Los Angeles has been defeated in its efforts to obtain blanket authority from the City Council to spend $25,000 for preliminary expenses incidental to its plan to take over the seventeen-million-dollar electric properties of the Los Angeles Gas & Electric Corporation. Councilman Mushet, who has consistently opposed the ordinance, said: "The Power Bureau should complete its power development along the aqueduct before taking on any new business. The Power Bureau is now buying from the Edison company half of the power the city sells. I believe that the people would prefer to have their $17,000,000 used for improvements which the city must make and which no one else can make, rather than to use that amount of money for taking over another company's electric business."

Montana Power Company Project Progressing.—Work on the Montana Power Company's new hydro-electric project at Mystic Falls, 20 miles southwest of Billings, is progressing satisfactorily. Its completion will enable the company to supply that section of Montana with electricity under more economical conditions. The new plant will have an initial installation of 12,000 kw. and will cost approximately $1,250,000. No dam is to be constructed to supply the plant, the water being taken through pipes set in a tunnel to the right of the falls and extending to the lake beyond, from which the water will be pumped to the penstocks. Completion of this plant will round out the company's system in that part of the state and add to its earning capacity.

Isolated Plants Authorized in Indiana.—The Indiana Public Service Commission has ordered the trustees of Purdue University to include an electric generating plant in the new power house to be erected for the school. The last Legislature appropriated $275,000 for the power house, but directed that no electric generating plant be included unless the commission, after a hearing, should decide that the school could thus provide its own electrical energy cheaper than it could be bought from a central station. The commission was of opinion that the university could do this. In a similar case recently the commission ordered the trustees of the Robert W. Long Hospital, the Indiana University School of Medicine and the James Whitcomb Riley Hospital for Children in Indianapolis to include an electric generating plant in the new power installation for these institutions.

Topeka Edison to Build New Plant.—It has been announced by Albert N. Patten, assistant general manager of the McKinley interests, that the Topeka (Kan.) Edison Company has acquired 50 acres of land below Tecumseh, 6 miles from Topeka, on which it will immediately erect a steam generating plant to cost $2,500,000 and have an initial rating of 15,000 kw. in two equal units. This plant will supply Topeka and surrounding territory, and after it is completed the present 6,000-kw. city plant will be operated only to furnish heat and for emergency purposes. Tecumseh is on the Kaw River, but it is said that the amount of hydro-electric power that could be produced there is so small that the expense of development is not warranted. Coal from southeastern Kansas will be used and storage for nine to twelve months provided. A steel-tower line will be built to Topeka.

Associations and Societies

Electric Club of Los Angeles.—The first annual outing of the Electric Club of Los Angeles is to be held Aug. 24 and 25. The outing will be in the form of a boat trip to San Diego.

Pennsylvania State Association of Electrical Contractors and Dealers.—All branches of the industry are invited to attend the semi-annual meeting of this body to be held at the Sterling Hotel, Wilkes-Barre, on Sept. 12 and 13.

Electrical Supply Jobbers' Association, Pacific Division.—This association will hold its regular quarterly meeting at Gearhart, Ore., Sept. 5, 6 and 7. The entertainment features are being handled by the northern members.

Casper (Wyo.) Electric Club.—The second organization to develop the "Electrify" movement in Wyoming is the Casper Electric Club, which comprises the leading contractor-dealers and representatives of the central station in that city. W. J. Sherwood, city electrician, has been elected president, and the other officers are P. M. Van Sickle, vice-president, and J. B. Flannagan, American Electric Company, secretary and treasurer. Dinner meetings are held weekly.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

New England Division, N. E. L. A.—Swampscott, Mass., Sept. 5-8. Miss O. A. Bursiel, 149 Tremont St., Boston.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 5-8.

Electrical Supply Jobbers' Association, Pacific Division—Gearhart, Ore., Sept. 5-7. A. H. Elliot, 502 Flatiron Bldg., San Francisco.

Conference of Electrical Leagues.—Association Island, Sept. 16-19. Society for Electrical Development, 522 Fifth Ave., New York.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 17-19. O. A. Weller, 900 15th St., Denver.

Association of Edison Illuminating Companies—Dixville Notch, N. H., Sept. 17-21. P. S. Millar, 84th St. and East End Ave., New York.

Michigan Electric Light Association—Grand Rapids, Sept. 18-20. Herbert Silvester, Detroit Edison Co., Ann Arbor.

Illuminating Engineering Society—Lake George, N. Y., Sept. 24-28. S. G. Hibben, 29 West 39th St., New York.

Association of Iron and Steel Electrical Engineers — Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

Indiana Electric Light Association—French Lick Springs, Sept. 26-29. T. Donahue, Northern Indiana Gas & Electric Co., Lafayette, Ind.

American Electrochemical Society—Dayton, Ohio, Sept. 27-29. Colin G. Fink, Columbia University, New York.

American Institute of Electrical Engineers—Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

Empire State Gas and Electric Association—Lake Placid, N. Y., Oct. 8-9.

Association of Electragists International—Washington, Oct. 8-13. Farquson Johnson, 15 West 37th St., New York.

Commission Rulings

Commission Jurisdiction Over Sale by City.—The Indiana Public Service Commission has held that it has no power to review the action of the board of trustees of Cambridge City in preparing for and making the sale of a municipal light plant, but that if errors or irregularities entered into the proceedings or if the discretion of the town board was improperly exercised, such matters are questions for the courts. The petition by a public utility company to intervene in a proceeding for the approval of a contract for the sale of the electric light plant was denied where it appeared that the utility was not a resident of the town or a taxpayer thereof and that it had no vested rights as utility in the town.

Acquirement of Mining Stock by Utility Disapproved. — The California Railroad Commission has held void a promissory note issued by the Alturas Electric Power Company to acquire 200,000 shares of the capital stock of a gold-mining company. The commission said: "It is alleged that applicant acquired an interest in the mining company for the purpose of endeavoring to procure additional business. To date no additional business has been obtained by applicant as a result of the purchase of the mining stock. Even if such business had been obtained, we do not believe that a utility is authorized to issue notes to acquire stock of a mining company under the circumstances outlined in this proceeding. The note is void under the provisions of the public utilities act."

Transformer Charges and Rural Customers. — Permission to place transformer charges in effect for all consumers was denied by the Wisconsin Railroad Commission to the Leopolis Electric Light & Power Company, although the company alleges that the collection of a transformer charge from rural consumers only constituted discrimination against these consumers. The commission said that it had specifically excluded consumers in more densely populated territory from the transformer charge because it was found that the costs of serving a consumer in a well-developed community are much lower than for a rural consumer. "This is not entirely due to the difference in transformer losses," said the commission. "Rural service requires a much larger investment per consumer, and while it is true that in many cases the rural consumer makes this investment and there is, therefore, no interest charge for the company to carry, the other charges, including maintenance, depreciation and taxes, make the costs much in excess of those for local service. Local service permits of the connection of a number of consumers to one transformer with consequent saving in investment and transformer losses."

Basis for Meter Rates.—The establishment of meter-rate schedules cannot readily be based upon a valuation of utility property coupled with a study of earnings and expenses, where flat rates have prevailed in the past, since operating costs when service is unmetered are likely to be quite different from such costs after meters are installed, the New Jersey Board of Public Utility Commissioners asserted in adjusting a complaint brought against the Branchville Electric Power, Water & Light Company. The board continued: "The record of the output of the plant would have no meaning in connection with the development of meter-rate schedules as it is customary to allow lamps to burn continuously where there are no meters and it is practically impossible to determine with any degree of exactness just what effect the meters would have upon the output of the plant and upon the consumption of energy by individual customers. The adoption of a schedule of meter rates where service has been previously furnished at flat rates must, therefore, be determined by the selection of a schedule which has apparently been equitable in communities of a somewhat similar character and size."

Valuation of Power Rights on State Dam.—In fixing electric rates for the People's Gas & Electric Company of Oswego, the New York Public Service Commission acknowledged its difficulty in evaluating the property of the company, which, besides purchasing energy from the Niagara, Lockport & Ontario Power Company and the Fabri company, has a plant on the Barge Canal, whence it derives surplus water. The commission said that it had "taken into consideration the facts that the water flow of the Oswego River in the city of Oswego is a natural resource, that the state built and maintains the dam from which the use of one-half of the surplus waters not required for navigation is taken for the hydraulic canal, that there is no means of conserving the water and preventing waste beyond the actual requirements of the People's Gas & Electric Company, that although this company has given a continuous twenty-four-hour service its load falls off during that period of time and it uses only the quantity of water necessary to carry the light load during that period of service and the rest of the water is absolutely wasted." The commission also considered the fact that there is a surplus of water at Oswego. Another consideration which received its attention is that "the locality should receive certain advantages in the increment or increased value of these water-power rights." The commission finally determined the fair present value of the company's land and water rights, for the purpose of a rate base, to be $250,000.

Recent Court Decisions

Opening and Closing Water Gates to Injure Public Utility Company Enjoined.—In Fulton County Gas & Electric Company vs. Rockwood Manufacturing Company the plaintiff sought to restrain the defendant from manipulating the waters in Caroga Creek to the injury of the former. It was shown that the defendant had erected a dam upstream from that of plaintiff and that it repeatedly closed its gates until its pond was full and then opened them wide, discharging the entire contents, so that the plaintiff was alternately without water and with too great a flow. No reason for defendant's action was shown, the manufacturing company making no use of its own riparian rights, though complaining that the central-station company had no right to maintain storage dams at two lakes which discharge into the creek and from which the plaintiff was forced to draw extra quantities of water because of defendant's conduct. The Supreme Court of New York, Appellate Division, affirmed judgment for the plaintiff, declaring that a riparian owner, having equipped a plant with machinery within the reasonable capacity of the stream, has a right to have the water flow continuously in its natural course and quantity without obstruction by an upstream owner. (200 N. Y. S. 225.)*

Municipal Power to Contract for Utility Rates Must Be Expressly Granted.—In supporting the refusal of the lower court to grant to the city of Uvalde an injunction against an increase of rates by the Uvalde Electric & Ice Company, on the ground of breach of contract, the Commission of Appeals of Texas said that the power of a city to regulate rates to be charged for electric lights for the use either of the municipality or of the inhabitants is a governmental power which could not be surrendered or suspended by a contract between the city and a public service company; hence a ten-year contract between the city and the company fixing the rates to be charged was void, being neither expressly nor impliedly authorized by law. The Legislature, said the court, may expressly authorize municipal corporations to enter into contracts prescribing rates to be charged by utility corporations for a specified time, which contracts when made have the effect of suspending during their duration the governmental power to regulate such rates, but for a contract to have that effect the authority to make it must be clear and unmistakable, and all doubts must be resolved against the authority of the municipality to make such contract. (250 S. W. 140.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

L. S. Streng Elected Vice-President of Louisville Company

L. S. Streng, for some time chief engineer and general superintendent of the Louisville Gas & Electric Company, was elected vice-president of the company at a recent meeting of the board of directors. Mr. Streng was graduated from the Massachusetts Institute of Technology with the degree of bachelor of science in electrical engineering in 1898 and one year later became associated with the General Electric Company at Schenectady, N. Y. Subsequently he was made assistant chief engineer of the Public Service Corporation of New Jersey, which position he resigned seventeen years ago to become chief engineer of the Kentucky Electric Company. In 1913 he became chief engineer and general superintendent of the company of which he is now a vice-president.

L. S. STRENG

C. D. SeCheverell Resigns from Railroad Commission

C. D. SeCheverell, for the past four years secretary of the Wisconsin Railroad Commissioner, has resigned to join the Middle West Utilities Company organization, where he will be assistant to Martin J. Insull, president of the Central Power Company. For the present Mr. SeCheverell will be stationed at Grand Island, Neb. For a number of years previous to his association with the commission at Madison he was an executive of the Superior (Wis.) Water, Light & Power Company, resigning to engage in war work. William Dineen, who has been connected with the commission for the past sixteen years, has been appointed secretary to succeed Mr. SeCheverell.

H. A. Joslin, manager of the Mountain States Power Company at Dallas, Ore., for the past four years, has resigned to take up new work in Portland.

C. L. Fortescue has recently been appointed manager of the newly created porcelain insulator and transmission engineering department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Charles L. Leighton, manager of the Minnesota Electric Light & Power Company at Cushing, Okla., recently resigned to ally himself with the Fort Smith (Ark.) Light & Traction Company as manager of its commercial department.

R. Z. Zimmermann, heretofore manager of the Salem (Ohio) Lighting Company, has been transferred to the Columbus, Newark & Zanesville Electric Railway property as manager of the Zanesville division. Mr. Zimmermann is succeeding E. O. Shryock, who has been made manager of the Youngstown & Suburban Railway Company.

C. J. Killian, formerly connected with the power engineering department of the Ohio Power Company's Canton division, has recently been transferred to the southern division as superintendent of the Lancaster district, succeeding S. F. McCracken, who resigned to ally himself with the Luffer Oil & Gas Company.

V. E. Bird, resident manager of the Connecticut Power Company, New London, Conn., has been appointed vice-president of the Connecticut Profit Sharing Company, which has been organized by various electrical utilities in Connecticut to further the sale of electrical merchandise through a system of coupon exchange. Mr. Bird will handle this work in addition to his duties with the Connecticut Power Company.

John T. Kester, who has been district manager for the Wabash Valley Electric Company, Sullivan, Ind., for about three years, has been transferred to Noblesville, where he will become district manager for the Central Indiana Electric Company, of which the Wabash Valley is now a part. Mr. Kester will have charge of the company's business in four counties, Hamilton, Tipton, Montgomery and Madison. He was superintendent of an electric and ice company at Noblesville for twelve years before going to Sullivan.

E. R. Hannibal, superintendent of the Interstate Utilities Company of Spokane, has been elected chairman of the Spokane Section of the American Institute of Electrical Engineers. For a number of years Mr. Hannibal was associated with the Mountain States Telephone & Telegraph Company and its predecessor, the Rocky Mountain Bell Telephone Company, and previous to his connection at Spokane he was identified with the Intermountain Electric Company in Salt Lake City as superintendent of shops. Mr. Hannibal is a graduate of the University of Utah.

Frank Espy New President of O. E. L. A.

Frank Espy, the new president of the Ohio Electric Light Association, has been engaged in the central-station business practically all his life and during late years has concentrated his efforts on the State of Ohio. At present he is connected with the Ohio Power Company at Canton, in charge of the subsidiary companies of the American Gas & Electric Company in that state. During the fourteen years Mr. Espy has been performing the duties of this office he has shown a vital interest in utility affairs in Ohio. He spent three years in the East, two in charge of the Atlantic City Electric Company and a year in the office of the American Gas & Electric Company at New York. Mr. Espy has been a prominent member of the Ohio Electric Light Association, serving during the past year as its vice-president.

FRANK ESPY

A. C. Babson, for five years vice-president and general manager of the West Virginia Water & Electric Company, with headquarters at Charleston, W. Va., has been made vice-president and general manager of the Merchants' Heat & Light Company of Indianapolis, as the successor of Charles O'Brien Murphy, who recently resigned. The appointment was made by Joseph H. Brewer, head of the Brewer interests, which own the Merchants' company. Mr. Brewer, accompanied by P. D. Kline, vice-president of the Wisconsin-Minnesota Light & Power Company, also one of the Brewer companies, and L. B. Andrus, chief engineer of the Brewer companies, went from Grand Rapids to Indianapolis to install Mr. Babson in his new position.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Should Motors or Organization Be Sold?

Policy Includes Service of Instrument for Getting Something Done—Advising Manufacturers of Motor-Driven Devices—Question of Prompt Deliveries

By J. M. Barr
General Manager Louis Allis Company, Milwaukee

FOR many years the Louis Allis Company, formerly the Mechanical Appliance Company, has worked on a method of selling motors which, from the standpoint of stability of the results obtained, has developed from a plan to a definite selling policy.

This policy is predicated on the broad principle that what we are selling is not a motor at all, but rather an instrument for getting something done. Therefore, the instrument we build is very much more complex than a mere motor. It involves certain basic attributes and does not consist merely of cast iron, electric sheet and copper, but contains a number of very human elements. This instrument must be capable of being ordered from the manufacturer as needed, must be available in reasonable time after it is ordered, its mechanical and electrical integrity must be a matter of course, and its characteristics naturally must be adapted to the work in hand. After being applied to the machine which it is to drive, it must go into the field not merely as a motor but with the continued support and backing of its home organization. It must carry with it continuously the certainty of service. This instrument must also be sold at a fair price commensurate with materials, labor, engineering thought and service, which must go into the instrument at the time of making and remain an integral part of it after it has been placed in the hands of the ultimate customer.

These latter factors apply not only to the highly specialized motors for a specific purpose but also must enter into the commercial service which goes with the so-called general-purpose motor as distinguished from highly specialized machines for a specific application.

It has been the practice for many motor manufacturers to sell their machines in competition, motor against motor, making many claims for individual technical superiority. While we do not discredit in any way that design and construction

J. M. Barr

which peculiarly adapts a motor to a specific service and makes for reliability, we cannot but realize that the buyer is likely to be confused in making his selection on this basis alone. Our company's policy has consistently insisted that this technical superiority must be augmented by continual and intelligent service both before and after the motor is sold. It was as a result of this policy that it was felt that the firm's old name was cold and impersonal and that to be consistent with the policy the name should indicate more of that service which goes with the product—should indicate that a real personality does enter into the output, looking upon that output as including in a very large measure, human thought and service.

Perhaps one factor which led to the adoption of this selling plan in the early days, outside of the natural desire to serve, was the fact that the company made an intensive study of the particular industry it was then selling and it was found that in the specifications for the motors there should enter such questions as rapid motor reversal and the peculiar conditions imposed by the use of centrifugals. There also entered into it the question of the damp atmosphere and even the human element as reflected by the mediocre grade of operating help and, in those early days, the absolute innocence of the public as regards the operation and maintenance of motors in general.

As a result of this intensive study, the volume from this particular industry began to increase very appreciably, which immediately led to the conclusion that the same service in connection with other industries should furnish a very real need. This led to the employment of thoroughly capable men who are capable not only with reference to the electrical part of the equipment which they sell, but also of getting an appreciation of our customers' problems. These men were so chosen and so intimately in touch with our home organization as to warrant an early slogan of the company, "Every salesman is an engineer," and their instructions were to sell not only motors but "service."

Higher Expense Involved

Naturally this type of selling service involves a somewhat higher expense. The company has come to look upon a perfectly definite portion of what is usually called selling expense as being service expense. In other words, it is a certain amount of money invested in the transforming of motors from simple motors to instruments in connection with specific applications.

This policy has also enabled the company to hold high-grade salesmen, because the intimate study of

an industry's requirements and the ultimate solution of its problem is a fascinating type of employement and offers a field that is almost kaleidoscopic in its nature. Continually taking up new industries furnishes a constant opportunity for ingenuity and resourcefulness, and even those industries which have been thoroughly motorized are in a continual state of change and improvement.

Some of these developments lead to a very appreciable investment on the part of our company, and in addition to field tests we have in a number of cases installed the equipment to be driven in our own factory and made observations which included not only the motor but also a detailed study of the driven device. In many cases it has thus become possible to suggest to the manufacturer of the device to be driven modifications which better suited it to motor application.

This type of development makes it necessary for our outside men to study intimately certain industries entirely foreign to our own, and this policy has resulted in our looking upon our outside sales organization as constituting a portion of the engineering department of our customers, with the result that our outside selling organization has developed to a remarkable extent the ability to throw itself into an industry, learning its salient features with particular reference to the application of motors.

Growing Knowledge of Motors

Occasionally we find an industry which determines for itself the general trend which its development is to take, and it is continually a matter of surprise to us to find how intimately industry in general is becoming acquainted with motor characteristics as applied to its particular needs.

A good example of this is the elevator industry. The high-torque motor such as is used for elevator service is not difficult to build, but many of the elevator manufacturers have worked out electrical devices, such as controls, brakes and other auxiliary apparatus, which, though basically electrical, are peculiarly adapted to their particular requirements. The motor manufacturers have done their part by definitely defining the short-time rating required by this industry, thus again transforming a mere motor into an instrument which, in the hands of the elevator manufacturer, is capable of satisfactorily performing the work which it has to do.

Although we do not hesitate to develop very special highly organized machines where these machines are indicated as a result of our studies, it should not be inferred that a detailed study leads to a special machine in all cases. While the industries which, in conference with our salesmen, find they can adopt an absolutely standard motor have done much toward assuring themselves of prompt service in the matter of shipment, we have found it necessary to be very frank with ourselves in not attempting to influence the use of standard motors where special motors should be applied. Such a policy would result only in a temporary advantage in the matter of shipments and would almost certainly react on account of unsatisfactory performance of motors in service.

Production Problems

There is another factor of prime importance to the customer which is often overlooked. The electric motor industry has become quite highly organized from the standpoint of production. Quantity production, however, has its advantages and also its penalties. The advantage of a system of rapid production of duplicate, interchangeable parts gives to the customer motors at comparatively low cost. The disadvantage is that the injection of special mechanical or electrical work becomes a very serious problem because it cannot be economically produced in a shop organized to produce a large percentage of highly standardized output.

A comparatively small organization like our company is fortunate in being able to keep closely in touch with its trade. This is particularly true on account of the intimate contact maintained between our customers and our outside field men as well as the officers of our company at the home organization. As a result of this contact, it is possible to make an analysis each year which indicates pretty accurately the general trend of business, at least so far as our own particular customers are concerned. As a result of this analysis, it is continually a matter of surprise to us to find the extent to which motors are being applied as labor-saving devices. The question of investment in the motors seems to be of comparatively little importance, and we are sometimes astounded at the investment which our customers consider legitimate in order to eliminate a comparatively insignificant amount of labor. Very frequently the application of a motor may make no direct saving in labor, but is warranted on account of increased convenience or even on account of increased safety, or both, in some instances.

An interesting example is the application of motors to window closers in industrial plants. The motors in this case very frequently are in operation only fifteen minutes in a ten-hour day.

From a beginning which developed motors for a particular industry there has been developed through a period of years a policy, not alone in connection with selling but in connection with the whole conduct of business, which looks upon the motor in a much broader sense than as merely an electric motor. It looks upon it as an instrument designed, in collaboration with the man who will use it, to do certain things, built with this duty in mind and sold with a full sense of the permanent responsibility for continued and satisfactory operation.

Bureau of Standards Tested 1,660,000 Lamps Last Year

MORE than 1,660,000 electric lamps purchased by the United States government were inspected by the Bureau of Standards during the fiscal year ended June 30, 1923. Samples of these lamps were tested for candlepower and were then subjected to the life test, which consists in burning the lamps continuously until they burn out. In order to reduce the time required for this test the lamps are burned at a higher voltage than their rated voltage, the relation between their life at this voltage and their life at normal voltage being known.

A total of 1,608 samples were thus tested, these consisting of 1,318 vacuum tungsten lamps, 216 gas-filled tungsten lamps and 74 carbon lamps. During this time the Bureau also tested about 350 samples, representing a number of brands which were submitted to the States of New York and Illinois in competition for state contracts.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

ALL of the electrical industry, in common with others, is overshadowed this week by the sorrow of national bereavement. Confidence remains unshaken as to the future under President Coolidge, and not a trace of uneasiness is reported in electrical circles as to the probable stability of business development under the administration of the new Chief Executive of the country.

Current orders upon electrical supply jobbers reflect seasonable conditions, but a substantial volume of trade is being handled week by week and the building industry is a continuing heavy buyer of material. Deliveries are slow in porcelain insulators and require considerable anticipation in placing orders for steel products. Little evidence of non-employment is apparent in electrical circles, although in some plants not much is being done in the way of adding to existing personell. Prices were more settled as the week began, with a tendency toward stiffer figures in wiring supply lines. Wire itself is rather weak. Considerable "pick-up" business from central-station companies is being handled by jobbers, but the principal wire market is the building industry.

Excellent Wiring Device Production with Slower Demand

DESPITE some recession in the demand for wiring devices common to this season, an excellent production volume is being handled by leading manufacturers and the outlook for the fall is encouraging. A representative wiring-device maker said last week that his sales are about equal to those of a year ago, although spring business was considerably ahead of the corresponding period of 1922.

Full-time operation is in progress, although additional employees are not being taken on at present. Raw materials are now in excellent supply, barring occasional temporary irregularities in the delivery of porcelain. These cause little real difficulty at present. Wages are firm and raw-material prices recently weakened slightly, resulting in a tendency to pass along the very moderate reduction to the buyer.

Considerable competition for business exists, and this has lately affected prices somewhat, tending toward instability. In well-informed circles the opinion was expressed last week that a plane of price stabilization has now been reached, and jobbers were advised to restock their none too ample supplies of staple wiring devices against the fall demand. Outside New York City there has been a continuing excellent volume of building work under way throughout the country, speaking broadly. Considerable manufacturing for stock is under way, and it is expected that increased movement of these products into the hands of distributors will very shortly be in evidence.

Pole, Truck and Range Active in Atlanta Market

THE Atlanta territory as a whole is experiencing the usual midsummer lull, although all indications point to satisfactory conditions throughout the section in the early fall. Textile plants report difficulty in obtaining orders at this time, but have confidence that buying will be resumed by Oct. 1. The Birmingham district reports a slight falling off in the steel and allied lines, though the cast-iron pipe dealers are still busily engaged on back orders. Agricultural prospects show some improvement, with all indications pointing to a fairly satisfactory, though spotty, cotton crop. Building of houses, apartments and all classes of commercial structures is very heavy, building permits for the entire section being largely in excess of those for a similar period last year.

Jobbers report a very active market for transmission-line material, one of the largest jobbers in the district reporting a 300 per cent increase in sales of cross-arms over their average sales. Poles are also in strong demand, with a growing tendency toward the use of creosoted pine, especially on high-tension transmission-line construction. High-tension insulators are moving satisfactorily, this activity being the natural result of high-tension line construction under way in the larger Southeastern power companies.

Long-continued sales efforts by electric truck manufacturers are beginning to bring results, as evidenced by the closing of orders last month by one dealer for nine trucks in Florida territory.

The successful merchandising efforts of central stations in the Southeast is evidenced by an approximate 40 per cent increase in electric range sales over the same period last year, with prospects that this activity will gain momentum during the fall and early spring months.

Chicago Quotes Armored Cable $42 from Pittsburgh Basing

PROBABLY the most important feature in this week's development of Chicago trade is the announcement of a price of $42 on flexible armored cable from a Pittsburgh basing. This announcement, following the reduction on July 18 to $39, sheds a light on the situation. At the time of making the previous reduction, no consideration apparently was given to the fact that steel had advanced the same week. From an unbiased viewpoint it would appear that the larger manufacturers reduced their prices to bring certain other interests which were demoralizing the market into line. Indications now are that some mutually profitable agreement has been reached.

Chicago is setting a new high record this year both in spending money for building and in obtaining added housing facilities for domestic and commercial uses, according to Oscar Hewitt of that city. The two best previous years were 1922 and 1921. The money spent in the first seven months of these two years compares with the same part of 1923 as follows: 1923, $204,717,912; 1922, $127,716,710; 1921, $66,460,600.

It is estimated that the total for 1923 will be above $260,000,000 as building has been going on at the rate of $320,000,000 for the twelve months. If the city were to keep up only with the last five months of last year, 1923 would total more than $300,000,000.

Believing that building costs have been in some cases too high, which might retard building, certain interests have announced price reductions to stimulate building activity. A boiler company announced in an advertisement a cut in prices and said it was for the purpose of promoting building. Various retail lumber dealers in Chicago about the same time reduced their prices. During the first seven months of this year permits have been issued for 18,178 apartments and residences, as against 15,242 during the same period last year. It is generally admitted that the city needs additional flats, and if building continues at the rate stated, business in the electrical trade should pick up materially during the winter months.

Motor Demand Slows to Normal in Middle West

THE present let-up in the motor business throughout the Middle West after the extended peak demand during the spring is allowing the manufacturers a breathing spell and a chance to get their bearings after the rush of business over many months. In addition, it is allowing production to improve since a definite schedule can now be adhered to in order to clean up the back orders.

This present slump is not creating any annoyance on the manufacturers' part; in fact, this period may be characterized as that following a storm—a welcome calm. The extremely high demand during the spring months was unhealthy since it caused much trouble to manufacturers who tried to explain why their deliveries were not better than eight to thirty weeks, depending upon the size of orders. Such a pyramiding of orders would naturally tend to inflate the demand and supply a market for motors. But the recession during July has to some extent remedied

this situation. Conditions might be said to be approaching normal again.

Business at present is good for this time of the year, which is usually characterized by a slight slump. One manufacturer declared that some of the railroads which had been out of the buying market for some time are now placing their orders. Most of the recent shipments are going to various industries which use them on motorized machinery, such as washing machines, pumps and elevators. There appears to be more of a slump in the demand for the smaller sizes than for the larger.

The price situation remains upon the level established during the middle of July, when readjustments were made regarding the recent recommendation of the Electric Power Club stipulating a 40-deg. motor without any overload rating. This change averaged about 5 per cent, with other changes depending upon the type of motor. These prices will remain unless further advances in the cost of labor and raw materials necessarily boost the present lists.

San Francisco Retail Business Promises to Be Fair

SAN FRANCISCO building permits totaled $3,227,115 for July, 1923, compared with $3,024,036 for July, 1922. Volume of general business is very good, but it is conducted with extreme caution. Retail business is good with encouraging signs for the future, especially in radio and household devices. Prices on the latter are fairly steady, such few changes as have occurred being in nature of whittling to market prices. Heavy factory orders of schedule material and rubber-covered wire have just arrived on the Coast, but little concern is felt over their size. Rubber-covered wire has advanced slightly. The summary for the season shows disappointing slump from pre-season expectations and large stocks left over. Motor business is rather slow, and power and light plants are particularly so.

The Metal Market

ACTIVE demand has been reported for lead with advancing prices. The market for other non-ferrous metals has been quiet. Antimony has registered a definite advance.

Most of the copper producers, it is said, would be willing to meet the market if attractive business were obtainable, but the lack of all interest by consumers continues, and nothing would be gained by cutting prices.

NEW YORK METAL MARKET PRICES

	Aug. 1, 1923 Cents per Pound	Aug. 8, 1923 Cents per Pound
Copper, electrolytic	14.62 to 14.75	14.62½ to 14.75
Lead, Am.S.& R.price	6.25	6.50
Antimony	7.00 to 7.25	7.75
Nickel, ingot	27.00 to 32.00	27.00 to 32.00
Zinc, spot	6.10	6.25
Tin, Straits	39.00	39.00
Aluminum, 98 to 99 per cent	26.00 to 27.00	26.00 to 27.00

Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Approve Habirshaw Plan

The reorganization plan of the Habirshaw Electric Cable Company and its affiliated companies has been approved by three-quarters of the creditors in amount, according to the reorganization committee. The time for filing assents to the plan has been extended until Aug. 15.

General Electric July Bookings

Despite price reductions in various lines this year, bookings by the General Electric Company in July were well ahead of the corresponding month in 1922. There was a decrease compared with previous months, but conditions with the General Electric Company are very good and billings are running at a satisfactory rate.

Western Union Buys 5,000,000 Lb. Copper for Construction

The Western Union Telegraph Company last week purchased 5,000,000 lb. of electrolytic copper at a price said by an official to have been a shade below 14.50 cents. The amount paid and the name of the seller were not disclosed. It was stated that the Western Union has purchased 20,000,000 lb. of copper in the last two years for its main line system and that the latest purchase was not exceptional. The copper will be used in regular construction work and for replacements.

Western Electric Cable Output Increases 22 per Cent

All records in the production of telephone cable are being broken at the Western Electric Company, Chicago. Based on the figures of the first six months of the year, when a total of 11,572,265,000 ft. of the copper wire which forms the communication conductor in the telephone lines was used in the manufacture of cable, it is estimated that the plant's output for this year will be at least 22 per cent greater than that of 1922. More than 23,000,000,000 ft., or about 4,350,000 miles, of copper conductor will be used before the year's shipments are completed. This represents an increase of more than 15,000,000,000 ft. over the amount of copper wire needed for the manufacturing processes of the same plant ten years ago. Production in most of the other branches of telephone manufacture is also being maintained at an extremely high rate.

The year's output of telephone receivers will probably reach the 1,750,000 mark. This is about 500,000 more than the plant turned out in 1922. Orders for new apparatus are pouring in at a rate that indicates that the next twelve months will be about the busiest in Western Electric Company history.

This increase in cable output, paralleling as it does a substantial increase in the production of all forms of telephone equipment, is a reflection of the continuous expansion in the nation's telephone facilities. The foregoing figures indicate how the Western Electric Company as the manufacturing end of the Bell System has been increasing its already great output to keep pace with this continued growth.

Order for 100 Ward Trucks

The Andrew C. Duncan Company, 2835 Washington Avenue, St. Louis, has recently secured an order from the Nafziger Baking Company, St. Louis, for 100 Ward electric trucks, to be used in the bakery's various plants. These trucks are all of ½-ton capacity and are equipped with Edison batteries. The Nafziger Baking Company has plants in Kansas City, Springfield, Mo., Memphis, Tenn., Decatur, Ill., and in several towns in Kansas.

Brandes New Factory Building

C. Brandes, Inc., manufacturer of radio head sets, has just purchased a new factory building containing 46,000 sq.ft. of floor space. This will be operated as a "feeder" plant for other of the firm's factories. The corporation with all its branch factories now occupies 70,000 sq.ft. of space. The executive offices and main plant are at 237 Lafayette Street, New York City.

Westinghouse Iron Essay Contest

The introduction of a new 6½-lb. flatiron in the Rocky Mountain territory by the Westinghouse Electric & Manufacturing Company has been started with an essay contest, prizes being one-day trips through the "Garden of the Gods" at Colorado Springs, with all expenses paid for the winners and guests invited by them. "The Value of Balance in an Iron" is the subject of the contest, the judges of which will be J. P. Sprunt, Jr., of the Westinghouse Electric & Manufacturing Company; Clyde Osborne of the Mine & Smelter Supply Company, and S. W. Bishop of the Electrical Co-operative League. W. E. Barrett, publicity man for the Westinghouse company in Denver, promoted the idea. Splendid co-operation on the part of the dealers is reported, with a number of attractive window displays being made throughout the city until the conclusion of the contest, Aug. 10.

Tornado Demolishes Large Chimney of Wico Electric Company

The 100-ft. brick chimney of the Wico Electric Company's plant in West Springfield, Mass., completed this year and occupied by the concern only a short time, was demolished by a tornado that mowed a swath through the principal industrial section of the town on Sunday, Aug. 5. Tons of brick were poured through the roof of the main shop, burying benches where employees of the assembly department to the number of twenty or more are working on weekdays. At the same time the force of the storm ripped away parts of the roofs of the Wico group and swept them along with a mass of débris from other buildings. The Wico's loss is estimated by the president, Phelps Brown, at $20,000. This was the only concern hit by the tornado whose insurance policy was written to cover loss by this cause. The management hopes that plant operations will suffer only a brief interruption.

Chicago Jobber Buys New Location

The Inland Electric Company, 14-16 North Franklin Street, Chicago, has purchased the five-story building at 16-20 South Wells Street, which it will occupy as soon as possible. With a frontage of 60 ft. on Wells Street, this building will have a total floor space of 27,900 sq.ft. The building will be divided into locations for lighting fixtures, radio supplies and electrical supplies as soon as the remodeling is completed. One side of the main floor will be devoted to radio while the opposite side will have retail counters.

On the second floor there will be a well-appointed display room of commercial fixtures so that engineers and contractors may have an opportunity to choose their fixtures before building. Part of this second floor will be used for the company's offices. Ample shipping facilities are provided by means of a private alley on the south and rear. This new building will also allow further expansion in taking on stock and acting as manufacturers' distributors. The officers of the company remain the same: President, Herman Larson; vice-president, Edward Stapleton; secretary, H. Steinberg; sales manager, V. T. Jennings.

Whitmore Electric Takes on Several New Lines

The Whitmore Electric Company, 1637 Court Place, Denver, formerly engaged in the distribution and sale of portable farm power plants, has become an exclusive manufacturers' representative in the Rocky Mountain territory. Among the accounts which have been taken on and for which wholesale stocks are being maintained are those of the Sweeper-Vac Company, Springfield, Mass.; Hart-Hegeman, Hartford, Conn.; Grinnell Washing Machine Company, Grinnell, Iowa; Moe-Bridges Fixture Company, Milwaukee, and the Domestic Motors Company, Cleveland. R. F. Whitmore is the general manager.

Heine Boiler Sales Changes

The Heine Boiler Company, St. Louis, announces several changes in sales organization effective Aug. 1, 1923. George F. Murphy, having completed the reorganization of the company's New York office, has taken charge of the Philadelphia territory, with headquarters in the Pennsylvania Building, Philadelphia.

Harold P. Childs, formerly special representative of the executive offices of the General Electric Company, has become associated with the Heine firm as manager of its New York office with headquarters at 11 Broadway.

J. R. Fortune, formerly manager of the Detroit office, has assumed charge of the territories heretofore covered by Pittsburgh, Cleveland and Detroit offices and will maintain offices in the Park Building, Pittsburgh. The Cleveland office has been discontinued.

A. E. S. & M. Company to Enlarge Motor and Transformer Plant

The American Electric Service & Maintenance Company, Springfield, Mass., is about to enlarge its plant for rewinding and redesigning motors and transformers by occupying the old plant of the Wico Electric Company, affording 15,000 additional sq.ft. of floor space adjacent to the present A. E. S. & M. establishment, the building having been acquired by a long-term lease. This structure will be remodeled and equipped with much new machinery.

A. M. Sofield, managing and con-

Edison Lamp Representatives in Conference at Harrison

THIS illustration shows the group attending the July conference of the Edison Lamp Works at Harrison, N. J., during the week of July 16. Two conferences are held during the summer, one in July and one in August. Representatives of "Edison Lamp" jobbers, central stations and district offices spent the first day of the conference in Harrison going through the factory. The rest of the sessions were held at the Newark Athletic Club where lectures were given by members of the different home office departments covering all phases in the lamp business. The entire week was devoted to such instruction. Representatives from all over the country and one from Japan attended this conference.

The August session is known as the "senior conference," and this will be devoted largely to lighting practice, with considerable merchandising and selling instruction included.

trolling owner, says that work on transformers the present year has run 200 per cent ahead of last year, and that repair work has amounted to $20,000 a month, as against $6,000 a month last year, this being in addition to buying and selling transformers and installation work at power stations. The improvements at the plant are to be started immediately, with a view to completion by the first of next year.

King Manufacturing Appoints Sales Manager

Walter T. Wells has resigned his position with the Mountain States Machinery Company of Denver to become sales manager of the King Manufacturing Company, with headquarters in Chicago. Mr. Wells was a street-lighting expert in the Rocky Mountain region, and his new position will provide a much larger territory for activities along the same line.

New Fixture Firm in Denver

The United Electric Company has been incorporated in Denver as an exclusive lighting fixture and accessory manufacturer's agency, with complete stocks to be carried in that city. W. J. Keating, formerly of the Electrical Supply & Construction Company of Denver, is president and manager of the new organization. Temporary headquarters are being maintained at 3890 Zenobia Street until satisfactory offices can be secured in a downtown building.

"Universal" Iron Campaign

Every week, on Monday, throughout July and August, Landers, Frary & Clark, New Britain, Conn., are running advertisements for their "Universal Wrinkleproof" irons in a selected list of newspapers in sixty cities. Officials of the company say that this extended advertising is being carried on this year because of the great enthusiasm aroused during the "spring iron campaign."

The Almetal Manufacturing Company, Inc., 7227 Manchester Avenue, St. Louis, announces the appointment of A. W. Lindgren as general sales manager to succeed N. D. Thompson, resigned. H. L. Draper, 280 Broadway. New York City, has been appointed the company's Eastern representative.

The Tubular Woven Fabric Company, Pawtucket, R. I., announces the resignation of Walter C. Rardin as district sales manager in the Chicago territory. William R. Collins, formerly with the Packard Lamp Division, has been appointed to succeed Mr. Rardin. The Chicago office has been changed to 1524 South Western Avenue.

The Sherwin-Williams Company, Cleveland, has appointed L. F. Mullen as sales insulation engineer for the Eastern district.

Harmer, Inc., New York City, recently incorporated for $100,000, announces that it will manufacture arc lamps and other electrical equipment. The company is now manufacturing some lines in Long Island City, but hopes to establish a plant in New York City at an early date. Further plans will be announced later. C. S. Ashley, 120 Liberty Street, New York City, is representative.

The Macbeth Daylighting Company, New York City, recently incorporated for $10,000 with permission to increase to $500,000, is a reorganization of the Artificial Daylighting Company, 227 West Seventeenth Street, manufacturer of lighting equipment and fixtures. A change in the offices of the company will be announced later.

The Wayman Electric & Manufacturing Company, East Palestine, Ohio, expects to erect a new factory building this fall.

The Radiant Electric Company, Massillon, Ohio, recently incorporated with capital stock of $25,000, will manufacture electric heating appliances, including electric ranges.

The Vaco Washer Company, Sabina, Ohio, has been incorporated with a capitalization of $10,000 to manufacture electric washing machines. The plant will be in Sabina and production is expected to start some time in August. R. W. Allen is president of the company.

The Conlon Corporation, Cicero, Ill., manufacturer of electric washing machines, announces the appointment of the Woodill & Hulse Electric Company, Inc., Los Angeles, as its distributor in southern California.

The International Electrical Supply Company, Inc., New York City, recently organized with $25,000 capital stock, will manufacture electrical fixtures.

A. H. Peacock, Inc., Queens County, New York, recently incorporated with capital stock of $10,000, will manufacture electrical fixtures.

Kaylite Manufacturing Company, New York City, recently organized with capital stock of $20,000, will manufacture electrical fixtures.

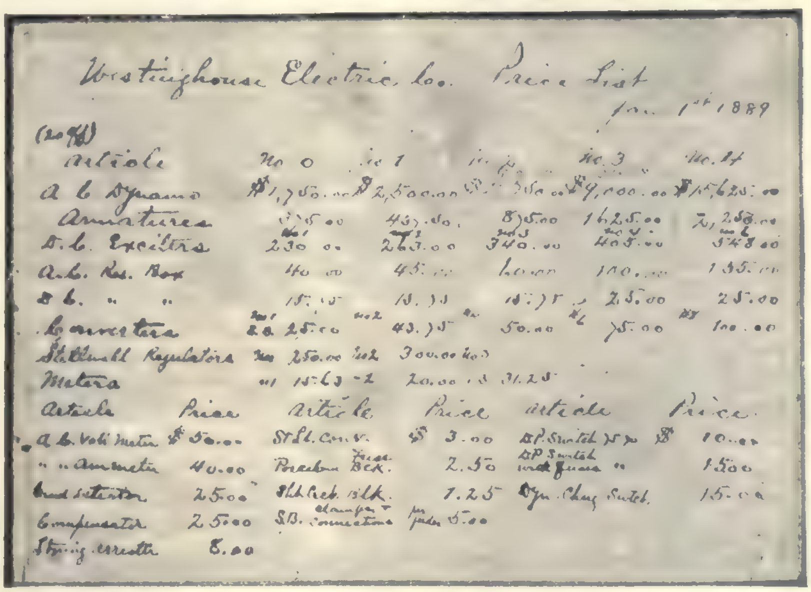
The Okonite Company, 501 Fifth Avenue, New York City, manufacturer of insulated wire and cables, with plant at Passaic, N. J., is disposing of a note issue of $600,000, a portion of the proceeds to be used for additions to working capital, expansion, etc.

The Bristol Company, Waterbury, Conn., manufacturer of recording instruments, has awarded a contract for the erection of its proposed new plant at Platts Mills. It will be a one-story building, 50 ft. x 100 ft., estimated to cost $50,000. Work will be placed under way at once.

The Star Porcelain Company, Muirhead Avenue, Trenton, N. J., manufacturer of electric porcelain products, has completed plans for the erection of a new one-story addition and will break ground at once.

The Western Electric Company has leased the twentieth floor and other space in the new Pershing Square Building, New York City, at an aggregate rental of $750,000. Immediate possession of the premises will be taken and used by the lessee for its sales organization, now at 195 Broadway.

Westinghouse First Price List in 1889


Westinghouse Electric Co. Price List

Jan. 1st 1889

(20%)

Article	No. 0	No. 1	No. 2	No. 3	No. 4
A.C. Dynamo	$1,750.00	$2,500.00	$[illegible]	$9,000.00	$15,625.00
Armatures	[illegible]	437.50	875.00	1625.00	2,250.00
D.C. Exciters	230.00	265.00	340.00	405.00	548.00
A.C. Res. Box	40.00	45.00	60.00	100.00	135.00
D.C. " "	15.[illegible]	18.75	18.75	25.00	25.00
Converters	25.00	43.75	50.00	75.00	100.00
Stillwell Regulators	250.00	300.00			
Meters	15.63	20.00	31.25		

Article	Price	Article	Price	Article	Price
A.C. Volt Meter	$50.00	St. Lt. Conv.	$3.00	D.P. Switch [illegible]	$10.00
" " Ammeter	40.00	Porcelain Fuse Box	2.50	D.P. Switch with fuse "	15.00
Ground Detector	25.00	[illegible] Blk.	1.25	[illegible] Switch	15.00
Compensator	25.00	S.B. clamps & connectors	per pair 5.00		
[illegible]	8.00				

THE accompanying illustration shows a price list of the Westinghouse Electric & Manufacturing Company dated Jan. 1, 1889, which is really the first Westinghouse catalog. It lists five alternators with the necessary auxiliary equipment for lighting service. Only the 500, 750, 1,500 and 3,000 light machines were being made at that time, the No. 4 unit still being "on paper." A catalog of supply apparatus recently issued by the same company contains 1,300 pages. This gives a good idea of the growth of the electrical industry. Only fourteen supply systems are listed on the price list of 1889.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Hongkong, China (No. 7,368), of motors, 5 hp. to 50 hp., generators and fans.

Purchase is desired in Tokyo, Japan (No. 7,366), of radio receiving sets and of ice-making machines.

An agency is desired in Mexico City, Mexico (No. 7,391), for radio receiving sets and parts.

An agency is desired in Marseilles, France (No. 7,392), for ice-making machines.

PROPOSED NEW ELECTRIC PROJECTS IN INDIA. — A number of power schemes are under consideration in India, *Commerce Reports* states, including the Nilgiri Hills hydro-electric project, which is to supply electricity to the towns of Coimbatore, Octacamund, Coonoor and Wellington, the work to be completed by October, 1924; the project at Cochin of the Crompton Engineering Company; a license for the supply of electricity, which has been granted to G. Ramachandra Chetty and others covering the town of Bellary, and the plan of Best & Company, Madras, to supply electricity to the municipality of Bezwada. A license to supply energy to the town of Madura was also granted to Best & Company, who are now seeking electrical equipment for this installation.

THE VICTORIA FALLS & TRANSVAAL POWER COMPANY, Ltd., Johannesburg, Transvaal, South Africa, has petitioned the Electricity Control Board, according to Commerce Reports, for an amendment to its license in order that it may construct a new power station on the Witbank coal fields. The cost of the station with transmission lines is estimated at about $5,000,000. It has been announced that one of the engineers of the company, who has left South Africa for London and the United States, will place orders for equipment needed for this development. One copy each of blue prints, plans, and a schedule showing the general scope of this proposed work has been sent to the Bureau of Foreign and Domestic Commerce, Washington, D. C., which may be obtained on loan on application to the Electrical Equipment Division at Washington or any of the Bureau's districts by referring to file No. 97,998.

New Apparatus and Publications

CREAM WHIPPER. — The Wisconsin Electric Company, Racine, Wis., has developed a cream whipper, "Dumore," for use in hotels, restaurants and soda fountains.

WATER HEATING UNIT.—The Arthur-Fowler Company, 119½ North Browne Street, Spokane, Wash., has placed on the market a water heating unit with heat-resisting cover, known as the "A. & F. Fibreform."

REFRIGERATING OUTFIT.—The Baker Ice Machine Company, Inc., Omaha, Neb., is manufacturing a refrigerating unit for use by butchers, creameries, florists, hospitals, hotels, etc.

PORTABLE ELECTRIC PLANT.—The Simms Magneto Company, East Orange, N. J., has developed a small portable electric light and power plant for use on the farm or the home.

HEADLIGHT.—A drum type headlight, Model 19B, with a removable door and back, has been developed by the Kilborn-Sauer Company, Fairfield, Conn.

ELECTRIC RIVET HEATER. — The American Car & Foundry Company, Berwick Heater Division, 165 Broadway, New York City, has placed on the market an electric rivet heater.

ELECTRIC INDUSTRIAL HEATING INSTALLATIONS.—Special publication No. 1,667, containing a list of more than 300 installations of Westinghouse industrial heating apparatus, has been issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. This list, which contains only the more important installations, gives a definite idea of the extent to which electricity is being used for industrial heating purposes.

AUTOMOBILE STOP SIGNAL. — The Tell-Stop Appliance Company, 1379 West Twenty-fifth Street, Cleveland, has placed on the market a "Tell-Stop" signal equipped with a dash-board indicator which operates simultaneously with the rear "Stop" light and indicates to the driver whether or not the rear signal is working.

ICE SCORING MACHINE.—The Artic Ice Machine Company, Canton, Ohio, is manufacturing an electric ice-scoring machine.

TRANSFORMER TEMPERATURE SIGNAL.—The Packard Electric Company, St. Catharines, Ontario, Canada, has placed on the market the "Packard" transformer temperature signal. This device, by mistake, was credited to the Packard Electric Company, Warren, Ohio, in the issue of July 7.

POLYPHASE MOTORS.—The Robbins & Myers Company, Springfield, Ohio, has placed on the market its new type "L" polyphase motor, which will be manufactured in sizes ranging from ½ hp. to 150 hp. Details on this line of motors are given in bulletin No. 135.

MOTOR STARTING SWITCHES.—The Trumbull Electric Manufacturing Company, Plainville, Conn., is distributing supplementary pages for bulletin No. 4 in which it describes its new "Circle T" motor starting switches with overload protection and under voltage release.

REFLECTORS.—The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, has brought out three junior sizes of "X-Ray" reflectors, known as the No. 3 "Mill" type, for use in factories; No. 7 "Scoop Jr." for lighting low deep windows, and No. 11 "Hood Jr." for use in low shallow windows. The company is distributing a four-page leaflet calling attention to the story of the "X-Ray Gallopin Dominos."

THEATER LIGHTING—The Ward Leonard Electric Company, Mount Vernon, N. Y., is distributing a booklet entitled "Theater Lighting Past and Present," in which it presents the development, construction and the use of the "Ward Leonard" theater lighting control system. It also includes a brief outline of the history of theater lighting.

ELECTRIC BOTTLE WASHER.—The Electric Specialty Company, Stamford, Conn., is distributing a leaflet covering its new "Esco" electric bottle washer and general household motor combined in one unit.

GRINDING AND BUFFING MACHINE.—The Hisey-Wolf Machine Company, Cincinnati, Ohio, is distributing bulletin No. 3014-S describing the "Hisey" motor-driven combination grinder and buffer.

INSULATED COUPLINGS. — "Flexible Insulated Coupling," is the title of booklet "F" issued by the Charles Bond Company, 617 Arch Street, Philadelphia, covering its "Grundy" flexible insulated couplings and the "Mather" couplings.

ELECTRIC FLATIRON. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has brought out a new model "Westinghouse" electric iron.

ELECTRIC METER. — An electric CO_2 instrument has been developed by the Bacharach Industrial Instrument Company, 7000 Bennett Street, Homewood Station, Pittsburgh. This device may be furnished either indicating or recording, or an indicating or recording CO_2 attachment can be furnished for it.

INSTRUMENTS FOR RADIO CONTROL PANELS.—The Roller-Smith Company, 233 Broadway, New York City, is distributing bulletin No. 10, covering the "Roller-Smith" small-size instruments for radio control panels.

STOKER.—Bulletin CB2 issued by the Combustion Engineering Corporation, 43 Broad Street, New York City, describes and illustrates the "Coxe traveling-grate stoker."

New Incorporations

THE LOST RIVER ELECTRIC COMPANY, Bowling Green, Ky., has been incorporated by W. H. McCampbell, H. V. Taylor and others. The company is capitalized at $1,650.

THE McBAINE ELECTRIC TRANSMISSION COMPANY, Columbia, Mo., has been incorporated by W. W. Riggs, E. J. Douglass and others

THE VIRGINIA-CAROLINA POWER COMPANY, Richmond, Va., has been granted a charter with a capital stock of $500,000 to distribute electricity in Brunswick and Mecklenburg Counties, Va., and in Warren County, N. C. The officers are: Marvin Smithey, Lawrenceville, Va., president; Whitney D. Meredith, Lawrenceville, vice-president, and William Gray, Richmond, secretary.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOSTON, MASS.—Plans are being prepared by the Fire Department for the construction of a fire-alarm station on Hemenway Street, to cost about $200,000. T. M. Glynn is fire commissioner.

LEOMINSTER, MASS.—The Leominster Electric Light & Power Company is planning to erect a new substation in North Leominster. A new 13,000-volt transmission line is being erected from the Mechanic Street station to the site of the proposed substation.

WORCESTER, MASS. — The State Department of Public Utilities has approved the petition of the New England Power Company for permission to erect an electric transmission line across the Wendell State Forest. This line is to be built in connection with the construction of a 75-mile transmission line from the hydro-electric plant being erected by the company at Whitingham, Vt., to a substation at Millbury, Vt.

WOONSOCKET, R. I.—The Blackstone Valley Gas & Electric Company will build a one-story substation, 100 ft. x 120 ft., on West Park Place, to cost about $50,000.

WOONSOCKET, R. I. — The Rathbu. Knitting Company will build a one-story power house at its mill on North Main Street, 40 ft. x 45 ft.

GLENBROOK, CONN.—The Norma Company of America, Inc., Anable Avenue Long Island City, N. Y., contemplates the construction of a substation at its plant to be erected at Glenbrook, to cost about $80,000. Francisco & Jacobus, 511 Fifth Avenue, New York, are architects.

HARTFORD, CONN. — The Hartford Electric Light Company will build an addition to its South Meadows generating plant to double the present capacity. Contracts for a portion of the equipment have been awarded. Extensions will be made in the transmission system.

Middle Atlantic States

BUFFALO, N. Y.—Electric power equipment will be installed in the proposed two-story baking-plant addition to be erected by the Egloff Bakery, Inc., 147 Genesee Street, to cost about $75,000. L. S. Beardsley, 116 West Thirty-ninth Street, New

ITHACA, N. Y.—The New York State Gas & Electric Corporation has petitioned the Public Service Commission for permission to extend its system to Laurens, Exeter and Otsego to supply electrical service.

NEW BRIGHTON, N. Y.—The Staten Island Edison Corporation now being organized to take over and operate the electric division of the Richmond Light & Railroad Company, contemplates extensions and improvements in the property. J. H. Pardee, president of the existing company, will head the new company.

LANCASTER, N. Y.—The Depew & Lancaster Light, Power & Conduit Company has issued 25,000 shares of capital stock, part of the proceeds to be used for extensions and improvements.

NEW YORK, N. Y.—The Mesabi Iron Company, 25 Broad Street, plans to install electric power equipment at its plant in connection with new sintering works to cost about $1,500,000.

PHILLIPSTOWN, N. Y. — The Central Hudson Gas & Electric Company is negotiating for the purchase of the capital stock of the Phillipstown Electric Corporation, recently formed by local residents to secure electrical service. If the stock is acquired, the Central Hudson company will erect a transmission line and distributing system here and will furnish electricity from the Poughkeepsie plant.

WINDHAM, N. Y.—The Valley Electric Company has applied to the Public Service Commission for permission to extend its system into Ashland and Prattsville Townships to furnish electricity for light and power.

NEWARK, N. J.—Electric power equipment will be installed in the proposed ice-

manufacturing and cold-storage plant to be built by the Associated Utilities Company, care of William Braun & Company, 30 Church Street, New York, engineers, to cost about $1,000,000.

BEDFORD, PA.—The Bedford Rustic Furniture Company plans to construct a power house at its proposed local plant, to cost about $75,000.

FRANKLIN, PA.—The Venango Public Service Corporation has secured permission to purchase and merge twenty-three light and power companies operating in Venango County, including Beaver, Knox, Salem, Washington and Mill Creek Townships, and at Shippenville, Edenburg, Emlenton and Clintonville. Extensions and improvements are planned.

MILLVILLE, PA.—The Greenwood Light & Power Company, a subsidiary of the Pennsylvania Power & Light Company, will take over and operate the Millville Electric Company. Extensions will be made in the transmission system.

MOSCOW, PA.—The Moscow & Roaring Brook Electric Company, recently organized, proposes to construct a transmission line and install a distributing system in Roaring Brook Township.

PHILADELPHIA, PA.—Delany & Company, Milnor and Cottman Streets, manufacturers of glues, adhesives, etc., plan to rebuild their power house and plant, recently destroyed by fire, causing a loss of about $400,000.

PHILADELPHIA, PA.—The Board of Trustees, University of Pennsylvania, is planning to construct a power house at the institution, to cost about $45,000.

PHILADELPHIA, PA.—The Viscose Company, Marcus Hook, Pa., plans to construct a power house at its proposed artificial silk mills in the Tacony-Holmesburg section, to cost about $2,500,000.

PHILADELPHIA, PA.—A number of utility companies are being organized by R. Van Horn and C. Schubert, Philadelphia, to construct and operate transmission and distributing systems, the companies taking their names from the respective township, as follows: Decatur Township, West Township, Lincoln Township, Spruce Hill Township, Frank Township, West St. Clair Township, East Providence Township and Uni Township Power companies. James C. Jones, Bullitt Building, is representative.

PITTSBURGH, PA.—The West Penn Power Company has secured permission to take over and merge the following companies in Butler County: Bruin, Fraser, Queenstown, Wayne, Springfield and Cowanshannock Township Electric corporations and Karns City Borough Electric Company. Extensions and improvements are planned.

MARTINSBURG, W. VA.—The West Virginia Transmission Company, recently incorporated, plans to erect a transmission line from the new power plant at Williamsport, Md., to Cumberland, Md., to connect with the system of the American Water Works & Electric Company.

NORFOLK, VA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 28 for seventy electric soldering irons for use at the local navy yard. (Schedule 1159.)

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, until Aug. 21 for electric cable, electric wire, electric fixtures, and other electrical and mechanical equipment. (Circular 1549.)

North Central States

DETROIT, MICH.—The Fisher Body Corporation will build a one-story power plant at its automobile body works, Trombley Street, to cost $50,000.

DETROIT, MICH.—The Detroit Connecting Railway, Dime Bank Building, contemplates building an electric railway (88 miles long) from Delray connecting Ecorse, Pontiac, Sylvan Lake Village, Mount Clemens and Marine City. G. H. Kimball, Sr., Pontiac, is chief engineer.

LANSING, MICH.—Electrically operated pumping machinery will be installed in connection with extensions and improvements to the municipal waterworks, to cost about $600,000. Otto Eckert is city engineer.

MOUNT PLEASANT, MICH.—The installation of a new street-lighting system is under consideration by the City Commission.

BELLEVUE, OHIO.—The installation of an ornamental lighting system in the business section is under consideration by the City Council.

BEXLEY, OHIO.—The Village Council has adopted a resolution providing for the installation of an ornamental lighting system to be installed before Jan. 1. The plans call for ornamental standards with 400-cp. lamps maintained by underground wires.

MASSILLON, OHIO.—The Ohio Public Service Company contemplates building a 30,000-kw. substation on Jarvis Avenue, to cost about $150,000.

TOLEDO, OHIO.—Plans are under consideration for the construction of a power plant at the Toledo Hospital, to cost about $80,000. P. W. Behrens is superintendent.

DANVILLE, KY.—The installation of electrically operated pumping machinery at the municipal waterworks is under consideration. Peare, Greeley & Hansen, 38 West Adams Street, Chicago, are engineers.

EVANSVILLE, IND.—Electrically operated pumping machinery will be installed in the municipal waterworks in connection with extensions and improvements to cost $270,000.

INDIANAPOLIS, IND.—The Indianapolis Light & Heat Company will make extensions and improvements, including the installation of a turbo-generator and auxiliary equipment in its generating plant on Kentucky Avenue. A new substation will be built in the Broad Ripple section. Extensions will be made in the transmission system. The work will be carried out in connection with an improvement program to cost $1,500,000.

CHICAGO, ILL.—The Board of Education will install two electric equipment shops in the new Theodore Roosevelt High School to be erected at Wilson and Leland Streets, to cost about $4,000,000. J. C. Christensen, 640 South Clark Street, is architect.

DECATUR, ILL.—The Illinois Power & Light Company, People's Gas Building, Chicago, contemplates building a power plant on Lake Decatur, to cost about $5,000,000. W. E. Baehr is vice-president and general manager.

ELGIN, ILL.—The Chicago, Aurora & Elgin Railroad Company is reported to have acquired a site on Grove Avenue on which it proposes to erect a substation, to cost about $160,000.

EAU CLAIRE, WIS.—The Dells Paper & Pulp Company is planning to build a 6,000-hp. power plant.

GLEN FLORA, WIS.—The citizens have voted to establish an electric light and power service. It is not yet decided whether to install a municipal electric plant or to connect with the transmission system of a private company.

GRANVILLE, WIS.—The Milwaukee Electric Railway & Light Company is planning to extend its 122,000-volt transmission line from Granville to Plymouth.

HARTFORD, WIS.—The installation of an ornamental lighting system is under consideration by the City Council.

MARINETTE, WIS.—The City Council is considering plans for the installation of an ornamental lighting system.

OLIVER, WIS.—The voters have authorized the installation of an electric light and power system. The Village Board is considering the establishing a municipal plant, or it may make arrangements with a private company to extend its lines here. Oliver has not a post office.

PORT WASHINGTON, WIS.—The Municipal Electric Light and Water Department has entered into a contract with the Milwaukee Northern Electric Railway Company for electricity for a period of one year to provide for the increasing demand for electrical service. If the arrangement is satisfactory, a ten-year contract will be made for additional energy.

WAUSAU, WIS.—The Wisconsin Valley Electric Company has applied to the State Railroad Commission for permission to issue $500,000 in capital stock, the proceeds to be used for extensions and improvements.

WEST ALLIS, WIS.—The installation of an ornamental lighting system on Sixty-eighth Avenue is under consideration by the City Council.

CLOQUET, MINN.—The Phœnix Utilities Company, Lyceum Building, Duluth, acting for the American Power & Light Company, has acquired several power plants and appropriated funds for the construction of new power dams at Cloquet and near Lake Vermilion. The cost of the entire project, including extension of feed lines, is estimated at $7,000,000. W. S. Robertson, care of Phœnix Utilities Company is engineer in charge.

MINNEAPOLIS, MINN.—The First National Bank, Fifth Street and Marquette Avenue, has authorized plans for extensions and improvements in its power plant to cost about $35,000. G. M. Orr, 516 Andrus Building, is engineer.

ST. LOUIS, MO.—The Union Electric Light & Power Company has acquired the properties of the Light & Development Company, which will be merged with the Union system. Extensions and improvements will be made.

DUNCAN, NEB.—The erection of a transmission line to supply electricity for municipal service is under consideration.

COLUMBUS JUNCTION, IOWA.—The Iowa Gas & Electric Company, Washington, has purchased the property of the Louisa County Power Company.

HAVERHILL, IOWA.—The Haverhill-Laurel Electric Company is planning to build an electric distributing system in Haverhill and Laurel and a transmission line to connect with the system of the Iowa Railway & Light Company at Marshalltown.

VILLISCA, IOWA.—Bonds to the amount of $75,000 have been voted for the installation of a municipal electric and power plant. The Iowa Service Company, Omaha, Neb., which furnishes electricity here, is erecting a new transmission line from Red Oak to Villisca. A new line is also being erected from Clarinda to Villisca to connect with the Red Oak station.

STOCKTON, MO.—The Stockton Light & Power Company has rejected bids received for the construction of a hydro-electric power plant on the Sac River. Revised plans will be drawn and new bids called in the near future. Russel & Axon, 404 McDaniel Building, Springfield, Mo., are engineers.

UNION STAR, MO.—George H. Durant, owner of the local power plant, contemplates extensions and improvements, to cost about $30,000.

DUNCAN, NEB.—The voters have authorized the installation of an electric distribution system. Electricity will be obtained from the Columbus (Neb.) Light, Heat & Power Company.

OMAHA, NEB.—Plans are under way by the Nebraska Power Company for the construction of a new substation at Twentieth and Howard Streets, to replace the temporary station and to cost about $600,000. The work includes the revamping of the direct-current elevator service.

RICHLAND, NEB.—Bonds to the amount of $10,000 have been voted for the installation of an electric distributing system. Electricity will be secured from the Columbus (Neb.) Light, Heat & Power Company.

SNYDER, NEB.—Bonds to the amount of $90,000 have been voted for the installation of a municipal electric light and power plant.

WICHITA, KAN.—The Red Star Mill & Elevator Company plans to construct a new power plant on North Emporia Street, to cost about $30,000.

TOPEKA, KAN.—The City Commission is considering the installation of ornamental lamps on Quincy Street and East Eighth Avenue, covering five blocks.

Southern States

CHARLOTTE, N. C.—The Southern Public Utilities Company plans to rebuild its power plant on the South Boulevard, recently damaged by fire, causing a loss of about $50,000.

ELIZABETH CITY, N. C.—Plans are being considered for municipal improvements, including the installation of a municipal electric light plant, waterworks and street paving, to cost about $300,000. J. J. Bray is city manager.

HIGH POINT, N. C.—The High Point Furniture Company is planning to install a generator and auxiliary equipment at its power plant.

HIGH POINT, N. C.—Bids will be received by the Mayor and Council until Aug. 22 for improvements to the sewerage system, including the construction of three sewage-pumping stations, each complete with receiving reservoir, building and duplicate motor-driven pumping units, etc. William C. Olsen, Kinston, N. C., is consulting engineer. A. E. Taplin is city engineer.

MOCKSVILLE, N. C.—The Council has awarded contract to the Electrical Construction Company for the installation of an electric plant, to cost about $15,000.

SHARPSBURG, N. C.—The Council is considering an issue of $10,000 in bonds for extensions to the electric lighting system.

SPARTANBURG, S. C.—The South Carolina Gas & Electric Company contemplates extensions to its hydro-electric plant at Gaston Shoals, to cost about $200,000.

PANAMA PARK, FLA.—The installation of an electric lighting system in Panama Park is under consideration. It is proposed to secure the service from the municipal electric plant at Jacksonville.

LEBANON, TENN.—The Lebanon Woolen Mills contemplate an addition to power house in connection with mill extensions to cost about $100,000. D. W. Southgate, 150 Fourth Avenue, Nashville, Tenn., is architect.

CHATTANOOGA, TENN.—The Tennessee Electric Power Company is preparing plans for its proposed plant extensions including a 20,000-hp. addition to the hydro-electric plant at Great Falls, 27,000-hp. addition to the power plant at Hales Bar, and 17,000-hp. addition to the auxiliary steam power station at Nashville.

CRAB ORCHARD, TENN.—The Southland Portland Cement Company, Nashville, Tenn., recently organized, plans to construct a power plant in connection with a local cement mill, to cost about $600,000. Benjamin L. Ireland, Nashville, heads the company.

JACKSONVILLE, TENN. — The M-B Automotive Corporation, Jacksonville, Tenn., recently organized, plans to build a power house at its proposed automobile manufacturing plant, to be erected at the Old Hickory powder works of the government. Guy Hamilton is vice-president.

KNOXVILLE, TENN. — The Knoxville Power & Light Company has filed an amendment to its application to make preliminary surveys for power development on the Clinch River with the Federal Power Commission, to enable it to make similar surveys on the Tennessee River at points known as Coulter Shoals and Marble Bluff.

BIRMINGHAM, ALA. — The Alabama Power Company is preparing plans for the construction of its proposed hydro-electric plant at Chewkee Bluffs, to cost about $5,000,000.

WETUMPKA, ALA.—The Alabama Power Company, Birmingham, contemplates erecting a transmission line to Wetumpka and a substation in East Wetumpka.

ABILENE, TEX.—The West Texas Utilities Company is asking for bids for rebuilding and electrifying the Roby & Northern Railroad (12 miles) recently purchased. New rolling stock is to be purchased and a station erected at Roby. The cost is estimated at $100,000. P. Campbell is chief engineer.

HOUSTON, TEX. — The Southern Cartridge Company contemplates building a power house at its proposed local plant, to cost about $200,000. W. C. Nunn is president.

Pacific and Mountain States

BELLINGHAM, WASH. — The Roche Harbor Lime Company plans to rebuild its plant and power house, recently destroyed by fire, causing a loss of about $750,000.

RIDGEFIELD, WASH. — The Bratlie Brothers Mill Company plans to rebuild its mill and power house, recently damaged by fire, causing a loss of about $100,000.

MEDFORD, ORE.—The California Oregon Power Company has applied to the State Engineer for permission to build a hydro-electric plant with an initial output of 9,500 hp.

RAINIER, ORE. — The Jacobson-Reid Lumber Company plans to construct a power house at its proposed local mill, to cost about $80,000.

ALHAMBRA, CAL. — An ordinance is being arranged for the installation of an ornamental lighting system on portions of Primrose, La France, Fremont and Palm Avenues, Huntington Drive, and other streets.

EMERYVILLE, CAL. — The Standard Underground Cable Company, First National Bank Building, San Francisco, is planning to erect a local plant, including a main building, power house and a warehouse, to cost about $200,000. A. Prack, Westinghouse Electric & Manufacturing Company, Emeryville, is engineer.

LOS ANGELES, CAL.—The California-Hawaiian Sugar Refining Company plans to construct a power house at its proposed refining plant in the Wilmington section, to cost about $350,000.

ORANGE, CAL.—The installation of ornamental street lamps on North Cambridge Street, to cost about $2,500, is under consideration.

SAN BERNARDINO, CAL.—The Southern California Edison Company plans to erect a warehouse and pole-treating plant on I Street, to cost about $55,000.

SAN BERNARDINO, CAL.—The Atchison, Topeka & Santa Fé Railway Company will install electric power equipment in connection with extensions in its local car and locomotive shops, to cost about $2,500,000.

SAN FRANCISCO, CAL.—The Kroehler Manufacturing Company, 1319 South Michigan Avenue, Chicago, proposes to build a power house in connection with its new furniture manufacturing plant for Pacific Coast trade, to cost about $850,000.

SAN FRANCISCO, CAL.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 31, for eighty-four electric outlets for use at the Mare Island navy yard (Schedule 1156); also, until Aug. 21, for six testing generators for the same yard (Schedule 1158).

SANTA ANA, CAL.—Plans are under consideration for the installation of an ornamental lighting system on Broadway between First Street and the northern terminus.

WOODLAND, CAL. — Plans have been prepared by the Pacific Gas & Electric Company, San Francisco, for the erection of warehouse, shops and office building here, to cost about $40,000.

MESA, ARIZ.—Work is progressing on the new power site on the Eastern Canal several miles below Mesa for the power plant of the Water Users' Association. The new site is to take the place of the one situated on the South Consolidated Canal, in the same neighborhood, which was rendered useless by the diversion of the water into the Eastern Canal. It is expected that the power plant will be completed and the machinery removed from the old site during the fall months.

DENVER, COL. — Extensions and improvements are contemplated to the water works system, including the installation of a 10,000,000-gal. steam-turbine-driven centrifugal pump at the Capitol Hill station, to cost $14,210; a 4,000,000-gal. electric motor-driven centrifugal pump at University Park pumping station, to cost $2,945, and an 8,000,000-gal. electric motor-driven centrifugal pump at Ashland Avenue station, to cost $4,820. A. K. Vickery is city engineer.

Electrical Patents

Announced by U. S. Patent Office

(Issued July 17, 1923)

1,462,132. ELECTRIC LIGHTING FIXTURE; H. W. Cordingly, Fredericksburg, Ohio. App. filed Aug. 26, 1922. Ceiling pan.

1,462,207. BATTERY LAMP; E. J. McEachron, Madison, Wis. App. filed Aug. 10, 1921. Hand flashlight.

1,462,209. UNIVERSAL CONDUIT BOX; F. J. Miner, Detroit, Mich. App. filed Jan. 27, 1919.

1,462,224. ELECTRIC COOKER AND MELTING POT; H. C. Bausert, Brooklyn, N. Y. App. filed Feb. 28, 1922. Two heating elements.

1,462,226. INHERENTLY REGULATED DIRECT CURRENT DYNAMO; H. Charlet, Krefeld, Germany. App. filed July 8, 1920.

1,462,251. SEQUENCE SWITCH; F. M. Slough, Rochester, N. Y. App. filed May 8, 1918. For automatic telephone systems.

1,462,252. TELEPHONE SIGNAL ALLOTTING SYSTEM; J. A. Taggart, Rochester, N. Y. App. filed Jan. 24, 1918. Auxiliary signal appears before operator only when she is idle and ready to answer call.

1,462,322. COFFEE MAKING OR BREWING MACHINE; V. Casoletti, Turin, Italy. App. filed Nov. 8, 1920. Electrically heated.

1,462,337. ELECTRICAL INSTRUMENT; C. I. Hall, Fort Wayne, Ind. App. filed April 13, 1920. Maximum demand indicator.

1,462,346. PROTECTIVE DEVICE FOR ELECTRICAL APPARATUS; C. H. Kline, Pittsfield, Mass. App. filed Feb. 16, 1921. High-voltage bushing for transformers.

1,462,350. ELECTRIC STEAM BOILER; W. L. Merrill and H. A. Winne, Schenectady, N. Y. App. filed Feb. 15, 1922. Three-phase boilers.

1,462,354. SPEED CONTROL FOR MACHINE TOOLS AND THE LIKE; B. S. Pero, Schenectady, N. Y. App. filed Oct. 4, 1921. Two-speed control for planers.

1,462,368. TELEPHONE REPEATING SYSTEM; M. Latour, Paris, France. App. filed April 28, 1923. Two-way amplifying system.

1,462,380. ELECTRIC HEATER; E. H. Richardson, Ontario, Cal. App. filed April 2, 1920. Reflector type.

1,462,392. ELECTRIC HEATER; E. C. Strickland, San Jose, Cal. App. filed Feb. 9, 1922. Pleating iron such as is used in laundries.

1,462,421. ELECTROLYTIC TREATMENT OF METALLIFEROUS MATERIALS CONTAINING METALS OF THE CHROMIUM GROUP; R. E. Pearson, London, and E. N. Craig of Ham Common, England. App. filed June 1, 1922.

1,462,431. ELECTRICALLY HEATED TOOL; E. A. Wagner, Fort Wayne, Ind. App. filed Dec. 5, 1921. Soldering iron.

(Issued July 24, 1923)

1,462,525. ARRANGEMENT FOR PRODUCING COMPLEMENTARY VISUAL AND AUDIBLE EXHIBITIONS; G. K. Thompson, Maplewood, N. J. App. filed April 11, 1922.

1,462,526. COMPOSITE RINGER SET; J. F. Toomey, New York, N. Y. App. filed Dec. 31, 1920. For telephone lines.

1,462,572. CONDENSING WELDING CIRCUIT; J. H. Gravell, Elkins Park, Pa. App. filed June 25, 1920. Power factor of welding machine increased by built-in condenser.

1,462,580. METHOD OF MANUFACTURING ELECTRIC CONDUCTORS; R. Rüdenberg, Berlin-Gruenwald, and A. Finckbein, Charlottenburg, Germany. App. filed Dec. 27, 1920. Coils for rotating machine.

1,462,586. SHUTTLE-BALANCING MECHANISM; E. C. Taylor, Longmeadow, Mass. App. filed Nov. 3, 1922. For wrapping annular objects such as coils of wire or tire casings.

1,462,612. COVER PLATE FOR STORAGE BATTERIES; A. H. Mones, Kerrobert, Saskatchewan, Canada. App. filed April 11, 1921. Easily attached or detached.

1,462,620. TORCH FOR USE IN ELECTRIC WELDING AND HOLDER THEREFOR; C. C. Peeler, Charleston, Wash. App. filed March 19, 1921. Holder for welding wire.

1,462,682 to 1,462,634. MEANS AND METHOD OF CONVERSION BETWEEN ALTERNATING AND DIRECT CURRENTS; G. B. Coleman, San Francisco, Cal. App. filed Dec. 11, 1919. Mechanical rectifier.

1,462,690. ELECTRICAL SWITCH; C. A. Deas, Rock Hill, S. C. App. filed Aug. 16, 1922. Pedal located near foot brake.

1,462,703. ELECTRIC WATER HEATER; W. S. Jones, Orwood, Cal. App. filed Sept. 13, 1921. Instantaneous heater attachable to faucet.

1,462,719. MEASURED-SERVICE TELEPHONE SYSTEM; W. W. Owen, Oak Park, Ill. App. filed June 14, 1919. Means for automatically controlling coin-collecting device.

1,462,770. SLIDE TROLLEY; P. Schultz, Des Moines, Iowa. App. filed April 17, 1922. May be reversed, thereby increasing life.

1,462,791. AUTOMOBILE LIGHT DIMMER SWITCH; A. D. Gaston, Austin, Tex. App. filed April 30, 1923.

1,462,795. ELECTRIC BATTERY; W. R. Loveman, Bridgeport, Conn. App. filed Jan. 5, 1921. Bag-type batteries.

1,462,819. AUTOMATIC TELEPHONE SYSTEM; W. T. Powell, Rochester, N. Y. App. filed Aug. 31, 1920. Circuits of non-numerical switches employed in automatic systems.

1,462,882. RECEIVING SYSTEM; H. Chireix, Paris, France. App. filed March 24, 1922. Relay for automatic calling arrangements in wireless telegraphy or telephony.

1,462,918. AUTOMOBILE BRAKE; C. E. Norton, Loveland, Col. App. filed Jan. 23, 1922. Electrically controlled brake.

1,462,973. ENGINE STARTER; W. L. McGrath, Elmira, N. Y. App. filed Oct. 1, 1919. Relates to engaging unit between motor and engine.

1,462,987. PROCESS FOR PRODUCING NITRIC ACID BY MEANS OF THE ELECTRIC ARC; W. Siebert, Laufenburg, Aargau, Switzerland. App. filed May 13, 1922.

1,463,004. ELECTRICAL RECORDING INSTRUMENT; F. H. Bowman, Lynn, Mass. App. filed Dec. 22, 1920. Damping vane for graphic meters.

1,463,005. HEATING UNIT; W. H. Dalton, Salem, Mass. App. filed Nov. 1, 1921. In form of elongated cylinder.

1,463,017. DYNAMO-ELECTRIC MACHINE ADAPTED FOR SYNCHRONOUS WORKING; L. J. Hunt, London, England. App. filed April 19, 1921. Means whereby machine can be run as synchronous machine at speeds other than cascade speed.

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The Romance of Electricity

AS NATION after nation has swung through the orbit of time and passed on, it has invariably stamped an impression of its art, thought, government or morals on history's pages. Greece left her glorified art enshrined in the Acropolis — a temple dedicated to Athene the beautiful. Rome became renowned for her establishment of law and order. The world then slumbered through the Dark Ages until the Renaissance, with its revival of art and literature. The centuries following witnessed aggressive geographical exploration, making the world far vaster. But the nation in which will be epitomized the great progress of civilization in the twentieth century will be America!

What will be the outstanding feature when some future Wells endeavors with a discerning and critical mind to set down what our own age has added to the ethnological stages of man's development? What beneficent revolutionary achievement will he ascribe to America? Will it not be the conception and initial development of electricity as a means of emancipating man from the necessity of ceaseless hard physical work? The future Wells will see this tremendous event in its true romantic light by his ability to view it in historical perspective. He will be able to set forth the miracle to which the men of today are so close that they do not grasp it.

None the less, the romance of electricity is already with us. It is here for those who will stop to analyze the wonderful advance America has made during the past twenty years. The electrical industry will greatly benefit from the presentation of this romantic side of electricity. Because it is a story of vast appeal to human interest, it will go far in assisting utilities in their public relations policies.

More stress should be laid upon the value of the service and less upon arguments over its cost. In the past too many engineering details have been flung before the public when the social and romantic features of this divinely given energy should have been depicted. Why not appeal to the poetry in mankind as well as to the prose?

Arthur W. Thompson

A far-seeing utility executive who is planning for the future power needs of the Pittsburgh industrial district.

AGGRESSIVE, capable, equipped with wide experience and planning with vision, Arthur W. Thompson well fits the job as chief executive of the group of utility companies furnishing light and power, gas, street railway service and steam heating for Pittsburgh and its surrounding territory.

His training as an engineer, educator, railroad executive and federal executive has given him the perspective, experience and judgment adequately to plan for the needs of one of the greatest industrial regions in this country, and the policies followed since he has directed the work of the utilities in the district give complete evidence of the value of his thoughts and efforts.

Mr. Thompson was born at Erie, Pa., May 8, 1875, and attended Allegheny College, graduating as a civil engineer in 1897. After finishing his college course, he became transitman at Pittsburgh for Wilkins & Davison and in 1898 entered the employ of the Pittsburgh & Lake Erie Railroad as instrument man. In 1899 he took charge of a surveying party for the Baltimore & Ohio Railroad at Pittsburgh, became assistant division engineer in 1900, division engineer at Cumberland in 1901 and at Pittsburgh in 1902. In 1903 he was chosen superintendent at Cumberland and at Wheeling in 1904.

In 1907 Mr. Thompson was advanced to chief engineer of maintenance of way of the Baltimore & Ohio Railroad and in April, 1910, to chief engineer. In December of the same year he was made general manager and in April, 1912, was elected third vice-president of the Baltimore & Ohio Railroad in charge of operation and later became vice-president in charge of traffic and commercial development.

Mr. Thompson came to Pittsburgh Feb. 1, 1919, as president of the Philadelphia Company and its affiliated corporations and has been active in all developments undertaken for the good of the district.

It was due to Mr. Thompson's aggressive efforts that the great new Colfax power plant of the Duquesne Light Company was erected to anticipate the electric power needs of the Pittsburgh district and provide abundant cheap electric power. Mr. Thompson has also worked out a plan for the reorganization of the Pittsburgh Railways Company, which has been in the hands of the receivers, by means of which he hopes to afford Pittsburgh and environs better street railway service.

He was given an honorary degree of Doctor of Laws by the University of Pittsburgh and St. John's College of Annapolis, Md. He is also president of the board of trustees of Allegheny College, Meadville, Pa.

Editorial Comment

Electrical World, August 18, 1923

Volume 82 Number 7

Public Pressure for Superpower

THE continuous appearance in the daily and popular press of articles and arguments regarding superpower is having its effect on the public mind. Possibilities of vast economy are painted, often in colors too glowing, by the uninformed popular writer. The most hopeful dream of widespread conservation of natural resources is pictured as about to come true through general interconnection. All of this is resulting in increased pressure from the public on the electrical industry to bring about the realization of the prophecies. On the other hand, it is also one of those matters of public interest upon which politicians may appeal to popular prejudice and where they may find a field for urging government development.

An article in the Chicago *Sunday Tribune* for Aug. 5, 1923, brings to a sharp focus some of the popular ideas. A nation-wide superpower plan is proposed, built on the idea of nation-wide—even continent-wide—rainfall. It is the superpower idea carried to its ultimate—to its extreme. There will doubtless be many similar popular articles built around the plan recently proposed by Frank G. Baum.

The point for the industry to take to heart is threefold: (1) The increasing public interest in superpower systems means increased pressure to have the idea made a reality. (2) At the same time this offers opportunity for the electrical industry to capitalize on the public interest and gain its support in its present attempts at wider interconnection, even if the final answer is not yet entirely apparent. (3) The industry should take active and definite steps to see that superpower is interpreted in its practical possibilities to the public so that there will be no violent reaction when reality does not satisfy false hopes.

A Question of Names

LONG association with a company name unquestionably tends to vitalize the corporate personality and to provide a background of achievement for executives and employees, but in some quarters the point has lately been raised whether it would not in many cases be greatly to the advantage of the industry if company names should be simplified, or broadened. Thus, it has been suggested that in place of the name "Jonesburg Electric Light Company" or "Smithtown Electric Illuminating Company" or "Brownsville Electric Light, Heat & Power Corporation," the simpler corporate designation "Jonesville Electric Company" be used, or, what is perhaps more significant and in keeping with the times, "Smithville Electric Service Company."

Those who approve such a change believe that the advertising and good-will values of the broader name would quickly offset any prestige of long association, driving home to the public the idea of a local concern constantly seeking to serve it electrically in every possible manner. The term "Smithville Electric Service Company" has been urged before and has much to commend it. Certainly such names as the "Jonestown Consolidated Electric Railway, Light & Power Company" or the "Bingville Gas & Edison Electric Light Company" have much to answer for if only in increased clerical costs all along the line. Some of these longer names are doubtless successors of shorter ones, brought about by reorganization, change of management or other temporary cause. But with the evident advantages of the shorter and better name, it would be interesting to the industry to have some of the "old-timers" come forward and show cause why this measure of linguistic simplicity may not be attained at small cost by changing long-winded corporate names of venerable history but of expensive upkeep!

Greater Service from Credit Men

BETWEEN the lines of the papers and addresses presented at last week's "Silver Jubilee" convention of the National Electrical Credit Association ran a very evident purpose to serve the industry more broadly and more deeply. Credit men are by occupation responsible citizens of the electrical commonwealth. With acceptance of responsibility often goes a measure of conservatism unfelt before; but in this membership it is gratifying to see that as the weight of decisions increases, new desires to help in the constructive development of the industry are manifested. How can this be realized?

Passing on risks is but a part of the credit officer's duty. The representatives of leading manufacturing and jobbing houses who met at Boston saw opportunities for closer co-operation with sales departments in planning the terms of campaigns. They marked the possibilities of a new day in relations with contractor-dealers, a day in which the business experience and knowledge of the trained credit man might be more fully placed at the disposal of the borrower to help stabilize business methods, to improve accounting and better to control purchasing. They noted the benefits of more prompt, accurate and thorough analyses of operations among electrical retailers and the advantages of regular and more frequent reports. These are ways in which the progressive credit men are seeking to broaden their usefulness, but to be successful the support of executives in backing up sound policies is absolutely essential.

A profitable volume of sales means a volume of business handled along proper lines of account settlement, and executives should insist upon team play between

sales and credit departments even at the sacrifice of temporary totals. The pooling of credit information through "moral risk clubs" or their equivalent is helping materially to prevent the pyramiding of orders and the doing of business upon a so-called "off and on" basis. The educational potency of a good credit manager in the electrical trade is still far from realized by many of the weaker organizations seeking accommodation, and the closer such concerns work with credit men of standing, the sounder their business methods are sure to become. It is for the industry to capitalize the services of its credit personnel more and more effectively through increased drafting of such abilities on behalf of the common welfare.

Help in Compilation of Experiences with Parallels

A PRAISEWORTHY task has been undertaken by the N. E. L. A. as a part of its work in inductive coordination—it is the compilation of experiences with power and communication parallels. This work is being conducted through the medium of the geographical sections or corresponding organizations.

When operating companies receive questionnaires on this subject they may unknowingly be doing themselves a good turn, and they will certainly help the industry as a whole, if they take real pains to catch the spirit of the questionnaire and answer it accordingly. The purpose is to ascertain the nature of parallels that exist and give no trouble, and also of those that are causing trouble, regardless of who may be responsible. Every engineer who gives the subject much attention will recognize that the compilation will be worthless unless all contributing conditions are reported, such as length of parallels, separation, voltage and frequency of power lines, nature of interference preventives, existence of unsuitably installed power or telephone equipment, existence or production of troublesome harmonics and their cause. If the questionnaire does not ask all the necessary leading questions, every company will be conferring a lasting favor on the industry if it will supplement the requested answers by sidelights on the situation.

Co-operate with the Architects

MOST persons leave details of house design to the architect, and this is particularly true of the electrical features. Yet the time to give thought to the electrical installation is when house plans are being made, because inertia and cost combine to maintain the status quo of a home after its completion. The home owner usually says, "Wait until we build a new home," or, "Well, we can get along all right without it, I guess," when the wife or the maid suggests new installations or changes in existing arrangements.

The obtaining of a convenient and adequate electrical installation in a home requires the concentrated and co-operative work of several agencies. The central-station company, the home owner, the architect, the electrical manufacturer and the electrical contractor are all interested in the achievement of success. The problem is to bring about co-operative work to obtain the desired results, and from many standpoints the central station is the best agency to take direct steps to bring about efficient co-operation.

The most necessary thing is to insure the co-operation of the architects because they afford direct contact with the home owner, and the desire of the home owner to reduce costs and the almost universal lack of knowledge of the electrical equipment now available for homes have a tendency to cause the architects to sacrifice immediately the electrical features of the installation. Too frequently—and unfortunately—the short-sighted electrical contractor will suggest ways to cut the electrical cost even if the architect has laid out a good installation. But a well-informed architect would not permit such a change.

Every possible means for bringing illuminating engineers and appliance men into closer contact with architects should be utilized, for all can learn something of value from the resulting discussions. Even if nothing tangible results except personal acquaintanceship and mutual understanding, the mingling will be worth while. The possibilities of this type of development should not be left to chance, but should inspire studied and active efforts by central-station commercial organizations.

The Struggle for Economy in Steam-Power-Plant Practice

HOW to design and build high-load-factor plants to operate with maximum thermal efficiency is indeed a subject of controversy and for study. Designers are dividing themselves into "schools" which are building stations that differ radically in the methods proposed for securing the desired result. Cost is admittedly the deciding element in each situation, but all concede that sufficient data are not available to decide the relative merits of the proposed installations from a thermal standpoint, and relative costs are still more difficult to predict. Hence arises the need for study to which allusion has been made.

For one thing, high steam pressures are being used, in two principal ways: (1) Using an initial steam pressure of about 550 lb. and a temperature of around 725 deg., the steam goes through a high-pressure cylinder of a cross-compound or tandem-compound turbine and then exhausts into a reheater where the temperature is increased until superheat is obtained, and then the steam goes into the low-pressure cylinder at 100 lb. pressure. Even two low-pressure cylinders are used in some installations, the second cylinder working under vacuum conditions. (2) Using an initial steam pressure of 1,000 lb. to 1,200 lb. at a temperature of about 725 deg., the steam operates a small high-pressure turbine and then exhausts through some kind of a water separator at about 300 lb. pressure into the ordinary type of turbine.

Stoker firing and pulverized-fuel firing for boiler plants have their respective advocates, with the result of innovations in furnace construction and boiler arrangements. Incidentally, the keen competition in this fuel question has brought about intensive studies of combustion-chamber and boiler arrangements that will ultimately result in improved operation independently of the type of firing used.

Main-unit bleeding for heating feed water in a regenerative-cycle scheme is now considered a practicable

procedure, and the relative merits and costs of two, three and even four-stage bleeding will soon be determined. In addition, superheaters, economizers, evaporators and automatic combustion-control equipment are contending with renewed zest for a more prominent position in the installations.

These advanced practices, which are seen here, there and everywhere on all sides, are occurring in the face of past experiences which indicate that a five-year period sees obsolescence in many practices, schemes of arrangement and types of equipment. Such developments are thought warranted in the light of the thermal gains and money gains which study indicates are probable.

The light and power industry is under a tremendous obligation to the engineers and companies that are wagering their reputations and money on the success of the stations now building which incorporate these radical changes in practice. But the fact remains that these plants are yet to be proved, and a widespread adoption of the several schemes is unwarranted until actual data are obtained whereby the influence of load factor, the added increment of investment required and the operating reliability can be accurately determined.

One Useful Field for the Automatic Substation

SOONER or later a growing distribution system reaches the midway position where it is difficult to decide what is the next and most economical step in acquiring increased capacity. Additional substations, particularly on the system which has had only one distribution point, are to be avoided as long as possible because they introduce new operating and expense problems. On the other hand, if the distances over which energy must be carried mount up to several miles, there is a decided limit to the use that can be made of star-connected circuits and even of voltages higher than the ordinary ones for primary distribution. The time comes when additional substations must be established.

This situation was reached in Peoria a year or more ago, and in last week's issue there was a description of the way in which the Central Illinois Light Company met the problem by using 13,200-volt circuits to supply the new substation sites and employing automatic substations to avoid the cost of attendance. The plan calls for the ultimate establishment of a series of loops around the territory served with substations connected to the loops. The future establishment of loops and substations will, of course, depend on the development of the load, but the way is left open to go as far as may prove necessary.

The automatic substation for alternating-current service is rapidly spreading in the territories where the service demands are not so severe as in the large cities and where the question of the cost of substation operation is a serious matter because the load development is on the border line between the old method of service from one point and the newer type of service from several points. This observation is not intended to imply that the field of the automatic substation is limited to such conditions, but merely to point out one of the situations in which automatic operation seems to have a marked advantage—a field in which a considerable growth is taking place.

How Serious Is Ionization in Cables?

RECENT reviews of experience with high-voltage cables and the offerings of cable manufacturers during the past year indicate several noteworthy steps in the gradual improvement of this important type of transmission conductor. With continued investigation of the properties of paper and compound, and with increasing attention to processes of manufacture and assembly, the thickness of cable insulation has been materially reduced without sacrifice of dielectric strength and at the same time with material reductions in dielectric loss and power factor. As a consequence the safe operating voltage is rising, 44-kv. and 66-kv. cables going into service and 132-kv. cables being seriously considered as permissible.

It is interesting to note that this improvement, so far as the materials are concerned, is of necessity entirely due to empirical methods of study. The insulation is literally the life of a cable, yet the breakdown processes of no type of insulation are as yet understood. Consequently cut-and-try methods are about the only ones available, and the cable stands out as a conspicuous case only because no other part of it causes any concern. This is not to say that the laws of cable insulation are not being studied. They are, and most vigorously, and much has been learned. But as long as there is uncertainty and difference of opinion among experts as to the nature of the losses in cables and the causes of breakdown improvements will come, not by analysis, but only by unguided experiment.

One of the great uncertainties in cable operation at present is the importance of internal gaseous ionization. It is considered a serious menace and a limiting factor by American engineers, but in Europe it is regarded as a danger which can be avoided by care in manufacture. Indeed, if we may judge by a recent careful analysis of the whole question of cable losses by a well-known European engineer, we in America have attributed to ionization losses which are to be accounted for by other well-known causes, and so are ascribing too much importance to a possible danger from which our best cables are probably as free as are theirs. The analysis referred to contains a careful review of all available data on ionization, hysteresis and conduction losses, and proposes a method of test for determining the presence or absence of ionization. This test is applied to a number of American data and furnishes the basis of the criticism. Making due allowance for certain well-known differences in the materials and requirements of cables here and abroad, it appears at the moment that our friends on the other side have a little the edge on us in the matter of analysis and have distinctly put it up to us to demonstrate in the matter of ionization.

The evidence is by no means conclusive. There is no doubt that copious gaseous ionization in time will attack fibrous insulation. It appears from its nature and from its local occurrence in entrapped layers to be peculiarly likely to cause isolated regions of deterioration, leading to increased conductivity and hot spots. But just how copious it must be, how long it must operate, how much these conditions are approached in the average cable, and whether the usual types of measurement do in reality show its presence, are questions on which an authoritative utterance from this side would do much to clear the air.

Strain and Suspension Structures for 132,000-Volt Line in Sweden

THE 132,000-volt trunk line between Trollhättan and Västeras, Sweden, is supported on steel-reinforced concrete structures like that shown at the right. Some of the structures have concrete cross-beams and others structural steel. At intervals structural-steel towers like those shown above are used for strain towers or transpositions. The cross-beam of the concrete structure is 57 ft. above the ground and the conductors are 20 ft. apart. One of the concrete poles was subjected to a right-angle pull of 7,600 lb. with a deflection of 6.1 ft. without cracking or permanent set. By simply setting one pole in line with the other two and extending the cross-beam space may be provided for six conductors. As the poles and circuits are now installed there is even room for a fourth conductor.

Power-Factor Correction with Loaded Synchronous Motors

An Analysis Showing the Advantages of Using Synchronous Motors to Carry Additional System Loads—Determination of Variation in Reactive Component with Variation of Load on Synchronous Machines

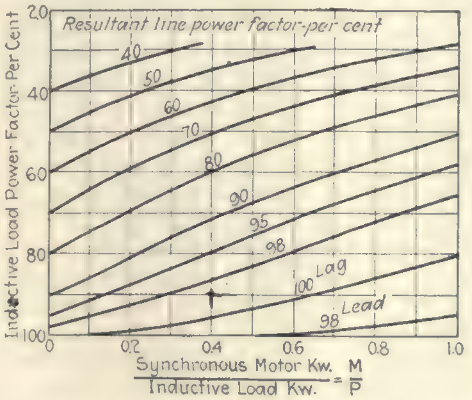
By CLIFFORD W. BATES
Research Engineer Philadelphia Electric Company

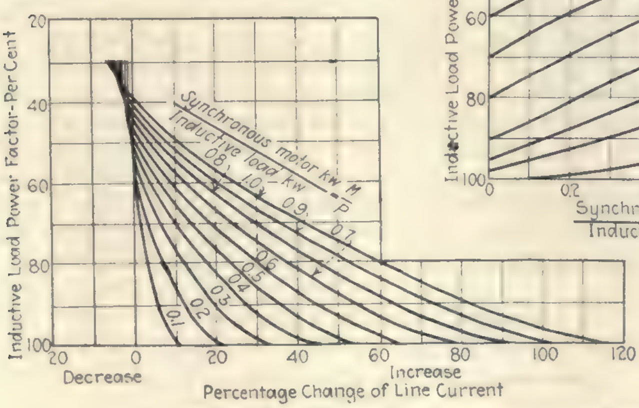
THE use of the loaded synchronous motor for power-factor correction offers opportunity for choice in regard to the results to be obtained. The improved power factor may be obtained by using the loaded motor in such a way as to cause reduced line current, allow additional load not included in the original motor load, or the same line current may exist—these variations being obtained by adjusting the motor excitation and its mechanical load so that the desired current is obtained with the motor power factor decided upon. It should be noted that as the mechanical load of the motor and the electrical load of the rest of the system vary the power-factor conditions will change.

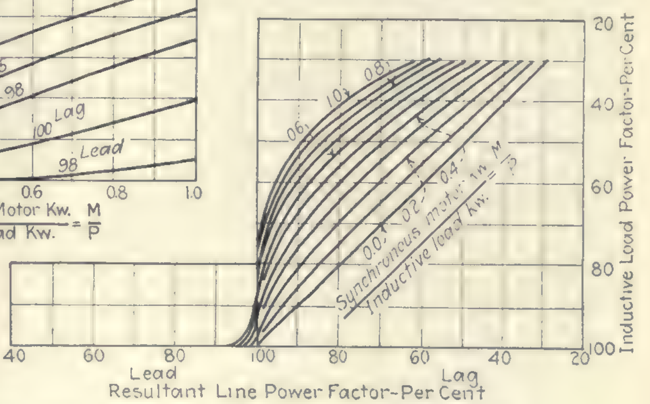
Manufacturers in general rate synchronous motors for 80 per cent leading power factor so that leading current may be drawn from the line while the motor carries rated mechanical load. This practice results in giving the motor a greater torque overload capacity than it would have at the 100 per cent power-factor rating.

In order to analyze conditions it is assumed that the synchronous motors are to be operated at a fixed power factor and are to deliver rated mechanical output at this power factor. The power factors assumed are 80 per cent leading and 100 per cent. The first does not involve a large decrease in the mechanical output as compared with 100 per cent and does give a very much increased correction effect. In fact, the correction is greater than that produced by the same size of machine when used entirely for correction purposes. The 100 per cent power factor case shows the effect that would be produced by any non-inductive load in combination with an inductive load.

The analysis was made by assuming synchronous motors of various rated power inputs (in kw.), M and N for 80 per cent and 100 per cent power factors respectively, in proportion to the power P (in kw.) of the inductive load to be compensated. The size of motor is expressed as M/P and N/P, the values used ranging from 0.1 to 1.0. The value of the resultant or line power factor was calculated for various values of the power factor of the inductive load for each motor size. It should be noted that the power of the motor is the motor input and that the motor is assumed to be operating at full load. If not operated at full load, the actual input of the motor is to be used wherever "size" or "rated load" is mentioned. The curves show the relations between the power factors, size of motor and change of line current, Figs. 1 to 3 being for 80 per cent and Figs. 4 to 6 for 100 per cent operation.







EFFECT OF ADDING A LOADED SYNCHRONOUS MOTOR OPERATING AT 80 PER CENT LEADING POWER FACTOR

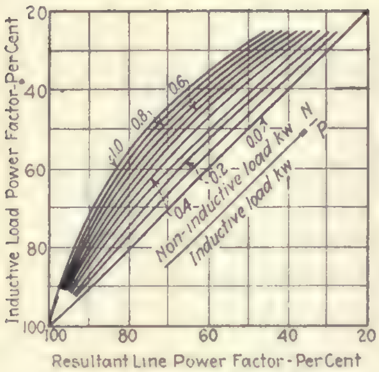
Fig. 1 (At Right)—Relation between inductive-load and resultant line power factor for various sizes of loaded synchronous motors operating at 80 per cent leading power factor while carrying the load.

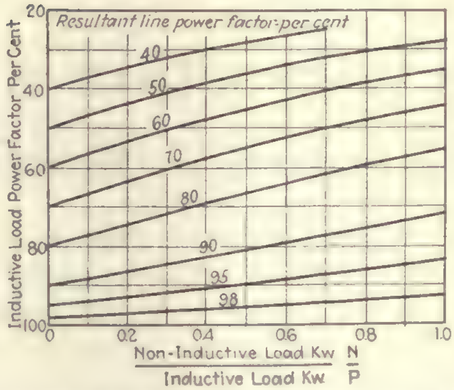
Fig. 2 (Top)—Relation between inductive-load power factor and size of synchronous motor operating at 80 per cent leading power factor for various values of resultant line power factor.

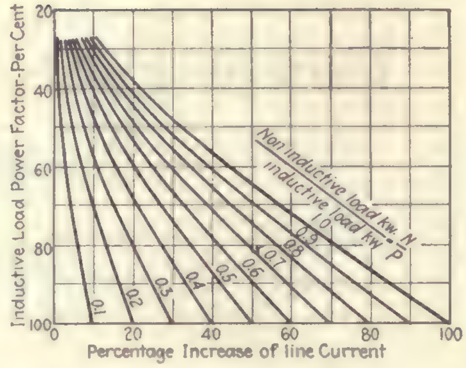
Fig. 3 (At Left)—Relation between inductive-load power factor and change of line current caused by adding various sizes of synchronous motors operating at 80 per cent leading power factor.

In Fig. 1 each curve shows the relation between the power factor of the previously existing inductive load and the resultant power factor due to the addition of a loaded synchronous motor operating at 80 per cent leading power factor. Each curve represents a definite size of motor, which is expressed in terms of the ratio of the power input M (in kw.) to the power taken by the previously existing load, P.

As an illustration of the method of application assume that an installation which takes 400 kw. at 60 per cent power factor is to be increased by the addition of a ma-







EFFECT OF ADDING A LOADED SYNCHRONOUS MOTOR OPERATING AT 100 PER CENT POWER FACTOR

Fig. 4—Relation between inductive-load and resultant line power factors for various non-inductive loads operating at 100 per cent power factor.

Fig. 5—Relation between inductive-load power factor and magnitude of non-inductive load for various values of resultant line power factor.

Fig. 6—Relation between inductive-load power factor and increase in line current caused by adding various amounts of non-inductive load.

chine requiring 100 hp. This is equivalent to a motor output of 75 kw. or an approximate input of 80 kw. M/P is then $80/400 = 0.2$. From the curve marked 0.2 it is seen that the power factor of the installation will become 71 per cent instead of 60 per cent if a synchronous motor is used which operates at 80 per cent leading power factor.

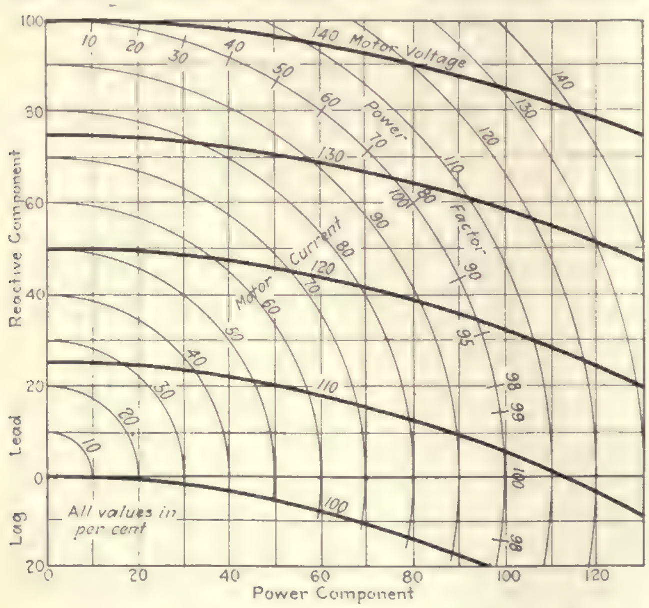
Fig. 2 shows the same facts as Fig. 1, but in a different way. Each curve shows the size of synchronous motor operating at 80 per cent leading power factor which is necessary to produce a fixed value of line power factor for various values of the power factor of the existing inductive load installations. For example, if it were desired to raise the power factor of a load of 400 kw. at 60 per cent lagging power factor to 80 per cent, at the same time utilizing all the mechanical load available, the curves show that M/P will be about 0.4, or the new motor will absorb 160 kw.—i.e., deliver about 200 hp.—if a synchronous motor operating at 80 per cent leading power factor is used.

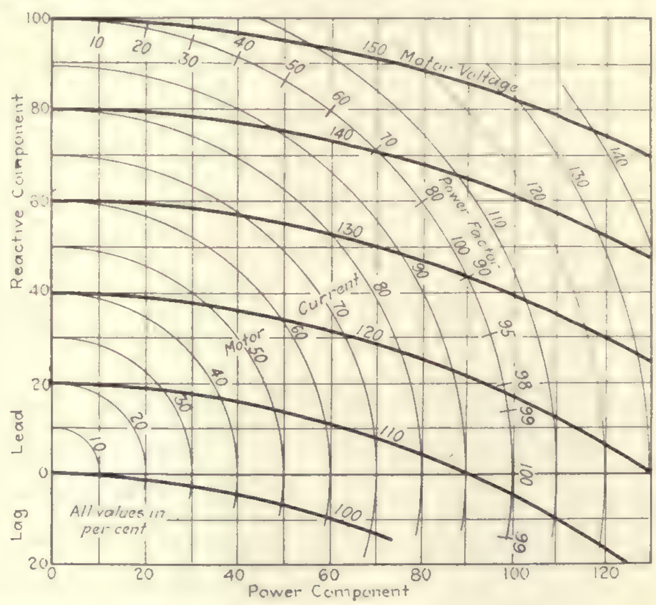
It is interesting to note that if no additional power is to be utilized a 235-kva. condenser or equivalent would be necessary. Also, if a combined condenser for power-factor correction and an induction motor operating at 60 per cent power factor is used for the additional power, their respective ratings would be 315 kva. and 133 kw. It may also be noted that if a synchronous motor operating at 100 per cent power factor were used, its rating would be little over 300 kw. These comparisons in general show that the loaded synchronous motor operating at a leading power factor affords the greatest power-factor compensation for a given size of machine.

Fig. 3 shows the relative change in line current due to the installation of a loaded synchronous motor operating at 80 per cent leading power factor. As shown by the curves, an increase in power delivered may result in a decreased line current if the power factor of the original load is quite low. In the example used in Figs. 1 and 2, where motors are considered which increase the power demand by 20 and 40 per cent and raise the power factor from 60 per cent to 71 and 80 per cent, respectively, the line current is increased only 1.5 per cent and 5.0 per cent by the respective motors.

The same general relations are shown in Figs. 4 to 6 for the synchronous motor operating at 100 per cent power factor. It should be noted that these relations apply to the addition of any unity-power-factor load.

The analysis thus gives a set of curves which show almost at a glance the effect of increasing the load of





EFFECT OF MOTOR IMPEDANCE ON OPERATION

Fig. 7—Variation of reactive component with mechanical load of synchronous motors at constant excitation, with 50 per cent motor impedance.

Fig. 8—Variation of reactive component with mechanical load of synchronous motors at constant excitation, with 40 per cent impedance.

an installation by loaded synchronous motors operating at a leading power factor or by adding any sort of non-inductive load. The curves bring out very definitely the advantage from the central-station standpoint of making additions to the equipment by synchronous machinery when the load is steady enough and required in large enough units to warrant the somewhat increased attendance and first cost.

Variation of Reactive Component

In investigating the power-factor correction which may be obtained by the addition of loaded synchronous motors to a load consisting mainly of induction motors, it is important to consider the effect of variation of the mechanical load on the motor, other conditions such as excitation being constant, on the reactive component delivered by the synchronous motor, as this has in turn a very appreciable effect on the line power factor.

An investigation of this variation has been made, the results of which expressed in a very general way are given in Figs. 7 and 8, which are identical except for the use of different values of the motor impedance. The figures show primarily the relation between the reactive and power components of the motor current (expressed as percentages of rated current) for several constant values of the motor excitation, which is expressed in terms of the induced motor voltage. This relation is shown by the flatter of the two sets of curves, which is marked with values of the motor voltage expressed as a percentage of line voltage. The other set of curves marked "Motor Current" shows the resultant of the reactive and power components; i.e., the total current. Values of the motor power factor are indicated on the 100 per cent current line by short radial lines.

	Fig. 7	Fig. 8
Impedance	50	40
Motor voltage	136	128
Power component, full load	80	80
Reactive component, full load	60	60
Power component, half load	40	40
Reactive component, half load	69	68
Total current, half load	80	78
Power factor, half load	50	51
Power component, no load	0	0
Reactive component, no load	72	70

To show the application of the figures, suppose that a motor having 50 per cent impedance is operating at rated load current with 80 per cent power factor. By locating the 80 per cent power factor point on the 100 per cent current line of Fig. 7 and following the vertical and horizontal lines to the corresponding scales it is found that the reactive and power components of the current are 60 and 80 per cent, respectively. Also by noting the position of this point with reference to the motor voltage curves, it is seen that the excitation must correspond to approximately 136 per cent of line voltage.

Now, if the mechanical load falls to half its original value, or 40 per cent, the excitation remaining the same as before, the new conditions are found by locating the 136 per cent voltage point on the 40 per cent power component line. It is found that the reactive component is about 69 per cent, the total current 80 per cent and the power factor 50 per cent. Similarly, if all mechanical load is dropped, the reactive component becomes slightly over 72 per cent of the motor rating.

The curves given in Fig. 8 for a motor having 40 per cent impedance are included mainly to show that an exact knowledge of the motor impedance is not necessary. Most motors have an impedance ranging from 40 per cent to 55 or 60 per cent with an average equal to 50 per cent or slightly less. The error caused by considering all synchronous motors to have 50 per cent impedance may be seen by comparing the results obtained from Fig. 8, corresponding to 40 per cent impedance, with the previous values, corresponding to 50 per cent. They are as given in the accompanying table.

It is seen that the results are almost identical so far as the correction effect is concerned. The excitation required is, however, higher with the motor of higher impedance.

It should be noted that the effect of resistance drop, which is always small, has been neglected, and also that the condition of absolute no-load power component cannot be attained owing to the mechanical losses.

Changes in Procedure that Will Bring Mutual Benefits

SEVERAL conditions and practices have prevailed in the letting of electrical contracts that have been unfair to the contractor and costly to the owner, Charles L. Eidlitz, commissioner of the Electrical Contractors' Association of Greater New York, recently declared. Among these objectionable conditions are: (a) The requirement that unit prices for additions and deductions be quoted; (b) the furnishing of insufficient plans; (c) the failure to state local requirements; (d) the incorporation of the "life-saving clause" in contracts; (e) the limitation imposed on working hours of electrical contractors by placing of concrete forms, reinforcing and pouring; (f) insufficient advance notice of overtime work; (g) the customary construction rush and failure to provide plans in the contractor's office.

A saving to owners of buildings and a fair deal to contractors would result, Mr. Eidlitz contended, if these conditions are remedied. For example, having estimates submitted on extra work and allowances for deductions would be much better than the unit prices now required. Floor plans alone do not furnish the contractor sufficient information for estimating. Sections and construction details should be included. Furthermore, specifications should definitely indicate the existence of special local requirements such as are enforced by the electric lighting companies.

The clause sometimes included in contracts that "anything that may be necessary, whether or not specified or indicated on plans, must be included by this contractor" is not only unfair but has no standing in law, according to Mr. Eidlitz, who went on to say:

"In the case of concrete buildings the forms and reinforcement are frequently installed after the regular hours of work, making it necessary for the electrical contractor to work overtime in order that the pouring of concrete may not be interrupted.

"This involves still another point to which very little thought has been given. The efficiency of the average mechanic, who works through the regular hours and is required on rare occasions to work a few hours' overtime, is not seriously affected, but wherever the amount of overtime work is substantial his efficiency, so far as his employer's interest is concerned, drops off in a startlingly increasing degree so that the contractor who is compelled to work overtime on a contract when he has not been able to estimate this in advance is bound to be the sufferer, even though he be reimbursed for the actual overtime expense.

Selective Overload Protection

Extensive Study Made of European Practice in Regard to Protection of Lines and Apparatus—Formula for Oil Circuit-Breaker Design

THE latest European developments of overload protection of large power stations, with particular reference to the localizing of the destructive effects of short circuits in large networks, have been elaborately treated by E. Vedovelli in a recent issue of the *Revue Générale de l'Electricité*. Depending upon the capacity and the operating voltage of a power station, several curves, two of which are reproduced herewith, are given to show the maximum possible short-circuit current in relation to the reactance of the system. Diagrams based on the cross-section of cables or overhead lines show the time within which the automatic breaker must open the circuit to prevent a dangerous heating of the conductors due to excessive current density. These somewhat complex diagrams are interpreted by actual cases.

For the proper and safe dimensioning of oil circuit breakers Mr. Vedovelli gives the following formula, which has been tried successfully for a number of years:

$$P = 240\, vD\sqrt{H}\, \sqrt[3]{Nd/(400 + T)},$$

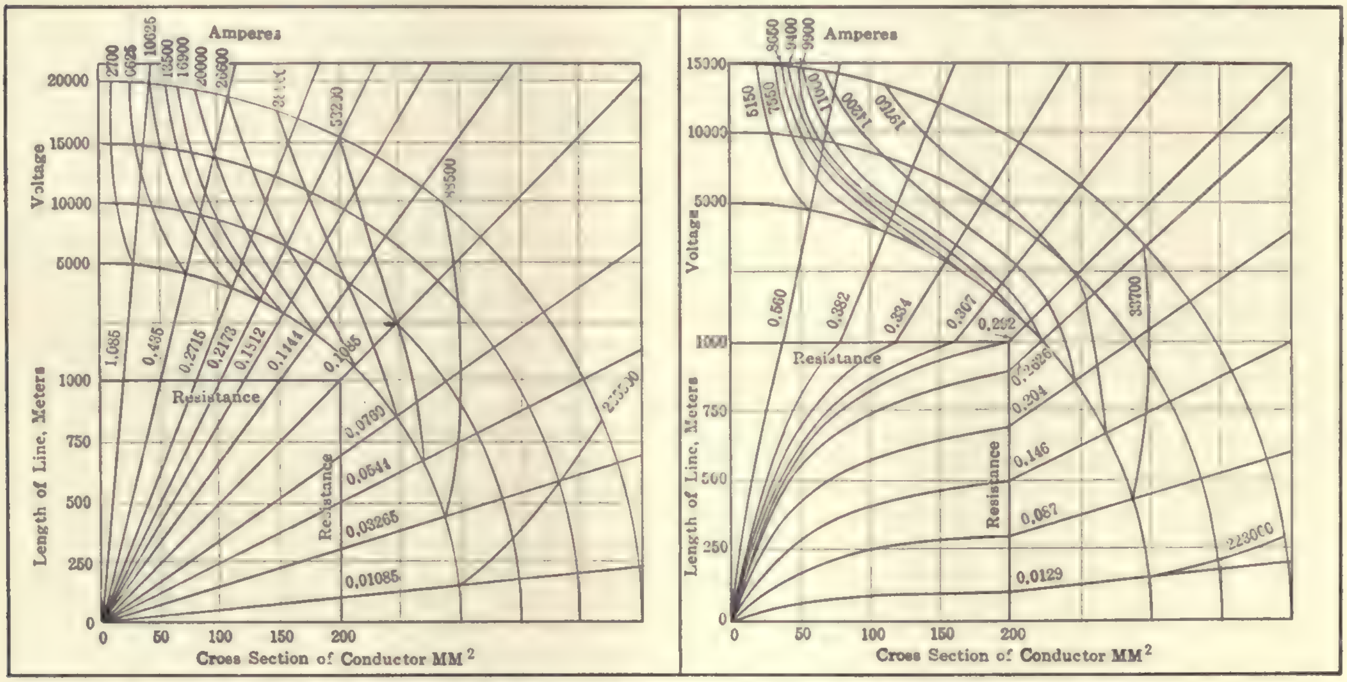
where

P = duty of breaker in kva.;
v = minimum speed of contact separation, meters per seconds;
D = distance between contacts, cm.;
H = height of oil above contacts, cm.;
N = number of ruptures;
d = striking distance against ground, cm.;
T = operating voltage.

The mechanical speed of opening varies for different types of breakers between 2½ m. and 12 m. per second. For electrical reasons there is an optimum speed of opening, below or above which it is dangerous to go. The relations between different breaker speeds, cable cross-section, capacity and voltages from 5,000 to 20,000 are also indicated in four curves. The beneficial influence of additional reactance coils is mentioned and their little use in Europe deplored. Short-circuit-proof dimensioning of feeders and the most suitable characteristics of transformers are dealt with.

The author discusses a great number of typical distribution systems and substation layouts with one or more transformers, and explains in every instance the best selective protection for the particular conditions encountered. In every case concrete figures are introduced to permit the valuation of important data.

The proper placing of breakers on more or less complex feeder systems is discussed, and the deductions in actual cases are illustrated again. Points are selected in the different cable systems at which the short-circuit current in case of failure is calculated to permit the exact dimensioning of feeders and breakers. As a final example a simple ring system is considered.



MAXIMUM SHORT-CIRCUIT CURRENT IN RELATION TO REACTANCE OF DISTRIBUTION SYSTEM

Left—Intensity of short-circuit currents on 50-cycle, three-conductor, three-phase underground cable. Right—Short-circuit currents on 50-cycle, three-phase overhead line with conductors in form of equilateral triangle.

The last section of the paper is devoted to the purely technical side of circuit breakers and their accessories. The contact device is shown of a new oil switch, which has parallel to its main laminated brush contacts two sets of arcing tips, so that the opening takes place in three successive stages. A novel type of magnetic shunt transformer which serves to actuate selective relays is described. A power transformer is mentioned which has upon its core near the "Y point" (three-phase) a special auxiliary winding for meter connection obviating a special current transformer. A time-adjustable mercury contact is described and illustrated which forms part of an automatic breaker and permits a very accurate time setting.

The description of a solenoid-operated switch-tripping mechanism, a relay with wattmeter characteristics, compensated relays, and finally oil-immersed reactors, concludes this highly interesting article.

Vitreous Enameling in Electric Furnace

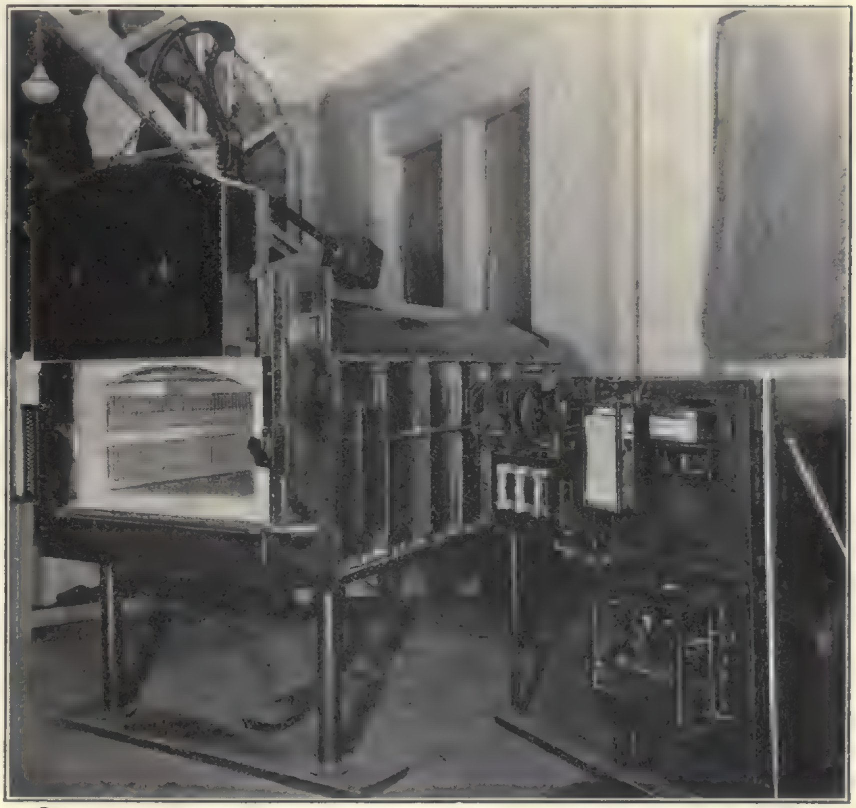
Its Advantages Include a Smaller Quantity of Damaged Product, Saving of Time and Space and Absence of Opportunity for Contamination from Fuel Gas or Refractories—Some Results Achieved

By J. L. McK. YARDLEY

General Engineer Westinghouse Electric & Manufacturing Company

TRUE enamels, or opaque glasses or glazes, produced by covering the metallic material to be enameled with a suitable mixture and heating both in a kiln until a glossy surface is obtained by fusion of the coating, are distinguished from japans or stoved lacquers by the fact that they are of an exclusively mineral nature while the latter are of vegetable origin entirely. The temperature required for vitreous enameling is accordingly very much higher than for vegetable enameling, though it is lower than that required by the burning of vitreous porcelain, with which, owing to some similarities in composition and appearance, it has very generally been confused.

The electric furnace for vitreous enameling has resulted from the desire to eliminate contamination and at the same time reduce the wear and tear upon furnace refractories due to high flame temperature. The idea has been to employ a heating source as uniformly distributed as possible at the walls of the furnace chamber, which would operate at a temperature above the necessary enameling temperature only sufficient to force the heat into the ware in the desired time. A number of advantages have been indicated:



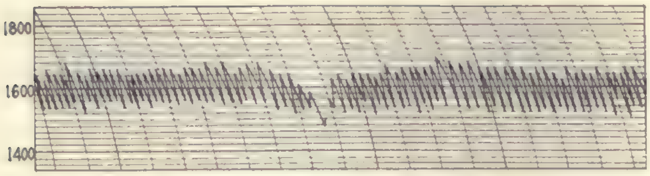
AN 80-KW., 2,000-DEG. F. FURNACE COMPLETE WITH OPERATING CONTROL PANEL

Door open to exhibit the radiant-type side and roof coils lying in grooves in the main firebrick of the furnace-chamber walls and held in place by T-shaped refractory supports.

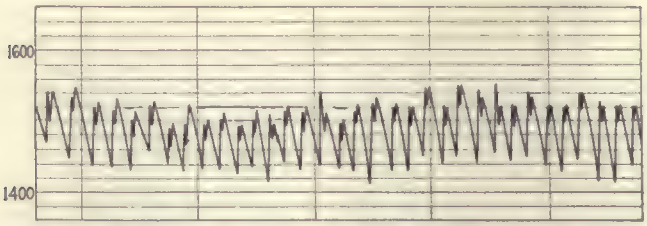
1. A smaller amount of burned and blistered ware.
2. Greater reliability; that is, less time lost due to furnace being too hot or too cold for proper enameling.
3. Saving in space by eliminating coal handling, oil or gas piping, storage or generation.
4. No possibility of contamination from fuel gases and, owing to low temperature of furnace chamber refractories, no likelihood of contamination within the furnace chamber whatever.

Indications as to economy, as a result of experience in the last year or two, are that the cost of operating the electric furnace when a moderate power rate is obtained is closely comparable to the cost of operating the clay or the carborundum muffle furnace. With power at less than 1 cent per kilowatt-hour, even a lower cost may result. Clay and carborundum muffle furnaces produce 5-ft. enamel bathtubs at an over-all fuel and maintenance cost of from approximately 30 cents to 90 cents per tub, or a total operating cost of from approximately 90 cents to $1.50 per tub. This is with an enameling labor cost of 60 cents per tub. With the same enameling labor cost of 60 cents per tub and power at 1 cent per kilowatt-hour, the comparative total operating cost in enameling with the electric furnace is $1.20 per tub. This closely coincides with the average fuel-fired furnace total operating cost. This is on the basis of 55 kw.-hr. power consumption per tub and 5 cents per tub maintenance. It must be borne in mind that a total operating cost should include all fuel and labor for firing, handling ashes, repairs on furnaces, idle periods, rejections, lighting off periods, etc.

A number of vitreous enameling electric furnaces have been installed which exhibit considerably different features of design and construction. One of these is used to bake either of two classes of material—cast-iron stove parts to be baked for nine minutes at 1,250 deg. F. and sheet-steel stove parts for four minutes at 1,400 deg. F. A large proportion of the parts are enameled in white or light gray colors that are very susceptible to spoilage from a contaminated atmosphere whether within or outside the furnace. Accordingly it is noteworthy that the rejects from the electric furnace are only, accordingly to reports, about 4 per cent of the total weight of all materials baked. The parts are sprayed with enamel by the wet process and set on pans assembled on trucks in close proximity



Typical operation chart from a Brown recording pyrometer-thermocouple projected through the roof at the center of the furnace. Each interval is fifteen minutes—sixteen to twenty changes per hour.



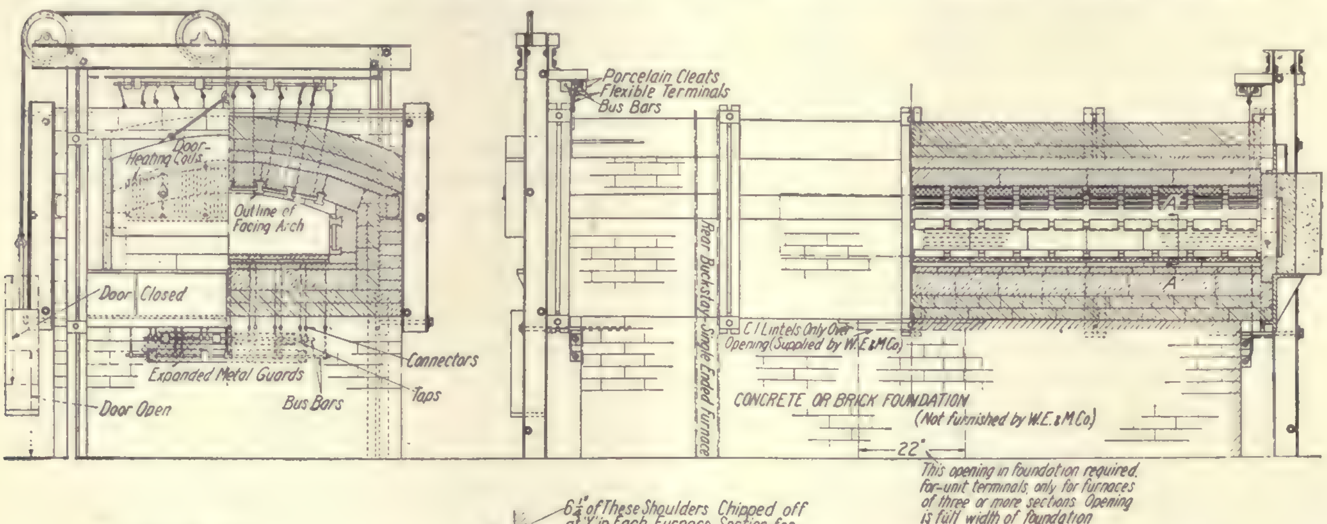
Typical operation chart from a Leeds & Northrup indicating, recording, controlling pyrometer. Each interval is twenty minutes. The chart shows production of sixteen to twenty loads per hour. Average load 120½ lb. racks and 25 sq.ft. of No. 22 gage ware, with enamel. The thermocouple for this instrument is projected through the roof and about 2 ft. from the door.

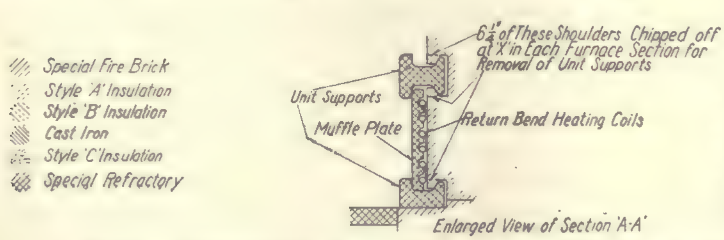
TYPICAL TEMPERATURE CHARTS

to the furnace to dry preliminary to baking. The furnace of 118-kw., 230-volt, three-phase, 60-cycle connected capacity has a maximum temperature range of 2,000 deg. F. and, under the operating conditions, is reported to have a capacity of approximately 7 lb. of metal per kilowatt-hour. The inside dimensions of the working chamber are 5 ft. deep, 3½ ft. wide and 23 in. high. The interior is divided horizontally into two compartments by the trays carrying the work to be enameled and by the narrow shelves at either side of the chamber upon which the trays rest. The door opens vertically to give access to the upper compartment only as necessary to insert or remove the pans by means of the charging prongs. Nickel-chromium heating elements are mounted in vertical plane away from the side walls and are distributed about evenly between the upper and lower compartments. No heating units are installed in floor or roof. This arrangement of side elements, however, which projects heat at the maximum rate of approximately 3 kw. per foot of side-wall area, together with the curved roof, is intended to cause the heat to strike the charge from all directions and permit of uniform heat distribution throughout the furnace interior.

Other electric enameling furnaces of chamber type have been in operation for a considerable number of months in which heating elements have been mounted in roof and floor as well as side walls for the purpose of causing the heat to strike the charge from all directions and be distributed uniformly throughout the chamber. By this uniform distribution it has been sought to force the maximum amount of heat possible in a given time into the work without unduly raising the temperature of the heating elements themselves. In the very latest furnaces of this type, while there are no door-heating coils, the wall coils are crowded somewhat toward the doors for the purpose of releasing a greater percentage of heat per unit wall area and compensating for the cooling effect of the door in the maintenance of uniform temperature. This concentration of heat supply is accomplished by spacing the grooves, and hence the adjacent convolutions of conductor, a smaller distance, as, say, every ¾ in. as compared with, say, 1 in. in the remainder of the furnace-heating surface; so that whereas the average maximum kilowatts released may be as low as 1.85 per square foot of wall-heating surface, near the door it may be in the neighborhood of 2.5 kw. per square foot, or greater, without increasing the watts released per unit of the heating element itself. The effect of the door upon furnace-chamber temperature is still further minimized by means of an 18-in. or 20-in. vestibule.

A furnace of this general type has been in service for more than a year in the enameling of bathtubs. Approximately 340 tubs per week is the production with one enameler and one helper, working on piece rates, operating such a furnace. This is an output of sixty tubs per twenty-four-hour day of three shifts for five





In the more recent furnaces of this type the muffle shown in the enlarged view of Section AA has been eliminated, and instead of longitudinal heating coils transverse heating coils have been employed, which are held in place within grooves in special refractory tile facing the firebrick forming the main part of the furnace-chamber walls by the same type of unit supports. The coils are made of nickel-chromium wire, No. 1 B. & S. gage, 80 per cent nickel, 20 per cent chromium.

GENERAL CONSTRUCTION OF CHAMBER OF 2,000-DEG. F. KILN-TYPE ELECTRIC ENAMELING FURNACE

days and forty tubs for Saturday. In order to deliver this weekly output the men often, or usually, work at a rate of from three to three and one-half tubs per hour and the furnace must be designed for such capacity and have the necessary electrical supply.

Successful Operation of Chamber Furnace for Enameling Sheet Iron

Another furnace of this general type has been in operation for some months in the enameling of sheet-iron ware used in stoves and ovens. The chamber is 4 ft. wide by 10 ft. long inside the vestibule. It is 13½ in. high at the sides and 17½ in. at the crown of the arch. A hearth area is then 40 sq.ft. The furnace floor area is 169 sq.ft. The floor space taken by the charging device is 216 sq.ft., in addition to which the fork protrudes 11 ft. more beyond the carriage and is 26 in. wide. Two sets of racks only are employed—one within the furnace supporting the work being baked, the other on the carriage being unloaded and loaded. The weight of these racks, depending upon the type of ware being burned, is from 126½ lb. to 159½ lb., and this weight must be raised about 500 deg. F. with each charge. Depending also upon the gage and type of ware, from eighteen to twenty-three loads of from, say, 35 lb. to 40 lb. each, ware plus enamel, are burned per hour. A comparison of the weight of work and of racks, each charged, indicates that improved economy would result could the charging mechanism and practice be changed so as to leave one set of racks permanently in the chamber. The table gives typical test runs made on this furnace.

TYPICAL TEST RUNS OF ENAMELING FURNACE OF CHAMBER TYPE

Total weight of racks, lb.	126½	126½
Loads per hour	22½	19
Gage of metal	24	24
Weight of steel per square foot, lb.	1	1
Weight of enamel per square foot, lb.	0.17	0.17
Number of pieces per load	10	14
Square feet per load	30	33.83
Square feet per hour	680	642.8
Total weight ware per hour, lb.	796	752
Power consumed, kw.-hr.	163.3	170.6
Cost per kilowatt-hour	$0.0146	$0.0146
Cost per hour	$2.385	$2.49
Cost per square foot	$0.0035	$0.00388
Weight of ware per kilowatt-hour, lb.	4.87	4.40
Square feet work per square foot hearth area	17	16
Labor cost per hour	$1.70	$1.70
Labor cost per square foot	$0.0025	$0.00264
Operating cost per square foot	$0.006	$0.00652

The unit cost of production is considered comparable to that obtained with oil-fired furnaces with oil at 6½ cents per gallon, owing particularly to the high production per unit floor space.

The furnace operates on a 60-cycle, three-phase, 220-volt circuit, regulation being obtained by the use of auto-transformers and a control panel automatically operated by indicating and recording controlling pyrometers from thermocouples within the furnace chamber. The charts show the furnace-chamber temperature at positions near the furnace door and also near the center. They show very well the small amount of necessary temperature variation which occurs.

The twenty-four heating coils in this furnace, each 5 ft. long, 8 in. wide, of No. 1 "Chromel" wire, ten coils in roof, ten in floor and two in each side wall, containing about 250 lb. of metal, are distributed into two three-phase control groups. The group covering the front half of the furnace takes a maximum of 94 kw. and the group covering the rear half a maximum of 81 kw., making a total of 175 kw. maximum input to the furnaces. The average consumption under regular operating conditions is 157 kw.-hr. per hour. As against a usual lighting-off period of around ten hours with fuel-fired furnaces, the lighting-off period for this electric furnace after a twenty-one-hour shutdown is only three hours and the consumption during this period is only 210 kw.-hr. The closed furnace actually drops only 360 deg. F. in twenty-four hours. Application of power for thirty or forty-five minutes will raise the temperature again 500 deg. F. After this is done the furnace is allowed to saturate at 1,700 deg. F. for the rest of the three-hour lighting-off period. After saturation only 18.3 kw.-hr. is required to maintain the temperature of the closed furnace at 1,700 deg. F.

Relative Air Density in High-Voltage Testing

Value Essential for Correcting Results Can Be Readily Obtained from Table Based on Correction Formula and Simple Device

By E. D. Doyle
Electrical Testing Laboratories, New York

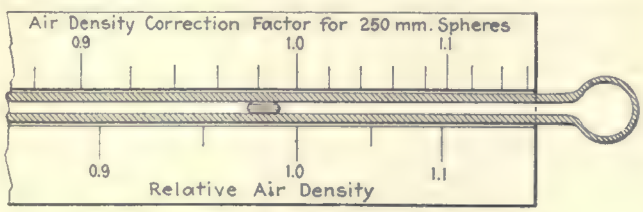
IN ALL high-voltage tests involving the formation of corona or sparkover one should determine the relative air density at the time of the test so that the observations may be corrected back to standard conditions—namely, 25 deg. C. and 760 mm. of mercury. The standards of the A. I. E. E. contain air-density correction factors for sphere spark gaps,* and Peek has published similar data for certain types of high-tension insulators, bushings and leads.† In general the corrections approximate the relative air density, although for the lower densities the corrections are not so great as the density.

The usual method of determining the density is to note the air temperature and barometric pressure at the time of the test and to substitute the observed values in the formula:

$$\text{Relative air density} = \frac{0.392\ (\text{barometric pressure, mm.})}{273 + (\text{air temperature, deg. C.})}$$

Table I, calculated by the above formula, will be found convenient in actual practice.

*"Standards of the A. I. E. E.," 1922 edition. Table No. 205.
†Peek, "Dielectric Phenomena in High-Voltage Engineering," pp. 112 to 114.



SIMPLE DEVICE FOR DETERMINING AIR-DENSITY CORRECTION FACTOR

This device consists of a small capillary tube to one end of which has been blown a thin-walled bulb. The bulb and a portion of the tube are filled with dry air which is separated from the atmosphere by a drop of clean mercury. The mercury, being free to move, equalizes the pressure on both sides, and, since the temperature of the air within the bulb is the same as that of the outer air, the relative air densities are equal. The quantity of air within the bulb (and a portion of the tube) remaining constant, changes in density are accomplished by an inverse change of the volume inclosed by the drop of mercury. By a suitable proportioning of the volumes of the bulb and the tube any desired range may be covered. The scales shown were drawn for use at sea level. It will be noted that two are provided, the upper one reading air density and the lower giving correction factors for a pair of 250-mm. spheres. This latter scale may be also used for 125-mm. and 500-mm. spheres with negligible errors.

TABLE I—RELATIVE AIR DENSITY AT VARIOUS TEMPERATURES AND PRESSURES—PER CENT

Air Temperature, Deg. C.	Barometric Pressure (mm. of Mercury) 620	630	640	650	660	670	[illegible]	690	700	710	720	730	740	750	760	770	780	790	[illegible]
—15	0.942	0.957	0.972	0.988	1.003	1.018	1.033	1.048	1.063	1 079	1.094	1.109	1.124	1.139	1.155	1.170	1.185	1.200	1.215
—10	0.924	0.939	0.954	0.969	0.984	0.999	1.014	1.028	1.043	1.058	1.073	1.088	1.103	1.118	1.133	1.148	1.163	1.178	1.192
— 5	0.907	0.922	0.936	0.951	0.965	0.980	0.995	1.009	1.024	1 039	1.053	1.068	1.082	1.097	1.112	1.126	1.141	1.156	1.170
[illegible]	0.890	0.905	0.919	0.933	0.948	0.962	0.976	0.991	1.005	1 020	1.034	1.048	1.063	1.077	1.091	1.106	1.120	1.134	1.149
+ 5	0.874	0.888	0.902	0.917	0.931	9.945	0.959	0.973	0.987	1 061	1.015	1.029	1.044	1.058	1.072	1.086	1.100	1.114	1.128
+10	0.859	0.873	0.887	0.900	0.914	0.928	0.942	0.956	0.970	0 984	0.997	1.011	1.025	1.039	1.053	1.067	1.080	1.094	1.108
+15	0.844	0.858	0.871	0.885	0.898	0.912	0.926	0.939	0.953	0 966	0.980	0.994	1.007	1.021	1.034	1.048	1.062	1.075	1.089
+20	0.830	0.843	0.856	0.870	0.883	0.896	0.910	0.923	0.937	0.950	0.963	0.977	0.990	1.003	1.017	1.030	1.044	1.057	1.070
+25	0.816	0.829	0.842	0.855	0.868	0.881	0.895	0.908	0.921	0 934	0.947	0.960	0.973	0.987	1.000	1.013	1.026	1.039	1.052
+30	0.802	0.815	0.828	0.841	0.854	0.867	0.[illegible]	0.893	0.906	0.919	0.932	0.944	0.957	0.970	0.983	0.996	1.009	1.022	1.035
+35	0.799	0.802	0.815	0.827	0.840	0.853	0.866	0.878	0.891	0.904	0.916	0.929	0.942	0.955	0.967	0.980	0.993	1.006	1.018
+40	0.777	0.789	0.802	0.814	0.827	0.839	0.852	0.864	0.877	0.889	0.902	0.914	0.927	0.939	0.952	0.964	0.977	0.989	1.002
+45	0.764	0.777	0.789	0.801	0.814	0.826	0.838	0.851	0.863	0 875	0.888	0.900	0.912	0.925	0.937	0.949	0.962	0.974	0.986
+50	0.752	0.765	0.777	0.789	0.801	0.813	0.825	0.837	0.850	0.862	0.874	0.886	0.898	0.910	0 922	0.935	0.947	0.959	0.971

TABLE II—SPHERE-SPARK-GAP CORRECTION FACTORS

Relative Air Density	Correction to Air Densities 62.5 mm.	125 mm.	250 mm.	500 mm.
0.50	+0.047	+0.035	+0.027	+0.019
0.55	+0.044	+0.033	+0.025	+0.017
0.60	+0.040	+0.030	+0.023	+0.015
0.65	+0.036	+0.027	+0.020	+0.013
0.70	+0.032	+0.024	+0.018	+0.011
0.75	+0.027	+0.021	+0.016	+0.009
0.80	+0.021	+0.016	+0.012	+0.007
0.85	+0.016	+0.012	+0.009	+0.005
0.90	+0.010	+0.008	+0.006	+0.004
0.95	+0.006	+0.005	+0.004	+0.002
1.00	[illegible]	0	0	0
1.05	—0.060	—0.050	—0.040	—0.020
1.10	—0.100	—0.080	—0.060	—0.040

In making sparkover tests of insulators, bushings, etc., where a barometer is not available, results may be at least approximately reduced to standard condition by checking the indicating voltmeter used in the tests against a sphere gap which is so set that the voltmeter indications will be the same under the two conditions of test. However, in making routine dielectric strength tests of electrical apparatus or high-tension cables where sparkover is not allowed to occur such a procedure may not be employed. In this connection Table II, used in conjunction with the previous table, gives correction factors for the more commonly used sizes of sphere spark gaps.

It is to be noted that the corrections shown are to be added or subtracted from the observed densities to get the corresponding air-density correction factor.

The device described below has been developed to obviate the use of the barometer and thermometer in obtaining relative air density. Moreover, it is light and compact as well as being sensitive.

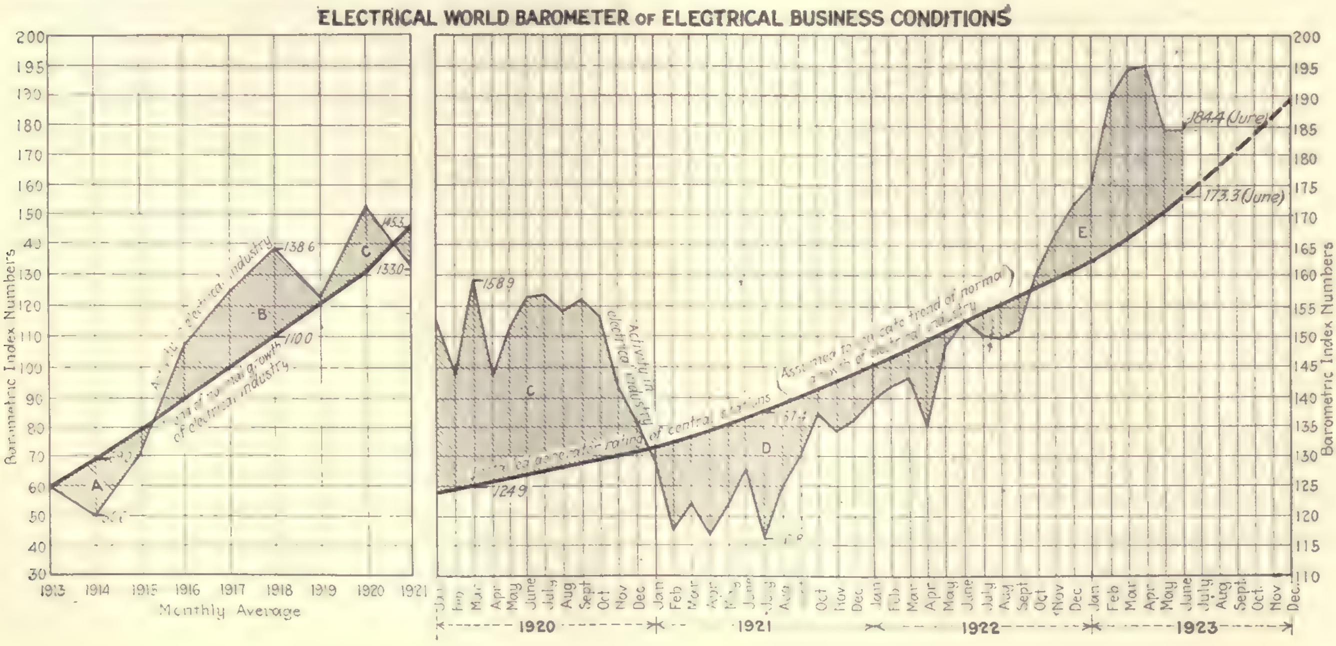
This device may have many other uses. It may also be used in connection with the corona voltmeter, in which case the scale could be graduated directly in volts for any given arrangement of electrodes. If used with a thermometer, barometric pressures can be determined without the use of a barometer.

Electrical Industry Operated at 11.5 per Cent Above Normal in June

INDEX figures upon which the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" is based indicate that activity within a large proportion of the primary industries of the country decreased slightly during June. Such a slowing up in the activity of the mills and factories of the nation is normal at this season of the year.

The data upon which the "ELECTRICAL WORLD Barometer" is based indicate an increase of one-tenth of a point on the barometer scale as compared with May activity. During this interval the industry has grown 2.6 points, leaving a net decrease in activity of 2.1 points on the barometer scale as compared with May. The electrical industry as a whole was operating in June at 11.5 points or per cent above what would have been the point of seasonal demand if growth in the industry had been normal. In May it was operating at 13.6 points or per cent above the point of normal demand.

ELECTRICAL WORLD BAROMETER OF ELECTRICAL BUSINESS CONDITIONS



Mortgage and Trust Agreements

An Analysis of First-Lien Public Utility Bonds with Recommended Provisions for Future Issues—Standardized Form Impracticable—Methods for Handling Redemptions

TO REPORT on harmful provisions which retard financing and to standardize, so far as practicable, on form and other requirements, the National Electric Light Association last year formed a committee which has made a study of mortgage and trust agreements for electric light and power companies. At the annual convention held in New York last June this committee, of which W. C. Lang was chairman, presented its report together with recommendations and suggestions which are here given.

To acquire material upon which to base conclusions and suggestions seventy-seven mortgages issued by public utilities from 1898 to 1923 were obtained and a comprehensive study was made of each. The mortgages were chosen from companies in different parts of the country doing a small and large business as well as those rendering joint service. These mortgages issued within the last twenty-five years are shown under the following groups: Prior to 1910, ten mortgages; 1911 to 1913, nineteen mortgages; 1914 to 1919, ten mortgages; 1920 to 1923, thirty-eight mortgages.

During the earlier years the mortgages were more simple in form and limited in scope—in fact, thirty-one of the thirty-nine mortgages prior to 1920 limited the aggregate principal amount of bonds issuable, and it was not until the last few years that the indentures contained provisions allowing the issuance of bonds of different series which may vary in respect to interest rates, dates, maturities, sinking funds, terms of redemption and other provisions.

Nearly all the mortgages provided for the issuance of additional bonds based upon property additions and earnings. These qualifications differed so widely that it is of interest to note the requirements found in the indenture reviewed.

Seventeen mortgages prescribed the minimum amount of maintenance and repairs to be included in operating expenses for the purpose of determining net earnings for the issuance of additional bonds. Of these twelve required from 4 per cent to 15 per cent of gross earnings for maintenance expenses, four included in addition to ordinary maintenance all sums set aside for renewals and replacements, and one imposed an additional item for sinking-fund deposits.

The sinking-fund investment theory was more prominent in the earlier mortgages. Those provisions have gradually been lightened by permitting the cancellation of bonds purchased and the use of sinking funds to reimburse the company for permanent additions to property, until today the more usual provision requires the maintenance of the property by stipulating that the company shall expend annually in maintaining or replacing it a sum equivalent to a given percentage of the bonds outstanding or, in some cases, of the gross earnings derived from the mortgaged property.

The growth of the utilities through mergers and consolidations was not provided for in the older mortgages, which limited the amount of bonds issuable and neglected in some cases to permit bonds to be called for payment before maturity, or, if redeemable, imposed such heavy premiums throughout the entire life of the bond that the option to call could not be exercised except at a heavy cost.

SERIES BONDS RECOMMENDED

A mortgage permitting the issuance of bonds of different series in respect to interest rate, dates, maturity, redemption and other provisions is preferable to the single series indenture, for under this arrangement a utility has one mortgage with several series of bonds in place of many different indentures. On account of the constantly increasing demand for facilities it is undesirable that the aggregate amount of bonds issuable

TABLE OF SEVENTY-SEVEN MORTGAGES SHOWING BONDS ISSUABLE

FOR PERCENTAGE OF COST OR FAIR VALUE OF PROPERTY ADDITIONS

Period	50 per Cent	70 per Cent	75 per Cent	80 per Cent	85 per Cent	90 per Cent	100 per Cent	Special	None	Total
Prior to 1910..	.	.	2	3	1	..	2	1	1	10
1910 to 1913....	.	.	4	6	6	1	2	..	..	19
1914 to 1919....	1	1	2	4	2	..	..	..	..	10
1920 to 1923....	.	1	27	8	1	..	..	1	..	38
Total.......	1	2	35	21	10	1	4	2	1	77

TABLE OF SEVENTY-SEVEN MORTGAGES SHOWING NUMBER OF TIMES INTEREST MUST BE EARNED ON BONDS OUTSTANDING AND ADDITIONAL BONDS APPLIED FOR

Period	One and One-half Times	One and Three-Quarter Times	Two Times	One and Three-Quarter Times, or 10 per Cent of Total Bonds	Two Times, or 12 per Cent of Total Bonds	Special	None	Total
Prior to 1910...........	1	1	3	..	..	..	5	10
1910 to 1913...........	7	3	2	..	..	..	7	19
1914 to 1919...........	..	5	4	..	..	..	1	10
1920 to 1923...........	2	17	12	2	3	2	..	38
Totals...............	10	26	21	2	3	2	13	77

under the mortgage be limited to a fixed amount unless such a limitation is required by some controlling state law.

The issuing clauses should be sufficiently broad to enable a company to include as fundable property not only additions made subsequent to the date of the mortgage to its systems but also plants and properties acquired after such date from others. The mortgage should provide that any series of bonds maturing prior to the termination of the mortgage, any divisional liens, any existing underlying bonds or any bonds or other prior liens outstanding on after-acquired property may be refunded. Under suitable limitations, the mortgage should permit the issuance of bonds for an amount equal to the specified percentage of the actual cost or fair value (whichever is less) of property subject to prior liens, less the amount of all such prior liens

existing thereon. A very important feature which should be included in all indentures is permission to issue bonds upon the deposit of cash with the trustee.

Earnings Requirements for Additional Issues

Whenever earnings are a requirement to the issuance of additional bonds the definition of earnings should be clearly set forth and there should not be imposed as an operating expense a fixed percentage of gross earnings or of outstanding bonds for maintenance expenditures. The definition for net earnings should also clearly indicate that amounts set aside for the purpose of maintaining a reserve for property retirements should not be included as an operating cost. If some provision is desired to assure proper maintenance of the property, it is preferable to cover the point by providing for a fund such as the renewal and improvement fund hereinafter referred to, or to require a "condition certificate" to be made by an independent engineer to the effect that the property has or has not been adequately maintained. If the certificate shows a failure on the part of the company to maintain its property a cash deposit may be imposed, such cash to be returnable to the company when expenditures for maintenance have been made. However, such a fund and a "condition certificate" should not both be required.

Provisions relating to the payment of fire insurance money should allow the company to retain amounts collected for minor losses and require the deposit of sums in excess of a given amount with the trustee. The expense of meeting usual existing requirements in respect to small fire losses is a burden.

The company should also be allowed to dispose of free from the lien of the mortgage any minor unimportant parts of its property without the necessity of applying for a release from the trustee. All property having a value in excess of an amount to be fixed in the mortgage should not be sold unless the trustee executes a release and receives the proceeds of the sale or other property in its place.

It is not always possible to allocate property additions to an underlying indenture, and the mortgage should provide for the release of property therefrom for the purpose of subjecting such property to the lien of an underlying indenture, thus enabling the company to withdraw funds deposited thereunder as proceeds from the sale of property or fire insurance.

A utility, unlike an industrial company, cannot, except to a minor degree, limit the extensions and additions which it must make. It must constantly expand to meet the demands for service. Furthermore, its expansion must come about almost entirely through the obtaining of new capital, earnings under the system of modern regulation ordinarily not being sufficient for this purpose. Again, it must be recognized that the capital in the aggregate constitutes a permanent, continuing investment. A sinking fund has the effect of reducing the debt, but unless the return allowed compensates for this the funds so used must be obtained through sale of other securities. A sinking fund or an improvement fund designed to increase the equity behind the debt without decreasing the debt itself, generally speaking, does not permit the most economical development and financing of a utility.

A renewal and improvement fund or similar fund dealing primarily with the maintenance of the property is recommended for consideration in lieu of sinking and improvement funds. The provisions relating thereto may be based upon the following: The company shall expend in maintaining, repairing, renewing or replacing its property a sum equal to a given percentage of the aggregate principal amount of bonds outstanding in the hands of the public, including underlying bonds but excluding bonds in treasury, held in sinking funds (if any) pledged as collateral, deposited as security for the issuance of bonds, or bonds for the retirement of which cash has been deposited with the trustee, or bonds which have been issued upon the deposit of cash to the extent of the amount of cash then on deposit with the trustee. If such expenditures are less than the amount required, there shall be deposited with the trustee the amount of the deficiency. In case the company expends sums greater than the requirements, such excess expenditures shall be allowed as offsets to prior or subsequent deficits. Any money so deposited may be used to reimburse the company for expenditures made in maintaining, repairing, renewing or replacing the property, or for expenditures for permanent additions to property, whether declared to be of the character that is fundable or not, and for the retirement of bonds. If fundable property is used as a basis for withdrawing such funds the company should have the right to restore the cash so withdrawn, and thereupon the property so released should be available for bonding purposes. Some companies prefer to base the amount to be applied to the above purpose upon a percentage of the gross earnings derived from the mortgaged property.

Redemption Before Maturity

Provision should be included in every mortgage permitting the redemption of a series of bonds in whole or in part before maturity. It is unreasonable to impose a fixed premium to extend throughout the life of the bonds; likewise it is a hardship to exclude too great a part of the life of an issue from redemption, and especially so if the interest rate is high.

Some recent mortgages contain provisions for bondholders' meetings, for the purpose not only of curing defects in the mortgage subsequently discovered, but also, and perhaps primarily, for the purpose of avoiding the expense and uncertainties of reorganizations through foreclosure proceedings. This is usually arranged by requiring the concurrence of a certain percentage of the total bondholders to the matters under consideration and also the consent of the company.

All mortgages should also contain complete provisions in respect to bondholders' rights and remedies, trustees' rights, immunities, resignation and removal, the appointment of successor trustees, the immunity from liability for mortgage debt of stockholders, directors and officers; mergers and consolidations and all points arising in connection therewith, the termination of the mortgage lien and the release of same upon deposit with the trustee of principal and interest to maturity or of funds sufficient to redeem all outstanding bonds.

The report does not purport to deal with legal requirements which vary in different states and which must have due consideration in the preparation of each particular mortgage. This limited study, however, indicates that a standardized form of indenture is not practicable, nor is it believed feasible to attempt the preparation of an outline of principles or provisions to be included in a mortgage, owing to the greatly varying conditions under which indentures are prepared.

Electricity on the Farm—A Bibliography

THE supply of electricity to rural communities is assuming greater and greater importance. With the growth of the problem into one of nationwide importance large numbers of articles have appeared in widely scattered places discussing the question. The co-operative efforts of many agencies will eventually be needed to bring about a realization of widespread rural electrification, but primarily it will be the electrical industry that leads in actually solving the problem and doing the work. The following list of articles and books is given to help those who are trying to assemble facts and ideas on this question:

THE accompanying bibliography of published material on the use of electrical energy on the farm was prepared originally by library authorities of several of the agricultural colleges and submitted to the ELECTRICAL WORLD through the courtesy of Raymond Olney, secretary of the American Society of Agricultural Engineers. It covers publications up to about May 1, 1923.

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(Numerals after name of periodical indicate volume and page. Il. = illustrated.)

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Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Existence of Ionization in Entrapped Oil Spaces

To the Editors of the ELECTRICAL WORLD:

The letter by William A. Del Mar, printed on page 78 of your issue for July 14, is, in my judgment, a very pertinent one. Without discussing his suggestions at all, I wish simply to point out some considerations regarding composite insulations, especially those consisting of a porous paper impregnated with an oil or a petroleum jelly.

We have ample evidence of ionization in occluded air spaces when subjected to moderately high voltages. In order to overcome this and permit the use of a higher potential gradient on the insulation, great care is now taken to insure complete impregnation with a flexible jelly which, at operating temperatures of cables, may be a viscous fluid. Thus we may be practically certain that the volume of entrapped air is of negligible importance.

However, does filling an air space with oil necessarily remove all the difficulties? How much improvement is afforded by a small occluded volume of oil over the same volume of air within a cable? Obviously a great deal, but ionization in oil is just as possible as ionization in air, although, to be sure, a considerably higher potential gradient is necessary in oil to produce the corresponding effect called corona. But just because the ionization does not produce visual corona in oil under a certain gradient, can we conclude that it is not present or is not injurious? There is evidence to believe that when a small volume of oil or semi-fluid jelly is surrounded by a solid organic insulating material ionization may cause chemical deterioration, even though the potential gradient is considerably less than that required to produce visual corona in oil. In any case, if actual visual corona exists in oil, for instance, it should cause fully as rapid chemical deterioration as corona in air surrounded by solid insulating material. Convection is not so free and recombination is less rapid.

This suggests that the question of increase of power factor with voltage which Mr. Del Mar raises is one of first-class importance, and it is imperative that its significance and cause be determined, as until this is done it remains an uncertain and disturbing factor in cable specifications. I am of the opinion that this increase of power factor with voltage is a phenomenon to be expected even with the most carefully impregnated cables and is intimately connected with the useful life of a cable if certain potential gradients are exceeded. It is probably due to ionization, not of air, but of the oil or semi-fluid petroleum. This ionization exists even with low-potential gradients, although it is very feeble, and it must increase with the voltage, probably nearly in direct proportion for the lower voltages, but at a faster rate for the higher voltages. This, however, would depend largely upon the temperature of the material and its state, i.e., solid or fluid. The latter state is more favorable for ionization, except in the case where the contraction of the jelly due to solidification allows gaseous ionization for the higher voltages. All this is on the supposition that the oil or gas is contained within a solid dielectric and does not apply to a volume of oil contained between metal electrodes.

Considerable attention seems to have been paid recently to applying various modifications of Maxwell's theory of a composite dielectric in the study of cable behavior. This tendency, while it may lead to a sort of empirical understanding, does not, in my estimation, give promise of very great advances in our actual knowledge of the existing mechanism. It does give a picture of the distribution of the stress within a cable, but when it comes to a question of its useful life when subjected to voltage, it seems that additional considerations must be taken into account. A study of the movements of an electron within a dielectric is of more importance in connection with the life of a cable than most engineers realize.

D. E. HOWES,
Research Department.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

Forecasting Water Supply

To the Editors of the ELECTRICAL WORLD:

Your recent editorial on forecasting water supply, appearing in the July 28 issue of the ELECTRICAL WORLD, would probably classify me as one of the "haphazard guessers," but I firmly believe, and think I am not alone, that it is absolutely impossible to forecast river flow and load conditions with any accuracy over a long period. Dependence must be placed upon continuous supervision of conditions, and each day's detailed operating schedule must be made up at midnight of the preceding day. If required by system load exigencies, it may be valuable and necessary to make a "hole in the pond" at an immediate sacrifice of hydraulic efficiency, the hole to be filled later through steam generation. Advance information of an increased river flow would also justify drawing a pond down unusually low; otherwise the water equivalent of the hole in the pond will be wasted over the dam when the augmented flow occurs. Then, again, it may be advisable during low-flow periods to draw down the pond during peak loads if there are compensating periods of less than normal load during which the hole can fill with the normal flow of the water. The importance of a high pond elevation at certain plants during low-flow periods should not be lost sight of as emergency reserve instantly available for a few hours.

Usually on a system which largely serves industrial loads of eight to twelve hours' daily demand the noon-hour load during low river flows is almost exclusively carried by steam. During such periods hydro-electric units may be operated with atmospheric pressure in the draft tube as synchronous condensers to hold up the voltage. This practice may become unnecessary if further development and adoption of quick-operating tap-changing devices for large high-voltage transformers take place because their present operation is chiefly necessary to offset the effect of intervening transformers which are tapped for transmission in the opposite direction.

In conclusion, water forecasts and load estimates over a long period can be used only as a general guide and must be accompanied by vigilant supervision of conditions as they approach or arise, giving due weight to good service, hydraulic efficiency, steam efficiency and system efficiency. This requires a high degree of intelligence, technical skill and continuous application on the part of the operating personnel. X. Y. Z.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

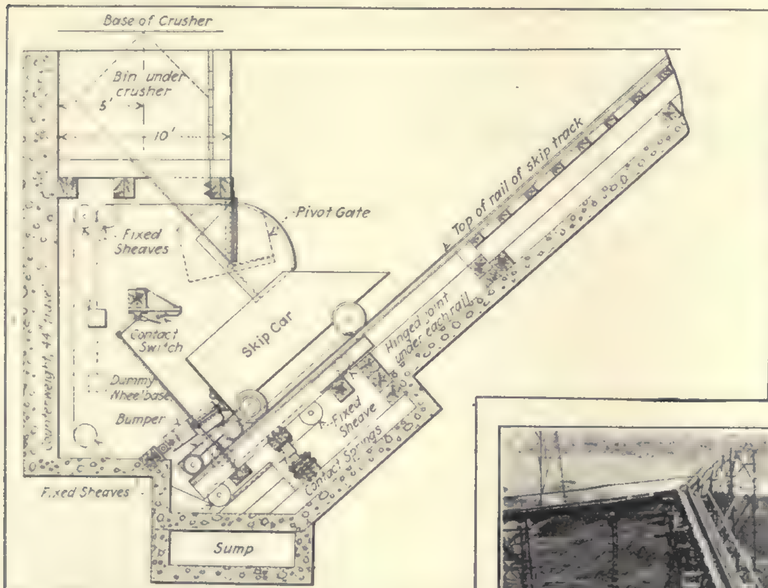
Plant Economy Increased by Coal Washer

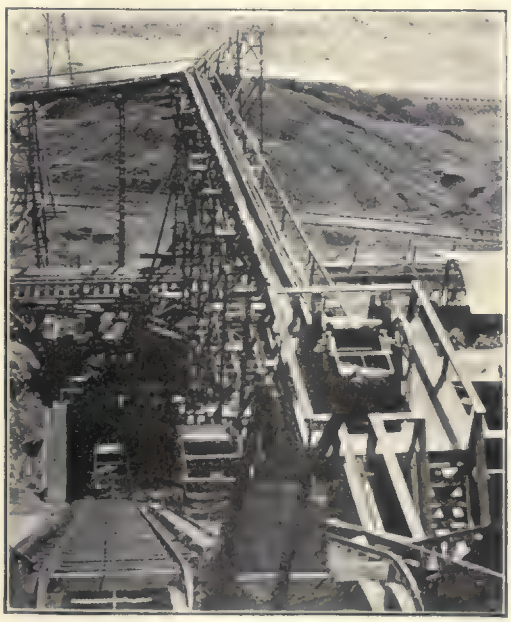
A. T. HUTCHINS,
Superintendent Production, Alabama Power Company, Birmingham, Ala.

OWING to the necessity of burning a lower grade of coal than that for which the Warrior steam plant was designed, the Alabama Power Company installed and has been operating for some time a coal washer, which has improved the fuel economy of the plant 17 per cent. The washer is mechanically operated throughout, all loading, dumping and hoisting equipment being automatic. Only two men are required to look after the machinery while in operation. Coal for the plant is obtained from a nearby mine on the Alabama Power Company property. Originally the coal furnished by this mine averaged about 13,000 B.t.u. and 12 per cent ash, but now the coal is being taken from another seam on the same property and runs as low as 10,600 B.t.u. and 27 per cent ash. As a result of the lower-grade coal the boiler rating was decreased by about 30 per cent. Furthermore, the excessive slate in the coal formed a slick surface on the grates and caused large quantities of coke to slide through to the ash pit while dumping ashes.

These objectionable features, together with the cost of handling the excess ash, made it advisable to consider cleaning the coal. A careful study of available washers led to the selection of a Montgomery jig washer.

The mine opening is on an elevation overlooking a narrow level strip of land between the hill and an adjoining river. Since this level land is required for storing 90,000 tons of coal, and also in order to handle the coal by gravity as much as possible, the washer was laid out on the side of the hill as shown in the accompanying illustration. Coal is brought in from the mine opening on a narrow-gage road and dumped into a hopper, from which a pan conveyor takes it to the crusher. From this crusher the coal discharges into an automatic loading bin at the lower end of the skip-hoist track, from which it is loaded into skip cars. The skip hoist dumps into a hopper at the upper end of its travel. From the settling tank, into which the coal goes after passing through the washer, it is raised by a short bucket conveyor and discharged into a cast-iron trough, through which it is distributed to the coal-storage area by sluicing.





SLATE REMOVED FROM 10,600 B.T.U. COAL BY COAL WASHER INCREASES ECONOMY 17 PER CENT

The slate discharged from the washer is carried to nearby low ground in a similar manner and used for filling and reclaiming additional area.

As mentioned before, the skip hoist is controlled automatically. The descending car opens a loading gate as it goes under the loading bin. The position of the skip

car at its loading point is such that the angle of repose prevents coal from running out beyond the capacity of the car. The weight of the loaded car closes a control switch under the track and starts the hoist, the coal gate being automatically closed by the upward movement of the car. A limit switch stops the car at the upper end of its travel, where it dumps into the upper hopper. Two cars are operated from the same drum, one car being at its loading point while the other is unloading.

The section of track on which the car rests while loading is hinged and spring-mounted in such a manner that the weight of the loaded car closes the starting switch. The closing operation of the gates on the loading bin is accomplished by means of weights and cables connected to the gates and dummy cars, as shown in the accompanying drawing. As the coal car comes into its loading position, it pushes the dummy car down to the bottom of its travel, which in turn raises the counterweight by cable connections. Another cable connects the same counterweight with the coal gate, and when the weight is raised the bucket opens because of its own weight. When the loaded coal car moves upward, the counterweight causes the dummy car to resume its upper position and at the same time closes the coal gate by means of cables connected to the gate.

The operation and maintenance cost on this skip hoist is very low in comparison with bucket, apron or belt conveyors.

With this washer it has been possible to wash the coal down to about 10 per cent ash without any appreciable loss of combustible matter. This makes a reduction of 11 or 12 per cent in the ash content of the coal.

In addition to increasing fuel economy 17 per cent and making it possible to operate the boilers at higher rating, the removal of this slate has reduced clinker formation and thereby reduced the boiler-room labor and maintenance.

Purifying Transformer Oils

Several Companies Give Experiences with and Dehydration Requirements of Filter Presses—Actual Tests on Two Types of Centrifugal Purifiers

REPORTS from six central-station companies relative to oil-purifying experiences are available in the accompanying table. All of the companies reporting use the blotter-type filter press, although, as reported in the ELECTRICAL WORLD for March 24, 1923, on page 698, one large Eastern company has obtained very satisfactory results with the centrifugal separator, claiming as advantages greater speed and economy over the filter press. One of the six companies reporting, namely, the Pennsylvania Power & Light Company, has considered the use of centrifugal purifiers, but expresses the belief that they would not be so satisfactory as the blotter-type filter presses owing to their weight. Quite extensive use of centrifugal oil purifiers was reported by the electrical apparatus committee of the N. E. L. A., which made a canvass of numerous operating companies. Many of these companies reported complete satisfaction with the equipment, although several reported this method slower than the blotter press. Others reported using the centrifugal machine as a primary purifier, finishing up with one run through the blotter press. It appears that the temperature of the oil put through a centrifugal machine exerts an exceedingly important influence on the rate of filtration or capacity of a given machine and on the dielectric strength of the filtered oil.

Studying the tabulated experiences, it is evident that there is a wide variation in opinion regarding the value of dielectric strength below which the oil should be filtered, the range being from 15,000 volts to 35,000 volts. Two companies state that they never dehydrate oil while the unit is energized, and most of the others purify oil in energized units only when it is impossible to take the apparatus out of service. The Pennsylvania Power & Light Company points out that it is much more desirable to take the transformer out of service, tap all the oil out of the transformer and thoroughly wash down the windings with the oil circulating through the filter and then dump the oil back into the unit again. This assures getting all sludge or other foreign material out of the ducts and off the windings. The same company asserts that with either a 7-in. x 7-in. or a 12-in. x 12-in. filter press it takes one man from eight to twelve minutes to change the blotters. The frequency of changing paper depends upon the moisture and sediment in the oil, every ten minutes being sometimes necessary and at other times every hour being sufficient.

TESTS OF CENTRIFUGAL OIL PURIFIERS

In the report of the electrical apparatus committee of the N. E. L. A. previously mentioned the Westinghouse Electric & Manufacturing Company, comments as follows on the use of centrifugal oil separators:

We have made very careful tests of the De Laval oil separator and found its operation very satisfactory. The machine used for our tests was guaranteed to clean 300 gal. of oil per hour, provided it is heated to a temperature of approximately 45 deg. C. The heating is done with a 6-kw. "Bayonet" heater, which does not have sufficient capacity to heat the oil sufficiently when put through at rated capacity in cold weather. We made tests with very dirty and very wet oil, and in all cases the operation of the outfit was satisfactory.

One lot of oil containing a considerable amount of dirt and water having a breakdown test of 6.6 kv. was run through the separator with the following results:

Gallons per hour	80	144	230	260
Temperature, deg. C.	39	39	28	27
Breakdown test in kv.	28.2	30.1	10.2	8.7

The last two tests show clearly the necessity of heating the oil up to the proper temperature.

Another series of tests with samples of the same lot of oil gave the following results:

Gallons per hour	155	200	275	410	500	550
Temperature, deg. C.	38	40	37	39	46	43
Breakdown test in kv.	28.2	27.6	27.6	27.6	22.6	22.6

Rates of water discharge in two of these tests were: 410-gal. rate, one pint in sixty seconds; 550-gal. rate, one pint in forty-five seconds. In these tests a grid heater was used in addition to the heater belonging to the outfit.

Another series of tests was made using some exceedingly dirty switch oil that had been in use for some time and that showed a breakdown of 4 kv. This oil was run through the purifier with the following results:

Gallons per hour	50	70	120	150
Temperature, deg. C.	48	50	48	49
Breakdown test in kv.	26.6	22	19.6	24.6

One gallon of solid material was removed from 40 gal. of this oil, in addition to considerable quantities of water.

The main objections that can be raised against the outfit are its cost and its slow rate. With a filter-press type of purifier the cleaning of very dirty and very wet oil requires frequent changes in filter paper, which is quite inconvenient, but if the oil is not too

Central-Station Users Give Experiences with Oil Filter Presses

Company	Below What Dielectric Strength Do You Require Oil Purification? 1/10-In. Gap	Do You Treat Oil While Unit Is Alive?	Are Transformers, Oil Switches, Lightning Arresters Permanently Piped to Oil Purifier?	When Using Filter Presses Do You Use Two in Parallel?	How Long Does It Take to Change Filter Paper?	Time Required to Filter Oil
Georgia Railway & Power Company	30 to 35 kv. for 11,000 to 110,000 volt oil.	Yes	No	Yes or double press	10 to 15 min.	From 24 to 48 hr. for 2,000 gal. of oil, depending on condition of bottom oil and weather.
Pennsylvania Power & Light Company	Endeavor to keep oil above 22 kv. Immediately filtered when it breaks down at 16,500 volts or lower.	Only with transformers when impossible to take out of service.	Only in power houses and large substations.		8 to 10 min. with one man; 5 to 6 min. with two.	In cases where there has been enough moisture to cause breakdown at 8,000 to 16,000 volts, by passing all the oil through filter press twice we were able to raise the breakdown voltage to 30,000.
Pennsylvania Water & Power Company	Below 15 kv. filtered immediately. Between 15 and 20 kv. as soon as possible.	Only when apparatus cannot be taken out of service.	Yes	No	6 min.	In one case 3,000 gal. of oil was filtered in 12 hours with a 6-gal.-per-min. pump. Filter paper usually changed twice an hour.
Philadelphia Electric Company	22 kv. for new oil and 16.5 kv. for oil in apparatus.	No	No	No	15 to 20 min. for 40-section press.	Wide variation. In some cases oil will meet 22,000-volt test when passed through press once, while in other cases it must be passed through several times.
Rochester Gas & Electric Corporation	15 kv.	No	No	No	5 min.	Oil with low dielectric strength due to presence of carbon or dirt can be brought up to standard in much shorter time than when considerable moisture is present. With 7-in. filter press approximately 15 min. is required to filter 50 gal. of oil. Oil with approximately 4 per cent moisture must be passed through filter press at least 5 times and sometimes as often as ten times to bring dielectric strength up to 25,000 volts using 1/10-in. gap with 1-in. flat face.
Utica Gas & Electric Company	22 kv.	In many cases.	Some of main transformers only.	No	10 min.	Average time to raise the breakdown voltage from 15,000 to 26,000 volts on a 1,000-kva., 22,000-volt transformer, containing approximately 1,200 gal. is from 18 to 38 hours, depending upon atmospheric conditions.

dirty or too wet, it can be cleaned and dehydrated much more rapidly than with a centrifugal separator.

Results of tests conducted by the General Electric Company on a No. 6 Sharples Specialty Company centrifugal separator have been submitted to the ELECTRICAL WORLD by the separator manufacturers. These observations are given below:

The first run was made on a batch of No. 10 "Transil" oil drained from a transformer that had been in service. It was heated to a temperature of 150 deg. F. and centrifuged at capacities varying from 100 gal. per hour to 300 gal. per hour, with the following results:

Capacity, Gal. per Hour	No. of Tests	Average Breakdown, Kv.
100	5	34.4
240	4	32.7
260	4	34.0
300	4	36.0
Original	5	25.0

In the above work one sample was taken at each capacity and four or five breakdown tests made from each sample. In all later runs two samples were taken at each capacity and four or five tests made on each sample. Only one breakdown was taken on each filling of the cup. At the end of the first run the bowl was taken apart and there was a deposit of about ⅛ in. of sludge in the rotor.

The engineers of the General Electric Company felt that the original oil tested was too good to indicate what the machine would really do. The tanks were, therefore, filled with a new batch of oil, and steam was bubbled through them for several minutes until the oil was white and milky. The original oil drawn from these tanks indicated an average breakdown of about 6 kv. In order to determine whether temperature was an important factor two sets of tests were run, with the oil at 105 deg. F. on one test and 125 deg. F. on the other. The breakdown results were as follows:

Capacity, Gal. per Hour	No. of Tests	Average Breakdown, Kv.
With temperature 105 deg. F.:		
120	9	24.0
175	10	32.9
212	9	32.0
238	10	31.4
318	9	31.0
432	9	29.9
600	9	28.3
Original	5	6.0
With temperature 125 deg. F.:		
75	10	38.1
140	10	38.2
230	10	38.5
385	7	34.1
Original	5	6.0

It will be noticed from the above that the most satisfactory results were obtained at 125 deg. F.

The engineers were then interested to see what results might be obtained on oil that tested at an intermediate point between the very worst oil and the good oil that had been tested. A batch of oil, therefore, was wet with steam and then diluted with good oil until a point was reached where the average breakdown was 11.4-kv. This run was made on a rainy day, which may or may not have affected results. The following breakdowns were obtained:

Capacity, Gal. per Hour	No. of Tests	Average Breakdown Kv.
110	10	32.5
230	9	37.1
306	8	34.9
510	7	28.4
Original	5	11.4

After all the tests were completed, the General Electric Company engineers and testing department expressed themselves as being very well pleased with the results obtained. Upon request, A. H. Scott of the company's engineering department said that he felt that a conservative rating for the machine would be a capacity of 400 gal. an hour to give a breakdown of 32 kv. or better when run at a temperature of 125 deg. F.

Air-Break Switches Reduce Service Expense

BUSES are not used on either high-tension or low-tension power circuits of the Southern Power Company, which has a great many individual high-tension distributing substations without attendants. These stations are of the outdoor type and are situated at the plant of the consumer. The high-tension sides of the transformer banks are provided with automatic air-break switches, and the low-tension sides with circuit breakers on the individual circuits in the plant of the consumer. The plan is to set the switch on the high-tension side high enough to take care of short circuits only, allowing the low-tension switches in the customer's plant to take care of ordinary overloads. The air-break switches operate quite well, and while they are more expensive than fuses, they cost a great deal less than oil switches. This permits taking on of smaller customers, without excessive substa-

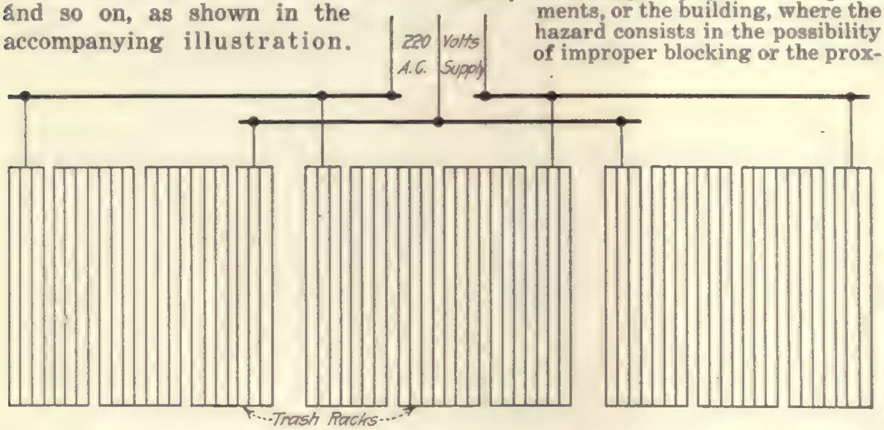
tion costs, than would be the case if oil switches were used.

Fuses are objected to because of danger of one of them blowing. They are also objectionable on account of delay in restoring interrupted service, particularly at stations where there are no regular attendants. It does not appear that it would be feasible to equip all substations, regardless of size or of operating conditions, with the air-break switches instead of the oil switch. There is, however, in these small individual substations a practicable field for the use of the air-break switch.

Ice Prevention on Trash Racks by Electric Heating

C. N. ANDERSON
New York, N. Y.

IN NORTHERN EUROPE the ice formation on trash racks is very troublesome, and oftentimes it is necessary to keep several men employed continuously at each station to keep these racks clean during cold weather. In order to avoid this, experiments in heating racks were conducted at the Kykkelsrud power station in Norway with satisfactory results. The bars of the rack are arranged in groups of ten or twelve, and alternate groups are connected alternately at the top and bottom so that the current passes down one group, up the second, down the third and so on, as shown in the accompanying illustration.



RACKS ADAPTED FOR ELECTRIC HEATING TO REMOVE ICE

Power was fed by means of three buses, one going out in each direction and one over-lapping, resulting in a delta load on the three-phase line.

In the Kykkelsrud station three transformers with a total capacity of 1,600 kw. were used, representing 7 kw. per cubic meter of water per second. In the Vamma station one 1,000-kva., 220-volt transformer is used with two more proposed.

Extracts from an Operating Code*

Maintaining Equipment

IN THE routine care and maintenance of equipment in the electric plant of a power system too much stress cannot be placed on assurance of personal safety. All apparatus should be considered alive unless they have been properly tested for voltage. Precautions to be taken in maintenance work follow:

1. Lines, circuits, feeders and apparatus must be considered alive at all times unless properly blocked and, in addition, tested for voltage. The most common method of making this test on equipment of 6,000 volts or higher, a method which is reliable only if performed by an experienced man, is to touch the conductor to be tested with the metal end of a switch hook, withdraw it slowly, and see if a spark jumps from the conductor to the switch hook. The presence of a spark indicates that the conductor is alive. For equipment of 2,400 volts or less the above method is not suitable. In these cases proper protection may be had by the use of standard rubber gloves or special insulating shields or stools provided for particular operations. This rule applies even for 110-volt or 220-volt equipment, as contact with these has caused painful, dangerous and fatal shock.
2. Feather dusters must not be used on or near high-voltage equipment.
3. In stations in which there is only one man per shift an additional man must be detailed when cleaning of a hazardous nature is to be done. By "hazardous cleaning" in this rule is meant not only the cleaning of live equipment, such as 2,400-volt oil switches, conductors, etc., but also the cleaning of dead high-voltage equipment, low-voltage equipment compartments, or the building, where the hazard consists in the possibility of improper blocking or the proximity of live high-voltage equipment.
4. After cleaning a general inspection of the equipment must be made before it can be considered ready to be put back into service.
5. Guard your own personal safety. Do not accept on faith statements that equipment which you are about to work on or near is safe. Assure yourself that it is safe.
6. Be sure that parts of equipment that are alive under normal operation are properly grounded before working on them. When an insulation test is to be made with megger, bell box, voltmeter or lamp, ground the equipment before making this test to assure yourself that it is dead.

Cleaning Rotating Equipment

When cleaning rotating machines by air blast too high a pressure must be avoided as the insulation of the coils may be injured either by being lifted or by dust or fine sand thrown into the air stream acting as a sand blast. Any water in the air blast may cause either short-circuiting or rusting of iron parts.

General Cleaning

1. Keep all apparatus thoroughly cleaned; accumulation of dirt, dust, oil or other foreign matter is unsightly and dangerous.
2. Blow the dirt and dust from the frame, commutator, windings and inaccessible parts of a machine with compressed air. The pressure of the air used for blowing should not be greater than 70 lb. per square inch. Always allow any accumulation of water in the compressed-air pipes and tank to be blown out before the blast is turned on a machine.
3. In addition to blowing, wipe the frame and all insulated parts that can readily be reached.
4. Cleaning should be done daily, where possible, but the frequency will vary with the location and local conditions. In no case should more than a week be allowed to elapse between cleanings.
5. After cleaning, check the air gaps to make sure that no foreign material has lodged in them and that the armature and pole faces are not rubbing. Checking should be done with the gage provided for the purpose or by holding a light at one side of the rotor and looking through the gap from the other.

*Abstracted from the operating code of the Philadelphia Electric Company.

Testing Overspeed Device at Reduced Speed

ON ACCOUNT of the possibility of leaving a machine without proper governor control when the overspeed device is tested at overspeed, a method has been developed of testing this device at reduced speed by attaching to it a small weight provided for the purpose. The addition of the weight increases the centrifugal force by a known percentage so that to each tripping speed with the weight attached there corresponds a higher tripping speed with the weight detached. Therefore tests can be made corresponding to speeds several per cent above normal at speeds which are actually several per cent below normal, thereby having the machine always under the control of the governor.

The detailed instructions for testing overspeed devices by this method follow:

1. If the turbine has been running, slowly close the throttle valve by hand and allow the turbine to come to rest.
2. Remove the hand-hole plate on the governor pedestal and place on the emergency trip the weight provided for the purpose. (Note.—If the machine has stopped in such a position that the weight cannot be attached, open the throttle sufficiently to turn the turbine shaft and trip the throttle immediately when the shaft starts to move.)
3. Replace the hand-hole plate.
4. Bring the turbine up to speed slowly and note, with the tachometer and frequency meter, the speed and frequency at which the emergency trip operates. The speed motor should be set so that the machine would operate at normal speed without the weight on the emergency trip.
5. After the throttle valve has operated properly under the action of the automatic overspeed device, operate the hand wheel to the closed position and reset the throttle trip.
6. If the emergency trip does not operate before the machine has reached normal speed, trip the throttle by hand.
7. Allow the machine to come to rest.
8. Remove the hand-hole plate and remove the weight from the emergency trip.
9. Replace the hand-hole plate.

Condition of Safety Devices Checked by Weekly Form

P. W. EBERHART
Safety Supervisor Substations Department,
Duquesne Light Company,
Pittsburgh, Pa.

THE safety report shown herewith is used by the substations department of the Duquesne Light Company to insure that all regulations in regard to safety devices are enforced. This report is made out weekly at each substation and sent to the substations department. Requests for any material, and particularly for material to replace that used from the first-aid boxes, are entered on the reverse side of the form. In this manner a direct check is kept on all safety equipment used in the substations.

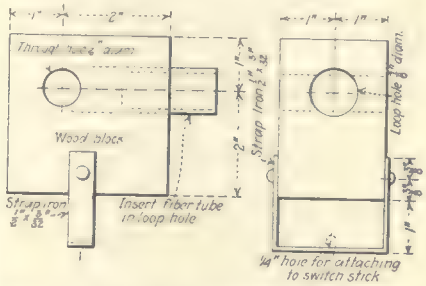
SUBSTATIONS DEPARTMENT
WEEKLY SAFETY REPORT
Date............192
Prone Pressure
Station.......Time.......M to ....M
Employees Present ....
Remarks ....
Condition of Safety Devices
Rubber Gloves....When last changed...192
Rubber Mats (if supplied)..............
Goggles ....
First-Aid Boxes ....
Ladders ....
Tools ....
Ground Chain ....
Remarks ....
(Request for replacing material for first-aid boxes must be made on the reverse side of this report.)
General
Condition of truck (if used for transportation) ....
Are working conditions made safe to the best of your ability?.................
Was it necessary to erect barriers?........
Was it necessary to erect scaffolds?.......
Certified correct ....Foreman
(Construction, Maintenance, Auto. Control Div.)

Device for Ascertaining if Conductor Is Alive

J. P. MCKEARIN
Electrical Engineer
United Electric Light Company
Springfield, Mass.

FOR conveniently determining whether lines are alive or not the United Electric Light Company, Springfield, Mass., recently fitted up a number of disconnecting switch sticks with headpieces like that shown in the accompanying drawing, utilizing the Westinghouse "spark C" tester for the necessary visual indication.

The headpiece consists essentially of a wooden block pivoted on a V-shaped piece of strap iron used to fasten the headpiece to the switch stick. Two holes are bored in the block at right angles to each other. In one of the holes is inserted the tester tube, while the other serves as a peephole and is equipped with a light shield. Owing to the pivoted mounting of the block it can be tilted so that the operator holding the



HOLDER FOR VISUAL INDICATOR FASTENED TO 8-FT. SWITCH STICK

switch stick can readily observe the tube from the floor. If the conductor is alive, the tube will glow at a distance of about 14 in. from a 66,000-volt circuit, 2 in. from a 13,000-volt circuit, ¼ in. from a 5,500-volt varnished cable or rubber-covered cable, and on contact with a bare wire at 2,400 volts.

Aiding the Development of Carrier Current

RECORD SHEET OF CARRIER CURRENT EQUIPMENT OPERATION

Date:- Location:-

Watch:-		12 Mn. - 8 A.M.						8 A.M. - 4 P.M.						4 P.M. - 12 Mn.					
Weather:																			
		Operating Condition						Operating Condition						Operating Condition					
		Normal	Sleet Run	Arrester Charging	Disturbance			Normal	Sleet Run	Arrester Charging	Disturbance			Normal	Sleet Run	Arrester Charging	Disturbance		
Speech Reception	Loud:-																		
	Medium:-																		
	Faint:-																		
	None:-																		
Quality of Speech	Clear:-																		
	Metallic:-																		
	Blurred:-																		
	Not Understandable																		
Ringing	Any ringing when not called?																		
	Were all calls received?																		
Tube Renewal	Transmitter																		
	Meter Statement at Holtwood																		
	Receiver																		
Any commercial code reception?																			
Remarks:-																			
Operator's Sig:-																			

TYPICAL FORM FOR NOTING OPERATION OF CARRIER-CURRENT EQUIPMENT

WHERE carrier-current telephone equipment is installed it has been suggested that records of reception be kept that will make it possible to eliminate any difficulties that exist. One form of record that is being used by a large Eastern company is shown herewith.

While carrier current is in the development stage, it may also be advisable to keep a record of the exact time at which the communication took place, so that operating conditions on the rest of the system at the time can be studied. This is particularly important if it is necessary to determine the effects on communication of switching operations, charging lightning arresters, etc.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Preventing Theft of Electric Service

Methods Most Commonly Used By Unscrupulous Customers to Beat the Meter—How Such Cases Can Be Remedied

By Ralph Pittman
Superintendent Light & Water Departments, Pine Bluff Company, Pine Bluff, Ark.

THERE is a certain class of consumers of electricity who have always considered a utility company as legitimate prey and have regarded the theft of energy more lightly than the theft of an equivalent amount of money or merchandise. It is exceedingly difficult to make these consumers understand that there is no difference in principle, and that their distinction between the two cases is purely a case of mental attitude.

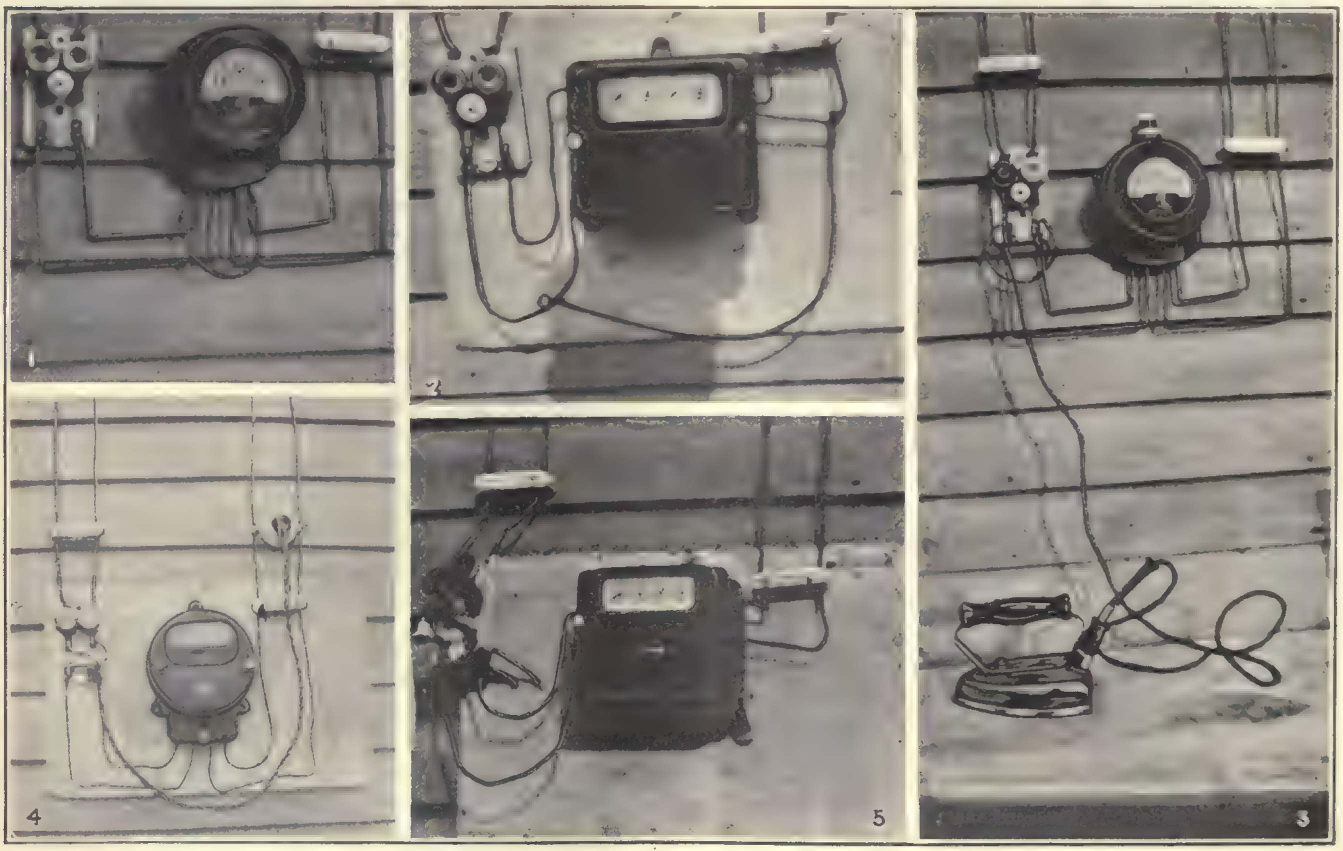
Better public relations, a clearer understanding of the problems of the utility by the consumer, closer personal contact with the consumers through representatives of the utility are proving to be effective means of correcting this attitude.

But the thief of electric service, though his tribe may decrease, will always be with us. To prevent such theft the utility must be always on the alert and well informed as to the methods usually employed. A number of interesting schemes used for the theft of current have come to the attention of the writer, and the means for their detection and prevention is here presented.

The first requirement for work of this kind is a quick-witted meter inspector. The man selected for this work must be absolutely trustworthy, for he will have numerous opportunities to accept bribes. As most utilities read each meter on approximately the same day of each month, the thief of electric service soon learns when the meter reader is to be expected, and consequently little can be accomplished with the regular meter readers.

Upon entering the consumer's premises, the inspector should first make a thorough examination of the meter, then remove the wires from the load side of the meter and test each outlet in the building to assure himself that no energy can be taken from any outlet except through the meter.

In making such an inspection the inspector should keep in mind those schemes that may be most readily applied to defraud the utility. Some of the methods most generally used are here briefly cited, with an effec-



FIGS. 1 TO 5—VARIOUS METHODS OF PUTTING METER WHOLLY OR PARTIALLY OUT OF SERVICE

tive means for preventing further tampering.

Case 1. Stoppage of meter disk. This is accomplished mechanically by inserting a small object through a hole drilled or punched in the meter case so that one end rests on the disk and prevents its rotation. This requires but a very small hole, which is conveniently plugged with some plastic material of the same color as the meter. Even if not plugged, the hole is so small that it is difficult to see except on very close inspection.

The only practical means of preventing this form of theft is by the use of glass-covered meters. The glass is difficult to drill, and the cast metal forming the base of the meter does not drill so easily as the sheet metal stamping forming the cover. New meters with glass covers cost no more than those supplied with metal covers, and the glass covers are interchangeable with metal covers of the same type of meter.

Case 2. Jumpers. A wide variety of jumpers are in evidence, ranging in refinement from the short piece of wire used in Fig. 1 to that shown in Fig. 2, which makes use of needle points which penetrate the insulation and when removed leave little marking on the wire.

One method of preventing the use of jumpers in localities where they are particularly numerous is to interchange the current and potential leads inside of the meter. If this is done the application of the usual type of jumper will result in a short circuit, and the would-be thief, not knowing the internal connections of the meter, will generally abandon the task.

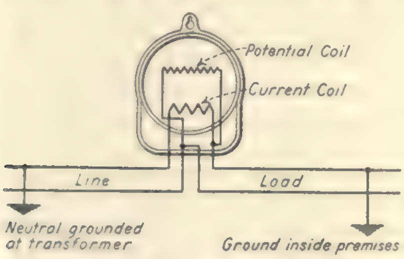


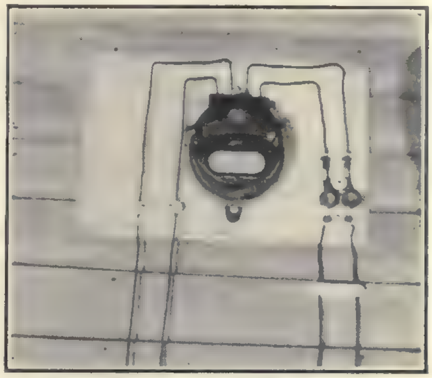
FIG. 6—PROPER CONNECTION FOR SYSTEM WITH GROUNDED NEUTRAL

The so-called safety boxes offer the best protection against this type of theft, as it is very difficult to apply the jumper when the wiring is so installed.

Case 3. Taps on line wires inside of building. The old and now obsolete practice of bringing the line wires through the attic of the building to the meter loop rendered this form of theft very prevalent.

Upon detecting a case of this kind, the utility should require such change in wiring as may be necessary to expose the line wires to the meter.

Case 4. Connection of devices to entrance switch. The fact that the back porch is the most convenient location for the meter has resulted in the connection of various appliances to the entrance switch. The appliance generally used in this way is the electric iron. Connections are usually made so they can be quickly jerked off the switch, should occasion require their speedy removal. Another scheme is to remove one of the fuse plugs, connect the blades of the switch together and screw the attachment plug of the device into the fuse block. Fig. 3 illustrates this scheme.



METER SHOWS NO OUTWARD INDICATION OF TAMPERING, BUT DISK WAS EFFECTIVELY STOPPED

This method of theft can be prevented only by keeping the entrance switch either locked or sealed, and this is by no means an easy task.

Case 5. Cord and plug from entrance switch to socket. By means of this arrangement it is possible to supply an entire building from the entrance switch. The illustration, Fig. 4, shows the arrangement.

In case the entrance switch is left closed, a short circuit will occur unless the polarity happens to be correct. For this reason, the entrance switch is usually found open. If the polarity does happen to be correct, the current will divide between the path through the cord and that through the meter, and the meter will thus register a part of the energy used. The means of preventing this form of theft is the same as that given under Case 4.

Case 6. Connection back of entrance switch. This scheme is very difficult to detect, because the arrangement can be so effectually concealed. A pair of wires is then carried to the wiring inside the house. If the polarity does not happen to be correct, a short circuit results. If this happens, the ordinary thief generally gives up the job in disgust. Fig. 5 shows one application of this scheme. Safety switches and exposed line wires from the service to the meter are the best means of preventing such connections.

Case 7. Burning out of current coils. The loss to the utility through the malicious burning out of current coils in meters is probably very small. If the transformer serving the consumer is small, and not too far away, the primary fuse of the transformer will be blown. But if the transformer is of large capacity, or is one of a bank consisting of a number of transformers, the insulation may be burned from the current coil of the meter.

A meter damaged in this way will run backward on no load, stop at about 20 per cent load, and run forward on loads greater than 20 per cent. Unless considerable energy is being taken through the meter, its condition will be detected from the readings.

Case 8. Shunting out current coils on secondary systems using grounded neutral. Without doubt the central station is losing a considerable amount of revenue through the careless connection of watt-hour meters on systems employing the grounded neutral. Some of this loss is no doubt due to intentional theft on the part of the consumer, but in many cases where this loss occurs the consumer is innocent of such an intention.

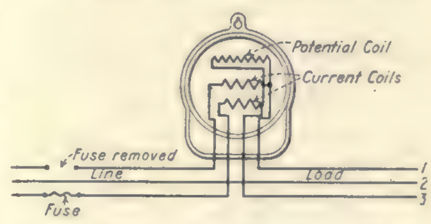


FIG. 7—EFFECT OF REMOVING FUSE IN THREE-WIRE SERVICE

This loss of revenue may be entirely avoided by taking especial care to see that the current coil of the meter is connected to that side of the transformer secondary which is not grounded. This wire is best found by means of a test lamp in the hands of the man setting the meter.

The meterman should be instructed to connect the current coil of the meter in that wire which lights the lamp to ground. Fig. 6 shows the connection. It will be noted that any connection to ground on the load side of the meter acts as a shunt across the current coil.

Case 9. Cutting out potential coil of three-wire meter by removing one fuse to open potential circuit. If one fuse is removed from the fuse block protecting a three-wire circuit the potential coil of the three-wire meter, since it is connected across the 220-volt wires, will not be excited, and as a result the meter will not register the energy taken from the circuit. Those outlets which are connected across the neutral and the other 220-volt wire can still be used, and the energy taken from these outlets under these conditions will not be registered by the meter. Fig. 7 shows this arrangement.

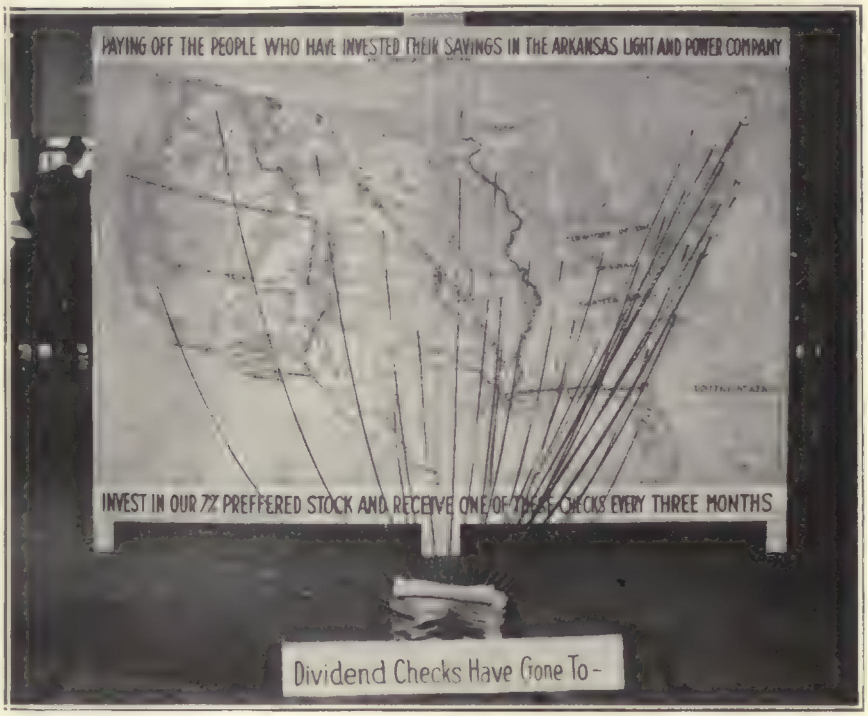
The only means for preventing this theft is either to keep the entrance fuses locked or to change the service to a two-wire service. Most large central stations have discontinued the use of small three-wire meters, which are undesirable for other reasons than the one here discussed.

These methods of theft, together with the means for prevention, are not intended as a dictionary upon this subject, but rather as a description of those schemes most generally prevailing. Careful inspection is the one means of preventing theft that the other methods all depend upon, and a good inspector and tester will generally pay big dividends.

Electricity Is Used to Hatch 100,000 Eggs

An electrically heated 81,000-egg hatchery is being successfully operated by Sam H. Moore & Son of Corvallis, Ore. This is the largest electrical equipment of the kind in the West, and the full capacity, which is 100,000 eggs, may be increased 100 per cent by double-decking the incubators. The incubator controls, also the large-capacity brooder on the second floor, which is of the special "bookcase" variety, are all electrified. The sleeping room occupied by the caretaker and the two offices, one equipped with a fireplace, are also heated by electricity. Thus one more use for electricity on the farm is being developed successfully.

Showing Who Receives the Central Station's Profits



HOW DIVIDEND CHECKS ARE DISTRIBUTED TO STOCKHOLDERS IN THIRTY-ONE STATES

To show its customers and stockholders how its profits are distributed the Arkansas Light & Power Company of Pine Bluff, Ark., at the time of mailing its latest quarterly dividend checks, used the very effective window display shown in the accompanying illustration. A large map of the United States was used upon which was indicated the number of stockholders throughout the country who were to receive dividends. A ribbon extended from each state to a pile of checks in the foreground. The company now has stockholders in thirty-one states, of which the greatest number (354) naturally are located in Arkansas. A continuous sale of its 7 per cent preferred stock is being carried on by the Arkansas Light & Power Company.

What Other Companies Are Doing

Providence, R. I. — Appliance sales by the Narragansett Electric Lighting Company's group of electric shops during June totaled $70,200 compared with $29,832 for June, 1922. During May, 1923, the company sold 1,040 vacuum cleaners at a total price of $58,956, and about 800 of these were sold over the counter. With each cleaner was furnished a portable lamp as a premium, and the estimated revenue added to the system from sales of electricity for these two items is $3,120 for the lamps and $3,744 for the cleaners. Last fall the company sold 1,125 cleaners in six weeks. A. H. Allcott is manager of electric shops.

Boston, Mass.—A department of commercial and industrial lighting has recently been organized by Charles H. Tenney & Company for the use of utilities operated by this management and other clients. Headquarters are at 200 Devonshire Street, Boston, and the work is in charge of Wyndham S. Wallace. The new department will be closely affiliated with the power engineering department of the Tenney organization and will strive to combine intensive studies of illumination and resulting mercantile and industrial betterment work with the power survey investigations now being made by V. M. F. Tallman, power engineer of the Tenney company.

Denver, Col.—Increased business has necessitated additional office space for the Denver Gas & Electric Light Company in its own building to the extent of almost 25 per cent. With the exception of a few offices on the third floor of the building, the company has been using the basement, the main floor and the second floor. As a result of recent changes the entire third floor has been taken over. Numerous alterations were found necessary.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Hydro-Electric Development and Steam Equipment

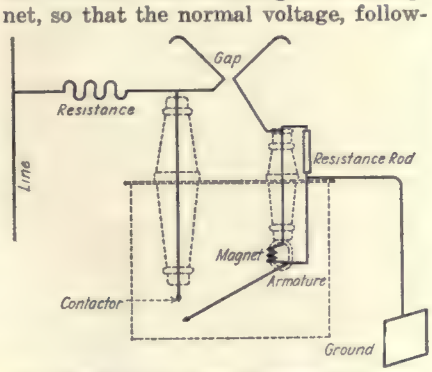
Efficiency of Gas Engines for Central Stations.—M. S. MASON.—Gas-engine stations to pay their way must operate all engines at practically full load for the entire time they are working. Cost figures for generating power with various loads are given to prove this point. One method of preventing the necessity of operating at points other than full load is to install storage batteries to take up peak loads and fluctuations. — *Electrical Review (England)*, June 29, 1923.

Mixed - Pressure Turbines. — Two mixed-pressure turbines, of rather unusual design, are being used in the power plant of the Calumet & Hecla Mining Company, Lake Linden, Mich. One is rated at 7,500 kw., and the other at 10,000 kw., and both utilize the exhaust from a number of copper stamp heads with a supplementary supply of live steam first passing through a high-pressure cylinder. The regulating gear is of interest as it must control not only high-pressure inlet and bypass valves but also two inlet valves admitting low-pressure steam to the low-pressure cylinder.—*Power*, July 3, 1923.

Power and Fuel Consumption of the Iron and Steel Industries in Pittsburgh District.—S. B. ELY and W. F. RITTMAN.—A detailed study of this industry with particular attention to the power requirements has been carried out by the authors. A table is given which shows the fuel consumption and general data on steel works in this district. Curves are also given covering the past ten years to show the rating representing the boiler capacity of all the iron and steel plants in the district, output curves for the steam produced by this boiler capacity, quantity and total value of the coal used, price of boiler coal per gross ton, total blast-furnace gas used, quantity and cost of natural gas used, total quantity and value of all fuels used, the percentage of coal in blast-furnace gas used, value of unit of fuel, quantity of fuel per ton of steel and the cost of power fuel per ton of steel.—*Mechanical Engineering*, July, 1923.

Generation, Control, Switching and Protection

Bendmann Arrester.—A. LIPPMANN. —The arrester described is a grounding device and consists of a horn gap with a resistance in the ground line. In parallel to the resistance is an electromagnet with a movable armature to which is attached a contactor. In case of an overvoltage of 15 per cent or more above normal voltage, the horn gap will arc over and will lead the surge over the resistance to ground. At the same time the voltage drop across the resistor will energize the magnet, which in turn will short-circuit the horn. This will extinguish the arc and also de-energize the magnet, so that the normal voltage, follow-



MAGNETICALLY SHORT-CIRCUITING HORN EXTINGUISHES ANY ARC FORMED BY OVERVOLTAGE

ing the overvoltage, will be interrupted. As the contactor is under oil, it acts like an oil switch and will break at or near the zero passage of the current. The entire cycle of operation is of about one-tenth second duration. An oscillogram is shown in which the action of this arrester, lasting 0.08 second, is plainly visible.—*Elektrische Betrieb*, June 24, 1923.

Transmission, Substations and Distribution

Design of Large Transformers.—I. R. MARCHAND. — Modern high-capacity power transformers must be designed and built in such a way as to withstand safely heavy overloads and the short-circuit forces of large power systems, as well as voltage surges of a multiple of the rated voltage of the machine. In this first installment of a somewhat general paper the author explains how mechanical forces occur in transformers during the switching-in current rush, during a ground or under short circuit. It is shown how and why a circular coil winding stands up best under radial forces. The safety of a transformer is seriously impaired if a large number of voltage taps is provided, because they unbalance the equilibrium between the high-voltage and the low-voltage windings and between the windings and the core. For main transformers, feeding important trunk lines, the author strongly recommends avoiding any taps and the use of a small auxiliary transformer with the necessary taps in series with the main unit. Spring-coil supports are of little use as shock absorbers under short-circuit stress, because their inertia is far too high to follow quickly enough the virtually instantaneous shock of a short circuit. Even as a take-up device for a shrinkage of the coil stacks the spring supports are of no great value, the author claims, because it is possible to so treat the windings as to avoid shrinkage safely. A regular inspection of the windings of a transformer during the first year of its operation, although it means an untanking of the core and coils every time, will be found to pay for itself soon. At these inspections any possible misalignment of the windings can be rectified before serious damage results. Finally, the use of two-step oil switches is recommended, with a properly dimensioned resistance between the two steps. These will reduce the initial current rush and help in the suppression of excessive mechanical forces.—*Revue Générale de l'Electricité*, June 23, 1923.

Superpower, a National Resource.—A symposium of three papers presented by P. T. Brady, R. F. Schuchardt and M. H. Aylesworth at the spring convention of the A. I. E. E. An abstract of each one of these papers may be found in the ELECTRICAL WORLD for April 28, 1923, on page 992.—*Journal of the A. I. E. E.*, June, 1923.

Units, Measurements and Instruments

Electrode Apparatus for the Location of Submarine Cables and Faults.—F. B. YOUNG and W. JEVONS.—A method is described for locating cable faults by means of a pair of towed electrodes, the cable section between fault and shore being energized by alternating or interrupted current. The limitations and difficults of the methods are discussed and remedies are indicated. Two practical trials of the gear are briefly described. Simple approximate formulas are derived for the range of the apparatus and numerical values are calculated for three typical cables.—*Journal of the Institution of Electrical Engineers (England)*, July, 1923.

Determination of Boiler Efficiency.—H. B. JONES.—Of the thousands of boiler tests made every year in this country a large proportion are of little value because they are conducted in utter disregard of the scientific principles that underlie all experimental work. The important factor is to know what errors may be expected in the various measurements in order to conduct the test in an intelligent manner. In this article the author makes a careful scientific analysis of the errors that arise in determining boiler efficiency.—*Power*, July 17, 1923.

Testing Transformers for Central Stations.—A. B. HENDRICKS, JR.—Tests of the dielectric strength of electrical equipment are as essential in its maintenance as in its manufacture. Such tests to be reliable, however, should be made with apparatus designed for the purpose. The article calls attention to the necessary qualifications for reliable insulation testing and describes the

various equipments standardized for this and for high-current testing.—*General Electric Review*, July, 1923.

Illumination

Developments in Art Gallery Illumination.—G. T. KIRBY and L. C. CHAMPEAU.—The authors point out the importance of the proper lighting of art galleries, that is, to light each object as nearly as possible in the same manner as when the object was executed. They explain how, with deflectors and prismatic glass, they control the daylight, thus bringing it to the object at the proper angle and maintaining it at that angle and intensity throughout the day and the seasonal changes. The authors further explain how with special lenses and deflectors they succeeded in producing artificial light of nearly uniform intensity the full height of the picture zone, this artificial light comparing favorably with daylight.—*Transactions of the I. E. S.*, July, 1923.

Lamps in Lighthouse Service—L. C. PORTER.—The author describes how electric lights have now successfully replaced older burners in lighthouses. A series of tests on lighting units for lighthouse service are described.—*General Electric Review*, August, 1923.

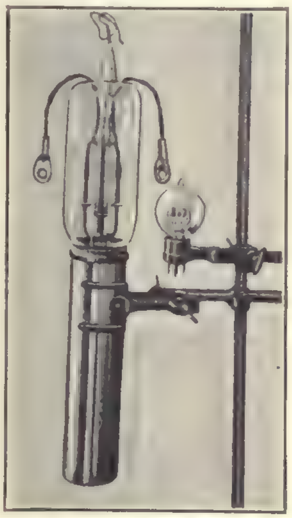
Motors and Control

Alternating-Current Versus Direct-Current Motors for Stoker Drive.—W. E. DOUGLAS and H. H. BATES.—The authors describe different types of motors, the application of variable-speed transmission and selective gears and factors to consider when selecting motors for stoker drive.—*Power*, July 3, 1923.

Latest Developments in Crane Motors and Their Accessories.—E. SCHWARZ.—Commutating poles are being used now universally on all direct-current crane motors on account of their established superiority in regard to running conditions and sparkless operation of the commutator even under heavy overloads. Three-phase motors with parted stator, or at least with parted bearing end shields, combine the electrical advantages of the alternating-current induction motor with the mechanical features of the direct-current motor type. Controllers for more than ten thousand weekly operations have now roller contracts instead of solid copper fingers, which gives them eight to ten times longer life. On large portal cranes it was thought necessary to connect the drive of the two extreme crane bases mechanically with bevel gearing and a long line shaft. Latest experiences have shown that this is not necessary, and that two individual motors, both designed for the same slip and with compensating resistances in the rotor circuits, may drive the two bases without danger of edging of the crane. A heavy locomotive crane has been developed whereby two self-maintained traveling cranes lift with their hooks a common beam spreader, on which hangs the load. By suitable connections the motors of both cranes can be controlled from either one of the crane cabs. On modern current collectors only porcelain is being used now as an insulator. Fiber and other insulating materials have been found to be unreliable. A pantograph type of collector with renewable wiping contacts made of bronze is the latest design, particularly for heavy currents (500 amp.). Lifting magnets are in extensive use today. One of the largest magnets built in Europe has a weight of about 7,000 lb. and can lift 6 tons of ingots. Several European concerns are endeavoring to introduce the storage-battery-driven electric mule, with which such excellent results have been obtained in America.—*Elektrotechnik und Maschinenbau*, July 8, 1923.

Telegraphy, Telephony, Radio and Signals

Metal Three-Electrode Vacuum Tubes of Large Capacity.—DR. B. V. D. POL JUN.—The water-cooled tube described uses a cylindrical anode as part of the outside. A chrome-iron anode with a



WATER-COOLED TUBE USES CYLINDRICAL ANODE AS OUTSIDE CASING

coefficient of expansion equal to that of glass solves the difficulty of a joint between metal and glass that must be air-tight at all temperatures. The tube is rated at 20 kw., 40 amp., and is 10 in. long and 2¾ in. wide.—*Sterkstroom*, July 4, 1923.

A 10-Kw. Poulsen Arc Sender.—H. THURN.—Describing the latest improvements made on the 10-kw. arc sender at Königswusterhausen, the author goes into full detail concerning the equipment of this new German radio station. The present improved keying method and the telephone arrangement are particularly emphasized. The sender can operate with wave lengths of 2,600 m. to 9,000 m. with a primary voltage of 650 volts to 800 volts.—*Elektrotechnische Zeitschrift*, June, 28, 1923.

Continuous-Wave Radio Transmission on Wave Length of 105 Meters.—F. W. DUNMORE.—A method and apparatus for continued transmission on the wave length of 105 m. are described. An electron-tube generating set was used which employed four 50-watt tubes in a tuned-plate primary circuit coupled to the antenna circuit. The antenna was rectangular in shape, 18 ft. high by 40 ft. long, and consisted of twenty-three wires connected in parallel. The generating set was coupled in on the lower side, and a gap which constituted a condenser was inserted on one of the other sides. In transmission tests conducted between Washington and Pittsburgh good signals were received in Pittsburgh during daylight.—*Proceedings of the Institute of Radio Engineers*, June, 1923.

Electrophysics, Electrochemistry and Batteries

Safety in Storage-Battery Plant.—C. T. FISH.—Medical supervision of employees, sanitation, ventilation, efficient mechanical guarding and continuous and persistent education of employees have minimized the hazards in storage-battery plants. As a typical example the Willard Storage Battery Company at Cleveland is listed. In this plant nothing has been overlooked to afford all safety possible.—*National Safety News*, July, 1923.

Electrolytic Zinc Deposition.—G. J. YOUNG.—A brief history of the development and production of the Consolidated Mining & Smelting Company in British Columbia, with descriptions and flow sheets of the lead and copper smelting units, the electrolytic plants, gold and silver refineries and the bluestone plant. In this ten-page well-illustrated article may be found a great deal of information of value to mining engineers.—*Engineering and Mining Journal-Press*, July 28, 1823.

Traction

First Russian Tramway Conference.—In December, 1922, a tramway conference was held for the purpose of investigating the state of Russian city lines and considering general measures for their improvement. Among the more important matters discussed were the number of cars in service, both passenger and freight, the condition of the system, the problems of making repairs and raising money for new equipment, and the cost of operating the system. In one case the operating expenses were 55 per cent for labor and insurance, 13 per cent for taxes, 25 per cent for electrical energy, 7 per cent for materials and miscellaneous.—*Electrickestvo (Russia)*, No. 2, 1923.

A Modern System of Overhead Railway Track Construction.—The main difference between the overhead line construction of the Lake Erie & Northern Railway and that in other instances lies in the use of catenary cables of steel cored aluminum of the type now common for long-distance transmission service. These cables are stronger and longer spans may be used than with copper cable of the same electrical resistance. The construction used is the steel-cored aluminum catenary with a grooved steel contact wire. Detailed description of the manner of effecting connections is given.—*Railway Engineer*, June, 1923.

Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

Conducted by PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N. Y.*

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Balancing Machine for Rotative Parts

The machine is an application of the principles of dynamic and static balancing invented by Dr. B. L. Newkirk of Schenectady so that it is possible to obtain complete dynamic and static balance by two single corrections individually measured and located near the ends of the body. When duplicate parts are to be balanced in production great rapidity can be attained, as static balancing is rendered unnecessary and the operator has only a few simplified positive and systematic steps to perform.—*Gisholt Machine Company, Madison, Wis.*

Inductance of Coils of Polygonal Form, Formulas and Tables for

Inductance coils wound so that each turn incloses a regular polygon are frequently employed. Since in this type of coil the wires have to be supported only at the vertices of the polygon, a minimum of solid dielectric material is required, and thus energy losses in the dielectric can be kept very small. Polygonal coils may be wound in a single layer, or, by the use of thin strips of insulating material at the corners to separate the layers, multilayer coils of relatively low capacity are readily constructed. Formulas have been derived for such coils, giving their inductance as a function of dimensions; numerical tables have been computed to facilitate their use. —*F. W. Grover, Bureau of Standards, Washington, D. C.*

High-Voltage Testing, Gases Liberated During

It was found that the gases liberated during the testing of insulators, using a 90,000-volt "flash-over" 60-cycle testing apparatus, are mainly ozone. Oxides of nitrogen were not found in quantities greater than 0.2 part per million, the limit of accuracy of the method used. The ozone concentration of the gas samples taken directly above the racks during the tests varied from two to ten parts per million. From the information available on the physiological effects of ozone, the amount found in these tests should cause no serious symptoms or after effects. However, it is advisable to have the test room ventilated at all times so as to reduce the ozone concentration below the values given above. — *G. W. Jones and W. P. Yant, Bureau of Mines, Pittsburgh, Pa.*

Measuring Instruments, Pivots for

The point under test is dropped by gravity upon surface plates of standardized hardness, and then both the pivot and the plate are examined under a microscope. A pivot which "mushrooms" by this treatment is softer than the standard hardness plate, and a pivot that makes a slight indentation in the plate, without damage to itself, is harder than the standard plate. If a pivot shows signs of chipping or fracture, this is an indication of burning during the hardening process.—*Paul MacGahan, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

Magnetic Material, Determination of

The determination of the amount of magnetic material (magnetite or pyrrhotite) in an ore is frequently required. With coarse magnetic particles the determination is simple, but when the ore requires to be ground very fine, below 200 mesh, to liberate the magnetic particles, it is almost impossible to make a determination dry. To render the wet determination of the magnetic portion of an ore both easy and expeditious, a machine was designed and built and has proved very satisfactory. The principle employed is to suspend the magnetic particles in an alternating and rotating magnetic field through which flows a stream of water.—*F. C. Dyer, University of Toronto, Ontario, Canada.*

Motors, Synchronous, for High Starting Duty

A new form of synchronous motor for high starting duty has been developed which obviates the disadvantages heretofore considered inherent where overload starting conditions are involved. The motor is so constructed that it is possible when starting to bring the armature, which is normally the stator, up to synchronous speed without any reference to the load. When the armature is at synchronous speed the field is applied in the ordinary way and the rotor gradually brought up to speed. The speed of the revolving stator is meanwhile brought down to zero by means of a powerful band brake which is locked in position when synchronous speed of the load has been attained.—*General Electric Company, Schenectady, N. Y.*

In Progress or Purposed

Emf., Electrolytic, Due to Motion

If two electrodes of similar material are placed in a salt solution, the external circuit being connected through a galvanometer, no current will flow. If, however, an oscillatory motion is given to one of the electrodes, the galvanometer shows a deflection, indicating a continuous current. The magnitude of the current depends upon the material of the electrodes, the salt used and the strength of the solution. Apparently platinum electrodes which have been thoroughly cleaned produce no emf. The laws covering this phenomenon are being investigated.—*A. G. Thomas, Massachusetts Institute of Technology, Cambridge, Mass.*

Fatigue of Metals

Plans have been made to carry forward for the first time a comprehensive research into the endurance limits of copper, brass, bronze and other non-ferrous metals and alloys, under repeated strains or shocks. The investigation will be conducted by the Engineering Foundation in collaboration with the National Research Council, the Copper and Brass Research Association, the University of Illinois, the General Electric Company, the Western Electric Company and other corporations. The work will be supervised by an advisory committee of specialists connected with the National Research Council. Dr. H. F. Moore, professor of engineering materials, materials testing laboratory of the University of Illinois, will be in immediate charge of the experiments, which will be conducted at Urbana. The Engineering Foundation, of which Alfred D. Flinn is director, has provided special equipment and funds.—*Copper and Brass Research Association, 25 Broadway, New York.*

Oil Circuit Breaker, Oil Under Pressure

Extensive research work has been carried on by the Brown-Boveri Company, Baden, Switzerland, with a circuit breaker of 700 kva. rating capacity under a high oil pressure of 7 kg. per square centimeter and has shown that the condition during the period of interruption was far less satisfactory than without pressure. It was found that under this pressure the duration and length of the arc was 70 per cent longer. The energy liberated in terms of heat during the period of interruption was approximately five times greater and the quantity of gas produced twenty times greater than without pressure. What results would be at pressures several times higher than the one applied above has not yet been determined and cannot be concluded from this test.—*G. Bruehlmann (from Brown-Boveri Mitteilungen, 10).*

Wattmeter, High-Tension

We expect to have completed and in good working order a 150,000-volt-to-neutral wattmeter for direct connection to the large conductors on our towers when subjected to single-phase voltages as high as 300,000 to 350,000 r.m.s. We feel that we have provided the necessary non-inductive, non-capacitive voltage-circuit resistance for this wattmeter.—*Harris J. Ryan, Stanford University, California.*

Welding, Electric, Resistance Method

The chief advance noted in this direction seems to be the replacement of steel castings or complicated machined parts by either drop forgings or steel stampings in halves and welding these halves together by the resistance method. By this procedure great uniformity of product and light weight are obtained, and while retaining or improving quality, articles so manufactured can be produced cheaper. — *H. Lemp, Erie, Pa.*

Apparatus Available for Research

Circuit Breakers, Generator for Testing

A specially built alternator (26,700 kva., 300 r.p.m., 25 cycles, 13,200/7,620/6,600/3,810 volts feeds power through two large-capacity oil circuit breakers to a "bomb-proof" testing compartment in which the test breaker is set up and may be loaded to destruction. One breaker acts as a generator protective breaker while the other is used as a closing switch to energize the bus leading into the testing compartment. By throwing disconnecting switches three high-voltage transformers can be energized and made available for testing. Four oscillographs, with an adjoining developing room, form part of the permanent station equipment. Apparatus is also available for recording rapid changes in gas pressure and the speed of opening the circuit.—*General Electric Company, Schenectady, N. Y.*

Suggestions for Research

Alternators, Refrigeration of Cooling Air for

If the temperature of the cooling air used in a large alternator could be artificially lowered by means of a refrigerating machine, the alternator output could be accordingly increased, especially on warm days. By actual computations R. D. Archibold has shown that within certain limits the refrigeration of the cooling air is economically sound.—Institution of Electrical Engineers (British), *Journal*, December, 1922, Vol. 61, p. 23]. This proposal should be of sufficient interest to the American electric utilities and to our refrigerating industry to install co-operatively an air-cooling machine in an electric power plant in which the conditions will be favorable for experimentation and research.

Circuit Breakers, Oil Type

According to the engineers of the General Electric Company, the following actions within the oil vessel should be studied in order to improve the performance of an oil circuit-breaker: The path taken by the arc; the general form of the gas "bubble"; the length of the arc under various conditions; the pressures generated; the speed of the moving parts at all stages of the stroke; the proper oil level; the scientific venting of the gas to prevent oil throwing.

Dielectrics, General Study of

The committee on electrical insulation of the Division of Engineering, National Research Council, has formulated a number of problems on dielectrics, under the following headings: (1) Review and compendia of work already done; (2) the nature of dielectric absorption; (3) phase difference in dielectrics; (4) electric strength; (5) dielectric constant; (6) resistivity; (7) theories. Even a partial solution of these problems will require co-ordinated work of many investigators over a number of years. It is earnestly recommended that those qualified to attack even one small problem in the long list published by the committee should communicate with the chairman, Dr. John B. Whitehead, Johns Hopkins University, Baltimore, Md. The committee's report has been printed in the *A. I. E. E. Journal*, 1923, Vol. 42, p. 618.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

American Officers Chosen

Eminent Engineers and Executives to Further Participation in London Conference

IN RESPONSE to invitations for American participation in the World Power Conference to be held in London next year under the presidency of the Earl of Derby, more than twenty engineering and industrial organizations in the United States have appointed representatives to a committee of arrangements, which has planned the following organization, in which electrical men are promiment:

Honorary Chairman—Secretary of War Weeks.

Honorary Vice-Chairmen—Secretary Work, Secretary Wallace, Secretary Hoover, Gen. Guy E. Tripp, Owen D. Young, Samuel Insull, Prof. Lester P. Breckenridge, Sydney Z. Mitchell.

General Chairman—O. C. Merrill, executive secretary Federal Power Commission.

Vice-Chairman—H. J. Pierce, president Washington Irrigation & Development Company.

Secretary—W. M. Steuart, Bureau of the Census.

Treasurer—H. M. Addinsell, Harris, Forbes & Company, New York.

Executive Committee—W. M. Steuart, Peter Junkersfeld, Calvin Rice, David P. Rushmore, Calvert Townley, H. M. Addinsell, H. I. Harriman, Fred R. Low, John W. Lieb.

Working committees have been appointed and General Chairman Merrill is now in London gathering information as to the scope and details of the American participation in the conference.

As already stated in the ELECTRICAL WORLD, water power is to have a special section devoted to it at the conference. There will also be sections on power resources (subdivided into chemistry, physics, research and raw materials), power development (engineering, transport, education, health, publicity), power applications (agriculture, industry, general utility), and power, economic and financial (national and international credit, currency and exchange, exports and imports).

The list of eminent British engineers, scientists, industrialists and financiers connected with the organization and management of the World Power Conference is an imposing one, and the grand council contains many high in electrical and engineering circles, including Lord Ampthill, Col. O. C. Armstrong, Sir J. A. F. Aspinall, L. B. Atkinson, J. Annan Bryce, Sir T. O. Callender, Lieut.-Col. F. A. Cortez-Leigh, S. Z. de Ferranti, Hugo Hirst, H. C. Levis, Charles H. Merz, Douglas Vickers, Sir John Snell and others.

Improvement Takes Place in Coal Situation

The threatened cessation of work in the hard-coal fields when the present agreement expires on Aug. 31, with its inevitable reaction on the soft-coal industry, seems likely to be averted as the outcome of the renewal of the conference between operators and miners which was brought about by the Coal Commission. A mutual agreement between the contending parties to discontinue "check-offs" on wages either for union purposes or to meet obligations of the miners for rent, insurance and other such purposes was reached on Wednesday when the conference reopened at New York. With this troublesome question out of the way, there is hope that a contract as to hours and wages will be signed.

Despite many rumors and newspaper reports asserting as a fact that first one course then another will be pursued by the government in the event of a shutdown, there has been no formal announcement of policy, and most of these reports may be set down as belonging in the realm of pure speculation.

The Executive does not possess any authority to take over the mines, and so far as powers of compulsion are concerned President Coolidge in the event of a coal strike would find himself in exactly the same position that President Harding occupied in the spring of 1922. There is, however, a decided difference between the two periods in that public sentiment has crystallized to a large extent within the last year against strikes which cut off supplies of necessities of life.

Declaring that the recent decision of the Interstate Commerce Commission refusing permission to the Virginian Railway Company to extend its Guyon branch in West Virginia to open up new coal mines amounted in effect to confiscation of property without due process of law and therefore was unconstitutional, the Virginian company filed a petition on Aug. 11 to reopen the case. The decision of the Interstate Commerce Commission was based upon the assertion by the commission that the bituminous-coal industry is overdeveloped and that the Virginian Railway last year was not able to supply sufficient cars to the mines already in operation along its lines.

Projects of Ohio Edison

To Purchase Marysville Light & Water and Southern Properties of the Northwestern Ohio

AUTHORITY from the Ohio Public Utilities Commission for the purchase of the Marysville Light & Water Company and the Southern district properties of the Northwestern Ohio Light Company by the newly organized Ohio Edison Company was formally requested on Aug. 4 and negotiations for their acquisition will be concluded within a short time.

The Ohio Edison Company, of which C. I. Weaver, general manager of the Springfield (Ohio) Light, Heat & Power Company, is president, was organized recently as one of the group of companies managed by Hodenpyl, Hardy & Company to take over the properties mentioned. The officers of the Springfield company and the Ohio Edison Company are identical. While details are not yet forthcoming, it is understood that Springfield will be made the center of the power zone and that the power generated in that city will be transmitted to other communities.

The amount involved in the proposed change has not been announced. The Northwestern Ohio Light Company has been operating in Urbana, Mechanicsburg, Catawba, North Lewisburg, Woodstock, Cable and Mutual, while the Marysville Light & Water Company properties are in Marysville and Milford Center.

Illinois Power & Light Plans Improvements

The Illinois Power & Light Corporation is planning extensive improvements to its plants and properties in Illinois which will include an addition to the power plant at Venice, Ill., near St. Louis, where a 20,000-kw. generator will be installed. The total cost will be $1,200,000. This plant carries a heavy industrial power load for the Venice and Madison manufacturing districts as well as supplying the southern division of the Illinois Traction System, a subsidiary of the Illinois Power & Light Corporation.

An engineering investigation is now being conducted into a five-million-dollar hydro-electric project at Decatur, Ill. It is also proposed to add plant equipment to the central station at Peoria, and improvements to many other of the utility properties of this company are contemplated.

General Electric's Big Order for Paulista Railway

Orders for new equipment totaling about $1,000,000 for electrifying 35 additional miles of the Paulista Railway, Brazil, have just been placed with the International General Electric Company. This extension constitutes part of the extra portion contemplated when the first contract with the International General Electric Company was closed in 1920, providing for 28 miles of double-track electrification, and brings the total electrified mileage up to 63 miles, starting at Jundiahy and extending north to Tatu. This is approximately half the total mileage originally planned and further extensions are expected.

Included in the order just announced are five 62-ton, 3,000-volt direct-current switching locomotives, a complete substation of 4,500 kw. ultimate capacity with motor-generator sets, step-down transformers, switchboards, switch gear and other auxiliary equipment and overhead-line material for the extension.

The Paulista is the most important railroad in South America to adopt the direct-current system for electrification. Power is being supplied at 88,000 volts, 60 cycles, by the São Paulo Light & Power Company and will be converted at the substation for train operation.

Beck Says Chicago Hurts Canada's Water Power

That an annual loss of $21,000,000 is being sustained by the people of Canada through the diversion of 300,000 hp. from the Great Lakes system by the Chicago Sanitary District officials is charged by Sir Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario, according to a Toronto dispatch. The Chicago Sanitary District takes from 8,000 cu.ft. to 10,000 cu.ft. of water per second for diluting its sewage so as to make it inoffensive and for the purpose of supplying electric light and power, Sir Adam said.

Officials of the Chicago Sanitary District in a recent tour of the Canadian lake cities, he said, argued that the diversion of the water did not affect the Canadian interests and that they were prepared to install regulatory water works costing $7,500,000 in the Niagara River below Buffalo, and in the St. Lawrence River at Gallops Rapids.

Sir Adam asserted that the amount of water diverted at times equaled the quantity which passes over the American Falls at Niagara.

"Half a Billion Dollars in Five or Ten Years"

A rebuke is administered to Sir Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario, by the *Financial Post* of Toronto for his alleged declaration that "if we are permitted to continue without interference, political or otherwise, our investments will amount to half a billion dollars in five or ten years." "Our assets are in farm lands, in industries and in untouched minerals," he declared, according to the *Financial Post*, and he is said to have further explained that the "frills" had been sheared off the Gregory commission and that the report to be made would not seriously affect the organization, which would proceed with a policy of developing radial lines along the border.

"Sir Adam Beck is a member of Mr. Ferguson's cabinet," says the newspaper; "but, in the face of the report of the Sutherland commission, and before the report of the Gregory commission has been submitted, and with a financial comptroller just appointed, we cannot believe that the government has made the decision to go ahead with Hydro plans which will run the investment up to 'half a billion.' Sir Adam seems to have spoken out of his turn as usual."

Mr. Work Again Defends the Dismissal of Davis

Answering a communication of James H. Dunlap, secretary of the American Society of Civil Engineers, this week, Secretary Work of the Interior Department again attempted to justify his removal of Arthur P. Davis as head of the Reclamation Bureau. His letter, however, is merely an amplification of his former statement regarding the problem of the water users and his own views of the superior qualifications of a "business man" over an engineer for the post in question. In part he says:

"The Secretary of the Interior, who alone is charged with the execution of the reclamation act, desires the greatest possible efficiency—not alone efficiency in one phase of the work, but efficiency in every phase and aspect of reclamation. He believes that the change to which you refer is made necessary by existing conditions, for

Electric Crosses Symbolize City's Grief for President

ON THE night of Friday, Aug. 10, after the final funeral service for President Harding had been held at Marion, Ohio, many of the tall buildings in New York City added strikingly to the signs of mourning seen on every hand by illuminating part of the windows in their façades so as to form the outline of a great cross. The building shown on the left is the Heckscher Building, at Fifth Avenue and Fifty-eighth Street.

unless improvement can be brought about many projects will be abandoned entirely by settlers—some have already gone—and the government not only will lose millions of dollars invested, but the settlers themselves will lose time, labor and money already placed by them on their farms. Although it is primarily essential to construct dams and ditches, these are not alone enough to secure successful farming to settlers, for whom reclamation was instituted."

Credit Men Hold Silver Jubilee Convention

Broader Opportunities for Serving the Industry Keynote of Boston Meeting—Uniform Methods of Risk Analysis—Wider Interest in Credit Problems

RESPONSIBILITY for sound financing combined with alert readiness to serve the credit seeker and to aid in the upbuilding of the electrical business were emphasized over and over again as the duty of the reconstruction period by the National Electrical Credit Association, which held its twenty-fifth annual convention and silver jubilee at the Copley Plaza Hotel, Boston, Aug. 9 and 10. About 100 registrations were recorded, and the proceedings were marked by a deep sense of the increasing importance of credit work, the value of co-operative effort toward bringing about sounder business practice on the part of credit seekers, and confidence in the future of the electrical industry. There was a widespread feeling of congratulation that the organization has attained so high a degree of usefulness and a real, if unspoken, dedication of the membership toward still higher ideals of service. The recreational side of the convention was greatly subdued because of the death of President Harding.

With President Clarence Kaeber in the chair, a warm welcome to Boston was extended by Corporation Counsel E. Mark Sullivan. Healthy activity was reported to be the rule in the geographic branches of the association by Almon Foster of Boston, F. A. Booth of New York, B. P. George of Chicago and F. P. Vose on behalf of the Pacific Coast Association. A growing use of association inquiry forms was noted, and the value was emphasized of exchanging credit information through "moral risk clubs" or their equivalent, of trying to train credit seekers of comparative inexperience along sounder lines of business conduct, and of the contact of executives and credit managers accomplished at the recent Del Monte (Cal.) convention of the Electrical Supply Jobbers' Association. Business prospects in general throughout the country were declared good subject to favorable labor conditions.

Stabilizing Business Methods

Means of preventing business difficulties among credit seekers and of stabilizing commercial practices were discussed in a paper by E. W. Shepard, general credit manager Western Electric Company, Inc., New York. Proper accounting methods on the part of contractor-dealers, monthly analyses of business, uniform comparison sheets and conservative financing of construction work are, he held, essential. In the discussion it was brought out that a rapid turnover is the only justification of large profits and that closer co-operation is important between credit and sales departments, with adequate executive support in cases where a firm policy should be adopted in controlling sales to "variegated" risks. Too many "individualists" are engaged in retail trade, and many would be better off working for others.

Paul Hollister of the Barton, Durstein & Osborne Company, Boston, pointed out the opportunities before credit men in helping sales departments frame partial-payment terms. Volume and character of advertising are indices of activity on the part of business organizations, he said, and should receive scrutiny in credit analyses.

A. F. Hearl, treasurer American Electrical Supply Company, Chicago, contributed a paper upon "How New Lines of Merchandise, Such as Radio, Affect Credit." The author reviewed the credit difficulties resulting from the overinflation and pyramiding of radio equipment orders during the first rush of popularity of this class of apparatus and urged keeping a close control of credits on such business. The rapid development of the art he thought in some measure responsible for sales and credit difficulties. In the discussion the sale of radio apparatus as a complete unit was strongly urged. The estimated undeveloped radio market in the United States contains business opportunities reaching $50,000,000. The seasonable phases of the business should be made clear to retailers, sales falling off over 50 per cent in the summer. At least two statements of financial condition should be required per year, and particularly about July 1 as to stocks. Caution should be exercised in distributor sales after May.

It was brought out that the Radio Corporation of America is considering plans for the sale of sets on a partial-payment basis. J. S. Thomas, Elliott-Lewis Company, Philadelphia, said that dealer sales on a plan involving the giving of notes by the customer have minimized losses on paper to less than over-the-counter losses.

Mercantile Agency Reports

The improvement of mercantile agency reports was reviewed by J. S. Thomas, Philadelphia, in an address emphasizing the need of complete, prompt and accurate reports. Careful analysis of such reports is vitally important, and historical data as to the credit seeker's experience, reputation, current condition of stocks and many other factors bearing upon credit, including uniform report forms, were cited as essential for consideration. It was generally agreed that too much credit information cannot be obtained in studying risks.

H. D. Clark, Brunt Porcelain Company, Columbus, Ohio, contributed a comprehensive discussion of what constitutes a complete credit report.

An appreciated feature of the convention was a review of the beginnings of the association by Charles M. Wilkins, Willard Storage Battery Company, Toronto, Canada. Memorial addresses upon the lives of former presidents, Frank Ridlon, James Wolff, John Forman and John H. Dale, were given. E. W. Shepard was elected president for the ensuing year, and the convention closed with a memorial service for President Harding, conducted by Rev. Bradley Whitney, chaplain Massachusetts State Prison.

National Electrical Credit Association Assembled at Boston for Twenty-Fifth Anniversary

The State Ownership Issue in Washington

The movement recently launched by the Public Ownership League of Seattle for the state-wide ownership of the entire light and power industry of the State of Washington is admittedly based on the water and power act of California, which was overwhelmingly defeated by the voters of that state in the election last November. The constitution of Washington limits the bonded indebtedness of the state to $400,000, which the advocates of the scheme admit is less than the cost of a substation. It is not clear how payment of interest on bonds can be guaranteed without involving the state treasury. None the less, under the lead of Oliver T. Erickson, Seattle councilman, committees have been appointed and plans definitely laid for bringing the proposal before the voters this fall. Apparently the city of Seattle has gone deeper into its municipal light and power development program than was anticipated in the beginning and would be quite willing to unload the burden on the state.

At a meeting of the Public Ownership League of America in Spokane on Aug. 3 a movement was started to combine the several political forces now working for public ownership in the state. It is planned to form a consolidated public ownership political organization, draft a bill and introduce it in the Washington Legislature early next spring. The Public Ownership League of Seattle is planning to send J. D. Ross, Seattle superintendent of lighting, and Oliver T. Erickson to the convention of the Public Ownership League of America, to be held at Toronto Sept. 10 to 13.

What Can Seattle Do with Its Coming Power Capacity?

Skepticism concerning Seattle's ability to use the 2,500,000,000 kw.-hr. a year which it is estimated can be produced by the municipal Skagit River power project when it is completed is freely expressed by local critics of the enterprise. The *Times* of that city, for instance, says:

"The Skagit will increase the department's output more than twenty-five times, it is pointed out by investigators who are trying to find out where Seattle is going to land under the colossal burden of bonded indebtedness imposed on the community by municipal ownership enterprises.

"Where, they ask, does the light department expect to find a market for the Skagit's gigantic output of electrical energy? No one, it is pointed out, expects the city population to increase more than twenty-five-fold in the next twenty years. A population running into the millions in 1943, when the project is to be completed, is beyond the dream of the most visionary, declare the investigators.

"They point out that proponents of municipal ownership talk incessantly of the many new and great industries to be brought to Seattle by an era of cheap power; but nobody expects industry to increase in the next twenty years at the sensational rate that would justify the Skagit's full production. . . . Investigators reiterate their previous statement that the enormous production of electrical energy by the Skagit is likely to force up the price to the consumer instead of lowering it. They reiterate that it is not the quantity available, but the cost of production, that determines the price to the consumer in this case."

Disposition of Hetch Hetchy Power an Active Question

The question of how to dispose of the 70,000 kw. of hydro-electric power that will be available upon the completion of the Moccasin Creek power house being built in connection with the Hetch Hetchy water supply of San Francisco is receiving the serious consideration of the Board of Supervisors of that city. City Engineer O'Shaughnessy on several occasions has recommended that the city wholesale the power. His department has been asked to make a study of the situation and report to the Supervisors.

The public utility committee of the Board of Supervisors has advised the board to distribute the power as a municipal enterprise, but suggests that before any action is taken a careful study of the situation be made, that proposals be received from the two power companies for the purchase of the power wholesale, that an estimate be made of the cost of constructing a complete distribution system and that prices for the acquisition of the Pacific Gas & Electric and the Great Western Power Company's systems be obtained. No action will be taken until these matters have been investigated.

A careful study of the situation has been made by the San Francisco Electrical Development League, and a resolution has been unanimously passed disapproving the proposed plan for the distribution of the power by the city. Copies of this resolution were sent to the Mayor, the City Supervisors and other interested parties.

Columbia Gas & Electric Sells Employees Stock

The Columbia Gas & Electric Company offers to sell to its employees a limited amount of its no-par-value stock at $32.50 a share on a partial-payment basis involving as little as $1 a month. More than four thousand men and women employed in the public utility companies operated or owned in Ohio, West Virginia and Kentucky by the Columbia Gas & Electric are eligible to buy stock under this plan, which, President P. G. Gossler announces, is undertaken to show the company's approval of the modern tendency toward improved industrial relations. The trustees of the shares are W. W. Freeman, H. A. Wallace, E. Reynolds, Jr., C. S. Duffield and B. R. Ruskamp.

White River Development

Plans Made for Great Dam to Impound Lake 100 Miles in Length— 160,000 Hp. in Sight

OFFICIAL announcement is made by the North American Company and Hugh L. Cooper & Company, whose interest in the Dixie Power Company's development on the White River in Arkansas has previously been chronicled, that an option on all of the rights and holdings of the company last named for the exploitation of water power on this stream has been obtained by Hugh L. Cooper & Company.

The White River development has been under consideration for more than ten years. President Taft in 1912 refused the Dixie Power Company a perpetual franchise; then followed years of struggle for federal water-power legislation. The federal water-power act became a law on June 10, 1920, and Permit No. 1 was granted to the White River project. An extensive topographical survey, with water-power investigations, has been made by the Dixie Power Company, involving a study of the whole White River terrain from Cotter to Forsyth, in the heart of the Ozark Mountains. The watershed above Cotter is roughly 6,200 square miles, with an annual average rainfall of about 45 in.

The Dixie Power Company is chartered and authorized by the State of Arkansas to construct water-power projects on the White River, and the state authorities are eager to have this great development go forward.

Hugh L. Cooper & Company, under contract with the North American Company, have commenced a complete study of the surveys, water-supply data, overflow damages, etc., and will make the necessary diamond-drill borings on the dam site. These studies and explorations should be completed during the coming fall, and construction work early in 1924 is a possibility.

It is proposed to construct a special arch-type concrete dam 225 ft. in height, its base being about 1,000 ft. in length and 1,800 ft. at the crest, establishing an artificial lake nearly 100 miles long covering more than 50,000 acres.

The White River project will develop around 160,000 primary electrical horsepower, an amount greater than that derived from the Keokuk Dam. The plans call for a high-tension transmission line to St Louis, 240 miles miles from the project. The total cost will be in the neighborhood of $25,000,000 to $30,000,000. After power requirements in nearby Arkansas and Missouri have been taken care of, the rest of the power developed will probably be transmitted to St. Louis over the line just mentioned, to be used by the Missouri subsidiaries of the North American Company.

Atlanta Gas Case Again

Declaring that Decisions of Supreme Court Conflict, Georgia Company Asks for Rehearing

DECLARING that the decision rendered in the Atlanta gas case on June 11 was at such variance with decisions in the Bluefield Waterworks & Improvement Company case on the same date and the Southwestern Bell Telephone Company case on May 21 as to cast doubt upon the law, the Georgia Railway & Power Company and its lessor, the Atlanta Gas Light Company, filed a petition in the United States Supreme Court on Aug. 11 in support of their motion for a rehearing.

The Atlanta gas case was decided adversely to the companies in an opinion by Associate Justice Brandeis, with Associate Justice McKenna dissenting. (See ELECTRICAL WORLD, June 16, page 1430.) The majority opinion pointed out that in the Atlanta case the Georgia State Railroad Commission, in fixing rates, had carefully considered replacement value and increased costs, although it did not allow all of the claims of the companies in this regard; hence the case differed from the Bluefield and Southwestern Telephone cases. "The refusal of the commission and of the lower court to hold that for rate-making purposes the physical properties of a utility must be valued at the replacement cost, less depreciation, was clearly correct," the majority opinion in the Atlanta case declared. In the Southwestern Telephone case the Supreme Court, in an opinion by Associate Justice McReynolds, had declared that contemporaneous reproduction costs must be taken into consideration in fixing rates for public utilities. In the Bluefield Water case Associate Justice Butler, speaking for the court, held that the West Virginia Public Service Commission had not given due consideration to replacement costs. In both of these cases Associate Justice Brandeis agreed with the majority in reversing the lower courts but dissented from the principle of rate making laid down.

OPINIONS DECLARED TO CONFLICT

In the petition for rehearing of the Atlanta gas case it is pointed out that the case was argued before and decided by a court of seven justices and that the other two cases, cited as involving virtually the same issues, were argued before and decided by a full bench and that in the latter cases "the principle for the valuation of properties for rate-making purposes was announced in direct conflict with the result reached by the majority opinion in this case."

"The majority opinion in this case, which is the latest decision by this court on the subject," the petition states, "when read in connection with the opinions in the Southwestern Bell Telephone case and the Bluefield Waterworks & Improvement Company case, must necessarily create grave doubt as to the law and make it uncertain whether the greatly increased cost of construction since the pre-war period can in effect be ignored where a commission says that it has considered it though the record shows that it 'did not accord proper, if any, weight' thereto.

"It is the established rule in this court that the present value of the property at the time the rate is being fixed is the amount on which a utility shall be allowed to earn. . . . This is the first instance in which a company has ever been denied the right to earn rates on the present value of the property."

West Virginia-Kentucky Men to Meet Oct. 19-20

The third annual convention of the West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers is announced for Oct. 19 and 20 at the Frederick Hotel, Huntington, W. Va. The program has already been prepared and is as follows:

FRIDAY, OCT. 19

Morning.—President's remarks; report on mechanical and electrical equipment records, J. H. Edwards; report on all-rubber-insulated versus braid-covered cables, N. A. Johnson; open discussion on purchased power versus individual plants.

Afternoon.—"Construction and Care of Transformers" (illustrated), L. G. Mason, Westinghouse Electric & Manufacturing Company; "What Can Be Done to Improve the Efficiency of Mine Pumping?" C. E. Rogers (chairman committee); "What Service Are We Getting in Supplying Repair Parts?" F. M. Reigher.

SATURDAY, OCT. 20

Morning.—"Hoisting Equipment," N. A. Maxwell; "Application of Fan Drives for Ventilation," J. J. Fluck; business meeting.

At 1 p.m. on Saturday the members will be guests of the association at luncheon at the Frederick Hotel, after which the party will go for automobile rides and will inspect one or more large industrial plants of interest.

Tentative Program for I. E. S. Convention Adopted

For the seventeenth annual convention of the Illuminating Engineering Society, to be held at the Fort William Henry Hotel, Lake George, N. Y., on Sept. 24-28, the following tentative program has been adopted:

MONDAY, SEPT. 24

Morning.—Registration.

Afternoon.—Address of welcome; president's address; survey of the year's work, report of general secretary; "Year's Progress in Illumination," committee on progress (F. E. Cady chairman); "Levels of Illumination in Inspection of Bearings," D. P. Hess and Ward Harrison; "Power-Station Lighting," Raymond A. Hopkins.

Evening.—Entertainment, informal dance.

TUESDAY, SEPT. 25

Morning.—Thoroughfare lighting symposium; "Pageant Street Lighting," S. G. Hibben.

Afternoon.—Boat trip with session of committee reports: "Motor-Vehicle Lighting Regulations," committee on motor-vehicle lighting (Clayton H. Sharp chairman); "Illuminating Engineering Nomenclature and Photometric Standards," committee on nomenclature and standards (E. C. Crittenden chairman); "Progress of the Tentative Code of Luminaire Design," committee to co-operate with fixture manufacturers (M. Luckiesh chairman).

Evening.—Address, Maxfield Parrish; "Light—the Designer," M. Luckiesh; outdoor spectacular lighting display.

WEDNESDAY, SEPT. 26

Morning.—"Determination of Daylight Intensity at a Window Opening," H. H. Kimball; "Utilization Factors for Daylight," Prof. H. H. Higbie; "Principles Governing Utilization of Daylight in Roof Fenestration," W. S. Brown; "Lighting for School Buildings" (preliminary draft of revised code), committee on lighting legislation (L. B. Marks chairman).

Afternoon.—Motor trip and lunch in woods.

Evening.—"Lighting of Steel Mills and Foundries," W. H. Rademacher; "Meeting Exacting Lighting Conditions," A. D. Curtis and J. L. Stair; "Railway Car Lighting," G. E. Hulse; "Effect of Dirt and Dust on Lighting Efficiency," E. A. Anderson.

THURSDAY, SEPT. 27

Morning.—"Research Problems," committee on research (E. F. Nichols chairman); "Visibility of Radiant Energy," K. S. Gibson and E. P. T. Tyndall; "Colorimetry and Photometry of Daylight and Incandescent Illuminants," Dr. I. G. Priest; "Effect of Color of Light on the Working Eye," C. E. Ferree and G. Rand.

Noon.—Council luncheon.

Afternoon.—"Accessories for Color Lighting," M. Luckiesh; "Production and Growth in Plants Under Artificial Illumination," Prof. R. H. Harvey; "Plant Growth by Artificial Lighting," Prof. Hugh Findlay; "Unit Costs of Industrial Lighting," Davis H. Tuck; "Testing Colored Material for Fastness to Light," H. S. Thayer.

Evening.—Banquet.

FRIDAY, SEPT. 28

Morning.—"How to Make the I. E. S. a Truly National Body," D. McFarlan Moore; discussion of matters pertaining to section development; discussion of chapters on "Light," prepared for high-school physics textbooks, R. W. Shenton.

New England N. E. L. A. Will Have Diversified Program

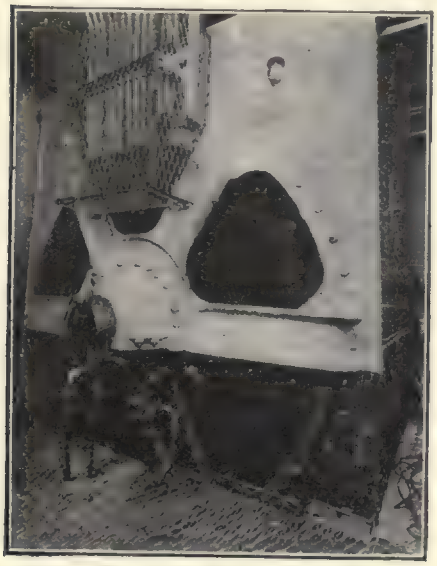
Plans are rapidly maturing for the fifteenth annual convention of the New England Geographic Division, N. E. L. A., which will be held at the New Ocean House, Swampscott, Mass., Sept. 5 to 7 inclusive, with a diversified technical, commercial and public relations program. The convention will open with a dinner at 7 p. m. Sept. 5, followed by a general session, at which President E. A. Barrows will deliver his report. The committees on accident prevention, customer ownership of securities, membership and purchasing agents will then report, followed by talks by public utility commissioners.

An entire day will be devoted to commercial sessions Sept. 6. The morning will be occupied by the power, contract and merchandising bureaus and the afternoon by the lighting, wiring, rate and new-business bureaus. The next business session will be on the afternoon of Sept. 7, when the Accounting Section will discuss the reports of the committees on merchandise and jobbing, transportation accounting, credits and collections and preservation of records, with a parallel Technical Section meeting at which the following papers will be presented: "Chronology of the Incandescent Lamp," Henry Schroeder, General Electric Company, Harrison, N. J.; "Engineering Features of the Boston Edison Weymouth Station," I. E. Moultrop and Joseph Pope, Boston; "Relaying of Interconnected Systems," C. A. Powel, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., and "Possibilities of the Future Cable," S. J. Rosch and E. F. Reid, National Conduit & Cable Company, New York.

The convention will close with a Public Relations Section dinner, with addresses by W. W. Freeman, H. A. Lemmon and others.

Four 8,000-Hp. Motors Will Propel the Colorado

The U.S.S. Colorado, ranked as the most powerful of all dreadnaughts and the last battleship the United States will build for many years, in accordance with the international naval agreement, is rapidly nearing completion at the New York Ship Building Company's yards, Philadelphia. The Colorado, which is electrically equipped and propelled, is 624 ft. long, displaces 32,600 tons and has a speed of 21 knots. Her electrical drive permits the use of her full power for both forward and reverse operation, thus providing the highest degree of maneuvering power. She burns oil and her two 15,000-hp. Westinghouse steam turbines supply electrical energy to four 8,000-hp. Westinghouse motors, which drive her propellers. The ship will go into commission in the early fall and will be manned by 1,403 officers and men. She will immediately start on a cruise around the world before joining the Pacific fleet.



ONE OF FOUR 8,000-HP. MOTORS TO DRIVE COLORADO'S PROPELLERS

Municipal Electric Plant Is Proposed for Buffalo

A proposal for the construction of a municipal electric plant for Buffalo, not to exceed in cost the sum of $5,000,000, created a fight in the Buffalo City Council when it was submitted by Commissioner Frank C. Perkins in the last meeting prior to adjournment for summer vacations. The proposal was voted down, but Commissioner Perkins insisted that he would bring it up again in September and demand a referendum at the next election.

It developed in the debate that the city is paying nearly $800,000 yearly for lighting streets and public buildings, and stress was put on the fact that in a referendum in 1907 there was a vote of four to one in favor of a municipal plant. Commissioner Perkins insisted that Detroit, Cleveland, Toronto and other cities saved millions through their publicly owned plants. On the other hand, it was argued that the present rates charged by the Buffalo General Electric Company were very low. Another commissioner argued that it was inadvisable to have an electric plant without a power load and that it was impossible for the city to sell electrical energy for power purposes.

Brief News Notes

Peshtigo Dam Completed.—Announcement has been made by the Wisconsin Public Service Corporation of the completion of its automatically operated hydro-electric plant on the Peshtigo River, erected at a cost of $500,000. This plant will help supply the power demands of the large territory covered by this company and the Menominee & Marinette Light & Traction Company.

Highway Lighting in Georgia.—Governor Clifford Walker of Georgia has approved an act giving county commissioners in counties of more than 200,000 population the right to appropriate public funds for the purpose of highway lighting. Heretofore it has been impossible to install highway lighting owing to lack of legal authority to set aside money for that purpose. The new act will do much to stimulate lighting along he important thoroughfares in the more populous countries of the state.

Million-Dollar Plant on Cumberland to Be Begun at Once.—As part of its development of power systems in eastern Kentucky, the Kentucky Utilities Company will start construction immediately of a million-dollar electric plant in Bell County, halfway between Elys and Four Mile, on the Cumberland River. The project will supply energy to many southeastern Kentucky towns and mining plants. Transmission lines will be extended to the plant to be built on Dix River, Boyle County.

Ford Will Use Largest Alternating-Current Motor in Steel Mill.—What is said to be the largest alternating-current motor for steel-mill use ever made in this country is being designed by the General Electric Company for use at the River Rouge plant of the Ford company at Detroit. This motor will develop 8,000 hp. with a speed of 240 r.p.m. It will be used to drive a large blooming mill at the River Rouge plant, for the manufacture of steel. Power will be supplied by four 2,000-kw. motor-generator sets.

Fort Wayne to Have 6-Cent Energy.—Revised schedules of rates proposed for Fort Wayne, Ind., by the Indiana Service Corporation and the city light and power plant and now before the Public Service Commission of Indiana propose a reduction in the lighting schedule of 1 cent a kilowatt for the first 150 kw.-hr. This makes the first step 6 cents per kw.-hr., the second step 5 cents for the next 300 kw.-hr., and the third step 4 cents for the next 500 kw.-hr. The minimum monthly charge will be 50 cents.

Cities Service Company Establishes New Bureau.—The board of directors of the Cities Service Company, New York City, has authorized the creation of a new department, to be known as the security holders' service bureau, for use by holders of the company's securities. The aim of the department will be to help holders of the securities with any matters which do not come under the jurisdiction of other departments. George Williams has been placed in charge of the new department and will be known as the stockholders' agent.

Alabama Water Power Before Legislature.—A resolution asking that a joint committee of two Senators and three members of the House be appointed to make an investigation of the natural resources of Alabama with a view to developing the water power of the state has been introduced in the Alabama State Senate and referred to the committee on rules. The resolution provides that this committee shall determine the general policy of the state in reference to the development of water power and the granting of rights for that purpose.

Idaho Power Takes Over Richfield Line.—The Public Utilities Commission of Idaho has recently canceled a certificate of convenience and necessity covering a transmission line in Lincoln County, Idaho, granted to the Wood River Power Company in March, 1922, and has at the same time granted to the Idaho Power Company a certificate covering the line. The action was taken on request from both companies. It is the intent to reconstruct the line for 44,000-volt operation. The line runs from Shoshone to Richfield. Power will be wholesaled to the Wood River Power Company at Richfield.

Utah Power Takes Over Municipal Load in Five Minutes.—About 200 ft. of the pipe line of the Logan City (Utah) municipal power plant was washed out a short time ago. The water had been shut off in order that some repair work might be done, and when it was turned back into the old pipe line a section of it gave way. The complete load was transferred to the Utah Power & Light Company's lines without more than five minutes' delay. Work on the new plant, for which the citizens recently voted $300,000 in bonds, will be rushed, without attempting to repair the old pipe line. In the meantime the entire load of the city's lines will be carried by the Utah Power & Light Company.

An Electrically Operated Directory Map.—A device now in use in Miami and Jacksonville, Fla., the invention of two young men, is designed to enable visitors to find their way easily in a

strange city, a large hotel or other places where it is often desirable to know the relative direction of one point to another. A large map of the business portion of a city, for instance, is hung with a directory of large business firms, the post office, theaters, churches, etc., alongside of it. Opposite each name is a push-button, and when this is pressed a tiny red light on the map indicates the location of the place wanted, while a green light shows the place at which the seeker for information is standing.

Pacific Gas & Electric Properties Not for Sale.—The Pacific Gas & Electric Company has notified the directors of the Sacramento Municipal Utility District that it will not place a valuation on its operating and distributing systems which the district has talked of purchasing, as the properties are not for sale. The Great Western Power Company has made no reply to a similar request, but is expected to refuse to fix a price for its properties for the same reason. This incident has significance in view of the fact that the San Francisco Board of Supervisors directed that similar information be obtained from both companies respecting a possible purchase of their San Francisco distribution systems for use in connection with the power from the Hetch Hetchy River.

Wisconsin Valley Company Contemplates Loop System.—If the Wisconsin Valley Electric Company of Wausau, Wis., can persuade the city of Marshfield to abandon its municipally owned steam plant, this company plans to erect a high-tension line in the form of a loop around Stevens Point, Marshfield, Stratford and Wausau to furnish electric light and power service. It will also supply Junction City, Milladore, Sherry, Auburndale and Hewitt, the smaller places on the circuit. Two proposals are under consideration. The first involves selling Marshfield all of its power, as well as the smaller places on the circuit, and the second serving all of the towns with the exception of Marshfield. With Marshfield included the company will meet the entire expense of building the power line. Without that city the company will ask that the towns to be served contribute toward the cost of the line.

General Electric Pays $1,119,300 in Supplementary Wages. — Payment has been announced by the General Electric Company of 5 per cent supplementary compensation for continuous service to all employees of the company receiving $4,000 or less per year who had completed five years or more of continuous service on June 30 last. The current payment amounts to $1,119,300, and the total number of employees to benefit is 26,324. The amounts paid by the different works and offices are: Schenectady, $436,000; Lynn, $195,000; Pittsfield, $100,000; Erie, $50,500; Fort Wayne, $50,500; lamp factories, $115,000; other factories, $21,500; district offices, $88,000; general offices, $61,800. Payments are being made in 8 per cent bonds of the General Electric Employees' Securities Corporation, in multiples of $10, the balance, if any, in cash.

Loveland (Col.) Municipal Plant Enjoined.—As a trustee of the Western Light & Power Company, which has a twenty-five-year franchise to supply Loveland, Col., with electric light and power service, the Franklin Trust Company of New York has obtained an injunction against the erection by the municipal authorities of a hydro-electric power station on the Big Thompson River to compete with the company. The trust company alleges that the city's project is illegal, even though authorized at a special election, and that it would cost $400,000 instead of the $128,000 voted, necessitating rates greatly in excess of a reasonable charge.

Union Electric Light & Power's Wired-Wireless System.—Conversations are being held daily over the 110,000-volt Keokuk dam cables between the Page Avenue substation of the Union Electric Light & Power Company, St. Louis, and the St. Charles (Mo.) substation by means of a wired-wireless system perfected by Roy L. Glasgow, assistant professor of electrical engineering at Washington University, St. Louis. The apparatus devised by Professor Glasgow comprises a duplex system whereby two transmission wires are used so that a person may talk and listen at the same time, using an ordinary telephonic transmitter and receiver, and a delicate relay system by which the incoming impulse switches in a local current to ring a bell or light a lamp as a calling signal. The transmission set uses two 5-watt tubes. Wires at each terminal are stretched for about 500 ft. parallel to the power cables. A feature of the relay system is a resistance of 2,000,000 ohms.

Big Canadian Power Plant Transferred.—Announcement is made that the Ottawa & Hull Power & Manufacturing Company's two power plants on the Chaudière just below the falls have been transferred to A. J. Nesbit, head of Nesbit, Thompson & Company, Montreal. A report that New York capitalists were interested in the transaction is denied. The first of these plants has a total rating of 18,600 hp. The second has three units of 7,500 hp. each, with room for a fourth. In addition to the Chaudière plants the company owns power rights and property at the falls below Bryson, where a big power plant is under construction. Transmission lines are being erected from Ottawa and Hull to Bryson, and when the plant is completed it will furnish an additional 60,000 hp., which will bring the aggregate capacity of the holdings of the company to more than 100,000 hp. Among the biggest consumers of the company's power are the Ottawa Hydro-Electric Commission, British American Nickel Company, Ottawa Light & Power Company, Hull Corporation and Hull Electric Company.

Associations and Societies

Electrical League of Washington Elects Officers.—The Electrical League of Washington, D. C., has elected the following officers: President, George P. Mangan; treasurer, George W. Colbeck; secretary, Robert W. McChesney; assistant secretary, Norman H. Barnes.

Mississippi Electrical League. — The annual meeting of the Mississippi Electrical League was held in Vicksburg last month with about a hundred delegates present. J. L. Longino, secretary Arkansas Light & Power Company, Pine Bluff, spoke on "The Relation of the Public Service Company to the Contractor and Dealer," and other addresses were made by utility men from Mississippi, Louisiana and Arkansas.

Electrical Co-operative League of Denver.—With more than 90 per cent of its budget for the present fiscal year underwritten in the first thirty days, the Electrical Co-operative League of Denver has started on what promises to be an even more productive period than the first two years. The program outlined will include a permanent lighting exhibit, an extensive advertising campaign, at least two electrical homes and a continuation of the field work.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

New England Division, N. E. L. A.—Swampscott, Mass., Sept. 5-8. Miss O. A. Bursiel, 149 Tremont St., Boston.

Pennsylvania Electric Association — Bedford Springs, Pa., Sept. 5-8.

Electrical Supply Jobbers' Association, Pacific Division—Gearhart, Ore., Sept. 5-7. A. H. Elliot, 502 Flatiron Bldg., San Francisco.

Pennsylvania State Association of Electrical Contractors and Dealers—Wilkes-Barre, Sept 12-13. M. G. Sellers, 15-18 Sansom Street, Philadelphia.

Conference of Electrical Leagues—Association Island, Sept. 16-19. Society for Electrical Development, New York.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 17-19. O. A. Weller, 900 15th St., Denver.

Association of Edison Illuminating Companies—Dixville Notch, N. H., Sept. 17-21. P. S. Millar, 84th St. and East End Ave., New York.

Michigan Electric Light Association—Grand Rapids, Sept. 18-20. Herbert Silvester, Detroit Edison Co., Ann Arbor.

Illuminating Engineering Society—Lake George, N. Y., Sept. 24-28. S. G. Hibben, 29 West 39th St., New York.

Association of Iron and Steel Electrical Engineers—Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

Indiana Electric Light Association—French Lick Springs, Sept. 26-29. T. Donahue, Northern Indiana Gas & Electric Co., Lafayette, Ind.

American Electrochemical Society—Dayton, Ohio, Sept. 27-29. Colin G. Fink, Columbia University, New York.

American Institute of Electrical Engineers—Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

Empire State Gas and Electric Association—Lake Placid, N. Y., Oct. 8-9. C. H. B. Chapin, Grand Central Terminal, New York.

Association of Electragists International—Washington, Oct. 8-13. Farquson Johnson, 15 West 37th St., New York.

Commission Rulings

Operation at a Loss Cannot Be Compelled.—Declaring that a public utility company cannot be compelled to operate for the service of the public at a loss where it is impossible to hold out to it the possibility of earning operating expenses, including depreciation and a fair return upon its property serving the public, the Indiana Public Service Commission granted the Winona Electric Light & Water Company authority to discontinue steam-heating service.

Deferred Charges and Stock and Bond Discount Not Capitalizable Items.—The Missouri Public Service Commission in authorizing the issue of new stock by the Missouri Gas & Electric Service Company decreed that deferred charges representing uncompleted maintenance work, promotion of new business, equalization accounts and suspense are of doubtful character as assets and are properly chargeable to current operating expenses, to income or to surplus. Stock and bond discount and expenses also, the commission held, are not proper items against which capital stock may be issued.

Proper Construction of Line Feeding Amusement Resort Insisted On.—The Public Utilities Commission of Ohio has ordered the Ohio Public Service Company not to sell any energy to the Mahoning Power Lines Company of Youngstown for use on the latter company's line to Milton Lake, where there is an amusement resort, until the Mahoning company shall have reconstructed a new 6,600-volt transmission line between Newton Falls and Craig's landing to conform to the regulations of the commission. The commission says that the transmission line is in dangerous proximity to the lines of a telephone company, the stipulated separation distance of 4 ft. not having been maintained, and that too few poles have been used to prevent dangerous sagging.

Rural Customer Should Not Be Made Responsible for Depreciation.—The Wisconsin Railroad Commission has disapproved a proposal satisfactory to both the Caroline Electric Company and a rural customer of its by which the company was to be relieved of all obligation to provide for depreciation reserves, the customer, who owns the line, undertaking to be responsible for its reconstruction and equipment. The commission held that such a division of responsibilities would interfere with adequate service and doubted the average customer's ability to judge requirements necessary to keep a plant in condition to render adequate service and to protect life and property. Recommendation was made that a monthly service charge sufficient to cover depreciation be imposed in addition to the rate for energy, or, failing this, that the line in question be turned over to the Marion Light & Power Company.

In Obtaining Rates Based on Combined Operation of Different Departments Company Waived Constitutional Right to Abandon Any Part of Service.—The Montana Public Service Commission has refused to permit the Helena Light & Railway Company to abandon railway lines operated at a loss, saying: "In this case we are satisfied that the company has explicitly and by long-continued conduct waived its right to insist that an unprofitable unit of its street-railway system be discontinued. The waiver comes from the company's own request that its street-railway utility, its electric utility and its gas utility be considered as one property and that, so treated, a fair return be provided for the consolidated property. This fair return has been provided by rates fixed by the commission, and under such circumstances the company's request has been fully met."

Recent Court Decisions

Powers of California Commission.—In Saunby vs. California Railroad Commission, a suit brought at the instance of customers of the Southern California Edison Company to have the rate decision of the commission affecting that company reviewed and annulled, the Supreme Court of the state held that it had not jurisdiction to inquire into the propriety of an order of the commission in limiting an investigation as to the reasonableness of the rates of an electric company, and in leaving the final adjustment of the rates to a proceeding to be later instituted by the commission on its own motion, in view of the broad powers conferred by the constitution upon the commission, the courts being empowered to interfere with the orders of the board only when they violate some constitutional provision, such as denial of due process of law, etc. (215 Pac. 905.) In Coast Truck Line vs. Commission, a case where the commission ordered the company to apply for a certificate of public convenience and necessity before continuing to do business between certain points, the company held, first, that the commission had no jurisdiction over the subject matter of the complaint; second, that the commission exceeded its authority in the issuance of an injunction, and, third, that the decision of the commission was unsupported by evidence and contrary to law. The Supreme Court found for the commission on all three points. (215 Pac. 898.)*

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

City Not Party to Proceeding in Which Rates Were Declared Excessive Cannot Enjoin Their Collection.—The city of La Crosse brought suit against the Wisconsin-Minnesota Light & Power Company to enjoin the collection of alleged excessive rates, basing its action on the fact that similar rates in Eau Claire and other cities supplied by the company were found excessive by the courts. The Wisconsin Supreme Court has held that La Crosse not having been a party to the suit in question, there has been no adjudication that the rates were excessive as to it and that the city must carry its complaint to the Wisconsin Railroad Commission before bringing action in the courts. (194 N. W. 47.)

Failure to Keep Proper Accounts Operates Against Company Seeking 20-Cent Rate.—On Oct. 1, 1920, the New Hampshire Public Service Commission granted the Plymouth Electric Light Company permission to charge 25 cents per kilowatt-hour for domestic lighting as an emergency measure to meet the exceedingly high price of coal. The company, at the request of the commission, on April 1, 1921, reduced the rate to 20 cents, but declined to make any further reduction. The commission issued an order April 30, 1921, fixing the rate at 18 cents. Upon motion of the company a rehearing was granted, and the order in the meantime suspended. Following the submission of the issue, the commission on Jan. 27, 1922, filed an exhaustive report of its findings and issued an order effective Feb. 1, 1922, fixing the maximum rate at 16 cents, with a minimum charge of $1.50. The company thereafter appealed to the Supreme Court of the state on the following points: (1) the question of the jurisdiction of the commission to lower the 18-cent rate on the company's motion for a rehearing, and (2) the question of the sufficiency of the 16-cent rate to afford the company a fair return on the fair value of its property devoted to public use. The Supreme Court has sustained the commission's order and dismissed the appeal, holding that there was not a clear predonderance of evidence that the order of the commission was unjust or unreasonable. The court held that that statute did not preclude the commission from lowering the rate-base value within two years after previous reduction, that disregard of present-day values in determining the rate base was not established, that the sale price of the company's assets was not a reliable criterion of value for use in determining the rate base, that the records indicating actual operation expenses were valuable, though not conclusive, evidence of requirements of the utility to be considered in determining the rate base, and that a company failing to keep accounts as required by statute cannot complain because expenses of like utilities similar in size and location are used in determining rates, notwithstanding that such comparative estimates are at most only approximate and unreliable. (120 At. 689.)

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Governor Scrugham Advocate of Commission for Colorado River Development

James G. Scrugham, Governor of Nevada, has recently proposed that the Colorado River situation be turned over to a commission similar to the port authority of the Port of New York for solution. Governor Scrugham is an engineer who has attained a high position in civic life. Since his graduation from the University of Kentucky in 1900 Mr. Scrugham, who is now forty-two years of age, has been actively employed as teacher, engineer, soldier and Governor in the Intermountain District. In 1903 he became professor of engineering at the University of Nevada and eleven years later was made dean of the engineering schools at that institution. While at the university he was actively connected with engineering and mining enterprises in the state and was an associate member of the consulting board of the United States Navy. During this period Mr. Scrugham was also active in the founding of the Pacific Coast Electrical Association, which is the Pacific Coast Division of the National Electric Light Association. He resigned his professor's chair in 1917 to become State Engineer of Nevada, in which capacity he displayed much energy and skill in the administration of the state water law with particular reference to irrigation and hydro-electric development. During the world war the government placed him on the board of regular army officers that co-ordinated the artillery program of this country with that of the Allies.

J. G. SCRUGHAM

Both as State Engineer and as Governor of Nevada, Colonel Scrugham has contributed many constructive ideas to the formulation of legislation and to engineering activities incident to the findings of the Colorado River Commission.

R. J. Vincent of the distribution engineering department of the Consumers' Power Company at Jackson, Mich., has been transferred to the position of distribution engineer at Owosso.

Tom Kennedy, formerly of the Denver Gas & Electric Light Company, has been made general commercial manager of the Doherty chain of utilities, succeeding George Williams, who has been named as stockholders' agent of the Cities Service Company.

L. A. Fiorani has been appointed chairman of the Merchandising Bureau of the Commercial Section, New England Division, N. E. L. A. Mr. Fiorani is commercial manager of the Union Electric Light & Power Company, Franklin, Mass.

J. J. Burri, who has been associated with the Kansas Gas & Electric Company as construction engineer during the past year, has received an appointment with the Phoenix Utility Company in Cuba. Mr. Burri will be stationed at Cienfuegos.

Louis C. Ayres, George E. Lewis, Robert Norris and **Donald C. May** have formed a partnership as consulting hydraulic and electrical engineers with offices in Ann Arbor, Mich. All of these men have been connected with Gardner S. Williams, consulting engineer of that city, Mr. Ayres as principal assistant engineer, Mr. Lewis as electrical engineer, Mr. Norris as supervising engineer and Mr. May as designing engineer.

George H. Wilmarth, manager of the Muskogee division of the Oklahoma Gas & Electric Company, has resigned to become manager of the Wisconsin-Minnesota Light & Power Company with headquarters at Eau Claire. The Wisconsin-Minnesota Light & Power Company was recently made part of the Northern States Power system. R. N. Pack, vice-president and general manager of the Northern States Power Company, made the announcement concerning Mr. Wilmarth's appointment.

D. C. Ray of the Pacific Gas & Electric Company has been appointed manager of the bureau of public relations, one of the constituents of the recently organized department of public relations and sales. Before going to the San Francisco office in 1921 Mr. Ray had been ten years in the Martinez office in the capacity of manager, and previous to that he was assistant manager at Grass Valley. In his new position he will work with H. M. Crawford sales manager.

G. W. Faller Assistant General Manager in Denver

Guy W. Faller, since 1913 vice-president and general manager of the City Light & Water Company, Amarillo, Tex., has been appointed assistant general manager of the Denver Gas & Electric Light Company and has already assumed his new duties. Mr. Faller was formerly with the Denver company, having served as assistant foreman of the street department, engineer of the gas distribution department and then as assistant superintendent of the gas and street department until his transfer to Amarillo in 1905 as general superintendent of the company there. As a native of Wisconsin he was appointed to the United States Naval Academy in 1894 and was graduated with the class of 1898 just in time to take an active part as an engineer officer in the Spanish-American War. He resigned from the navy in 1903 to become the operating engineer of the Madison (Wis.) Gas & Electric Company and remained there until his first transfer to Denver by Henry L. Doherty. During the existence of the Amarillo Street Railway Company he served as vice-president, general manager, federal receiver and special master of the company. In going to Denver to assume his new office, which was only recently created, relief will be given to the general manager and the general superintendent of the company in some of their duties and in the re-establishment of the Doherty Training School, of which Mr. Faller acts as director.

G. W. FALLER

John A. Reed, general manager of the Iowa Electric Company, Cedar Rapids, Iowa, has been made a vice-president of the company.

Ernest T. Craig, for the past sixteen months assistant manager of the Leominster (Mass.) Electric Light & Power Company, has been appointed manager, succeeding Ezra O. Wedge, who has resigned on account of ill health. Mr. Wedge became manager of the company in 1917.

D. C. McClure New President of Rocky Mountain Division

D. C. McClure, elected to head the Rocky Mountain Division of the National Electric Light Association, is the youngest man ever elected to that office. Mr. McClure was born in Coxsackie, N. Y., in 1890 and was graduated from Rensselaer Polytechnic Institute with the degree of electrical engineer in 1913. Immediately he entered the service of Henry L. Doherty & Company and was assigned to the cadet training school maintained by the company at Denver, Col. After completing the course he was detailed to design and revamp the electrical generating and transmission system of the Denver Gas & Electric Light Company. For a year and a half prior to the war he devoted his time to operating work as assistant superintendent of the electrical department, and upon his return from war service in 1919 he re-entered the employ of the Denver company as superintendent of the electric and steam-heating departments, the position he holds at the present time. Mr. McClure has been second vice-president and first vice-president of the association he now heads.

D. C. McCLURE

Arthur Gillete, formerly chief engineer of the Consumers' Power Company at Pontiac, Mich., has been made the new hydro-electric foreman on the Au Sable River. Mr. Gillete received this promotion when Arthur Robinson resigned.

Frank H. Wentworth, for some years manager of the Natick office of the Edison Electric Illuminating Company of Boston and later manager at Brookline, has been promoted to the position of district manager at Somerville. Mr. Wentworth is suceeding H. W. Jones, who resigned.

O. L. Mackell, chief clerk and office manager of the Denver Gas & Electric Light Company, was recently elected to head the Electrical Co-operative League in Denver. Mr. Mackell has been identified with the electrical industry of Denver for ten years and during that period has been active in the affairs of the National Electric Light Association, the Denver Civic and Commercial Association and other business groups. Since the organization of the Electrical Co-operative League he has been a member of the advisory board and served last year as treasurer. Dean D. Clark, who served on the advisory board of the league last year, has been elected to succeed Mr. Mackell as treasurer of the organization.

Earl F. Whitney, for fifteen years connected with the General Electric Company in the Northwest, has been appointed manager of the Portland (Ore.) office to succeed A. S. Moody, formerly assistant Northwest manager, who was recently made manager of the Los Angeles office of the company. Mr. Whitney has been in the San Francisco office, the Seattle office, and in 1912 was transferred from there to Portland. Since that time, with the exception of two years during the war, he has specialized on electrical applications in the logging and lumbering industry of Oregon and Washington and for the last four years has been manager of the lumber industries department of the General Electric Company in the Northwest.

T. T. Richards Is Made Vice-President of Wagner Electric

Thomas T. Richards, who was recently elected to the office of vice-president of the Wagner Electric Corporation, has been associated with the company since 1905. In that year he joined the sales department and subsequently advanced to the office of new-business manager with the additional duties of advertising and assistant sales manager. Four years ago he was made sales manager, which position he occupied until his recent election as vice-president and manager of sales.

Mr. Richards was born in St. Louis, Mo., in 1871. His early schooling was at Smith Academy in that city, and he was graduated in 1888 from the St. Louis Manual Training School. After taking an engineering course at Washington University he spent two years in the plant of the Emerson Electrical Manufacturing Company and two summers in the plant of the Wagner company. This practical factory experience was followed by the student course of the Westinghouse Electric & Manufacturing Company. Upon his return to the Emerson company he was elected vice-president and for several years performed the duties of this office. Mr. Richards is a member of the National Electric Light Association, the American Institute of Electrical Engineers and the Power Club.

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T. T. RICHARDS

George W. Vaughan, formerly assistant professor of electrical engineering at Trinity College, Durham, N. C., is now connected with the electrical division of Electric Bond & Share Company.

Obituary

Hermann J. Strobel, supervisor of appraisals, Stone & Webster, Inc., Boston, died Aug. 3, following an operation. Mr. Strobel was forty-one years of age and had been with Stone & Webster since 1911. From 1905 to 1911 he was chief draftsman and assistant engineer on the Port Morris and Yonkers generating station developments of the New York Central lines. He was assigned to electrical work upon the South Boston station of the Boston Elevated Railway after joining the Stone & Webster organization and in 1917 took up appraisal work.

Arthur H. Jones, formerly superintendent of the Greensboro (N. C.) Electric Company, now the North Carolina Public Service Company, and well known throughout the Southeast as an electrical engineer, died in the latter part of July at his home in Atlanta, Ga., at the age of fifty-five years. Death resulted from a stroke of paralysis which he suffered several months ago. Since his retirement from the Greensboro company four years ago Mr. Jones had been identified with the electrical machinery business in Atlanta as head of the Jones Machinery Company.

J. W. Peterson, formerly president of the Richardson-Phenix Company of Milwaukee, died in that city on July 24, at the age of forty-seven. In 1903 Mr. Peterson went to Cuba as a representative of the Westinghouse Electric & Manufacturing Company, remaining there two years, when he returned to the United States to ally himself with the American Blower Company. Early in 1907 he became connected with the Van Dyke Churchill Company, a New York firm, thereby laying the foundation of the oiling-system business which was to be his life's work. Mr. Peterson was a member of the A.S.M.E.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Influence of Credit Analysis on Earnings*

A Discussion of the Part that Credit Study May Be Made to Take in Reducing Business Risks—Diversity of Problems in the Electrical Industry

BY E. W. SHEPARD
General Credit Manager Western Electric Company

OWNERS or stockholders of a business furnish its original capital, and the way in which it is used determines the success or failure of the concern. Unless the management has the ability to invest and handle its own capital successfully, there is no reason to believe it will be more successful in handling the funds of its bank or suppliers. Therefore the work of the credit man is closely concerned with the most important problems of business management.

It is generally accepted that the two fundamentals of credit are character and capacity. Character, of course, must be present, but the discovery and development of capacity, in customers giving us the major share of their business, is the most interesting part of credit work and in my opinion our greatest responsibility.

THE TOLL OF FAILURES

The record of failures for the past five years, according to statistics of Dun & Company, was as follows:

	No. of Failures	Per Cent of Failures to Concerns in Business	Liabilities
1922...	23,676	1.19	$623,896,000
1921...	19,652	1.02	627,402,000
1920...	8,881	.49	295,122,000
1919..	6,451	.38	113,291,000
1918...	9,982	.58	163,020,000

Perhaps none of these is what might be considered a normal year, but the last two years, with their tremendous liabilities caused by the inflation period which culminated in 1920, at least demonstrate that we should take advantage of our lessons of the past. The classification of causes of failure shows that from 75 to 85 per cent are within the control of the management. Is not the development of better business management therefore our principal problem?

Credit men have many sources of information for determining capacity, or, otherwise expressed, "in reaching conclusions," but it is recognized that the most valuable source is the comparative balance sheet and operating statement. The analysis of comparative figures shows that although the problems of many concerns are similar, there is a great difference in their degree of seriousness. Each business has its individual problems, and capacity cannot be measured on the basis of ratios in each industry.

Owing to the numerous classes of customers in the electrical industry, I believe we have more interesting credit and collection problems than in those industries where there is only one channel of distribution. A few of the more important classes are as follows: (1) Central stations; (2) industrials; (3) contractor-dealers; (4) railroads; (5) municipalities. These, of course, may be divided into two major classifications —those who buy for consumption, and those who buy for resale. However, in order to be more definite, I shall limit my remarks on capital investment to two classes — central stations and contractor-dealers.

CENTRAL-STATION ELEMENTS

The balance sheets of many central stations and other public utilities show that most of the capital investment is tied up in fixed assets and that a large part, if not all, of the current assets are represented by floating debt such as notes and accounts payable. Investigation of a condition like this usually shows that the promoter either buys new property or starts new construction work before proper financing has been effected. This often necessitates the use of bank funds and suppliers' money for permanent capital, or until the debts may be liquidated either through the sale of securities or increased earnings.

Would it not be just as logical for an individual to build a home on the same basis? Why should he not let contracts for labor and material and when furnished try to finance by the sale of a mortgage? You all know who would carry the investment if he was not successful in selling the mortgage. Almost any one will recognize that this is unsound financing, and the sooner these promoters are educated to finance new construction work or new property before rather than after purchase the better it will be for the industry.

There is our greatest opportunity for improving the mortality rate in the industry. The capital investment is often of such a minor quantity, or has been tied up in such a way, that the customer fails to keep his funds in liquid condition. What we are interested in primarily is the bill-paying ability of the customer, and this is demonstrated by the relation of current assets to current liabilities.

There are many instances among this class of customers where too large a proportion of capital has been invested in the following assets: (1) Merchandise; (2) receivables; (3) fixed assets. Unquestionably all of us have analyzed financial statements during the past few years that showed customers who were bankrupt and didn't know it. If discovered soon enough, large investments in merchandise and receivables may in time be properly liquidated, but large investments in fixed assets often prove fatal.

CONTRACTORS' PROBLEM

For many years emphasis has been placed on proper accounting methods for contractors and dealers. This educational work has also been going on in other industries, but progress has been slow. What then can we do to improve conditions, or, in other words, decrease failures and losses? A desire must be created on the part

*A paper read before the National Electrical Credit Association, Boston, Aug. 10, 1923.

of the contractor-dealer *to know conditions before too late.* He must be convinced that the proverb "An ounce of prevention is worth a pound of cure" applies to business as well as to the physical condition of the individual. In my opinion, we can all stimulate this desire to know by showing customers the necessity, value and use of a monthly analysis. The National Electrical Credit Association and the affiliated associations could also do good work in advertising: "Analyze your business monthly; it pays dividends." Perhaps some one will suggest a shorter and better slogan. The accompanying form is suggested for a simple monthly analysis.

FORM FOR ANALYSIS OF BUSINESS

	July 1923	July 1922	Seven Months 1923	Seven Months 1922
Total sales......	....	....	....	....
Gross profits....	....	....	....	....
Expense.........	....	....	....	....
Investments:				
Merchandise......	....	....	....	....
Receivables	....	....	....	....

These figures of course necessitate a proper accounting system. The only figure to be estimated is the merchandise investment at times when a physical inventory cannot be taken. It is a natural assumption that the electrical manufacturers and jobbers know not only how they stand but in what direction they are going each month. Therefore we have a responsibility in educating these customers, with less experience, as to the value of frequent analysis and how to find the proper remedy when one is needed. Intelligent effort along this line will benefit not only the contractor dealers but the electrical industry as a whole.

An Experience in Simplification

How One Company Has Put the Principle in Effect by Actual Elimination—How It Benefits in Actual Practice

BY A MANUFACTURER

AT THE recent conventions of the Associated Manufacturers of Electrical Supplies and the Electrical Supply Jobbers' Association simplification was one of the principal issues before the members and perhaps the most generally discussed topic. The jobbers are clamoring for a reduction in the number of varieties in manufactured lines. Several manufacturers have made very extensive eliminations of duplicating items or other excess varieties. Manufacturers generally are feeling more directly the importance of doing something to promote the economies that appear to be offered and are recognizing the possibility that something may be done even with their own product. What is needed most, I believe, is a free discussion of the subject that will bring out the experience of various manufacturers in the electrical industry who have made a serious effort to simplify their lines.

MAKING A START

A couple of years ago or more this company realized that it had too many listings of electrical material. There was too much overlapping and some duplication. In some cases we are making three devices which serve the same purpose where in all probability one would suffice in so far as the needs of the user are concerned. We were listing in our catalog some 1,400 or 1,500 numbers in the line of sockets, receptacles and specialties. We had another thousand numbers or more in our marine line. We had about 4,800 numbers in our panelboard line. We made a very careful study of our enameled-steel reflector line from the standpoint of what the consumer really requires and found it possible to discontinue making a considerable number that had appealed to us when they were brought out as interesting and necessary developments in the line but which are today not actually essential to the adequate service of the market. The sum total of this gave us a 200-page catalog which required about thirty pages for the purpose of indexing alone.

Of course, it is difficult to strip an article out of the line arbitrarily as long as the annual sales seem to justify keeping it in listings. However, we decided to take a firm stand and begin gradually to eliminate all obsolescent material and step by step to reduce the number of devices which tended to duplicate one another in purpose.

The result was that early this year we sent out notices to our distributors which retired from our list about 200 catalog numbers and rendered them invalid. Since our first notice we have accumulated a list of seventy or eighty more catalog numbers which will shortly be included in a notice of discontinued devices.

We also contemplate a reduction of more than one-third in our marine list of water-tight and steam-tight fittings and our panelboard line. We have recently reduced the number of pages of listings on panels in the hands of the publishers who print catalogs for electrical supply jobbers from forty-eight to seventeen.

All of this is a move in the direction of practical simplification, and we intend to carry on this standardizing process until we have arrived at the point where the rule is pretty generally in practice that there should be "one device or one design only for each specific purpose."

This policy is having a far-reaching effect on the listings of all our material which are appearing and will appear in future electrical supply jobbers' catalogs. We have reduced the number of catalog pages which we ask the jobber to take by about 50 per cent. In fact, we are trying to include in the pages which are offered to jobbers for their catalogs only that material which we believe the jobber can reasonably stock, and we base our selection on what we believe will be the jobbers' turnover.

RESULT FOR JOBBER

While, of course, we are not even yet fully cognizant just what material of ours the jobber should stock, it is our desire and plan to promote only those listings reaching the hands of publishers of catalogs which include fairly fast-moving material. Gradually, as the manufacturers take steps in this direction and the jobber himself studies his own stock from a standpoint of turnover, this new policy will have a far-reaching and beneficial effect upon the entire jobbing business. One result will be that there will be less of the jobbers' catalog tied up in dead stock and slow-moving material.

Inasmuch as all of this works around in a circle, we thoroughly believe that the effect of this policy of standardization and simplification, when once it is reflected in distributors' stocks and when once they have been able to reduce very greatly the number of items they carry, will be that the manufacturer will find his volume greatly increased on those items which are retained. As a result prices will tend to come down and selling expense will be greatly

reduced all the way along. With this increase in turnover, profits will be increased and both manufacturer and jobber will be enabled to lift themselves out of the unprofitable conditions that have been surrounding the electrical supply business for these last several years.

Where Economies Come

The first result of such a program of simplification will, of course, be the reduction of catalogs, and this is the first end to seek. But it can only be achieved by co-operation between the manufacturer and the dealer. If the jobber leaves out ten items and the manufacturer continues to list them and send his catalogs into the jobber's territory, customers will continue to order them from the jobber and he will usually fill the orders. Working together, however, it is neither a long nor a difficult process to remove a device from the demand if one had an improved substitute to offer. Such a reduction in the size of supply catalogs will conserve a large amount of money in the electrical industry. But it will save far more in the effect that will follow in the day-to-day process of ordering, handling, shipping, billing and warehousing of the actual stock. And not only the manufacturer and jobber but the contractor, the dealer, the central station, the industrial plant and all other purchasers will be benefited by the elimination of excess-stock investment, unnecessary labor and waste in space, which all costs money. Surely it is an end greatly to be desired and worth working for.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

BUSINESS developed a decided spurt Monday after the cessation of last week, orders upon jobbers piling up through accumulated withholding. Seasonal conditions still control the larger trend of affairs, however, and there is considerable hesitancy in purchasing for remote deliveries. Stocks are meeting current demands without much trouble, although in New England a few sizes of conduit boxes were scarce at the beginning of the week and the usual protracted delivery conditions on porcelain prevailed. Prices are firm on the whole, with minor readjustments. Stiffer quotations on cotton had not been reflected in the price of wire among jobbers at the week end. Building operations continue active and central-station outputs are gaining rapidly. Car loadings are at the peak, surpassing all previous records in the country as a whole. Labor's pay has a high purchasing power compared with even the 1920 peak, and the opinion is widespread that much more liquidation in wages is essential to sound business expansion. Money is fairly easy and credits are in good shape for the most part in the electrical industry, according to reports before the Boston convention of the National Electrical Credit Association last week.

Non-Renewable Fuse Business Slow with High Competition

PRESENT sales of non-renewable fuses, as reported by five makers, are running the same as every month since January of this year. There has been very little variation this year, they say. The renewable fuse has undoubtedly kept the sales of this type of fuse from increasing. The only favorable factor in the market has been the stabilization of prices after a long period of very severe competition.

In view of the fact that there is about five times more manufacturing capacity than there is demand, it is obvious that deliveries are exceptionally good. It is said that any manufacturer can deliver any reasonable quantity from stock. This field is probably the most overburdened from the standpoint of the makers of all in the industry. The total volume of non-renewable fuse sales is not over $1,250,000 a year, and there are about fifteen manufacturers dividing this business.

Prices have not changed recently, and they are not very apt to change in the near future. The present price is very low, yet the price cannot go higher on account of the excessive competition in the field, and the manufacturers can hardly make the fuses at a lower price.

Range Makers Do Not Expect Usual Fall Slump

RANGE sales are running considerably higher than they were one year ago, reports just received from six leading manufacturers agree, but the reports add that orders during the first quarter of the year were approximately 35 per cent heavier than the present volume. All of these manufacturers are of the opinion that there is a great deal more interest in ranges this year on the part of central-station companies, which have gone after the range business with renewed effort. No doubt, says one of the most important makers, the preparatory work of the "better business program" of the National Electric Light Association, started last year, has helped the range business. Improvement in general business conditions has given the central stations more confidence to plan campaigns and to make them successful.

Deliveries by the majority of the six makers are normal, although one describes the delivery situation as longer than normal because the business increase has been so much larger than anticipated and says it will take until the end of the year to catch up. This sales manager says his business would be even larger if he could deliver from stock. "It will take years to get the central stations to plan their range sales well ahead in order to give the manufacturers opportunity to take care of shipment during the peak season," he declares.

Prices are firm and are quite likely to continue so. The range business has acquired such momentum that manufacturers expect it to continue good at the present rate and are not looking for the usual fall slump. They look for a fine fall and holiday market.

Appliance Sales in Middle West Are Exceptional

APPLIANCE sales throughout the Middle West for June and July, according to central stations, jobbers and manufacturers, have been better than for the corresponding period in 1922. One utility serving a widespread territory around Chicago reports a 50 per cent increase in its appliance sales for the first six months of 1923 over 1922. The hot weather during June created an excellent demand for fans which has about depleted stocks of most companies. This organization also reports a very active sale of percolators, toasters and grills. While the stores in the larger towns have felt most of this good business, yet every salesroom in the smaller towns has come to the front with a similar increase in sales.

In the city of Chicago the sale of irons, washers and vacuum cleaners, percolators and grills is running on a much higher merchandising rate than it did in 1922. The local utility company, with shops in the "Loop," has had an increase in business to about 30 per cent better than in June, 1922. During that month a portable-lamp sale was conducted with excellent results. Although the July figures have not come up to those of June, they are, however, much higher than those obtained for July, 1922. The sales on fans have been so good that stocks are now low.

Accounts from a local manufacturer indicates that the sales on appliances, including toasters, grills, percolators, etc., have been running about 12 to 14 per cent better this summer than in the preceding year. They feel that the slight summer slump over the June

sales will gradually work off into more and better business throughout the fall, culminating in an excellent Christmas business. At present there is no indication of any price changes for the next three months.

In the jobbing line the same relative percentages seem to hold true, although in some cases where sales efforts have not been as aggressive such excellent increases have not been reported. However, most jobbers report that their general summer business has been developing at a normal rate and is much better than the business that was done last year.

Healthy Business in Fixtures Reported for South

BUSINESS in the Atlanta territory as a whole is very good, but jobbers report a falling off in orders from south Georgia due to crop failures on account of rain in that section. Considerable interest is being displayed by central-station companies in campaigns for improved lighting, and jobbers and dealers are putting on sales campaigns, with the result that a very healthy movement in both commercial and residential fixture lines is reported. A rather general price reduction in schedule material is reported, the reduction varying in extent from 5 per cent to 10 per cent.

Recognition of electrical appliances as labor-saving devices is becoming more general as evidenced by the installation of fifteen electric ranges in a new apartment house in Atlanta and a similar number in an apartment house in Selma, Ala., while two large apartment houses nearing completion in Atlanta have been equipped with refrigerating machines, one house installing thirty "Frigidaires" and the other thirty-five "Kelvinators." One apartment house in Birmingham has installed seventy-three "Kelvinators" this season.

Chicago Trade Is Quiet; Lamp Cord Reduced

ELECTRICAL business in Chicago remains rather quiet with the jobbers. There were no important reductions in prices, with the exception of lamp cord. One manufacturer has reduced the price of all lamp cord approximately 10 per cent, and it is expected that the other manufacturers will follow suit between now and the first of September.

Pole-line hardware demand is good and is keeping up to last month's pace. The conduit situation is not any better and the consensus of opinion of the various manufacturers seems to be that prices will advance in the fall. This probably is due to the enactment of the eight-hour day in the steel industry, which will go into effect shortly. Certainly stocks are no more complete and the situation as to deliveries has not improved materially. The railroad situation is affecting most commodities, and although the railroads are attempting to put on additional equipment to take care of the increase in shipping, the congestion is being felt in this section.

Building activity gained a little this week, and it is expected that the month as a whole will show an increase over last month. Labor conditions show improvement.

Slower Non-Metallic Conduit Business Is Seen by Makers

NON-metallic conduits are in somewhat less demand than they were six months ago, owing principally to the fact that jobbers stocked up rather liberally on the advancing market and have adequate stocks at the present time.

A great many orders were taken by manufacturers which might be called blanket or protection orders. These amount to nothing more than an option to purchase on the part of the jobbers, subject to cancellation if the market declines or if for any reason the jobbers decide they do not need or want the material. There has been a tendency recently to discontinue this bad practice, and the manufacturers have hopes that the non-metallic-conduit business of the future will be conducted on more businesslike principles; in other words, that orders for actual requirements will be placed for reasonably prompt delivery only.

Manufacturers do not expect to do a large volume of non-metallic-conduit business during the next six months, for the reason that jobbers' stocks are probably larger than normal and the demand from the building and automobile industries is showing a tendency to fall off.

The present average price of this commodity is only 20 per cent higher than it was at the low point in 1921, and as costs of manufacture, both labor and material, have greatly increased, the market is expected to be fairly firm in spite of the prospects of a reduced volume of business.

A Review of the Summer's Fan Market

Sales Showed Slight Increase, Although Bookings for 1923 Were Below 1922—Tendency Is for Better Product and Reasonable Price to Increase National Consumption

AS FANS are seasonal, the weather is always the main factor in determining sales to the consumer. The season of 1921 was very good, whereas the season of 1922 was very poor, leaving big stocks of fans on hand with the jobbers and dealers, particularly the dealers. Orders booked by the manufacturers for 1922, however, were comparatively high, whereas for 1923 they were low, this being a direct reflection from the heavy stocks carried over by the resellers from 1922.

Believe Stocks Are Low

Wholesaling of fans is well over by the first of July, and although reports of resales have not as yet been obtainable, the unusual heat strain that the country suffered during the last few days of May, and the continued warm weather of June and early July gives assurance of very good retail conditions this year and the closing out of stocks practically everywhere in the United States. Weather conditions indicate that with the exception of the extreme South and the Pacific Coast, all localities have had more than the usual amount of hot weather. This, coming as it did in June and again in July, has resulted in exceptionally good fan business. This manufacturer estimates his sales for 1923 as 50 per cent greater than last year. Further assurance of this is derived from telegraphic and long-distance requests for emergency shipments during the latter part of June and the early part of July. The 1923 season will doubtless close very much more favorably all around than last year.

Manufacturers believe that in future years the matter of price will not be such a factor as heretofore. The consumers, they say, want a good product and a durable one, and they find that the cost is not the biggest factor in buying an appliance with a motor. It is believed the tendency for the next year with the majority of manufacturers will be to produce a satisfactory fan at a reasonable price. As for cheapening the product to make a lower price possible, it has proved impracticable and unprofitable in the past for many manufacturers. Those who have consistently supported the policy of "a reliable fan at a reasonable price" find that their sales this year are far greater than any they have ever experienced. It is known that their production was sold before April 1.

Expect Firm Prices

Prices will, no doubt, remain unchanged at least until Sept. 30, 1923, which is the date generally agreed upon as the end of the fan season. It is the opinion of the manufacturers that there will be very little price change for 1924 unless there is something unlooked-for in the labor and material markets.

The principal outlook for business in the last six months of 1923 would be in export, except some special orders and perhaps late bookings of this year for 1924. The export business shows better activity at this time than it has for several years and may be expected to continue with a fair percentage of increase. Whatever bookings may be taken during the latter part of this year for domestic deliveries early next year are expected to be very favorable compared with the latter part of 1922. So may also the bookings taken for the early months of 1924 be favorable compared with the same period in 1923.

Exports in First Half of This Year Amounted to $34,514,924

EXPORTS of electrical apparatus and supplies from the United States during the first six months of 1923 were valued at $34,514,924, which represents an increase of $2,894,412 over the corresponding period of 1922, according to preliminary figures announced by the electrical division of the Department of Commerce. The increase is attributed mainly to increased business in small plants and supply lines rather than in heavy power equipment. The announcement gives the following summary of exports for the semi-annual period:

The total value of generating apparatus exported, including both alternating-current and direct-current equipment, was $2,025,171 during the first six months of 1923, a 6.8 per cent increase over the same period of 1922. Shipments of mechanical-drive turbines taken alone, however, were less this year than during the half of 1922.

Export shipments of self-contained lighting plants during the first half of 1923 were nearly double in value those of the same period of 1922. More than 1,200 lighting sets were shipped between January and July of this year.

Dry-battery exports increased about 36 per cent in number and 15 per cent in value during the period in question in comparison with 1922. Storage-battery shipments also showed a heavy increase, $1,224,572 worth being the amount exported during the first half of 1923, while the total was only $653,539 for the same period of 1922.

Shipments of transformers, converters, switchboards, circuit breakers and lightning arresters aggregated $4,384,619 in value during the first half of 1923. This is somewhat less than the exports during the same period of the previous year, which were swelled by large individual shipments of power-plant equipment.

The total for all kinds of meters shipped abroad between January and July, 1923, amounted in value to $686,109, also a decrease over the previous year.

Fractional-horsepower motors gained largely over 1922, a total of 68,332 motors valued at $981,533 having been exported during the first six months of the year. Shipments of other kinds of motors, however, fell off during the first half of 1923. Thirty-four electric railroad locomotives, valued at $1,926,990, were sent to foreign markets. In the same period of 1922 there were only two such locomotives shipped, valued at $22,361.

The value of electric fans exported during the January-June period in 1923 was $513,867 as against $497,055 during 1922. It is interesting to note that the number of fans shipped was 6,793 less than in 1922.

Shipments of metal-filament lamps decreased in value, although a larger number were exported during the half of 1923 than during 1922. A total of 118,955 motor-driven household devices went abroad during the first half of 1923, these being valued at $453,254. This is an increase of 57 per cent over the same period of 1922. An even larger increase took place in the case of domestic heating and cooking appliances, the total for the first half of this year being valued at $474,546. This is almost 80 per cent above the 1922 period.

Radio apparatus shipments varied widely from month to month during 1922. A much wider distribution is shown this year by the manner in which the quantity of exports maintained a steady high level. During the first six months of 1923 the shipments were valued at $1,209,389.

Exports of house-wiring supplies and fixtures made a 207 per cent increase during the first half of 1923 over the total for the same period of 1922. This is in line with the same tendency shown in the case of motor-driven household devices and domestic heating and cooking apparatus, indicating the great development which is taking place in our foreign sales of these lines.

The electrical export business of the first half of this year has made a most creditable showing, and it is safe to say that a steady if not rapid increase is taking place in the demands of foreign countries for American electrical goods.

The Metal Market

METAL markets are exhibiting expected midsummer dullness. Scattering orders, some of good proportions, have been received, but the total volume of sales has not been large. Prices are substantially unchanged from those recorded last week, and there seems to be no great pressure to sell on the part of the producers.

NEW YORK METAL MARKET PRICES

	Aug. 8, 1923 Cents per Pound	Aug. 15, 1923 Cents per Pound
Copper, electrolytic	14.62½	14.25
Lead, Am. S. & R. price	6.50	6.50
Antimony	7.75	7.75
Nickel, ingot	27.00 to 32.00	27.00 to 32.00
Zinc, spot	6.10	6.10
Tin, Straits	39.00	39.00
Aluminum, 98 to 99 per cent	26.00 to 27.00	26.00 to 27.00

Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Denver Engineering Works Sold to Stearns-Rogers

The Denver Engineering Works of Denver, Col., manufacturers of "Dewco" brand of electric hoists, smelting machinery, etc., have been sold to the Stearns-Rogers Manufacturing Company of Denver. The new firm will continue the manufacture of the "Dewco" brands.

Frank E. Shepard, who was president of the Denver Engineering Works, will open an office as a consulting engineer at 810 Patterson Building, Denver. John W. Beam, formerly sales engineer with the Denver Engineering Works, will have his office with Mr. Shepard, but he will represent the Paxton & Vierling Iron Works.

Frank Adam Electric Company Announces Personnel Changes

Announcement is made by the Frank Adam Electric Company, St. Louis, of a number of changes in its organization. Arthur L. Abbott, formerly of St. Paul, has been made sales manager. Nicholas Schmelig, who until recently had charge of the cost department, has been made manager of the production division. Joseph Mann, formerly factory manager, is now in charge of the sales promotion for the Central Western States. Emil Zinsmeyer, who several years ago was sales manager, has returned to the organization as supervisor of sales in the Eastern territory.

Johns-Manville Discontinues Screw-Joint Fiber Conduit

The H. W. Johns-Manville Company, New York, has advised distributors that the manufacture of screw-joint fiber conduit will be discontinued henceforth. The production of this material has for some time seriously retarded the production of standard material.

The demand for screw-joint fiber conduit is confined to uses which in the aggregate do not constitute a field sufficiently great to warrant the special handling required in its production. On account of its being made with a wall generally twice as thick as standard material, it takes double the time in all processes. There is also a great loss sustained in machining, the manufacturer states. The Harrington joint fiber conduit will be sold for the purposes formerly met by the screw-joint type.

Columbian Electrical Supply and Satterlee Combined

The Columbian Electrical Company, St. Joseph, Mo., a hundred-thousand-dollar corporation, has recently been purchased by W. B. Satterlee, Kansas City, and Walter S. Blue, St. Joseph, who will combine the business with that of the Satterlee Electric Company of Kansas City. The new organization will conduct a wholesale electrical supply business under the name of the Columbian Electrical Company. The company has taken a ten-year lease on a four-story building at 1717 Walnut Street and will conduct a general supply and jobbing business in western Missouri, Kansas and Oklahoma. It will be the distributor for Westinghouse in that territory.

Westinghouse Lamp Training Course Well Under Way

The Westinghouse Lamp Company's training course for students is now well under way, with a large number of college graduates enrolled. A parallel course is also being conducted by the Westinghouse Electric & Manufacturing Company at the East Pittsburgh works.

The training course begins with a general course in lamp manufacture, lasting about three months. The course then divides into the technical course and the commercial course, according to the work most favored by each student, and this part of the course takes from three to four months, at the end of which time the students are given assignments in the different departments of the company to which they have shown themselves best adapted.

Every effort is put forth to make the training course a complete education in the lamp industry, to which end authorities from other companies take part in the work. On July 31 P. S. Millar of the Electrical Testing Laboratories addressed the students, while on

Aug. 2 W. T. Blackwell of the Public Service Electric Company explained the relationship of the central station to illumination. F. W. Loomis of the Duquesne Light Company, Pittsburgh, also discussed the electric lighting industry.

Combustion Engineering Capital Stock Increase

An increase in capital stock from 250,000 shares to 450,000 shares has been recommended by the board of directors of the International Combustion Engineering Corporation to provide for the acquisition of the Raymond Brothers Engineering Company and the Raymond Brothers Impact Pulverizer Company, manufacturers of industrial pulverized fuel systems. Heretofore pulverizing machinery has not been manufactured by the Combustion Engineering Corporation, but the acquisition of the Raymond companies will enable it to furnish complete equipment for its pulverized fuel installations. A meeting of stockholders will be held on Sept. 7, to approve the capital increase. It is understood that not exceeding 100,000 shares will be issued for the acquisition of the entire capital stock of Raymond Brothers Impact Pulverizer Company and its affiliated companies. Stockholders will be given the right to subscribe to 50,000 shares at a price not yet determined on.

Western Electric Moves Into New St. Louis Building

The telephone department of the Western Electric Company in St. Louis has just moved into a building recently completed at 3900 Chouteau Avenue. This move will separate the supply department from the telephone department of the Western Electric Company and will effect a combination of the telephone department of the Western Electric Company with the operating department of the Southwestern Bell Telephone Company.

This new building has 40,000 sq.ft. of floor space and 20,000 sq.ft. of yard space for the storing of cables and other material for outdoor use. The location of the building along the "Frisco" right-of-way is exceptionally convenient from a standpoint of transportation. Being also adjacent to the warehouse, pole yard and garage of the Southwestern Bell Telephone Company, it enables both companies to effect economies which have heretofore been impracticable.

The Nilco Lamp Works, Inc., St. Mary's, Pa., manufacturer of electric lamps, is enlarging its plant and installing additional equipment heretofore used at its Emporium (Pa.) works.

The Electric Equipment Service Company, Pittsburgh, is planning for the erection of a one-story factory on Liberty Avenue.

The Aladdin Manufacturing Company, Muncie, Ind., manufacturer of fixtures, has just completed an addition to its factory which will double its present capacity.

The Waage Electric Company, 12 South Jefferson Street, Chicago, makers of appliances, has recently added the following items to its line: waffle iron, heating element, curling iron and cup percolator.

The Triumph Electric Company, Cincinnati, builders of direct-current and alternating-current polyphase motors and generators, through its district sales manager at Pittsburgh, D. D. Gill, announces that it has added to its line single-phase motors manufactured by the Jeannin Electric Company, Toledo, Ohio.

The American Wringer Company, Inc., manufacturer of clothes wringers for electric washing machines, Woonsocket, R. I., has been reorganized with the following men as officers: Harold T. Merriman, president and treasurer; William G. Roelker, vice-president, and G. R. Keltie, secretary and general manager.

Horne Electric & Manufacturing Company.—John S. Isdale, formerly electrical superintendent of the New York Harbor drydocks at Rosebank, Staten Island, N. Y., has joined the organization of the Horne Electric & Manufacturing Company, Jersey City, N. J., as manager of marine and railway sales.

The Eagle Electric Manufacturing Company, 430 Kent Avenue, Brooklyn, N. Y., manufacturer of electric plugs, sockets and clamps, has recently made additions to its plant by connecting with it the building at 38 South Eighth Street. The company reports July as the largest month in its history.

The Acme Abrasive Company, Chicago, manufacturer of commutator smoothing stones and cement, has just moved into its new building at 1046 Webster Avenue. The Green Equipment Corporation, 260 Monadnock Block, Chicago, is the company's distributor.

The Electrical Engineering & Manufacturing Company of Pittsburgh has opened a branch office in the Lafayette Building, Buffalo, to be in charge of W. A. Harman as Buffalo district manager. Mr. Harman was formerly with the General Electric Company at Schenectady and later was for several years chief inspector of the Panama Canal for the United States government.

The Adamant Porcelain Company, East Liverpool, Ohio, manufacturer of porcelain for electrical purposes, is now making extensions to its plant at the expense of more than $10,000 in order to improve production.

The Maring Wire Company, Muskegon, Mich., manufacturer of magnet wire, is now occupying its new factory at Barclay Street and Western Avenue. Sufficient vacant property adjoining the plant is controlled by the firm in order to insure further required expansions.

The E. T. Chapin Company, manufacturer of red-cedar poles, Spokane, Wash., has moved its Eastern office from Chicago to 165 Broadway, New York City. Kurt C. Barth is Eastern manager.

The Pure Carbon Company, Wellsville, N. Y., announces the appointment of a Chicago representative, John Nangle, 184 West Washington Street.

The Alloy Metal Wire Company, Inc., Grand Central Terminal Building, New York City, manufacturer of resistance wire, has recently installed much new equipment in its plant at Yonkers, N. Y., in order to increase its production of materials for use in the manufacture of heating devices of all kinds.

The American Floor Surfacing Machine Company, Toledo, Ohio, electrical machinery for surfacing floors, has recently built a 50-ft. x 200-ft. addition to its plant. This company expects to build a larger addition in the near future.

The Rome Wire Company, Clyde Avenue, Buffalo, manufacturer of electrical wire and cables, has acquired a block of property adjoining its present works, bounded by Clarence and Amherst Streets, Clyde and Hutchinson Avenues, comprising about 4 acres of land, and will use the site for early future expansion. Plans for an initial building have been completed.

The Westinghouse Lamp Company, New York, N. Y., will demolish four old factory buildings at William and Hamlin Streets, Middletown, Conn., to provide a site for a new plant unit. The company has completed plans and will take bids at once for the construction of its proposed three-story warehouse and factory branch on Milwaukee Avenue, Kansas City, Mo., to cost about $80,000.

The Fibre Conduit Company, Orangeburg, N. Y., manufacturer of electrical conduits, etc., has awarded a contract for the erection of the first unit of its proposed new plant on a site recently purchased at Richmond, consisting of several one-story buildings, estimated to cost about $400,000, with equipment. S. R. Bradley is president of the company.

The Standard Underground Cable Company, Pittsburgh, has awarded a general contract to the Dinwiddie Construction Company, Crocker Building, San Francisco, for the erection of a new Pacific coast plant at Emeryville, Cal., to be two-story, 125 ft. x 300 ft., estimated to cost about $200,000.

The Hartford (Conn.) Electrical Supply Company has been appointed distributor for Connecticut for the Crouse-Hinds Electric Company, Syracuse, N. Y., and for the Lindsay Light Company, fixture manufacturer, New York City.

The Stewart Storage Battery Company, Inc., Gloversville, N. Y., recently incorporated for $500,000, announces that it will carry on the manufacture of a general line of storage batteries.

Foreign Trade Opportunities

INSULATORS FOR THE MORWELL (AUSTRALIA) POWER SCHEME.—Tenders will be received by the State Commission of Electricity, Melbourne, Australia, until Oct. 6 for 22,000-volt insulators, under specification No. 23/117. For details see Searchlight Section.

ARAPUNI (NEW ZEALAND) POWER SCHEME. — Additional specifications in connection with Section 1, headworks of the Arapuni (New Zealand) electric power scheme, for which bids will be received until Feb. 28, 1924, are on exhibit for use by prospective tenderers at the New York, Cleveland, Chicago and San Francisco offices of the ELECTRICAL WORLD and *Engineering News-Record*. For details see Searchlight Section.

FREQUENCY CHANGER FOR WHITE BAY (AUSTRALIA) POWER HOUSE.—Tenders will be received by the New South Wales Government Railways and Tramways, Sydney, until Sept. 19 for one 7,500-kw. frequency changer for the White Bay Power house.

EQUIPMENT FOR ELECTRIC PLANT AT BOWEN, QUEENSLAND. — Tenders will be received by the Municipal Council of Bowen, Queensland, Australia, until Sept. 3 for the construction of an electric system, including boiler plant, steam-driven electric generating station, main switchboard, etc. A. E. Harding Frew and T. W. Bridger, Telegraph Chambers, Queen Street, Brisbane, Australia, are consulting engineers.

NEW ELECTRIC PLANTS IN ECUADOR. —A contract has been entered into by the municipality of Pillaro, near Ambato, *Commerce Reports* states, for an electric light plant, the service of which will be extended to the parishes of San Miguelito and Isamba. Work has begun on the erection of an electric light plant at Cubijies, near the town of Riobamba. A further installation is to be made at Alausi, which is to be completed within one year.

HYDRO-ELECTRIC DEVELOPMENTS IN CHINA UNDER CONSIDERATION.—Negotiations between the Foochow Electric Company, Ltd., and the Chinese government, according to *Commerce Reports*, are reported to be under way, for the right to construct a hydro-electric plant on the Kutien branch of the Min River, about 50 miles from Foochow. Investigations are being made for another hydro-electric project on the Sha branch of the Min River, 125 miles from Foochow.

New Apparatus and Publications

INSTALLATION AND CARE OF TRANSFORMERS.—The Packard Electric Company, Warren, Ohio, is distributing a booklet entitled "Installation and Care of Transformers," and also its "Load Value Card," which is intended as a guide for the proper fusing of transformers.

STREET-LIGHTING EQUIPMENT.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued Catalog "8-A" on overhead street-lighting equipment and Catalog "8-B" on ornamental street lighting. In addition to the lighting equipment, the catalogs contain a complete descriptive list of accessories, such as cables, potheads, mast arms cut-out pulleys, etc.

EXHAUST STEAM VALVES AND STEAM APPLIANCES.—Atwood & Morrill, Salem, Mass., are distributing catalog "D," covering their exhaust steam valves for turbine and condenser service. Catalog "E" describes other "Twentieth Century" steam appliances manufactured by the company.

WINDOW FLOODLIGHT.—The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, has developed a "Mogul" socket window floodlight "Hippo," using a 300, 400 or 500-watt standard "Mogul" base lamp.

AUTOMATIC LIGHTING PLANT.—The Carpenter Automatic Electric System Company, Inc., White Plains, N. Y., has placed on the market a fully automatic electric lighting plant.

ELECTRIC DRILL.—A new ⅜-in. "Jones" electric drill has been placed on the market by the Jones Drill & Specialty Corporation, 245 Seventh Avenue, New York City. Equipment can be supplied with this drill to make it a portable or stationary grinder, buffer, polisher, scratch brush machine, valve grinder, etc.

AUTO LAMP PLUGS.—The Kem Company, Inc., 474 Sterling Place, Broklyn, has brought out a line of auto lamp plugs, made in single and double contact styles for headlights and tail lights.

HEADLIGHT.—An inspection car type of headlight with reflector, "Golden Glow," designed to be suspended from the platform of inspection or private cars, has been placed on the market by the Electric Service Supplies Company, Philadephia.

HEATER SWITCH.—The Hart Manufacturing Company, Hartford, Conn., has placed on the market a line of reciprocating three-heat series-parallel heater switches in single-pole and double-pole types.

SLOT RECEPTACLES.—Publication No. 3,038 issued by the Cutler-Hammer Manufacturing Company, Milwaukee, describes its new "T-slot" receptacles and also calls attention to the small "C-H" cord connector, which is a high-capacity 10-amp. connector of small dimensions for use with portable heaters, lamps, etc.

TIER LIFT TRUCK.—The Lakewood Engineering Company, Ceveland, has placed on the market a new model "Tier-Lift" truck for handling commodities such as sheet tin, taking into consideration loading tin at the mill and unloading and storing it at the factory.

AMPERE-HOUR METER.—The Sangamo Electric Company, Springfield, Ill., is distributing bulletin No. 62 (superseding bulletin No. 58), covering its locomotive type ampere-hour meter. Bulletin No. 60 issued by the company contains instructions for installing and connecting the "Sangamo" type H single-phase and polyphase watt-hour meters.

INDUCTION MOTORS. — The Jeannin Electric Company, Toledo, Ohio, is distributing a thirty-six-page booklet covering the Jeannin single-phase repulsion-induction motors.

TRANSFORMERS. — The Pittsburgh Transformer Company, Pittsburgh, has issued bulletins Nos. 2,021 and 2,022. The first describes the features of construction of the "Pittsburgh" transformers and the other contains diagrams of polarity and phase rotation test of transformers.

DISHWASHER.—A small dishwashing machine, known as the "Baby Champion," for use in small lunch rooms, tea rooms and coffee shops, has been placed on the market by the Hamilton-Low Company, 62 Van Winkle Avenue, Jersey City, N. J.

WAX REMOVER.—A device for eliminating wax in making gold inlays has been placed on the market by the Halverson Company, Union Avenue and East Oak Street, Portand, Ore. A lifting device has been provided for lifting the flask.

VERTICAL MORTISER.—A new vertical mortiser operated by a 3,600-r.p.m. motor equipped with ball bearings has been placed on the market by the J. A. Fay & Egan Company, 2700 Robertson Avenue, Cincinnati.

COMBINATION HEATING APPLIANCE.—The Reliable Stamping & Manufacturing Company, 417 Lake Avenue, Cleveland, has placed on the market a combination heater, toaster and hot plate to operate on an ordinary commercial lighting circuit.

STOP SIGNAL.—An automobile stop signal which is controlled by the foot brake has been brought out by the Darsie Manufacturing Company, 121 West Thirty-fifth Street, Los Angeles.

New Incorporations

THE KATAHDIN ELECTRIC COMPANY, Patten, Me., has been incorporated with a capital stock of $50,000 to generate and supply electricity for light, heat and power. The officers are: Raymond D. Gardner, president, and Ira D. Carpenter, treasurer, both of Patten.

THE PUBLIC SERVICE COMPANY OF COLORADO, Denver, Col., has been incorporated by Rodney J. Bardwell, Roy C. Hecox and Edgar McComb. The company is capitalized at $100,000 and will deal in gas, electric and other utilities. The company, it is understood, will take over the Lakeside Construction Company and operate the large power plant now being built at Boulder.

THE SARANAC RIVER POWER CORPORATION, Plattsburgh, N. Y., has been incorporated with a capital stock of $200,000 to generate and distribute electricity for light and power purposes. The incorporators are: Robert H. Guibord, Plattsburgh; Clifford H. Allen, Glens Falls, and A. James Eckert, New Hartford, N. Y.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOSTON, MASS.—The Edison Electric Illuminating Company has disposed of a note issue of $4,000,000, part of the proceeds to be used for extensions and improvements.

ONSET, MASS.—The Tremont Nail Company is erecting a new power house.

PROVIDENCE, R. I. — The board of directors of Homeopathic Hospital of Rhode Island plans to erect a power house at the new institutional buildings on the Pleasant Valley Parkway.

NORWALK, CONN. — The Connecticut Light & Power Company plans to construct a substation here to cost $50,000.

Middle Atlantic States

COEYMANS, N. Y.—The Municipal Gas Company, Albany, has petitioned the Public Service Commission for authority to purchase the franchises and electric system of the Atlantic Light & Power Company. If the transfer is approved, the Municipal company will erect a transmission line to supply electricity in Bethlehem and part of Coeymans Township, at a cost of about $150,000. The proposed line will also supply energy to the yards of the New York Central Railroad Company now under construction in Bethlehem.

FLUSHING, N. Y.—The Queens Gas & Electric Company plans to construct a new power house to cost about $90,000.

GARBUTT, N. Y.—The Empire Gypsum Company, Cutler Building, Rochester, N. Y., plans to install electric power equipment in connection with the proposed rebuilding of its local plant, recently destroyed by fire with loss of about $30,000.

NEW YORK, N. Y.—The United Electric Light & Power Company will build a substation on Locust Avenue, near 134th Street, to cost $80,000.

NEW YORK, N. Y.—Plans have been filed by the New York Edison Company for the construction of a new power station at 27 West Forty-seventh Street, to cost about $190,000. William Whitehill, 709 Sixth Avenue, is architect.

THIELLS, N. Y.—Bids will be received by Mortimer B. Patterson, president of board of managers of Letchworth Village, 7 Wall Street, New York City, until Sept. 5 for construction of assembly hall and industrial building (girls' group), including heating, electric and sanitary work. Sullivan W. Jones, Capitol, Albany, is state architect.

TULLY, N. Y.—The Syracuse (N. Y.) Lighting Company has been granted a franchise to extend its electric system to serve Tully and the towns of Lafayette, Tully and Fabius under franchises granted by the municipalities. The work includes an 11,000-volt line to be erected on a private right-of-way.

JERSEY CITY, N. J.—The Public Service Electric Company has filed plans for the erection of an addition to its plant on Duffield Avenue.

GRANTVILLE, PA. — The Grantville Electric Company, recently organized, plans to erect a transmission line in East Hanover Township.

HARRISBURG, PA. — The Harrisburg Light & Power Company plans extensions to its generating plant on Cedar Street, including the installation of two turbo-generators of 18,500 hp. each and auxiliary equipment.

McCONNELLSBURG, PA.—The McConnellsburg Electric Light, Heat & Power Company, recently formed, is considering the construction of a transmission line.

MYERSDALE, PA. — The Meyersdale Coal Company, recently organized, contemplates the installation of electric power equipment at its properties. J. Rowe is interested in the company.

PHILADELPHIA, PA. — The Kroute & Fite Company plans to build a power house at its textile mill at Allegheny and Emerald Streets.

PHILADELPHIA, PA.—Plans are being

prepared by J. T. Windrim, architect, Commonwealth Building, for an exchange and office building for the Bell Telephone Company, to be erected at Seventeenth and Lombard Streets, to cost $550,000.

POTTSVILLE, PA. — The Tunkhannock Township-Wyoming, Lemon Township-Wyoming and Falls Township-Wyoming Electric companies, recently organized by Charles W. Rigg, Pottsville, and associates, plan to erect transmission lines in the respective districts.

BARTON, MD.—The George's Creek Coal Company, recently formed, contemplates the installation of electric power equipment at its mines in the George's Creek section.

FRANKLIN, W. VA.—Plans are being prepared for the construction of a municipal hydro-electric power plant on the Potomac River.

ALEXANDRIA, VA.—The Aquia Creek Quarries Company plans to install electric power equipment at its new local plant.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Aug. 24 for vacuum tubes, transmitting, 50-watt, XL filament, in lots of 1,000, 1,500 and 2,000. (Circular 15482-1 CP.)

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Sept. 4 for a quantity of electric wire and cable, for Eastern and Western yards. (Schedules 1207, 1208.)

North Central States

DETROIT, MICH.—The Sand Lime Brick Company, Vinton Building, contemplates the construction of a power house at its proposed plant at River Rouge, for which bids will soon be asked.

IRON RIVER, MICH.—The Peninsular Power Company, Madison, Wis., contemplates the construction of a power plant here, to cost about $250,000.

KALAMAZOO, MICH.—The Kalamazoo Vegetable Parchment Company will install electric power equipment at its new mill, now in course of construction, to cost about $2,000,000.

SAGINAW, MICH. — The Cooper Coal Company will install electric power equipment at its mines in Kochville Township. Otto L. Dittmar is president.

GEORGETOWN, KY.—The Council is considering establishing a municipal electric plant and waterworks system.

LOUISVILLE, KY.—The Louisville Railway Company contemplates erecting a transmission line from Scotts Station to Shelbyville (6 miles) to cost about $45,000.

LOUISVILLE, KY. — The Ford Motor Company, Highland Park, Mich., contemplates the construction of a power house at its proposed local assembling plant, to cost about $150,000.

OWENSBORO, KY. — The Owensboro Clay Products Company plans to build a power house at its proposed local plant, to cost about $50,000.

BLOOMINGTON, IND.—The Interstate Public Service Company is disposing of a bond issue of $7,192,000, part of the proceeds to be used for extensions and improvements.

FORT WAYNE, IND.—Plans for new local textile dyeing works, to cost about $60,000, now being prepared by Lockwood, Green & Company, 38 South Dearborn Street, Chicago, engineers, provide for a power plant. The owner's name will be announced in the near future.

JEFFERSONVILLE, IND. — The construction of a steam-driven electric plant on the Ohio River east of Jerffersonville is under consideration by the Interstate Public Service Company, Indianapolis. The plans, it is understood, provide for a 30,000-kw. plant, to cost about $2,000,000.

McLEANSBORO, ILL.—At an election to be held Aug. 20 the proposal to issue $24,000 in bonds will be submitted to the voters. Of the proceeds $6,000 will be used for an engine-driven generator set, for which funds to the amount of $7,500 are already available. The W. A. Fuller Company, Railway Exchange Building, St. Louis, is engineer.

SAWYERVILLE, ILL.—Permission has been granted to the Illinois Power & Light Company, People's Gas Building, Chicago, to erect a transmission line from Sawyerville to the mine of the Mount Olive & Staunton Coal Company in Madison County.

APPLETON, WIS.—The Wisconsin Traction, Light, Heat & Power Company contemplates erecting a transmission line from Greenville to Ellington.

DARLINGTON, WIS.—The City Council is considering installing electrically driven pumping machinery at the waterworks to replace the steam pumps now in use.

MARINETTE, WIS.—Improvements are contemplated to the municipal waterworks, including the installation of electrically operated pumping machinery. The cost is estimated at $100,000.

MILWAUKEE, WIS. — The Milwaukee Electric Railway & Light Company is planning to build an addition to its boiler house on Edison Avenue, to cost about $65,000.

MILWAUKEE, WIS. — The Milwaukee Electric Railway & Light Company is planning to build a new high-voltage transmission line from Milwaukee to Racine, a distance of about 30 miles.

MILWAUKEE, WIS. — The Wisconsin Telephone Company contemplates extensions to the Broadway exchange, to cost about $500,000.

MONROE, WIS.—The Wisconsin Utilities Company has submitted a new street-lighting contract to the City Council (the old contract having expired) under the terms of which the company offers to replace the 400-cp. arc lamps with new lamps ranging from 100 cp. to 250 cp. with new fixtures and to erect lamps at every street corner. Lamps are now placed at every other corner.

NORWALK, WIS.—The village officials have applied to the State Railroad Commission for permission to sell the municipal electric plant to the Wisconsin-Minnesota Light & Power Company, Eau Claire.

PORT WASHINGTON, WIS.—The Milwaukee Electric Railway & Light Company is planning to extend its transmission lines to Port Washington to connect up with municipal electric light plant. An agreement has been made under which the company is to furnish the local plant with all the energy it needs above the capacity of the plant.

SHULLSBURG, WIS. — The Northern Mines Company is planning to erect an electric transmission line, to cost about $25,000.

WAUSAU, WIS.—The Wisconsin Valley Electric Company is planning to install a new generator at its local plant.

BRAINERD, MINN. — A large steam power plant, to cost about $650,000, is reported, will be erected at the local locomotive shops of the Northern Pacific Railway Company.

CALEDONIA, MINN. — The Houston County Drainage and Conservancy District contemplates building a levee and pumping station, to cost about $428,000. The Central States Engineering Company, Laurel Building, Muscatine, Iowa, is engineer.

EVELETH, MINN.—The Minnesota Utilities Company is seeking permission to erect a transmission line across the Superior National Forest.

LITCHFIELD, MINN. — Improvements are contemplated to the municipal electric light plant, for which bonds have been voted.

CASCADE, IOWA. — The plant of the Cascade Electric Light & Power Company has been acquired by the Iowa Electric Company, Cedar Rapids, which will erect a transmission line from Monticello to Cascade.

DECORAH, IOWA. — The Interstate Power Company is making arrangements to rebuild its transmission line from Decorah to Ossian, changing the voltage to 33,000.

ST. LOUIS, UNIVERSITY STATION, MO.—The Delmar Boulevard Improvement Association has awarded a contract to the Union Electric Light & Power Company for lighting Delmar Boulevard.

TROY, MO.—The East Missouri Power Company has acquired the electric systems at Warrenton and Jonesburg. It proposes to install additional machinery and to erect a transmission line from Troy through Wright City to the above towns.

NORTH PLATTE, NEB.—Arrangements are being made to install a new street-lighting system on Dewey Street, to cost $2,800.

BONNER SPRINGS, KAN.—The Kansas Portland Cement Company, Federal Reserve Bank Building, Kansas City, Mo., plans to build a power house at its proposed local mill, to cost about $1,000,000.

Southern States

ASHEVILLE, N. C.—The Asheville Light & Power Company is negotiating for the purchase of the system of the North Carolina Power Company and will consolidate the property. Plant extensions are under consideration, with additional transmission lines.

HAW RIVER, N. C.—The Williamson Mills Company, recently organized, contemplates the construction of a power house in connection with its proposed cotton mill. W. F. Williamson, Burlington, N. C., heads the company.

HENDERSON, N. C.—Plans are being prepared for an addition to the power house at the Henderson Cotton Mills.

NORWOOD, N. C.—The Norwood Manufacturing Company contemplates building a power house in connection with an addition to its textile mill, to cost about $150,000.

POWELLSVILLE, N. C.—The Council has awarded contract to Banks & Burke, engineers, Norfolk, Va., for the erection of a transmission line from Ahoskie to Powellsville.

WINTON, N. C. — The Council has awarded a contract to Banks & Burke, engineers, Norfolk, Va., for the erection of a transmission line from Ahoskie to Winton.

PAGELAND, S. C.—Plans are being prepared for the installation of a municipal electric light plant. The Ryan Engineering Company, Columbia, is engineer.

ATLANTA, GA.—The finance committee to the City Council has ordered that the proposal to issue $1,500,000 in bonds to construct a municipal hydro-electric plant be submitted to the voters.

THOMSON, GA. — The Mosteller-Ward Lumber Company, recently formed, contemplates the construction of a power house at its proposed local lumber mill.

BOYNTON, FLA.—Electrically operated pumping machinery will be installed in the proposed municipal waterworks plant, to cost about $75,000.

BRONSON, FLA.—The Bronson Manufacturing Company is planning to construct an electric light and power plant for local commercial service.

FORT PIERCE, FLA.—The installation of a 294-hp. boiler in the municipal electric and water plant is under consideration by the Council.

SANFORD, FLA.—Electric power equipment will be installed in the refrigerating and precooling plant to be erected by the Florida Vegetable Corporation in Sanford, to cost about $65,000.

CHATTANOOGA, TENN.—The Tennessee Power Company is planning to extend its transmission line from Mascot to Morristown.

HOHENWALD, TENN. — Surveys are being made for a municipal hydro-electric plant.

MEMPHIS, TENN.—The Memphis Power & Light Company is making investigations in West Memphis with a view of extending its lines across the river to furnish electrical service to the new city.

BIRMINGHAM, ALA. — The Peoples' Hydro-Electric Company contemplates a 40,000-hp. hydro-electric development at Lock No. 2 on the Coosa River. Roswell C. Cobb is president.

MONTGOMERY, ALA.—Steps have been taken by the different civic clubs for the installation of an ornamental lighting system in the downtown district.

NORTHPORT, ALA.—The Deal-Parsons Planing Mill Company contemplates extensions to the power house and mill of the Modern Lumber Company, recently acquired, to cost about $75,000.

COLUMBUS, MISS.—Surveys are being made by E. P. Lowe and F. G. Erkekine, engineers of the State Department of Geology, for a water-power development in the upper river in the vicinity of Aberdeen and also the Buttehatchie.

JACKSON, MISS.—The Jackson Public Service Company is interested in a project to install an ornamental lighting system on Capitol Street from the old Capitol building to the Union Station.

FORT SMITH, ARK.—The installation of electrically operated pumping machinery in connection with extensions and improvements to the municipal waterworks, to cost about $500,000, is under consideration.

BEAUMONT, TEX.—The Neches Lumber Company contemplates the construction of a power house at its proposed local mill, to cost about $70,000.

CRYSTAL CITY, TEX. — The Crystal City Electric & Ice Company is planning to erect a new building.

FERRIS, TEX.—The Ferris Brick Company, recently organized to consolidate a number of local brick-manufacturing plants, plans to install additional electric power equipment. J. A. Carpenter is secretary and treasurer.

GRAND SALINE, TEX. — The Saline Coal Company, Texarkana, Ark., recently organized, plans to install electric power

equipment and mechanical apparatus at its local coal properties. J. F. O'Neal is general manager.

GREENVILLE, TEX.—The installation of electrically operated pumping machinery in connection with extensions to the municipal waterworks, to cost about $325,000, is under consideration.

HARLINGEN, TEX.—The Texas Central Power Company, San Antonio, has acquired the local municipal power plant. Extensions will be made, including additional transmission lines.

ORANGE, TEX.—The Texas Creosoting Company, recently organized, plans to build a power house at its proposed local plant.

Pacific and Mountain States

SPOKANE, WASH.—Reconstruction and repair of the headgate house of the Monroe Street power station of the Washington Water Power Company, to cost about $14,000, have been authorized.

LA GRANDE, ORE.—The Mount Smiley Lumber Company contemplates the construction of a power house at its proposed local mill, to cost about $100,000.

ALTURAS, CAL.—The Alturas Electric Power Company has been granted permission to issue $29,000 in bonds, the proceeds to be used for extensions to plant, including the construction of a storage reservoir, to cost $13,500; improvement to penstock and water supply system and replacing penstock, $10,143; waterwheel equipment and extensions and improvements to transmission and distribution systems, etc.

GLENDALE, CAL.—Plans are being prepared for the installation of an ornamental lighting system on Glendale Avenue between San Fernando and Monterey Roads.

SAN PEDRO, CAL.—The E. K. Wood Lumber Company will build a new one-story transformer station at its plant.

MANTECA, CAL.—The State Water Commission has granted the San Joaquin Irrigation District permission to construct a 7,500-hp. hydro-electric power plant on the Stanislaus River, to cost about $390,000.

SAN DIEGO, CAL.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 4, for one coil-winding machine for the San Diego Navy Yard. (Schedule 1214.)

SAN DIEGO, CAL.—A permit for the diversion of 50 cu.ft. of water per second from Boulder Creek at a point about 2 miles west of Cuyamaca Dam has been granted to E. Fletcher and associates by the State Department of Public Works, division of water rights. The plans provide for a hydro-electric development of 9,222 hp., at a cost of about $390,000. Thomas H. King is chief engineer for the Fletcher interests.

SAN FRANCISCO, CAL.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 4, for one induction-motor and one planing-mill exhauster fan, for use at the Mare Island Navy Yard. (Schedule 1200.)

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company will soon call for bids for the construction of a steam-operated electric power station on Stevenson Street, to cost about $250,000. Property has been purchased on Tenth Street, Richmond, for a new substation.

SAN FRANCISCO, CAL.—Plans are being prepared for eight buildings for the San Francisco Protestant Orphan Asylum, care Bliss & Faville, architects, Balboa Building, including an administration building, six two-story cottages and a laundry and power-house building, to be erected on a ten-acre site bounded by Twenty-eighth and Thirtieth Avenues. The cost is estimated at $350,000.

LONG BEACH, CAL.—Plans are being arranged for the installation of an ornamental lighting system on Fourth Street.

TAFT, CAL.—Bonds are being arranged for the installation of an ornamental lighting system on the main streets. Edward M. Lynch, Central Building, Los Angeles, is city engineer.

BURKE, IDAHO.—The Washington Water Power Company, Spokane, plans to install three 5,000-kw. transformers at its new transformer station at Burke next fall. The company will connect with the lines of the Montana Power Company, Butte, Mont., at this point.

WARREN, IDAHO.—The Unity Gold Mining Company is building a hydro-electric plant on the south fork of the Solmono River, to cost about $100,000. The power will be used to operate its mill, air compressors, etc.

CLEARFIELD, UTAH.—The Utah Power & Light Company, Salt Lake City, has been granted a franchise to supply electricity in Clearfield.

SALT LAKE CITY, UTAH.—The Ford Motor Company, Highland Park, Mich., contemplates the construction of a power house at its proposed local assembling plant, to cost about $200,000.

PHOENIX, ARIZ.—The Western Cotton Oil Company contemplates the construction of a power house at its proposed mill on Seventh Street, to cost about $100,000.

PHOENIX, ARIZ.—The Palo Verde River Irrigation District contemplates an issue of $23,000,000 in bonds, the proceeds to be used for the construction of two or more hydro-electric power plants. New transmission lines will be built.

STEAMBOAT SPRINGS, COL.—Application has been made to the Federal Power Commission by Donald L. and Walter Carver, owners of the Steamboat Service Company, for permission to build a hydro-electric plant on the Yampa River, 15 miles south of Steamboat Springs. The plans include a dam 200 ft. high. The initial installation will have a generating capacity of 12,000 hp.

Canada

CALGARY, B. C.—Work, it is understood, will soon begin on the erection of a transmission line from the plant at Kananaskis to the Bow River plant. G. A. Gaherty is chief engineer of the company.

WINNIPEG, MAN.—The installation of ornamental street lamps on Kennedy Street, Broadway and Portage Avenue, to cost about $16,500, is under consideration by the City Council.

PORT ARTHUR, ONT.—Work will soon begin on the installation of two additional generating units at the Cameron Falls development, which will increase the output of the plant by 24,000 hp., for use in the district and the cities of Port Arthur and Port William.

ST. THOMAS, ONT.—The Hydro-Electric Power Commission of Ontario has authorized the erection of four suburban Hydro-Electric zones centering in this city. The lighting of the gravel road from London to Port Stanley with electricity furnished by the Hydro-Electric system is under consideration.

TORONTO, ONT.—Tenders will be received by C. Alfred Maguire, Mayor, chairman of board of control, until Oct. 9 as follows: Tender No. 44—For one 80,000,000-imperial gal., low-lift centrifugal pump; Tender No. 45—one 25,000,000-imperial gal. pumping engine; Tender No. 46—one alternating-current generator; also for cast-iron pipe, valves, etc.

HULL, QUE.—Announcement has been made of the incorporation of a new company, to be known as the Ottawa River Power Company, Ltd., to take over and develop the power holdings formerly owned by the Ottawa & Hull Power Company, located at Bryson, Que. The head office of the company will be in Hull.

Electrical Patents

Announced by U. S. Patent Office

(Issued July 24, 1923)

1,463,029. Combined Trolley Frog and Electric Cut-Out; C. M. Andrews, Caryville, Tenn. App. filed June 2, 1922.

1,463,105. Plunger Shoe; J. F. Webb, Jr., New York, N. Y. App. filed Dec. 30, 1922. Plow and contact shoes of train-stopping apparatus.

1,463,136. Method of and Apparatus for Operating Printing Telegraphs; E. E. Kleinschmidt, Brooklyn, N. Y. App. filed May 1, 1919. Information is alternately transmitted in opposite directions between the two stations.

(Issued July 31, 1923)

1,463,152. Electrolytic Condenser; L. W. Chubb, Pittsburgh, Pa. App. filed Dec. 30, 1919. Automatically adjusted power-factor-correction apparatus.

1,463,164. Telephone System; H. H. Ide, La Grange, Ill. App. filed July 28, 1919. Automatic selector switch for use in automatic telephone system.

1,463,168. System of Control; R. T. Kintzing, Wilkinsburg, Pa. App. filed Oct. 27, 1920. For machines operated in tandem.

1,463,170. Automatic Electric Meter; M. O. S. Madsen, Aarhus, Denmark. App. filed Nov. 4, 1922. Coin electric watt-hour meter.

1,463,178. Electric Incandescent Lamp; B. E. Shackelford, East Orange, N. J. App. filed March 9, 1918. Type of lamp used for signaling.

1,463,200. Ringing Arrangement for Multiplex Circuits; J. Davidson, Jr., Montclair, N. J. App. filed Sept. 24, 1919. Over carrier-current lines.

1,463,208. Connection Protector; Edgar C. Gnau, East Aurora, N. Y. App. filed Dec. 3, 1921. Protector designed to shield connection between electric wires.

1,463,271. Party-Line Telephone System; T. G. Martin, Chicago, Ill. App. filed March 1, 1910. Automatic switches employed.

1,463,304. Transformer - Controlling Means; R. V. Bingay, Pittsburgh, Pa. App. filed Feb. 20, 1922. Terminal board for transformer taps.

1,463,331. Vehicle Turning Signal; H. Miner, Minneapolis, Minn. App. filed Jan. 17, 1921. Illuminated arrow.

1,463,372. Sound-Reproducing Instrument; E. A. Reynolds and De E. A. Reynolds, Yonkers, N. Y. App. filed July 28, 1917. Magnetic sound amplifier.

1,463,386. Radio-Telegraph System; W. L. Carlson and Earl C. Hanson, Washington, D. C. App. filed April 22, 1920. Electric circuit for selectively receiving electric signals.

1,463,391. Radio-Telegraph System; E. C. Hanson and W. L. Carlson, Washington, D. C. App. filed Feb. 11, 1920. Operated on undamped-wave principle.

1,463,392. Therapeutic Electrode; E. C. Hanson and W. L. Carlson, Washington, D. C. App. filed Nov. 30, 1920. High-frequency electrodes for electric treatment of body.

1,463,420. Trolley-Wire-Holding Rail; K. C. Hale, Detroit, Mich. App. filed June 26, 1922. For use under bridges, etc.

1,463,430. Automobile Signal; A. L. McMurtry, Dunnville, Ontario, Canada. App. filed March 4, 1920. Rear direction signal.

1,463,432. Vacuum-Tube Apparatus; H. W. Nichols, Maplewood, N. J. App. filed Aug. 2, 1917. Tube acts as rectifier to reduce the alternating current to pulsating direct current.

1,463,433. Signaling; H. W. Nichols, Maplewood, N.J. App. filed Dec. 4, 1918. Thermionic amplifier for telephone lines.

1,463,463. Switch Mechanism; L. L. Evans, Bridgeport, Conn. App. filed May 10, 1920. Pull-chain lamp socket.

1,463,475. Thermionic Translating Device; S. Loewe, Berlin, Germany. App. filed March 19, 1921. Method of using electron tubes efficiently.

1,463,513. Electric Furnace; C. L. Lee, Dayton, Ohio. App. filed April 13, 1921. Rotating type.

1,463,523. Lightning-Protection Apparatus for Oil Tanks; R. A. Wyatt, Dallas, Tex. App. filed May 24, 1921. Shield of high-voltage wires over tanks.

1,463,554. Mounting for Stems of Crystal Detectors; A. N. Pierman, Newark, N. J. App. filed Feb. 4, 1922.

1,463,559. Sectional Electric Furnace; E. L. Smalley, East Orange, N. J. App. filed Aug. 6, 1920. Resistance type.

1,463,597. Electric Measuring Instrument; W. M. Scott, Lakewood, Ohio. App. filed Jan. 26, 1918. Ammeter for automobile cowl board.

1,463,600. Telephone System; C. Sparks, Oak Park, Ill. App. filed Aug. 5, 1918. Cord circuits for interconnecting telephon lines of different type.

1,463,617. Electric Liquid Heater; F. E. G. Eisselt, Chemnitz, Germany. App. filed July 7, 1921. Electrode type.

1,463,630. Electric Heater; W. A. Rankin, Oak Park, Ill. App. filed April 12, 1921. Thermostatic control for electric iron.

1,463,713. Electromagnetic Separation or Concentration of Minerals; W. M. Mordey, Westminster, England. App. filed April 2, 1920.

1,463,714. Chain-Welding Machine; J. L. Mueller, York, Pa. App. filed April 22, 1921.

1,463,730. Heater; E. D. Stout, New Rochelle, N. Y. App. filed Jan. 7, 1922. Electric room heater.

1,463,779. Alternating-Current Rectifier; V. F. King, Tonawanda, N. Y. App. filed Feb. 5, 1921. Mechanical rectifier.

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Half-Hearted Merchandising

CLOSE contact with central-station commercial men during the past few months reveals a widespread feeling in not a few companies that the higher executives are indifferent to the value of merchandising effort. Here and there progressive policies are backed to the limit. But in too many cases, so the merchandisers say, their superiors take little interest in the success of these departments, sometimes crowding them literally to the wall on appropriations, "canning" recommendations for aggressive sales effort, loading the bookkeeping with heavy fixed charges, balking at compensation in some proportion to sales volume, and, what is hardest to understand, overlooking the customer-relations aspect of contacts with the public in the appliance division.

What is the result? They point to discouraged personnel, lost incentive, stifled originality, high turnover among ambitious employees, reduced profits and diminished popular good will.

It is not enough when some executives say that the proportion of revenue derived from appliance sales is too small to justify executive enthusiasm. Other executives are honestly convinced that all appliances, and even lamps and fuses, should be sold only by local dealers, and they point with pride to the results of this policy in definite localities. The pros and cons of the old question —"to sell or not to sell" anything other than electrical energy—still are argued and are vigorously discussed at all conventions where commercial phases of the central-station business are under consideration and with concrete data supporting each side of the issue. But the point of these comments is that, if a company has decided to merchandise appliances and if the work is being conducted by competent people, lukewarm executive support of the activity is injuring the advance of electric service and of all branches of the electrical industry.

Words would be wasted at this late day in arguing the mutual importance and interdependence of the technical and business sides of utility activity. It has been proved in general experience and stands of record. Probably the fact that many executives grew up with the central station upon a strict engineering diet is responsible for the attitude that seems too often to assume commercial development as something apart from their personal concerns. But it is high time that vigorous supporting action should take the place of indifference, or worse, in companies pretending to serve the public through appliance retailing.

What is worth doing at all is worth doing well, and if employees are to be stimulated to do their utmost to popularize electric service and to make friends of the local public, and are to prosper and advance individually in proportion to their ability, executives of the industry will do well to get rid of their satisfied conservatism, which in many cases seems to be driving able workers into other fields and hampering the good work of those who remain. The future captains of the industry will be recruited from every department, and the young men of the merchandising staffs should have all reasonable encouragement in their formative years to show their caliber and the stuff of which they are made.

Luther Roberts Nash

An engineer of distinguished experience and an authority of the first rank in the fields of public utility economics and regulation.

HIGH reputation as a public utility economist rests upon an interesting and varied career in the case of Mr. Nash, who is public relations manager for Stone & Webster, Inc., specializing in rates, fares, franchises, taxation and regulation matters for companies operated by this organization and in similar problems for other clients. Mr. Nash was born at Ridgefield, Conn., in 1871. He was educated at the Massachusetts Institute of Technology (S. B. 1884) and at the Harvard University Graduate School of Arts and Sciences (S. M. as of 1898). He has been continuously connected with Stone & Webster since 1895, his earlier work embracing drafting, construction inspection, designing and executive engineering. From 1904 to 1908 he was manager of the Savannah (Ga.) Electric Company.

For the past fifteen years, with headquarters at Boston, Mr. Nash has been actively concerned in the development of regulatory practice, keeping familiar with all important decisions of courts and commissions. He has appeared as an expert in many rate proceedings throughout the country, has made valuations aggregating many millions of dollars for such cases and has advised on other valuations by his organization totaling several billions, giving special attention to overhead and other intangible elements of value. The design and analysis of rate structures for central-station, gas, traction and especially wholesale power and street lighting have received his keen attention. Franchises, service at cost, taxation methods and occasional lectures on public utility financing, rates and operations at Harvard and the Massachusetts Institute of Technology have also occupied him, and Mr. Nash has written extensively upon the foregoing topics for a wide and appreciative following.

In valuation Mr. Nash has advocated the cost-of-reproduction method to the extent that higher valuations have been necessary in connection with the maximum practicable rate of return to secure to public utility investors a return having a purchasing power reasonably consistent with that obtainable in other industries, so that the development of public utilities would not be hampered by restrictions on new capital which would result in community as well as utility stagnation. In the broader problems of regulation he has recommended liberality and flexibility in the rate of return as an incentive to progressive, efficient administration and expansion of service. He is a member of various national organizations and has done much committee work.

Editorial Comment

Electrical World, August 25, 1923

Volume 82 Number 8

Ford the Experimenter or Ford the Experiment?

MUCH publicity has been given the Ford plan to "burn coal twice," a pseudonym or an alias of our old friend by-product coke. Apparently Henry Ford, who can amply afford to do so, is going to conduct a huge experiment to find out the practical economics of taking all the more valuable by-products out of coal before it is burned.

Every one ought to be glad that Ford is making this experiment. But there is some doubt, to say the least, as to the propriety of his publicity bureau in ascribing the origin of this idea to him or his engineers. It is a plan which has been urged for years by fuel engineers and has been tried out to some extent, and if it does, in the end, work economically, it ought to provide cheaper —and eventually more uniform—fuel. But since he can buy the publicity, he of course will have it. What matters most is that experimenting is proceeding, from the results of which, if intelligently conducted, all should benefit.

As a matter of fact, no better use of the Ford millions could be made than to conduct experiments on a practical scale with many plans which look good to engineers but which the expense of modifying existing equipment or the expense of new installation has prohibited. Thus progress has been delayed. If Henry Ford, the experimenter, will help out, it should do only good.

While some disagree with Steinmetz that Henry Ford himself should be elected president as an experiment, they cannot but be grateful to him for using his millions for this and similar investigations which may result in extensive commercial economies.

Protection Factor— the Antithesis of Meaning

IN THE last few years several combination or selective spark gaps have been devised by manufacturers of protective equipment and offered to operating companies. The two principal efforts of the designers of these gaps have been, (a) to equalize the values of spark-over voltages in wet and dry weather as much as possible, and (b) to make the spark-over voltage for surges with steep wave front not much higher than the wet spark-over at 60 cycles. In some discussions on the subject the term "protection factor" has been tentatively used and defined as "the ratio of the impulse discharge voltage of a gap to the 60-cycle discharge voltage" under rain. For ordinary gaps this ratio is greater than one, and the higher it is the less protection the particular gap offers against lightning and surges. Though the term "protection factor," in the above-defined sense, has by no means been generally accepted, now is the time to ask if this term is not a misnomer. Is it not really a "non-protection factor"?

Impulse ratio, a term which is also used to express this ratio, is much more indicative of what the term means. But if this is not acceptable and if it is desirable to retain the idea of "protection," it would be much better to define "protection factor" as "the ratio of 60-cycle breakdown voltage to impulse breakdown voltage," which is the reciprocal of the present definition. In this case the higher the factor the greater would be the protection, which seems logical.

Public Relations— A Practical Example

SAMUEL INSULL has always declared that good public relations are the most valuable asset a public utility can have. One definition of good public relations is that they are the relations brought about by a business so conducted that the public has complete confidence in the ability, the integrity, the progressiveness and the fairness of the management—a partnership proposition, in which from time to time the public's decision is to be taken rather than that of the management. Some doubters have said that such a policy is a fine one while everything goes with a smile, but that the proof will come when something starts to pinch the pocketbook.

Two happenings in Illinois during the past year show that Mr. Insull means what he says and practices what he preaches:

A year or more ago the Illinois Commerce Commission made a cut in gas rates for the city of Chicago. It was a serious question whether the gas company could stand the cut with the then existing cost of operation. With no wail of distress nor any threat of a court action that must ensue, Samuel Insull, as president of the company, called attention to the situation in a few words and then said that the company would accept the decision and put forth the utmost effort to operate under the new rate level and make it a success, but it might be found necessary later to come back and ask the commission to readjust the rates in an upward direction. Exactly the same course has been followed with reference to the recent decision of the Illinois Commerce Commission in which gas rates in the Chicago territory and electric rates for several Insull companies in the state were reduced and in which it was recommended that the Commonwealth Edison Company make a cut in one of its schedules. Mr. Insull merely announced that the companies would give the rates and recommendation a fair trial and endeavor to make them a success. More than likely the companies will succeed in this effort. They at least are working under the best of conditions and with the good will of their public.

There is no thought of implying that these are the only two examples of forward-looking utility management. But it is worth while pointing these out, for too often in cases of this kind action is in sharp contrast to

that depicted; legal lights are allowed to shine in immediate court action; the public is aroused to antagonism. In these cases Mr. Insull has surrendered no legal rights—nor has he built up any belligerent feeling. If the rates won't work under commission supervision, he at least has the record of having tried, and whatever action he may then find it necessary to take can be taken on a clean-cut basis of such facts as experience has brought forth.

When cases like this are handled as they have been by Mr. Insull, illustrations of good public relations in fact and not in theory are given—this is good public relations in action.

Practical Engineering Is "Crowding" Research

THE practical aspects of electrical engineering in power supply have encroached upon the realm of research because of the rapid advance in the engineering applications of theoretical principles. This was evidenced at the recent A. I. E. E. convention at Swampscott, where the so-called "high-brow" research papers drew large audiences, excited great interest and stirred up interesting discussions.

Even though much of the vocabulary and mathematics of the specialists was not understood by all present, a bystander gathered the impression that all the hearers wished to see each specialist come under the wire a winner. The operating men are very much interested in the work of the research specialists because they are ready to use the results in the everyday engineering on their systems. The economic and practical engineering features of a modern power-supply system demand an immediate solution to many vexatious problems if increased efficiency in operation and greater reliability of service are to be obtained.

Yet these problems largely lie under the jurisdiction of specialists and research workers and many of them have defied solution for several years. Dielectric and heating phenomena are not yet understood completely, the limits in system stability and regulation must be definitely determined, protective equipment is yet to be perfected, and many problems are encountered in the field of measurement.

Progress has been made and is being made, but there are inherent elements in the problems that seem to prevent conclusive results. A physical understanding of the phenomena does not exist, and there are so many variables introduced that mathematical researches fail to be conclusive. It seems evident from a survey of the extant research work that a generalized solution can be obtained only by attacking each element of the subject and then co-ordinating the individual researches into a complete solution. Both experimental and mathematical research work will be required on each item, and a splendid example of the close co-ordination that can result from such practice was afforded by the A. I. E. E. Swampscott papers dealing with cables and with the cooling of machines. The combined attack of Steinmetz with his mathematical tools and of Whitehead, Hayden and Eddy with their experimental ability achieved noteworthy results. In addition, the experimental work of Luke combined with the mathematical researches of Rice to give a more definite understanding of the phenomena involved in dissipating the heat generated in electrical machinery.

The Electron a Bridge Between Physics and Chemistry

UNDER the sustained attacks of the physicists the atom is gradually opening up, and chemistry and physics, so long separated but recognized as being fundamentally closely related, are now rapidly merging into one great science. The chemists have long demanded an explanation, on the basis of physical laws, of chemical affinities and neutralities, of the conspicuous family groupings of the elements in the Mendelejeff table, and of a vast variety of orderly molecular phenomena, pointing to some form of regularly organized sub-atomic structure. The physicists, so long occupied with and restricted to the study of the behavior of matter in bulk, are now meeting the demand of the chemists, with a great flood of light on the structure of the atom, which bids fair to explain chemical combinations on the basis of physical laws. The first and most important step was the discovery of the electron and its presence in all forms of matter. The atoms of different elements are known to contain different numbers of electrons, and the greatest further discoveries have come through study of the behavior of the positively charged atom after the abstraction of one or more electrons, as in the positive rays in vacuum tubes, and of the X-ray spectra of different substances.

One great fundamental question is as to the law by which the electrons in the atom are in equilibrium with the positive core or nucleus which makes up practically the entire mass of the atom. The most obvious assumption is that the centrifugal forces of electrons, rotating in orbits, are just balanced by the electrostatic attractions between electrons and the positive center of the atom. This simple hypothesis, while attractive as providing explanation of many of the phenomena of electromagnetic radiation, has been found to lead to many conclusions quite inconsistent with the facts of observation.

According to Sir J. J. Thomson, discoverer of the electron, the inverse-square law cannot account for the equilibrium of the atom, and he proposes a law under which the electrons and the positive nucleus attract beyond a certain distance of separation but repel each other for smaller distances. Applying this law to atoms of increasing numbers of electrons and their positive centers, the conditions of most stable equilibrium are found to call for successive zones of increasing diameters, of eight electrons each. Atoms with even multiples of eight electrons are very stable and chemically inactive. When the number of electrons is not a simple multiple of eight, the odd electrons are in the outer ring, and they are in various degrees of unstable equilibrium, are more easily detached, and are therefore liable to pass to another atom or attract other electrons, depending on the resulting energy changes. Thus chemical action is a matter of the readjustment of the unstable rings of electrons of two atoms to a more stable combination.

In his recent Franklin Institute lectures Sir Joseph reviews a remarkable series of chemical phenomena which may be accounted for on this theory and describes others heretofore unknown, though predicted by the theory, which have been found to be true by suitable experiment. A beginning only has been made; there are still many difficulties, and there are other theories

of the atom, but it appears certain that the whole great field of chemical action will ultimately find a basis in the physical laws of electric forces. Will it ever be possible to go deeper still and explain the forces themselves?

Some day some electrical engineer or electrophysicist is going to tie up a good deal of electrical practice to the electron. More and more is equipment being developed whose behavior is forecast or controlled through knowledge of the electron's own behavior and peculiarities. Surely electrical engineers who are looking ahead to the major developments of the future cannot fail to watch the present development of knowledge and experience along the lines discussed above.

Closer Contact Between Factory and Operating Engineers

TRIPS of operating engineers to electrical apparatus factories in connection with prospective purchases or equipment installations have long been mutually helpful to designers and to users of such products. Individual limitations as to time, however, often curtail the benefits of such visits, and the opportunity for broader discussion of trends of practice develops more rapidly under the inspiration of group meetings like that of the New England System Operators' Club, held recently in Schenectady. Where it is possible to multiply mental contacts by concentrating the attention of a group of operating men and factory specialists upon a few important subjects in intensive sessions covering a day or two, much good can be accomplished along the line of harmonizing experience and theory.

The manufacturing engineer often possesses latent resources which have little opportunity to function until he is brought face to face with field conditions that are familar enough to the operating man, but which are only remotely influential in the ordinary routine of the designing expert's life. The limitations of correspondence are painful. Frank consideration of equipment performance in service by a group of producers and users sitting in a small enough meeting to permit free discussion as among friends offers both parties a rich opportunity to become acquainted as men, to comprehend the conditions under which apparatus is produced and utilized and to mark out tentative lines of improvement in both design and application.

Until the operating man sees something of the complexities of modern manufacture with its massed quantities of material in process he can have little real appreciation of the cost of unnecessarily departing from standardized designs. After the designing engineer has met the user, either in the field or in the stimulating atmosphere of the factory conference room, the performance of equipment takes on a new interest extending far beyond the initial installation and guiding the factory specialist in his further efforts to meet commercial requirements at lower cost to both producer and purchaser. The old adage that two heads are better than one can be proved over and over in group gatherings of technical men of common active interests in one or more closely related branches of applied electricity, and far-reaching improvements in design and operation may follow a well-planned and industriously conducted conference of this sort with the modern factory as its locus.

Electric Steam Boilers Increasing in Number

IN THE last sixteen months about 200,000 kw. in electric steam boilers has been put into operation or has gone under construction in this country and in Canada. This development is typical of those that always occur in the electrical industry when an economic place is found for a new application. The operating voltages range from 220 to 22,000, single-phase, two-phase or three-phase, and the steam pressures range from 4 lb. to 220 lb. gage, with capacities up to 50,000 kw. The direct-resistance and indirect-resistance methods are used in smaller units and the electrode method of heating is employed for the larger units.

Economic considerations form the sole handicaps to a wider use of these electric steam boilers, for their operating performance is admittedly satisfactory. Competition starts, roughly speaking, when energy costs 1 mill per kilowatt-hour as compared with five-dollar coal and 2 mills per kilowatt-hour as compared with oil at 6.5 cents per gallon. But such figures are subject to modification because operation of plants seldom occurs at a uniform or high load factor, and often incidental items, such as increased production, greater convenience, better power factor and utilization of surplus equipment, have a decided influence on the decision.

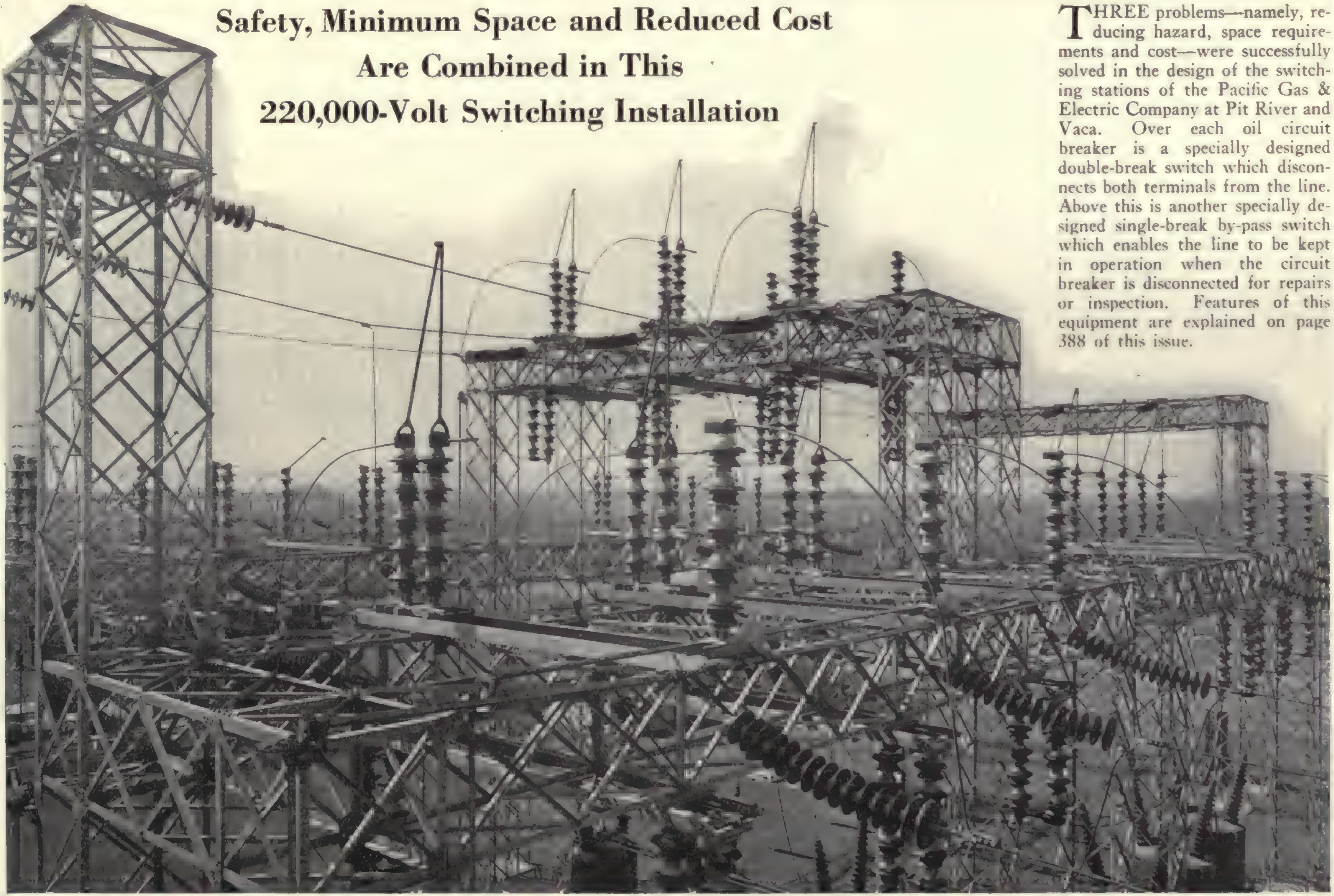
Where surplus water power goes to waste, where the cost of fuel is high, and where there is a necessity for steam in manufacture or for heating purposes, an ideal opportunity is offered for use of the electric steam boiler in the interests of national fuel conservation, and most of the installations come under this classification. But there are other cases that offer opportunity for economical use of these boilers. Certain industries, such as steel mills, rubber mills and foundries which have intermittent loads with a wide variation in power demands and a need for steam, have been studying the possibilities of the electric steam boiler as an absorber of off-peak energy, the results indicating a real opportunity. Where block rates and demand rates exist, electric boilers can be used sometimes to absorb capacity at night and on Saturdays and Sundays.

Particularly encouraging results come from studies showing that steam for heating purposes can be generated on off-peak periods and stored for use during peak periods. At 200 deg. F. and 125 lb. gage, 1 kw.-hr. of electricity will produce more than 3 lb. of steam, so efficient are the boilers used, and where off-peak rates are favorable or where power demands fluctuate steam production at this high rate and with short time storage can be seriously considered. In other industries and in house heating at certain times of the year hot water can be produced quickly and conveniently by electric boilers, and there is opportunity for development of this business.

So, although a general analysis shows electric steam production and electric water heating on a widespread scale to be uneconomical and unsound, many specific cases occur where they prove both economical and convenient. The rapid growth of the business proves that generalized condemnation of the development should not handicap the introduction of the practice in the proper places.

The very fact that installations of the magnitude mentioned have occurred shows that economic studies have not always eliminated the electric steam boiler from consideration.

Safety, Minimum Space and Reduced Cost Are Combined in This 220,000-Volt Switching Installation



THREE problems—namely, reducing hazard, space requirements and cost—were successfully solved in the design of the switching stations of the Pacific Gas & Electric Company at Pit River and Vaca. Over each oil circuit breaker is a specially designed double-break switch which disconnects both terminals from the line. Above this is another specially designed single-break by-pass switch which enables the line to be kept in operation when the circuit breaker is disconnected for repairs or inspection. Features of this equipment are explained on page 388 of this issue.

Automatic Synchronous Condenser Station

On a Transmission System the Synchronous Condenser Is Used to Insure Good Voltage Regulation—Automatic Operation and Protective Devices Insure Reliability of Service

By R. J. WENSLEY and W. L. NEWMEYER
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Westinghouse Electric & Manufacturing Company

AUTOMATIC operation and protection of electrical apparatus has long since gained a sure foothold in power plants in this country. This is true viewed not only from the economic phase of the problem of operating equipment but also from the efficiency standpoint. Electricity has proved itself to be accurate, swift and safe for this work, and its use in controlling equipment is bound to speed operation and insure safety. Automatic principles such as these are incorporated in the 5,000-kva. synchronous condenser recently installed at the Madera substation of the Penn Public Service Company. Here the economical advantages obtained by the elimination of the operators made automatic switching a logical necessity.

A partial map of the lines of this company is shown. At Seward is a 40,000-kva. generating station. Transmission from this plant to the Glory substation, a distance of 19 miles, is at 66,000 volts. From Glory to Madera, a distance of 46 miles, 22,000-volt transmission is used. Clearfield and Philipsburg are each about 20 miles from Madera. At Clearfield there is a small plant used primarily for local district heating, while at Philipsburg there is a similar small plant and also a 10,000-kva. generating station.

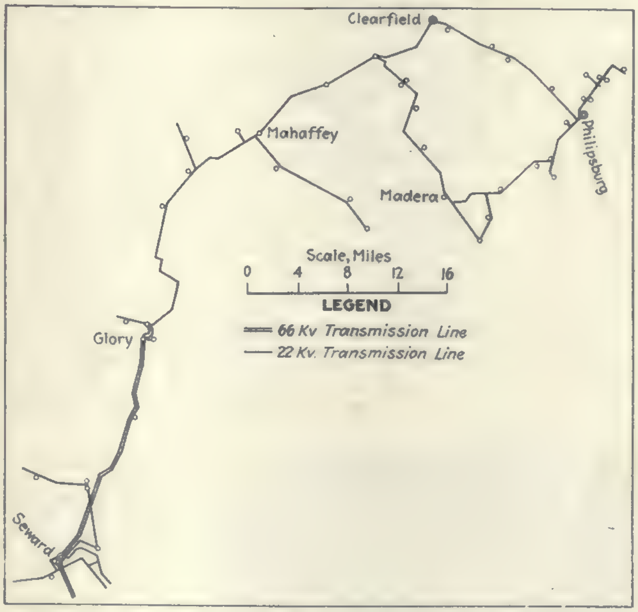
This last plant has been operated principally for voltage regulation, but with the condenser service at Madera only one unit of 2,500 kva. will be operated except during the peak periods and not at all during the light-load period at night. After putting the condenser into service, operating tests showed that the voltage could be maintained within the desired limits by the condenser under the control of an automatic voltage regulator.

The Madera station is not entirely equipped with automatic switching. The local service feeders are under the care of an attendant who is only in the station part of the time. The condenser is put into service by the closing of a push-button control switch and remains in operation as long as the alternating-current supply is maintained. Should the supply be interrupted, the condenser will be disconnected until voltage is restored, upon which it will immediately start without the supervision of an operator. Should any of the automatic safety devices, such as a bearing thermostat, cause the disconnecting of the condenser from the line, the attention of an inspector or maintenance man is required before the machine can again be put into service.

METHOD OF OPERATION

The condenser floats on the line at all times under the control of the regulator, supplying only sufficient wattless component to the system to maintain voltage at a predetermined value. The regulator is of the vibrating type and is provided with an overload device which limits the output of the condenser should the system require more than its rated capacity to maintain the usual standard of voltage.

The condenser is equipped with heavy damper windings in the revolving-field poles and is started as an induction motor by the application of reduced voltage from taps on the main-station lowering transformers. During the starting cycle the field is connected through its own rheostat to its exciter. The field thus discharges through the exciter during the period of acceleration



PARTIAL SYSTEM MAP OF THE PENN PUBLIC SERVICE CORPORATION. THE AUTOMATIC SYNCHRONOUS CONDENSER IS AT MADERA

and the flow of induced current during acceleration prevents the exciter building up to normal voltage. This method eliminates the opening or closing of the exciter or condenser field circuits.

Fig. 2 is an oscillogram showing the condition existing in the field circuit of a synchronous motor during the starting cycle, the field being solidly connected to the exciter. The induced current and voltage decrease in frequency in inverse proportion to the speed. Distortion of the voltage curve due to the exciter potential is noticeable. When the induced current vanishes the exciter builds up rapidly, the small initial potential helping to pull the motor into step with the line. This oscillogram shows that the rise in exciter potential is a positive and safe indication of the synchronous position of the motor and may therefore be used as an indication of the proper time to apply full voltage to the motor. As a condenser has starting characteristics

identical with a synchronous motor, this method is used in the automatic control of the condenser under discussion.

Sequence of Starting and Running Operations

Starting is normally accomplished by the closing of a master push-button switch. This energizes a master relay from the 125-volt control battery. The oil circuit breaker in the 22,000-volt circuit to the lowering transformers is then closed, electrical interlocks on the low-tension starting and running breakers insuring that these breakers are open before the high-tension breaker closes. At the same time the motor of a small oil-pressure pump is started. This pump supplies oil under high pressure to the bearings to lift the shaft off the bearing metal, thus greatly reducing the starting kva. required. A contact-making pressure gage insures that an adequate pressure is reached before the starting breaker is closed.

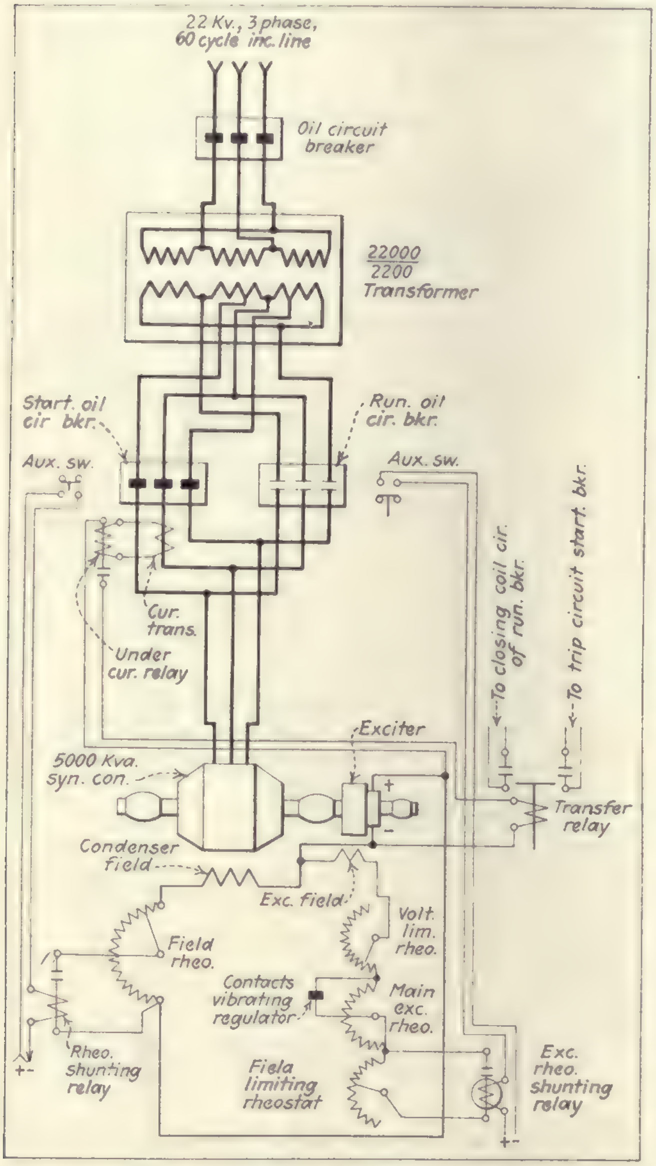


FIG. 1 — PARTIAL SCHEMATIC DIAGRAM SHOWING THE MAIN AND FIELD CONNECTIONS OF THE SYNCHRONOUS CONDENSER DURING THE STARTING PERIOD AND AFTER TRANSFER TO THE NORMAL OPERATING VOLTAGE

Note that transfer is made when (1) the undercurrent relay closes and (2) the transfer relay is energized.

The oil pressure having reached the proper value, the low-tension starting breaker is closed. The condenser then starts and accelerates to synchronous speed.

As the condenser is a relatively large piece of apparatus as compared with the system to which it is connected, it is essential that the transfer from the starting to the running taps be made with the least possible draft of current from the line. To obtain the best possible condition it is essential (1) that the condenser be in synchronism with the line, (2) that the excitation be of the correct value.

The condition of synchronism is verified in two ways. As pointed out in a previous paragraph, the exciter does not build up until the induced motor-field current ceases to flow, which occurs when synchronism is reached. As the motor pulls into step with the line there is a marked decrease in the current input to the motor stator winding, though just prior to the synchronous point in the acceleration cycle there are a number of relatively slow but large oscillations of the armature current. The reduction in current is therefore a measure of the condition of synchronism, but the relay which measures this current must be well damped so that these final oscillations will not cause its operation prematurely.

The indication of low line current is given by an induction relay, the contacts of which are held open by the armature current until the reduced current indicates that the desired condition is obtained. This relay is shown in the schematic diagram, Fig. 4. The transfer relay is energized from the exciter through the contacts of the under-current relay and is adjusted to close on a certain voltage. The transfer which occurs when the transfer relay closes cannot therefore take place until (1) the under-current relay closes and (2) the exciter voltage reaches a predetermined value. To insure a minimum disturbance on the closure of the running breaker it is essential that the excitation be a certain value. Some operators adjust the excitation for minimum armature amperes while on the starting tap. This is not conducive to smooth transfer since the full voltage applied with such excitation will cause a heavy flow of lagging current. The excitation should be such that if the machine were being mechanically driven the no-load voltage would equal the full normal line voltage. The connections of the armature, field and exciter during the starting cycle are shown in Fig. 1. The closure of the high-tension breaker and the low-tension starting tap breaker causes the condenser to start rotation on power supplied from the low-tension starting taps. During the starting period the entire condenser field rheostat is in circuit. This is partially short-circuited by a shunting contactor when the running taps are connected to the condenser. In like manner the exciter voltage is limited prior to the actual closure of the running breaker. These connections prevent undue rise in excitation before the transfer to the running position, and these values of the resistances were adjusted by actual test to secure the minimum disturbance at time of transfer. After the transfer has taken place the condenser-field rheostat is partly shunted and the field-exciter field-limiting rheostat is entirely shunted. The condenser is now entirely under the control of the vibrating regulator, which automatically adjusts the exciter to maintain the desired voltage.

An operator in putting a regulator into service adjusts the main field rheostat and the voltage-limiting rheostat of the exciter to avoid disturbance as much as

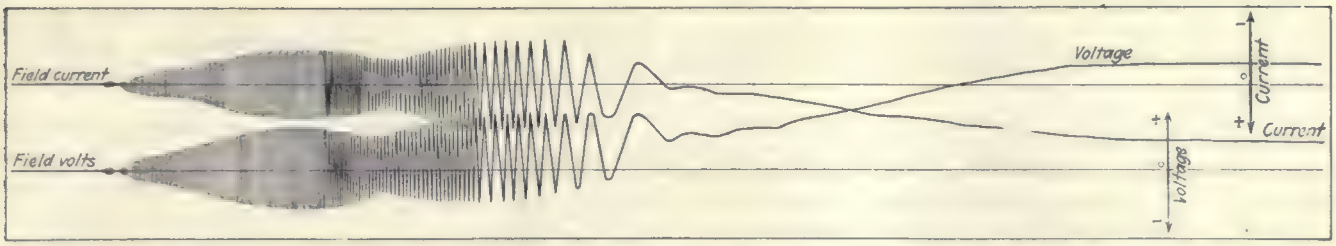


FIG. 2—OSCILLOGRAM OF THE FIELD CURRENT AND FIELD VOLTAGE OF A SELF-STARTING SYNCHRONOUS CONDENSER DURING THE STARTING PERIOD

The field is connected to the armature of the direct-connected exciter at all times.

possible. The action of these shunting relays closely duplicates the methods used by the operator, but with the added precision of an automatic device which no human being can hope to equal.

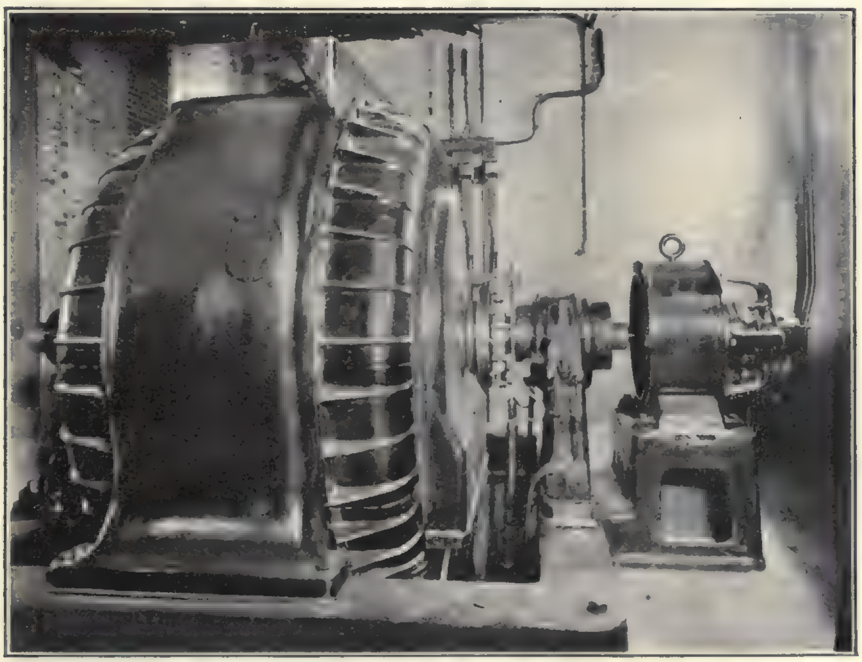
In a station where there is not a responsible operator in charge it is essential that adequate automatic protective devices be provided. The protective equipment falls naturally into two classes. Class 1 consists of the devices which operate in case of temporary trouble. These devices permit the station to restart after the cause of the trouble has vanished. Class 2 consists of those devices the operation of which indicates the presence of serious trouble. After the operation of any class 2 device the station can only be started by the manual resetting of a lock-out relay which is actuated by these devices. In the lock-out relay is incorporated an annunciator which shows the maintenance man where to look for the trouble.

PROTECTIVE DEVICES, CLASS 1

Low Voltage.—If the line voltage is below the limit which insures proper acceleration, a low-voltage relay prevents the functioning of the control equipment. The condenser is thereby prevented from starting until the voltage has reached an adequate value for acceleration. This relay also causes the disconnection of the condenser if the line voltage drops to a low value while the condenser is operating.

Polyphase Potential.—The phase balance starting relay prevents any attempt at starting if the phase rotation is reversed or if one phase is open. Starting is immediately permitted when conditions become normal.

Phase Failure.—Should any phase open while the condenser is running, the machine will not immediately be shut down. The condenser, being a synchronous machine, will act as a phase balancer and tend to maintain balanced polyphase potential on the system, but in so doing there will be an abnormally heavy current flowing in the loaded phase, and if such operation be continued for an excessive interval the windings will be damaged. Connected to the secondaries of the main current transformers are two thermal overload relays so that the current flowing in these relays is directly proportional to the armature current in the condenser. This current is used to heat the elements of the thermal relay, which are so proportioned that they have approximately the same relative thermal capacity as the windings of the machine. Should the abnormal condition persist until the operation of thermal relays, the condenser will be shut down until the relays (and machine windings) cool. If the phase voltage conditions are then normal, the condenser will restart.



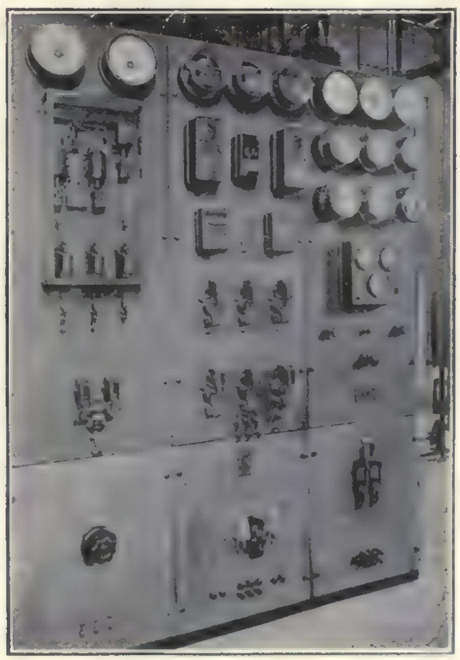


FIG. 3—5,000-KVA. SYNCHRONOUS CONDENSER AND AUTOMATIC SWITCHBOARD

Left—5,000-kva., 2,300-volt, three-phase, 60-cycle, self-starting synchronous condenser with direct-connected 125-volt exciter. All bearings are equipped with bearing thermostats, which act to disconnect the machine automatically if temperature gets too high.

Right—Automatic switchboard for the control of a 5,000-kva., 2,300-volt, three-phase, self-starting synchronous condenser. Mounted on the board are the necessary meters, control relays, automatic regulator and temperature indicator.

Field Thermal Relays.—This relay is connected across a shunt in the condenser-field circuit and prevents operation over an extended period with excessive excitation.

Load-Limiting Device.—This is an integral part of the voltage regulator and serves to limit the excitation when the armature amperes reach the maximum safe amount. The condenser will therefore endeavor to maintain voltage until it is loaded to capacity, after which it will allow the voltage to fall just enough to prevent further increase in load.

Oil Pressure.—A contact-making pressure gage in-

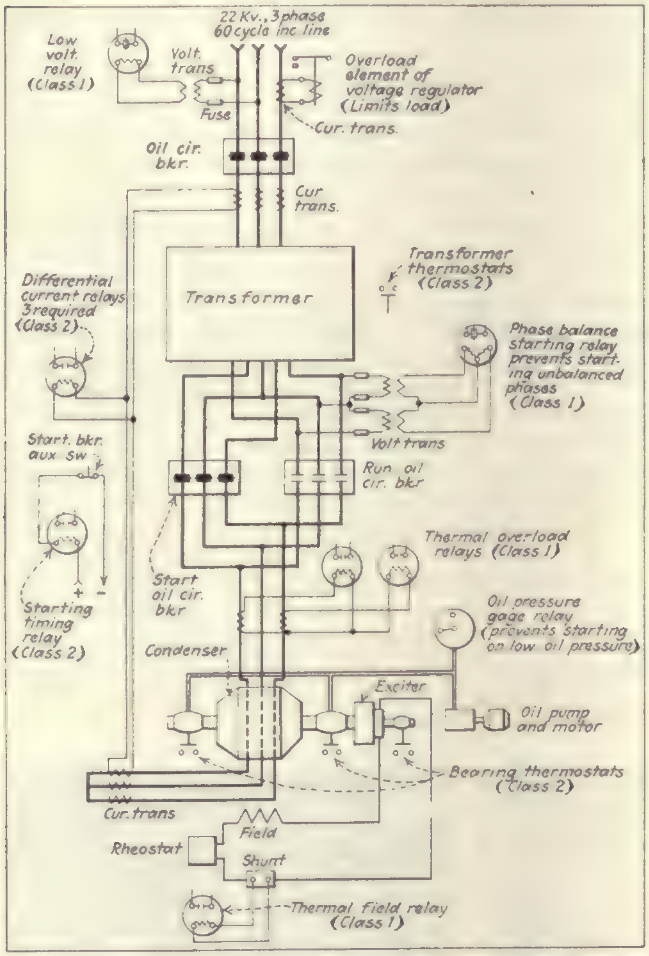


FIG. 4—SCHEMATIC DIAGRAM SHOWING PROTECTIVE DEVICES

dicates to the master relay that the oil pressure in the bearings has reached a safe value for starting. Should the oil not reach this pressure, the machine will not be started.

Protective Devices, Class 2

Differential Protection.—Current transformers are provided on the high side of the power transformers and in the star connection of the condenser windings, the two sets being connected differentially. Operation of the differential relays trips the lock-out relay, and this entirely disconnects the condenser from the line until it is manually reset. This protects against any failure of the machine or transformer windings or the connections between the two.

Excessive Starting Times.—If the starting sequence is not completed within the normal time (approximately one and one-half minutes), a timing relay operates the lock-out relay. This prevents any damage that might be caused if the control fails to transfer the condenser connection to the running position within the allotted time.

Bearing Thermostats.—Each bearing is equipped with a fluid expansion thermostat, the bulb being installed in contact with the babbitt metal at the bottom of the bearing where the greatest heating occurs. Should a bearing overheat, the thermostat will trip the lock-out relay, necessitating the personal attention of a maintenance man before the condenser can again be put into service.

Transformer Thermostats.—Each of the main lowering transformers is equipped with a contact-making thermostat which will trip the lock-out relay should the transformer temperature exceed a safe limit.

From the above it may be seen that the condenser is far less likely to suffer harm than if it were equipped with only the customary protection, the operator being depended upon to catch the less frequent cases of trouble. The continual expansion of power-system networks and the abandonment of small local plants, together with the continued rise in the standards of service rendered the consumers, emphasize the value of automatic equipment such as that described. This is true because the reduction of the labor cost chargeable to operation justifies the power-system engineer applying the automatic equipment in a liberal manner, and the better protection afforded lowers the maintenance charges and makes possible a higher grade of service.

J. H. Lytle of the engineering department of the Penn Public Service Company and P. H. Harris, superintendent of power houses of the Penn Public Service Company, were responsible for the engineering features, and L. J. Driggs, construction engineer, supervised the installation of the equipment. The entire equipment was supplied by the Westinghouse Electric & Manufacturing Company.

Holland and Italy Now Have Direct Radio Service to United States

DIRECT radio-telegraphic service between the United States and The Hague, Holland, and between the United States and Caltano, Italy, has recently been established. The opening of these services raises the total number of direct radio circuits radiating to European countries from New York City from six to eight and not only affects Holland and Italy but provides more direct routes between the countries adjoining them and the United States.

The addition of these new circuits to the already existing channels of radio communication to many parts of the world materially advances plans which are being worked out by the Radio Corporation of America to make the United States the center of a world-wide radio communication network. Because of the centralized location of the United States, with Europe to the east, South America to the south and the Orient to the west, this country enjoys a natural advantage which helps to make it possible to link the principal nations of the world by radio around New York as the pivotal center. This plan is rapidly nearing completion, there being at present eight connections across the Atlantic and one bridging the Pacific.

Characteristics of Enameled Magnet Wire

High Dielectric Strength, Elasticity and Other Factors of Which Advantage May Be Taken in Design Work—Appropriate Methods and Tests for Rating Enameled Wire

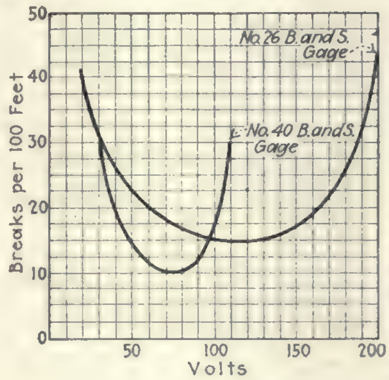
By W. D. A. PEASLEE
Chief Engineer Belden Manufacturing Company

IN GENERAL, to obtain the maximum benefit from enameled magnet wire the entire design around which it is used should be so adjusted as to take advantage of the following characteristics peculiar to wire of this type:

1. A very high dielectric strength (600 volts per mil of insulating film or greater).
2. Elasticity of the enamel coating, permitting the bending of the wire around very small radii and the stretching of the wire (sometimes unavoidable in rapid-production methods) without harm to the insulation.
3. A hardness of the film that will resist abrasion and abuse attendant upon high-speed production methods.
4. Adhesion of the enamel to the copper to such an extent that even under considerable stretching the enamel will not separate from the wire.
5. The ability to withstand successfully temperatures that would ruin textile-insulated wires. Enameled wire properly made will withstand temperatures up to 149 deg. C. (300 deg. F.) without harm to the enamel film.
6. Chemical inertness. It is only slightly affected by ordinary solvents encountered in the production or operation of electrical machinery.
7. Non-aging. It has been subjected to repeated cycles of heating and cooling to temperatures greater than those allowed in electrical apparatus of ordinary types without losing the above characteristics.
8. Uniformity of thickness of the enamel film.

In addition to these general characteristics, which vary between different makes of wire, all makes of this type of magnet wire share the following advantages to the designing engineer:

1. A much smaller over-all diameter as compared with textile-insulated wires is secured with a much greater dielectric strength of the insulating film, permitting the use of a smaller coil for given ampere-turns—a saving of both copper and iron in the design.
2. A much greater ability exists to conduct heat from the inside of windings to the surface, whence it may be radiated. This means that for a given surface temperature of the winding the hot-spot temperature of an enamel coil will be decidedly lower than the hot-spot temperature of the coil made of textile-insulated wires containing the same number of ampere-turns and the same surface temperature. (Interesting quantitative data have been obtained on this subject and will be published shortly.)
3. The cost per pound is generally less than for textile-insulated wires, and on a basis of cost per foot or cost per ampere-turn of winding very substantial savings in cost can be realized by the use of this wire, without sacrificing in any way the quality of the windings or machine in which they are placed. This is entirely aside from the saving due to the fact that on account of the space-factor characteristic a given number of ampere-turns can be secured with a shorter conductor and lower attendant copper loss.
4. The cotton and silk coverings of textile-insulated wires are hygroscopic, absorbing moisture freely even from slightly humid air, and so their use in windings entails a considerable expense for impregnation, while enamel-insulated wires are waterproof to a high degree. Thus the necessity and expense of impregnation of coils is avoided in many cases by the use of this type of wire.



EFFECT OF VARIATION OF APPLIED VOLTAGE ON APPARENT NUMBER OF BREAKS IN ENAMEL FILM

A complete investigation of this method of testing has brought to light a remarkable and startling fact. With a given length of wire immersed in the mercury and a given speed through the mercury bath, the apparent number of breaks in the enamel film per 100 ft. of wire decreased as the applied voltage was increased up to a certain point and increased as the voltage was raised above this minimum point. It has been suggested that this phenomenon is due to the well-known characteristic of a mercury film in that the surface tension of the mercury is increased under increasing electrification. This characteristic is also found in electrolytes in general.

MERCURY TEST INADEQUATE FOR DETERMINING QUALITY OF INSULATION

It has been found impossible to define the number of breaks per 100 ft. in the enamel film of a wire above which the wire is unsuitable for winding into coils, despite the need of a really dependable test that will give a reasonably quantitative measure of its suitability for such use. For example, an extended series of experiments indicated that enamel wire having in the neighborhood of 200 apparent breaks in the enamel film per 100 ft. could be wound into coils with no more loss due to short circuits between turns than was encountered in using wire having twenty or thirty breaks per 100 ft. measured at the same voltage.

This fact, coupled with the sensitiveness of the "mercury test" to the length of wire in the mercury, speed of wire through the mercury, voltage applied (see accompanying illustration) and sensitivity of the recording circuit, throws considerable doubt upon the propriety of depending upon the mercury test to any decided degree in forming an opinion as to the quality of enamel-insulated magnet wire.

Attention has therefore turned to other methods of testing, and the following tests have been developed

BASIS FOR RATING ENAMELED WIRE FOR GIVEN USE

Should any value given in this tabulation be improper for the proposed use, it can be adjusted. For example, in relay work when the voltage applied to a coil is extremely low the designer might feel that this characteristic should not be given so much importance and therefore could adjust it accordingly.

(Index number 100. Add ratings to get index number.)

Characteristic	Rating	Method of Determination of Percentage and of Index Numbers
Dielectric strength (mandrel test)	20	2,000 volts per mil-base. 400 volts per mil-minimum. For each 100 volts per mil average deviation from 2,000 add or subtract one point. If below 400 volts per mil, give 0 for this characteristic.
Stretching	10	30 per cent stretch without harm to enamel or wire = base. For each 2 per cent below 30 per cent at which enamel or wire fails deduct one point. No. 25 and smaller breaking of wire = base. For each 2 per cent below breaking point of wire at which enamel fails deduct one point.
Bending	10	As base: Perfect enamel = 10 Slight cracking of enamel = 8 Large cracking of enamel = 4 Flaking of enamel = 0
Baking for bending and finish	15	As base: Perfect enamel = 15 Slight cracking of enamel = 10 Large cracking of enamel = 5 Flaking of enamel = 0
Baking for softening of enamel	10	No denting of enamel or softness = 10 Slight denting of enamel, no softness = 8 Slight denting of enamel, and softness = 6 Deep denting of enamel, and softness = 2 Wires touching = 0
Effect of neutral mineral oil and transformer oil	10	No effect = 10 Can mark with fingernail = 6 Can scrape off with fingernail = 2 Can wipe off with cloth = 0
Effect of varnish with petroleum-base filler	12	No effect = 12 Slight softening—can mark enamel with fingernail = 6 Can scrape enamel off with fingernail = 0
Appearance and gloss	5	Glossy = 5 Slightly dull, deduct two Very dull, deduct five
Smoothness and uniformity of gaging	8	Smooth and both bare wire and enamel diameters close to nominal on average = 8 Very slight roughness, deduct 2 Decided roughness, deduct 4 Average diameter near maximum or minimum, deduct 4 Bare spots visible, deduct 8

to cover the determination of the previously mentioned essential characteristics of the wire and to bring together quantitative values for these characteristics under a general index number that would be a measure for the particular use contemplated of the value of the various wires so tested.

TESTS FOR RATING ENAMELED MAGNET WIRE

1. **Dielectric Strength.**—Wind a layer of wire about 1½ in. long on a mandrel 1 in. in diameter of bakelite or other insulating material. Over this wind a second layer. Measure the effective alternating-current voltage at 60 cycles required to puncture between the layers. In this test the conditions are practically identical with those under which wire is used when wound into coils, giving a voltage between turns that the wire can withstand. The results of this test should be expressed in voltage to puncture the enamel and in volts per mil thickness of the enamel film.

A test of this general character has been employed wherein two wires are twisted together and the voltage required to break down the film between the strands is measured. While superior to the mercury test and giving in general the same data as the mandrel test, it is believed that the twist test does not so well reproduce the working conditions under which the wire is used as the mandrel test and is therefore not quite so justifiable as a rating test.

2. **Elasticity.**—Stretch the wire sample in tension and note the percentage of elongation between 10-in. marks at which the enamel cracks or peels as visible to the naked eye and the degree to which the wire meets the A. S. T. M. B3-15 specification for elongation of the wire.

3. **Adhesion of Enamel to Wire.**—Wrap the wire around a mandrel as follows: Sizes Nos. 6 to 17 inclusive, twice the diameter of wire; sizes Nos. 18 and smaller, the diameter of the wire. Record the results as "O.K." or as showing slight cracks, large cracks and flaking of enamel.

4. **Aging.**—(a) Bake the wire at 100 deg. C. (212 deg. F.) for forty-eight hours, test as in paragraph 3 above and record the results in the same terms.

(b) Twist two pieces of the wire together with the turns per inch given in the following table and bake at 105 deg. C. (221 deg. F.) to 110 deg. C. (230 deg. F.) for five hours:

	Turns per Inch
No. 36 and finer	8
No. 35 to 30 inclusive	6
No. 29 to 25 inclusive	4
No. 24 to 20 inclusive	3
No. 19 to 17 inclusive	2
No. 16 and larger	1

Untwist wires after baking and record condition as one of the following: No denting of enamel or softness; slight denting of enamel, no softness; slight denting of enamel and softness; deep denting of enamel and softness; wires touching through enamel. Softness will be indicated by a tendency of wires to stick together when untwisted.

5-a. **Solubility** (Important for Transformer Construction).—Immerse the wire in transformer oil at 121 deg. C. (250 deg. F.) for forty-eight hours. Record the result as one of the following: No effect; can mark enamel with fingernail*; can scrape off enamel with fingernail; can wipe off enamel with cloth.

5-b. **Solubility** (Important for Windings to Be Impregnated).—Immerse the wire in any standard insulating varnish containing a petroleum naphtha thinner.† Record the results as: No effect; can mark enamel with fingernail; can scrape enamel off with fingernail.

6. **Uniformity.**—(a) Describe the appearance as to finish as glossy, slightly dull or very dull.

(b) Record condition of surface as smooth, slightly rough or very rough.

(c) Record diameter as average-diameter bare wire, nominal-diameter bare wire, average-diameter over enamel or nominal-diameter over enamel.

(d) Record also whether or not bare spots are visible to the naked eye.

The results of these tests can now be combined into a rating table like the one reproduced, which explains the means whereby quantitative values are assigned to each of the nine characteristics selected as of major importance in the determination of the quality of the wire, based on the requirements of a large majority of the users of enameled wire. An important advantage, however, of this method is that the valuation of the characteristics can be adjusted to suit the requirements of the particular application. For instance, in a wire used to wind a coil of a large number of turns having, as in relay work, only a few tenths of a volt applied to the terminals of a coil, the engineer would probably feel that so high an importance should not be given to dielectric strength. The figure 20 could be changed then to any figure that in his judgment was applicable and similar changes made throughout this column. It makes absolutely no difference what these values allotted are as long as the same values are used to compare the different wires investigated.

It should also be noted that this method will compare equitably only wires of the same diameter; that is, a rating number of a No. 30 wire cannot be compared to that of a No. 40 wire, but several No. 30 wires or several No. 40 wires can be compared. This is true because, owing to inherent characteristics of manufacturing, the rating numbers obtained will be slightly different for different-size wires.

This method of rating has been in use for a considerable time, both for judging and maintaining the quality of wire produced in the manufacturing department and for determining its validity when compared with the losses encountered in a large coil-winding

*It is recognized that this test is defective in that no standard fingernail can be defined, but it has been found by a number of tests made by different people that if the same person makes the test, comparing different wires, he will get a very satisfactory comparison on the different wires in this test, and even with different investigators remarkably uniform results are obtained.

†"Impregnation of Enameled Wire Coils," by W. D. A. Peaslee, ELECTRICAL WORLD, Oct. 28, 1922.

department. The method is not commonly used on wires larger than No. 25 B. & S. gage, but in the larger wires, as they are stiff and difficult to handle, certain obvious modifications will be required in the determination of the different characteristics. The degree to which different operators making these tests on the same wire will check each other as to the index number obtained is surprising, and it is also surprising what a wide difference in index numbers will be arrived at in testing the standard products of various manufacturers in this line available on the market today.

PRECAUTIONS IN THE USE OF ENAMELED WIRES

Because of the peculiar characteristics of the enamel film care should be taken in using enameled magnet wires to avoid rough edges in the winding space and to avoid drawing the wire over rough edges or corners that might scrape the enamel from the wire, especially at the high winding speeds used in modern production methods. Moreover, the impregnation of enameled wires calls for precautions not ordinarily necessary in the textile insulated wires.†

It is believed that the method herein described as modified to meet the particular conditions of use contemplated is a very satisfactory one for an engineer to use in determining the relative value of various makes of enameled magnet wire submitted for his use. This confidence is based on a long period of use of the method in controlling the production of enameled magnet wire and in comparison with the production losses in a large coil-winding department. It is hoped that the ideas presented may be beneficial in acquainting engineers with the specific characteristics of enameled wire and widening the field of use of this material, permitting designing engineers to get the utmost benefit of its various characteristics.

†"Impregnation of Enameled Wire Coils," by W. D. A. Peaslee, ELECTRICAL WORLD, Oct. 28, 1922.

Tests of Line Materials

Wooden Pins, Cross-Arms and Other Overhead Construction Materials Tested and Weak Points Determined — Methods of Failure Indicated and Recommendations Made for Specifications

By HOWARD P. SEELYE
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TWO subjects, standardization and safety, have for a number of years been becoming more and more prominent as essential considerations in any engineering work. These two subjects are more or less interdependent in that no satisfactory standardization of materials or construction methods can be accomplished unless the element of safety is considered. Conversely, safety is promoted by the establishment and enforcement of proper standards.

Many central-station companies have been and are now studying the matter of standardization of overhead-line construction materials. The overhead-lines committee of the National Electric Light Association is doing a great deal to stimulate such action by its published standards. It is a dangerous practice, however, for any company to adopt, inadvisedly, the standards of any other company or of any group of companies as satisfactory for its own use. The special local conditions under which the materials are to be used must be taken into consideration, and, among other things, the mechanical strength of each item should be studied to determine whether under these conditions a sufficiently large factor of safety will be obtained in its use.

The National Electrical Safety Code furnishes data which can probably be satisfactorily adapted to most localities and from which can be readily determined the strength which should be demanded from any part of the construction, such as a cross-arm or a pin. A difficulty arises, however, when it is attempted to determine just what strength may be expected from any particular cross-arm or pin which is being used. The theoretical strength may be computed from the standard beam and column formulas, but in very many cases tests and actual experience in the field show results which do not compare well with such figures. There are several reasons which probably account for these discrepancies:

1. The materials are assumed to be more or less rigid in ordinary computations, while elasticity may have an important bearing on the strength as used in line work.

2. The loading is usually assumed as simple and directly applied to beam or column, while in fact it may be quite complex and eccentrically applied. Also the loads are extremely variable, sometimes involving a large impact loading.

3. Materials of different characteristics, such as wood and steel, are used together. The combined action may be quite different from that of either one separately.

4. Many of the materials are of odd shapes, very different from the rectangular or cylindrical beams or columns for which the formulas are developed.

A great deal can be learned of the action of various materials under load from strength tests, applying the load as nearly as possible as it will be applied in actual practice. A number of such tests on various overhead-line materials have been made by the author from time to time for the Detroit Edison Company in connection with the work of standardizing overhead-line materials. These tests have in most cases not been extensive enough to indicate conclusively the absolute strength of the class of materials tested. They have served, however, to indicate the method of failure of these units and the weak points. A study of these has led to improvements in design in some cases and has served to indicate what strength may be expected and what safety factors should be allowed. It is thought that some of these results and the conclusions drawn from them may be of interest to others engaged in such work and possibly stimulate further investigation.

The principal tests to be discussed were concerned with wooden pins, cross-arms and cross-arm braces. Under each heading will be given a brief description of the tests and the materials tested, the results and the conclusions drawn.

Wooden Pins Lack Uniformity

A series of tests was made on wooden pins of various sizes and types. In order to simulate field conditions as nearly as possible, the pins were set in a cross-arm, an insulator was screwed on and the load was applied by a loop of wire around the groove of the insulator (Fig. 1). The test was made in a laboratory testing machine. About 150 specimens in all were broken. The various sizes were:

Shank Diameter (In.)	Length (In.)	Thread Diameter (In.)
1½	9	1
1½	9	1⅜
1¾	10½	1
1¾	10½	1⅜
1¾	14	1⅜
2	18	1⅜

There were also some pins with ⅝-in. bolts through the axis with large washers and nuts under the cross-arm.

Some of the most important points observed and the conclusions drawn are as follows:

1. There is a great lack of uniformity in the strength of wooden pins. For apparently sound pins taken from the same lot the weakest in many cases showed only about half the strength of the strongest. For pins which were somewhat defective the difference was even greater. Considerable difference was noted also between pins of the same type tested at different times. This can probably be attributed largely to different grades of wood.

2. It seemed to make little difference in the strength of straight-grained pins whether the pin was held with the grain stratification parallel to, at right angles to or diagonal to the direction of the load (Fig. 2).

3. The longer pins, 14-in. and 18-in., in the majority of cases broke square off at the shoulder. The shorter pins in nearly all cases failed first by shear. This shear usually started by a crack at the lowest thread and followed along the grain toward the shoulder. Where the grain was perfectly straight the first shear was sometimes followed by another through the axis of the pin. In case the grain ran from the lowest thread somewhat toward the center, the first shear usually was the only one. Final failure, if the loading was continued, then came by the breaking off of the lower half at the shoulder (Fig. 3).

According to the generally accepted theory of stresses in beams, considering the pin as a simple cantilever beam, failure should take place either by a break in the fibers at the point of greatest bending moment—the shoulder—or by shear along a plane through the axis, according to the one of these stresses which first reaches the breaking strength of the material. Apparently, with the longer pins, in most cases the stress due to bending at the shoulder exceeded the tensile strength of the wood before the shearing stresses at any point passed the shearing strength. This might be expected on account of the relatively greater length and hence greater moment for the same load. It was also indicated by the fact that the breaking load of these longer pins was considerably less than that on the shorter pins of the same diameter at thread and shank (1¾ in. x 10½ in. x 1⅜ in.). The 14-in. and 18-in. pins showed fairly uniform strengths of around 1,000 lb. The 1¾-in. x 10½-in. x 1⅜-in. pins tested showed an average of 1,450 lb., but varied from as low as 590 lb. to as high as 2,280 lb.

With the shorter pins, however, somewhat different conditions prevail. Consider a cross-section *AA* through the pin just below the first thread (Fig. 4). The fiber stress at the extreme edge, *a*, may be computed by the usual formula. Similarly the stress at the bottom of the thread, *b*, may be computed and will be greater than at *a* for the same moment. If now we consider the section to be taken through *cd*, or on the edge of the thread, it would appear that there is an unbalanced tension between *c* and *d* on the right of the section with 0 tension at the left and that the stress on a unit area at the point *c* is greater to the left than to the right. Obviously this cannot be a true condition, so we must assume that the line of balanced stresses follows some indeterminate curve such as that shown dotted. This puts a tensile stress across the fibers of the wood in a direction in which the tensile strength is weak. Moreover, the natural stresses in the part above the point *c* must be transmitted to the part below by shearing stress along a plane through *c*. Both these factors tend to cause a crack at *c*, the actual unit stress being indeterminate and depending on the shape of the dotted curve. This action continues down the grain opened by this crack aided by the natural shearing stresses. If the load is continued after the shear, the strength of the pin may then be assumed to be that which the original pin would have had if sawed through on a longitudinal plane through *c* (Fig. 5) and will break by either bending stress at the shoulder or shear through the neutral axis. This theory is further borne out by the fact that pins with 1⅜-in. thread showed considerably more strength than those with 1-in. thread but of the same dimensions otherwise (at least 50 per cent more), and that comparatively small increase in strength was found with increase in size of shank from 1½ in. to 1¾ in. The 1½-in. x 9-in. x 1-in. pins showed an average strength of around 700 lb. applied at the insulator, but varied from as low as 430 lb. to as high as 870 lb. The same size pin with 1⅜-in. thread diameter stood 1,300 lb. average, 610 lb. minimum, 2,060 lb. maximum.

The pins first tested were of a design, as shown in Fig. 6a, with ten threads and a concave profile. It was thought, from the above theory, that considerably greater strength would be obtained by a reduction in the number of threads and a change in the profile. It was found that for all the standard small insulators in use six threads would be ample. A new pin was designed as in Fig. 6b. Sample pins of this design were made and tested, showing an apparent increase in strength as high as 46 per cent. Part of this may have been due to a better quality of material as more recent tests on commercial pins have not shown quite such favorable results. It is felt certain, however, that a considerable increase in strength is obtained at little if any increase in cost.

4. The insertion of a steel bolt through the axis of the wooden pins apparently added nothing to the strength of these pins; in fact, some of the tests showed an apparent decrease. In most cases the wood failed by breaking off at the lower thread (bending stress, not shear), the bolt bending. Continued loading splintered the wood in the threads and pulled the insulator off. This result might be expected from the fact that the bolt is at the neutral axis of the pin, where the bending

stress is least. This does not discount the possible advantage which the bolt might give if it were large enough to stand considerable bending stress itself.

CROSS-ARMS AFFECTED BY GRAIN

A number of cross-arms were tested in a beam machine, some with the load applied in the direction of the axis of the pinholes (simulating dead weight of wires, etc.) and some with the load applied at right angles to that direction (simulating dead-end stress). In these tests a block was bolted to the center of the arm simulating the pole. In addition, some field tests were made on both single-arm and double-arm construction, the arms being bolted to the pole as in practice considerable effect on the strength. The average figure given above was quite closely checked if the moments were figured about the first pinhole rather than the center. For those arms which broke at the center the unit strength, figuring moments about the center, was much higher than those breaking at the pinhole, indicating that the support of the gain probably reduced the actual stress between pinhole and center. In making these computations allowance must be made for that part of the cross-section cut out by bolt and pinholes.

3. Double-arm construction to be tested was erected with four 4-in. x 4-in. spacing blocks, one at each end and one at each pole pin (Fig. 7—$\frac{5}{8}$-in. through bolts through each block). Theoretically the strength of such construction might be figured in one of two ways —(a) as two single arms, (b) as a truss, the spacing blocks being assumed to be rigid. The latter method would indicate a strength five or six times that of the former.

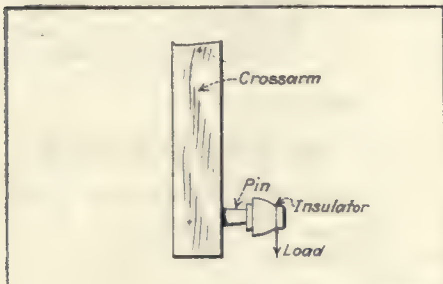


FIG. 1

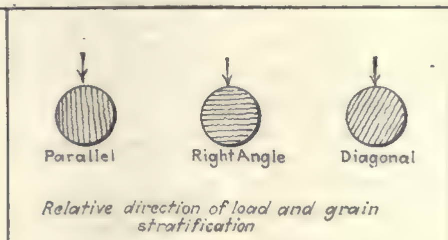


FIG. 2

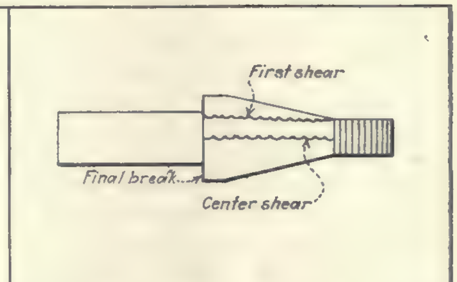


FIG. 3

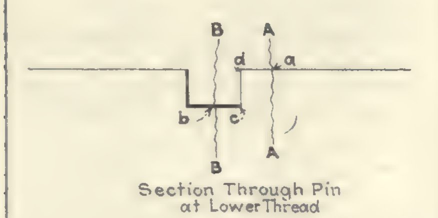


FIG. 4


FIG. 5

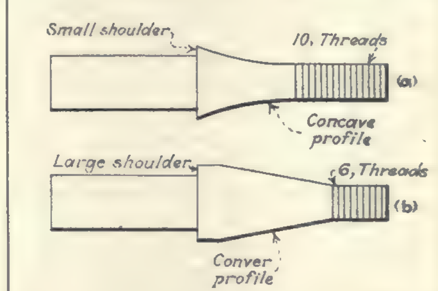


FIG. 6

FIG. 7

LINE MATERIALS TESTED

Fig. 1—Wooden pin.
Fig. 2—Effect of grains.
Fig. 3—Effect of pin length.
Fig. 4—Fiber stress in short pins.
Fig. 5—Shear and bending stresses.
Fig. 6—Old and new designs.
Fig. 7—Tests of double-arm construction.
Fig. 8—Tests of bracing.

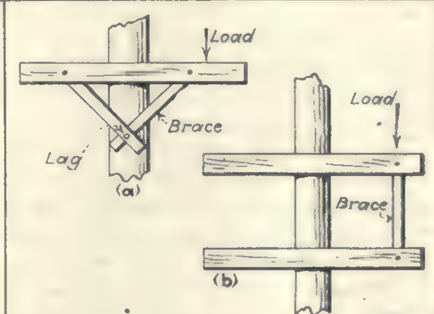


FIG. 8

and the load applied by block and tackle. The results noted were as follows:

1. In general the arms broke either at the center or at the first pinhole either side of the center. When the grain was very straight the break was usually sharply across the grain, although in some cases there was shearing on the neutral axis. Where the grain was a little crosswise there was usually shearing or a diagonal break.

2. For the arms tested the strength seemed to check fairly well the figure of 5,000 lb. per square inch for ultimate strength of Douglas fir given in the handbooks. For vertical loading—i.e., parallel to axis of pinholes—the method of taking moments about the center of the arm appears accurate. For horizontal loading (at right angles to axis of pinholes) the support given by the flat surface of the gain on the pole seemed to have

The tests made show that the spacing blocks do not hold the construction rigid. Their corners crush into the face of the arms and allow the arrangement to become distorted. The ultimate strength shown was somewhat higher than that of two arms acting independently, but probably not more than 25 to 30 per cent greater on the average.

Tests were made to determine the strength of flat crossarm braces individually under direct compression (Fig. 8a) and also in their usual position in construction (Fig. 8b). Comparative tests were made on braces of

¼-in. x 1¼-in. section and of 5/16 in. x 1½ in. These included both tests made in a testing machine using a jig to simulate conditions on the pole and field tests on a pole with load applied by block and tackle. The results may be summarized as follows:

SUMMARY OF BRACE TESTS

1. The braces tested (¼ x 1¼ in., 24 in. between bolt holes) showed considerable stiffness under direct compression (Fig. 8a). The average was about 1,800 lb.

2. Two such braces placed together on one side of the arm showed less than twice the strength of a single brace (about 75 per cent of that amount), due possibly to eccentric loading. Two braces one on either side of the arm showed about twice the strength of the single brace.

3. In theory when braces are erected, as in Fig. 8b, the brace on the side opposite the load will be in tension and, neglecting elasticity and distortion, the ultimate strength will be the strength of that brace. It was found that the weak point of this construction is the point *g*, where the braces are fastened to the pole. The tension in the left-hand brace and the compression in the right-hand brace combine to exert a considerable side thrust on the lag or bolt in the pole. The wood crushes under this stress, the lag is forced to one side, and the brace which is in compression finally fails by buckling. The ultimate load as shown by the machine tests was about 50 per cent higher than that of a single brace on the compressive side only under similar loading. The distortion of the angles between braces and cross-arm reduces the stress on the tension brace and increases that on the compression brace so that it fails at comparatively low impressed loading. This was further shown by the fact that the machine tests were made using a piece of hard maple for the pole with a ½-in. bolt, while the field tests were made on a rather soft cedar pole with a ½-in. lag. The load at failure for the former was considerably higher than for the latter (2,700 lb. as compared with 1,400 lb., for example, for some of the higher values shown). In some of the tests on the pole failure took place at quite small loads (800 lb. or 900 lb.), applied over the end of the brace.

The advantage gained by the use of a heavier brace is somewhat doubtful. In most of the tests the ultimate load appeared to be somewhat higher for the heavier brace, probably owing to its greater strength under compressive loading, which appears to be the criterion of strength after distortion takes place. The better solution of the problem would seem to be to strengthen the point of attachment of the braces to the pole so as to prevent, as far as possible, failure and distortion at that point. If this can be done, the smaller brace should be satisfactory for all ordinary loads, as shown by the machine tests in which that point was strengthened.

Several other tests have been made on various materials, but the results are less important. Two points may be of sufficient interest to be mentioned.

One theory of computing the strength of an anchor has been to figure the weight of a cone of earth with its apex at the anchor, base at the ground surface and sides at the characteristic angle of repose of the soil. The few tests made seem to show that this action takes place only near the surface of the ground. At the depth at which such an anchor is usually buried the strength depends rather on the area of the anchor and the resistance of the soil to compression.

Some side-arm braces made of angle iron and some of pipe were tested. The actual load was only a fraction of that computed by the usual column formulas, even making allowance for the large value of the quantity derived when the length is divided by the radius of gyration. This was probably due to the eccentric loading as the braces were bent and forged at both ends.

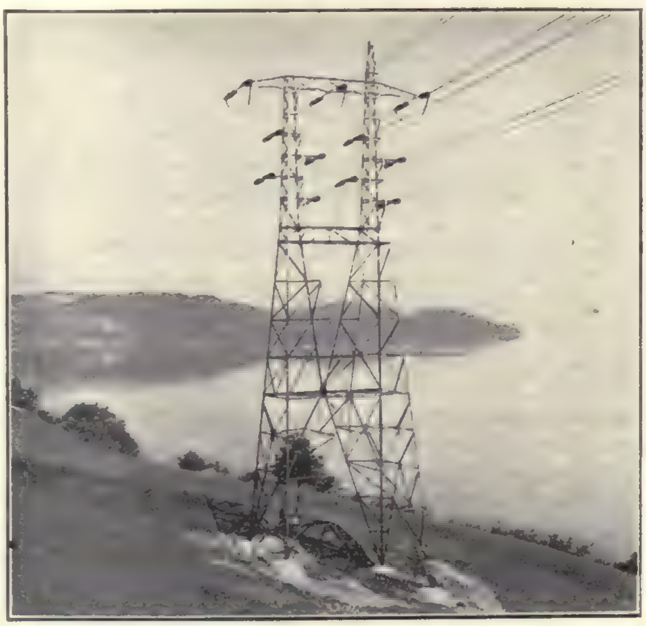
The results of these tests and the conclusions which have been drawn from them as expressed above are by no means considered final. Definite numerical values for strengths of various materials have purposely been omitted in most cases as they are not conclusive and might be misleading. It is felt that all these matters are worthy of further tests and study, and the above discussion is offered merely as an indication of what has been observed and what should be looked for in such work.

Transmission in Switzerland

Combination of 60,000-Volt and 135,000-Volt Lines on One Tower Structure—Two Frequencies—Insulator Design and Span Construction

BY A. KUHN
Consulting Engineer, Zurich, Switzerland

HIGH up in the Swiss mountains, paralleling the recently electrified Gotthard Railway system, runs a very modern high-voltage transmission line. Eight single-phase, 60,000-volt lines, operating at 16⅔ cycles, and a three-phase, 135,000-volt line, at 60 cycles, are carried on the same towers. The eight single-phase conductors transmit power from the Amsteg hydroelectric plant for the Gotthard Railway, and the total amount of power transmitted is 50,000 kw. The top

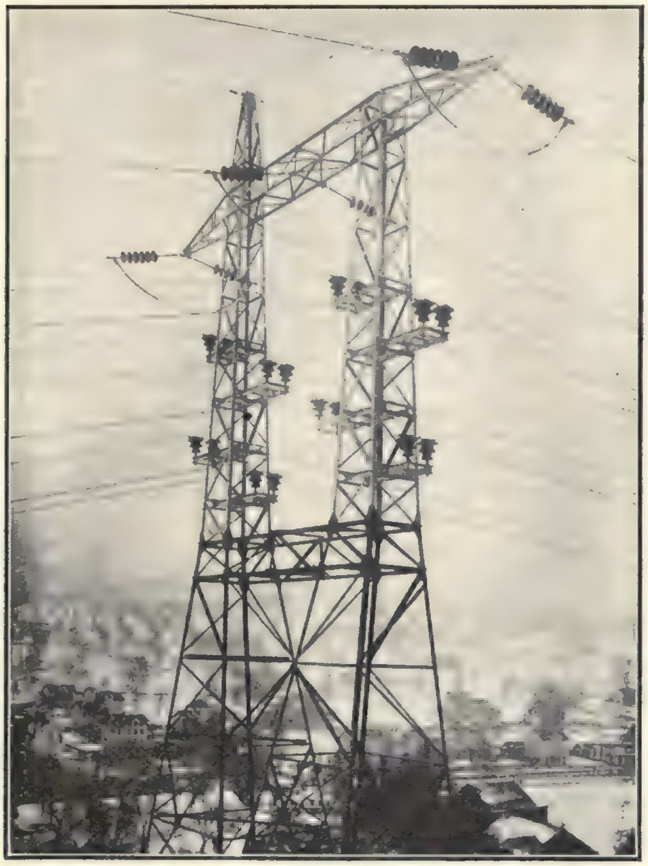


TOWER USED ON TANGENT CONSTRUCTION WITH 60,000-VOLT AND 135,000-VOLT LINES ON THE SAME STRUCTURE

circuit, consisting of three cables in a horizontal plane, is built for 135,000 volts and transmits the surplus power of the Amsteg plant. This amounts to 32,000 kw. and is now transmitted at 80,000 volts, 50 cycles.

This circuit may later on be used as a feeder for railway systems in the north, though considerable

difficulties will have to be overcome in installing a single-phase, 60,000-volt, 16⅔-cycle system. The eight single-phase conductors are of copper of 95 sq.mm. cross-section (185,000 circ.mils) for normal spans up to 600 ft. Bronze conductors of the same cross-section are used for spans up to 1,680 ft. The minimum horizontal distance between conductors is 7.23 ft.; the vertical distance is 9.20 ft. The distance between the



ANGLE TOWER CONSTRUCTION WITH 60,000-VOLT AND 135,000-VOLT LINES ON SAME TOWER

conductors of the 135,000-volt system is 14.8 ft. The cables for normal spans are of aluminum, having a cross-section of 191 sq.mm. (375,000 circ.mils) and consisting of thirty-seven wires each, the over-all diameter being 0.725 in. For long spans bronze cables of the same dimensions as the aluminum are used. The overhead ground wire of standard steel of 49.5 sq.mm. section (0.35 in. diameter) is mounted on a special top construction on the side of the line closest to the mountains.

The idea of combining the two systems on one tower line was suggested by Dr. B. Bauer, director of the Société Suisse pour le Transport d'Energie, Berne. The plan resulted in building lines through a very difficult territory in the most economical way and also solved the problem of "economical use of surplus energy."

Heavy avalanches of snow in winter and earth slides during the rainy season are very frequent throughout this territory, and the utmost caution was exercised when surveying the route of the line. The towers, because of the duties that they are to perform, are of somewhat special type. Cement and practically all the other materials for construction had in most places to be transported by mules or men or mechanical devices. The towers and lines are designed to withstand a wind pressure of 26.6 lb. per square foot, the factor of safety being not less than four at any place. The transmission line is 31 miles long and has been in operation since the summer of 1922.

The insulators adopted after long and careful tests are Locke No. 7215 pin type for the single-phase spans of normal length. For the long spans and for the 135,000-volt system Locke suspension insulators No. 5800 and high-strength type No. 7500 were adopted. Of the pin-type insulators, 1,900 were used; of the suspension type, 7,900. For all strain strings the Locke high-strength type has been used, thus permitting the use of single strings of insulators on long spans up to nearly 1,700 ft. The use of a single string of these high-strength insulators has proved a money-saving factor for the entire project as well as an improvement from the electrical point of view. A small number of insulators of another make have also been used.

It is probable that when the voltage of the three-phase system is raised to 135,000 some device may be adopted for improving the voltage gradient along the string. The maximum voltage loss of both systems ranges between 4 and 5 per cent.

The total cost was 4,680,000 Swiss francs. The builders are considered to be the national leaders in high-voltage transmission-line construction. The 130,000-volt line which is built at this time will constitute only a small part of the projected south-north transmission system of Switzerland. The Société pour Transport, strictly a private company, with a capital of more than 10,000,000 Swiss francs, is backed by the leading hydro-electric concerns of Switzerland, as well as by the Federal Railways. It is, therefore, especially fitted to carry out and complete the main high-voltage distribution systems in that country.

Electrification of Railroads in the British East Indies

DETAILS of the electrification project of the Great Indian Peninsular Railway are reported by T. M. Wilson, United States Consul at Bombay. Contracts have already been placed for the Harbor Branch lines from Bombay to Kurla and the Mahim Chord linking the Harbor Branch with the Bombay, Baroda and Central Indian Railway at Mahim. It is hoped to have electric service on this section in January, 1925.

Contracts have been placed also for the local passenger service between the Victoria Terminus and Thana. Electrical operation of this section will commence shortly after the electrical operation of the Harbor Branch, probably early in 1926.

Power will be delivered by the Tata hydro-electric companies to the railway company at the receiving station at Dharavi at 20,000 volts, whence it will be transmitted through underground cables to the railway substations at Wadi Bunder and Kurla. Power will also be supplied later at the railway company's substations at Thana and Kalyan at 40,000 volts. At all four of the substations it will be transformed to direct current at 1,500 volts by means of transformers and rotary converters.

Aside from the electrification of the railroads as far as Kalyan, work upon which is to commence at once, the electrification of what is known as the Ghaut section of the railways is to be effected. When the Ghaut section is electrified through passenger service as far as Igatpuri and Poona (119) miles) is planned.

Selling Electric Service to Large Users

Proper Selection of Sales Force—Engineering Service Must Be Aided by Commercial Ability—Certain Forms of Advertising that Have Been Used Effectively

By W. H. WHITTON
The New York Edison Company

CONSIDERED in general terms, the problem of selling electric service to large buildings is much the same as that of selling any other commodity. Stated briefly, it is merely how to create in the mind of the prospective customer a desire for the product sufficiently strong to overcome his sales resistance. Like so many other problems which in principle are quite simple, it becomes, however, highly complex when affected by the very practical considerations of time, place and circumstance, the personal equation, habits, customs and manners, and the thousand and one other factors that may weigh so heavily in the scale when a sale is in negotiation.

The selling methods used by the New York Edison Company in its canvass for large-building service are the logical outgrowths of the experience gained in many years of effort in its particular field—a field which differs in some respects from that occupied by perhaps any other central-station company. Manhattan being the great business and financial center of the country, her large electrical installations reflect the nature of the city's principal activities, which, being commercial rather than industrial, have resulted in a remarkable development of office, commercial, hotel, apartment and amusement building construction. The large industrial plant is conspicuous by its scarcity, for while it is true that Manhattan's output of manufactured articles ranks high in value, the greater number of manufacturing establishments are relatively small units housed in loft buildings, the larger of which may contain half a hundred individual establishments.

Few Private Plants Installed

This situation has, of course, had its effect on the development of the large building selling force, the proper selection of which will be recognized as a fundamental requisite. Proceeding partly on the theory that a personality that is 100 per cent good for engineering may nevertheless be nearly 100 per cent bad for selling, and partly on the fact that in Manhattan the bulk of purchasers are business executives rather than those of more technical inclinations, salesmen are selected for their selling qualifications and with comparatively little reference to their engineering knowledge, although some experience or training of the latter kind is, when added to a good selling personality, a decided asset. Engineering problems have, of course, to be handled, but this is done through an organization of commercial engineers whose services are available to the men on the firing line. This concentration of engineering talent which makes it possible for any one of the six hundred-odd members of the commercial department to get the best engineering advice on any commercial topic is considered to have been a valuable contribution to the success of the company's large building canvass.

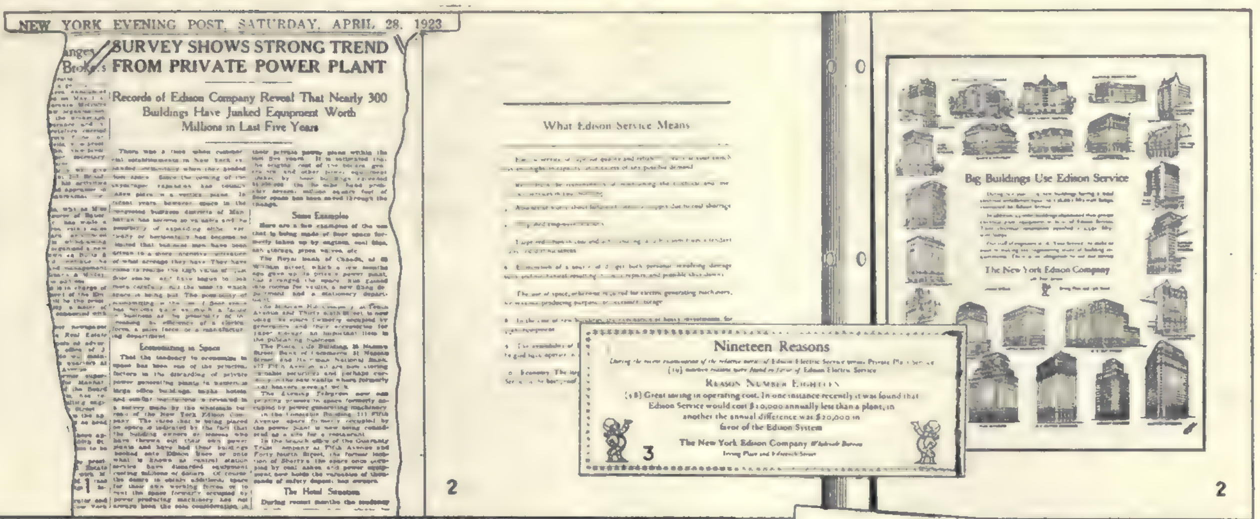
The measure of this success is to be found in the present standing of the private plant—whether considered in connection with proposed new buildings or in existing structures where plants are operated—as compared with its position in earlier years. A decade ago it was the proposed plant that received the principal attention of the selling force; now it is the existing one. This is the natural result of the improved position of the central station as a successful competitor, an improvement which had almost eliminated the isolated plant as a factor in new buildings and has made its continued life in old buildings a matter of great uncertainty. This can best be illustrated by actual figures from the company records of plant competition covering the past twenty years. In the twelve months of 1902 no less than fifty-three private plants were installed in new buildings in Manhattan. In the intervening years the number of cases of the kind has dropped to the point where during the past five years there has been an average of less than one yearly. In 1902 twenty-one existing generating plants were abandoned. During the past five years the number has averaged fifty-seven yearly, and the buildings represented are of immensely greater size than in the earlier period.

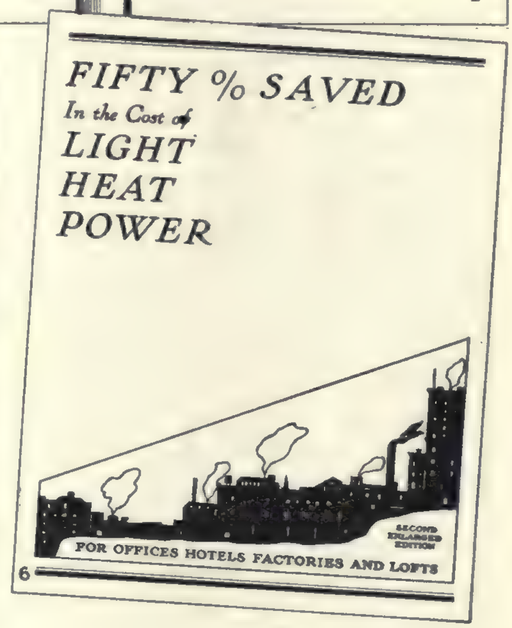
Many factors have contributed to this favorable result. Of first importance is the fact that practically every item of cost connected with plant operation is very much higher today than twenty years ago, in contrast with which the central-station rates are materially lower. Hydraulic elevators were then the best available for the highest class of service, and their adoption usually led to the installation of generating equipment as well. Basement and even sub-basement space has in many instances developed unexpected value; and, of not the least significance, the public in general and large building owners in particular have come to a better realization of the merits of central-station service and to a better appreciation of the attitude of those who have made it what it is.

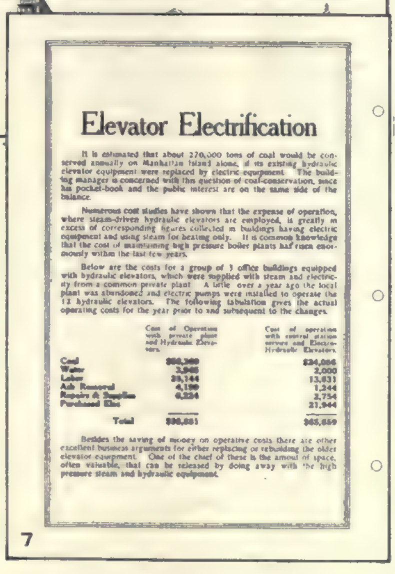
To just what extent intelligent selling effort has contributed to the general result it is difficult to estimate, but there can be no question that it has taken an important part in establishing the superiority of central-station service and that the main burden of the work has rested with the salesmen through personal contact with the public. Realizing this, it has been the endeavor to place at the disposal of the salesmen the best auxiliary resources in the shape of engineering assistance, publicity and advertising, letter writing and so forth that could be made available.

Letters to Owners Entering Wedge

Particular emphasis has been placed on letter writing. A tactful letter paving the way to an interview or confirming and driving home what was said at the interview is an extremely useful auxiliary, while a poorly written letter does more harm than good. Form or semi-form letters as a means of opening up leads have been used to good advantage. It has been found







Elevator Electrification

It is estimated that about 270,000 tons of coal would be conserved annually on Manhattan Island alone, if its existing hydraulic elevator equipment were replaced by electric equipment. The building manager is concerned with this question of coal-conservation, since his pocket-book and the public interest are on the same side of the balance.

Numerous cost studies have shown that the expense of operation, where steam-driven hydraulic elevators are employed, is greatly in excess of corresponding figures collected in buildings having electric equipment and using steam for heating only. It is common knowledge that the cost of maintaining high pressure boiler plants has risen enormously within the last few years.

Below are the costs for a group of 3 office buildings equipped with hydraulic elevators, which were supplied with steam and electricity from a common private plant. A little over a year ago the local plant was abandoned and electric pumps were installed to operate the 13 hydraulic elevators. The following tabulation gives the actual operating costs for the year prior to and subsequent to the changes.

	Cost of Operation with private plant and Hydraulic Elevators.	Cost of operation with central station service and Electro-Hydraulic Elevators.
Coal	[illegible]	$24,086
Water	3,948	2,000
Labor	28,144	13,631
Ash Removal	4,189	1,244
Repairs & Supplies	6,224	2,754
Purchased Elec.		21,944
Total	[illegible]	$65,659

Besides the saving of money on operative costs there are other excellent business arguments for either replacing or rebuilding the older elevator equipment. One of the chief of these is the amount of space, often valuable, that can be released by doing away with the high pressure steam and hydraulic equipment.

7

SELLING METHODS USED BY NEW YORK EDISON COMPANY

1. Reproduction of news item. 2. Report binder. 3. One of series of nineteen blotters. 4. Reproduction of newspaper "ad." 5. Elevator electrification circular. 6. Pamphlet discussing efficient operating methods. 7. Elevator advertisements.

that people do not as a rule pay much attention to what they recognize as form letters, and it seems to be true that they usually do recognize them, no matter how skillful their execution. This difficulty has been largely overcome, when letters are sent out in quantities of not more than a few hundred, by using a general form, but introducing into each a sentence or two having application to the particular building to which it refers. The returns from such letters have exceeded by several hundred per cent those from straight form letters, even where the latter have been individually typed. It requires considerable careful thought to add the special touches that make the letters practically individually dictated, but the results have justified the effort and expense.

Engineering services and information, either from within the company or from outside, are liberally supplied, including bound reports of comparative operating cost studies and of other technical subjects. The conduct of comparative cost studies necessarily includes complete tests and observations, and it has been found of great assistance where change-over work from steam to electric apparatus or from high-pressure to low-pressure steam is under consideration to furnish the building owner with properly prepared specifications. Work of this kind, if not skillfully planned and executed, may prevent the accomplishment of the full measure of savings possible and thus bring unmerited discredit to the central-station substitution idea. In connection with proposed new buildings engineering assistance has been found acceptable in the preparation of lighting and power layouts, elevator and heating studies and cost estimates of various kinds.

Where reports are made to building owners it is the endeavor to couch them in terms as non-technical as is practicable considering the technical nature of the subject, clearness and conciseness being emphasized. They are bound in flexible paper binders, the inside covers of which, as shown in the illustration, are used to spread the gospel of central-station service. In practically all cases where cost comparisons are desirable—in shutting down plants, keeping out proposed plants, replacing hydraulic elevators by electric ones, substituting electric for steam auxiliary apparatus and so forth, reports of this kind are made.

A typical isolated-plant report will contain in the

introductory pages a brief statement of the operating conditions, the purpose of the study and the conclusions reached, including a summarized tabulation of the relative operating costs and the expected savings. The thought is to present a compact but comprehensive picture of the whole to the prospective customer before he becomes immersed in the details. In the body of the report appear the recommendations covering changes in equipment and operation methods, and under appropriate headings are discussions of each item of expense, whether with the isolated plant or with central-station service. Statistics relating to the building and its equipment are usually included as an appendix.

Personal Contact and Supplementary Advertising

The canvassing system requires periodic calls on every "prospect," but that there are limits beyond which it is injudicious to trespass upon the time and patience of owners of large buildings every good salesman realizes. Thus there come inevitable time gaps. These can, however, be bridged in a measure by the use of advertising material, for while it will be realized that selling electric service to large buildings is distinctly not a mail-order proposition, good use can be made of advertising and publicity mediums. Some examples of the kind of material used are shown in the illustrations.

The circulars No. 2 and No. 4, with the pictures of large buildings around the borders, are reproductions of advertisements which have been run in the daily papers. Each circular when mailed is accompanied by a return post card, and it is interesting to find that many more leads were obtained from the distribution of circulars than from the newspaper advertisements, although much favorable comment was made on the latter and their value as contributing factors should not be underestimated. Several notable contracts can be credited to this direct-by-mail feature of the canvass for plant abandonment. Illustration No. 3 is one of a series of nineteen blotters, on each of which appears a separate point of superiority of central-station service. These blotters were mailed to private-plant operators at intervals of two weeks, the series thus covering a period of thirty-eight weeks and serving as a reminder during that time of the desirability of central-station service.

It has long been the policy to give space in each issue of the company's house organ, the *Edison Monthly*, to an article having to do with the use of energy in notably large installations, with the intent to spread as broadly as possible information regarding the extent to which central-station service is being utilized in important structures. Publicity of a more indirect kind is shown in Nos. 1, 6 and 7. The first is the reproduction in circular form of a news item which appeared in one of the local papers, which has thus been called to the attention of those to whom it should be of the greatest interest. No. 7 is a program advertisement, which in due time is scheduled for reproduction and distribution where it will do the most good.

The pamphlet, "Fifty % Saved," which has been placed in the hands of every private-plant operator in the city, is a valuable contribution to the economics of central-station service in connection with low-pressure steam systems. It discusses in detail the considerations involved in deciding between central-station and private-plant service and the changes that should be made to adapt existing installations for the most advantageous system of operation in conjunction with central-station service, and it gives some interesting figures of actual results under various operating methods. Other publications bearing either directly or indirectly on the subject have also been distributed at various times, not only to plant operators, but to real-estate firms and large property owners, architects and engineers.

The use of photographs has not been overlooked. Pictures of important buildings, both new and where plants have been shut down, as well as of abandoned generators and electrified machinery, are part of each salesman's equipment. "Before and after" photographs of plants shut down have been particularly helpful, especially where accompanied by corresponding figures of operating cost.

The keeping of records is a tiresome but necessary feature of any well-conducted selling organization. It is something that can readily be overdone, for it is much easier to devise a complicated system than to keep it up afterward, especially as the good salesman is rarely systematic and is not especially noted for attention to details. The attempt has been made to devise a system complete enough to record fundamentals and to keep track of canvassing developments, but simple enough to prevent its being a burden to those charged with its maintenance. Separate card records are kept of the individual buildings in the various divisions, such as new buildings, hydraulic elevator buildings, private-plant buildings and so forth. Papers pertaining to each building are kept in individual envelopes, filed according to key numbers. Carbon copies are, of course, kept of all correspondence, office memoranda, orders, reports and other papers, and when a case is in its active stages, which it may be for a year or more at a time, these papers are arranged chronologically and kept together by a simple fastener. A bird's-eye view of the status of the case and of everything of importance that has occurred can thus be obtained in a very few minutes, a feature the value of which will be appreciated by any manager who has found it necessary to familiarize himself quickly with negotiations covering a more or less extended period and involving details of perhaps considerable complexity.

Choosing the Right Salesman for the "Prospect"

The assignment of "prospects" to salesmen is a matter that has received much attention. At one time geographic divisions were observed, but this plan, while perhaps offering the simplest and most convenient system, was early discarded as illogical and ineffective where large and important undertakings are concerned. In its stead has been substituted a scheme of assignment according to the character of the building, this being modified, however, whenever it seems advisable, by questions of personal acquaintanceship, special qualifications or other determining factors. The successful application of a method as flexible as this presupposes an intimate acquaintance with the selling field and with the qualifications and characteristics of the salesman. It has certain obvious elements of weakness, but there seems to be nothing quite so important in selling as picking the right man for the job in hand, and the system that permits this needs no apology for any minor defects.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Proposes "Marker Wiring"

To the Editors of the ELECTRICAL WORLD:

Noting the editorial in the July 28 issue with particular reference to the subject "Need of Distinguishing Between Polarized and Identified Wiring," may I suggest "marker wiring"? G. W. SHOESTER.

Trenton, N. J.

Suggests the Word "Selective" as Substitute for "Polarized"

To the Editors of the ELEC RICAL WORLD:

Referring to your editorial on page 167 of the issue of July 28, I should like to suggest the use of the term "selective" to be applied to wiring receptacles, etc., in place of the word "polarized." The word "selective" seems to be an improvement on "identified," as suggested by you, for the reason that while it would be all right to speak of identified wiring, one can hardly refer to an "identified receptacle," whereas the word "selective" can be applied equally well, as in "selective wiring," "selective receptacles," "selective plugs," etc. The meaning would be easily grasped by any one. Perhaps other readers of your paper will express their opinion of the suitability of the term.

Toronto, Canada. A. S. L. BARNES.

Economic Loading of Line Transformers

To the Editors of the ELECTRICAL WORLD:

The article "Economic Loading of Line Transformers" in your June 23 issue, written by H. W. Watt, electrical engineer of the Westchester Lighting Company, has just come to my attention and has been read with a great deal of interest.

When the writer was manager of the Lake Charles (La.) Railway, Light & Water Works Company about seven years ago he saw the necessity of a better means of ascertaining the condition of pole transformers in reference to load than that presented by the usual records of connected load, etc. The use of recording ampere meters was tried for this purpose, but they were not altogether satisfactory and so the manufacturers of the transformers were asked to state the limit of safe temperature of oil that their transformers would stand, as read by a mercury-tube thermometer, and a small margin was allowed and the loads on the transformers were adjusted with that in view. After the danger point was reached additional load was never connected without a further study of the conditions.

The thermometer used for this purpose was a self-registering, armor-clad, straight tube, suspended in the oil of the transformer. The period of test depended on conditions that are obvious. We found the use of these thermometers to be a great economy in rearranging and extending our distribution system as it effected a considerable saving in transformers.

H. F. CAMERON.

Arkansas Light & Power Company, Malvern, Ark.

Deviations from Code Should Be Determined by Inspection Department

To the Editors of the ELECTRICAL WORLD:

The article entitled "Delay in Changing the Code," by R. S. Hale, which appears on page 102 of the July 14 issue of the ELECTRICAL WORLD, it seems to me, rightfully emphasizes a very important matter in administering the electrical code when the author says that electrical inspection departments should decide for themselves when deviations from the code will make not only just as good or safe an installation but possibly a better installation than the one contemplated by the code.

It would seem that the conditions prevailing in Wisconsin are particularly well adapted to secure this flexibility while at the same time maintaining a proper standard. The law which imposes upon the Industrial Commission the duty to investigate, ascertain, declare and prescribe the standards for safety to life and property also requires the commission to modify or waive its standards or orders whenever it can be shown that another method of securing the same protection is to be used.

This provision of the statutes practically insures employers and others against the imposition of arbitrary standards, rigidly enforced by inspectors, no matter how good the substitute or new way may be. Moreover, the commission seeks in the first place to make its standards and orders conform to the best and least expensive practice which will insure safety. Therefore the various codes, including the electrical code, which are now in force were adopted only after they had been drafted and recommended for adoption by an advisory committee, thoroughly representative of the various classes affected by any particular code. As an example, the Wisconsin State Electrical Code was drafted by a committee of fourteen electrical men, representing all branches of the industry. This committee did its work carefully and slowly and at the end of two years by unanimous action recommended the present code for adoption by the commission, and the commission adopted it as presented. Future changes in the code will be made in the same manner, so that if some new and better construction is developed than is called for by the code and any existing provisions in the code should prohibit the use of such new construction, the electrical industry through this advisory committee will be enabled to advise the commission as to what changes to make in the code. Such changes are certain to be made provided they do not tend to reduce the safety of the installation.

Finally, while it requires thirty days for a general order of the commission to become legally effective, orders may be repealed in fifteen minutes if such haste be necessary to prevent an injustice.

As much as possible, it is the aim of this commission to establish standards by means of general orders; but this means that exceptions will arise, and when they do arise proper modifications of orders are intended to be made upon application. As a matter of fact, however, the number of applications for modification of orders of the electrical code are very few, which seems to indicate that the code, which follows closely the two national codes, meets practical conditions very satisfactorily. JOHN A. HOEVELER, Electrical Engineer.

Industrial Commission of Wisconsin, Madison, Wis.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Special-Type Disconnecting Switch Developed for 220,000 Volts

By Frank P. Lawler
Engineer with Frank G. Baum, Consulting Engineer, San Francisco, Cal.

Factors which are practically negligible in the design of 110,000-volt switching stations become of paramount importance in the design of stations for 220,000-volt operation. In the past few years development of high-voltage transmission systems has been very rapid and has progressed to a point where the voltages and capacities are of a magnitude that fully justifies far more careful consideration in connection with the switching stations at the ends of the lines than has heretofore been customary. Probably no item in conjunction with the electrical system development of recent years has increased in greater proportion than the expense of the high-voltage outdoor switching station. For switching a double-circuit line the space requirement during this period of development has increased from a few thousand square feet to more than a hundred thousand square feet.

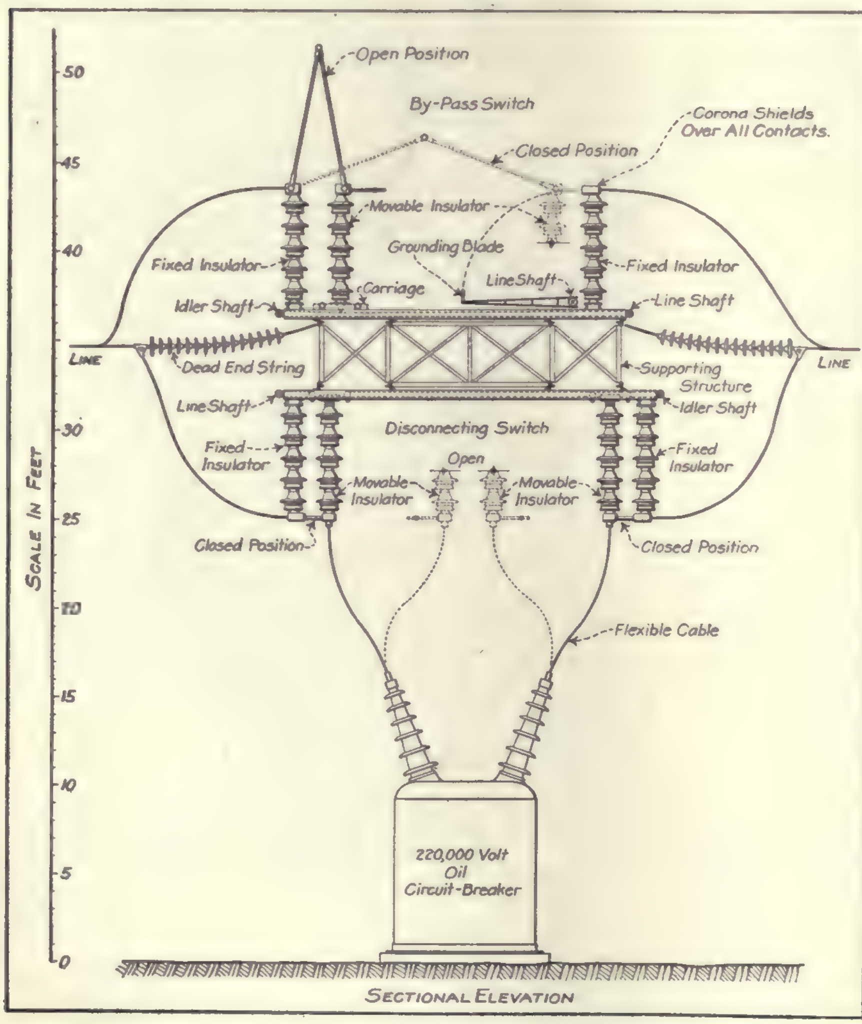


FIG. 1—SCHEMATIC DIAGRAM OF 220,000-VOLT DISCONNECTING SWITCH USED BY THE PACIFIC GAS & ELECTRIC COMPANY

In designing the 220,000-volt generator switching station at Pit River* and the Vaca-Dixon receiving substation on the 220,000-volt system of the Pacific Gas & Electric Company, an endeavor was made to develop a switching scheme which would possess all the qualifications of safe operation combined with minimum cost and an absolute minimum space requirement. This work was done in the office of Frank G. Baum, consulting hydro-electric engineer of San Francisco, under the direction of the writer.

The accomplishment of the object in view was principally due to the development of a new type of disconnecting switch, radically different from anything used heretofore. The main requirements taken as the basis for the development of this switch were:

1. To obtain a switch in which there would be no tendency to change its setting through the influence of gravity following the mechanical failure of any part.
2. To obtain a switch in which all opening or closing motion would be in a vertical plane through the line conductor, therefore requiring no extra clearance for its installation in the line.
3. To obtain a switch which could be mounted above or below with equal facility and which could readily be equipped with a grounding blade.
4. To obtain a switch which has no long blades rotating in a horizontal plane and hence requiring extra separation between the several phases, or having no long blades opening in a vertical plane, necessitating large overhead clearances.

The principle of operation and general form of this 220,000-volt air-break switch are shown in Fig. 1 and Fig. 2. A general view of the disconnecting switch and supporting structure is also shown in the engineering frontispiece, page 372, of this issue. A patent on this apparatus has been applied for. Over each oil circuit breaker is provided a double-break disconnecting switch which disconnects both terminals from the line. Above the disconnecting switch is mounted a

*"The Pit River Power and 220,000-Volt Transmission Problem," by Frank G. Baum, Electrical World, Jan. 27 and Feb. 3, 1923 (pages 205 and 263 respectively).

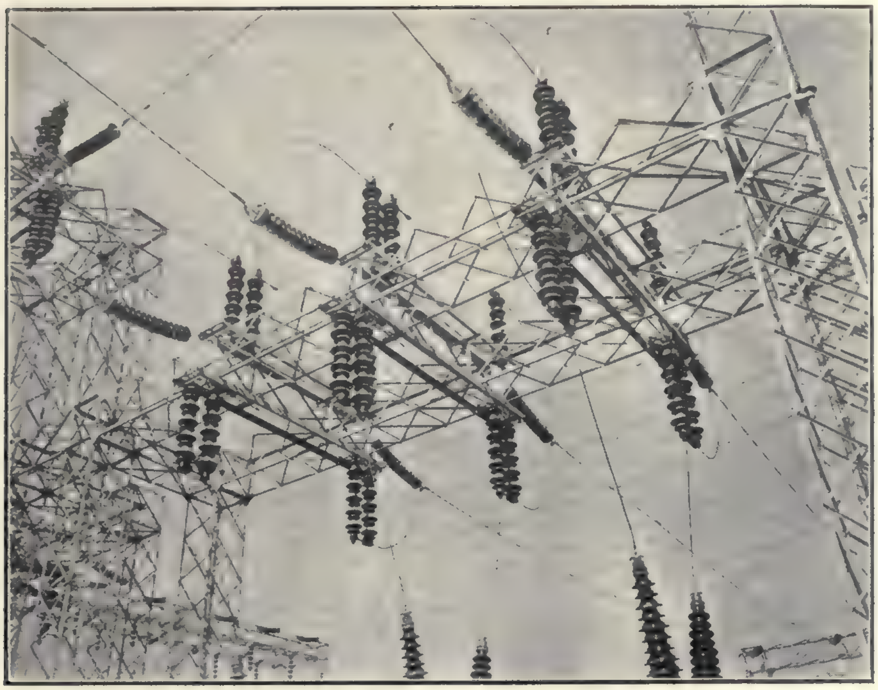


FIG. 2—MINIMUM SPACE REQUIREMENTS ARE COMBINED WITH MAXIMUM BREAKING DISTANCE IN NEW 220,000-VOLT DISCONNECTING SWITCH

single break by-pass switch which allows the line to be kept in operation when the oil circuit breaker is disconnected for repairs or inspection. The readiness with which the operator or workman can see if the line is open or closed is an important feature of this design and imbues the workman particularly with a sense of safety.

The by-pass switch consists of three insulator pillars, of which the two outer are fixed, the center one being movable in a trackway. The movable insulator is connected by a toggle to one of the stationary pillars. This toggle is literally a section of the line which is "lifted" out of place or "lowered" into place by the movement of the center insulator. The operation of the three poles simultaneously is accomplished by the rotation of a line shaft at one end of the trackway. The line shaft is connected to the carriage of the movable insulator by means of a sprocket and endless chain. A grounding blade, which short-circuits one of the fixed insulators, is provided and is operated by a separate line shaft as shown in Fig. 1.

The disconnecting switch consists of four insulator pillars, the two outer ones fixed and the two center ones movable on carriages. The control is by means of a line shaft similar to the by-pass switch, the rotation of which causes the movable insulators to move simultaneously in opposition to one another to and away from the contacts on the fixed insulators, as shown in Fig. 1. Thus the contact is made and broken at two points. Flexible cables connect the contacts on the movable insulators to the oil circuit-breaker terminals as shown in Fig. 1.

The three horizontal line shafts which operate the by-pass switch, the disconnecting switch and the grounding blades are extended to the supporting columns, where by means of bevel gears they connect to vertical riser shafts which drop to hand-wheel controls suitably located above the ground. The three controls are provided with locks in both open and closed positions.

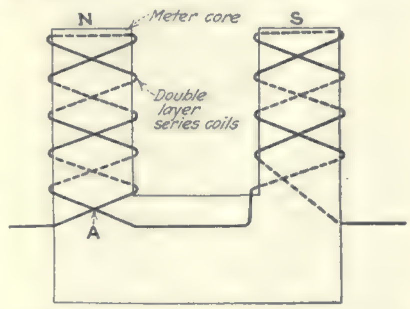
Air-break switches of the rocking insulator and the rotating insulator types have been used very successfully on many of the comparatively low-voltage lines, but are not adapted for 220,000-volt operation. In the older design of switches, aside from the mechanical problem of rocking three insulator pillars, each of which is about 7 ft. long and weighs about 150 lb., there is present a gravity factor which may throw the switch into the wrong position following the failure of a mechanical part. Counterweighting to avoid this complicates the structure and adds to the cost. In rotating an insulator pillar of this size the torsional strain becomes excessive. The torsional strength of the insulator has not been increased in proportion to that of the voltage, length or weight. In addition, the rotating insulator is usually accompanied by a rotating arm at its top, and the movement being in a horizontal plane necessitates extra separation of the phases. The importance of this can best be appreciated from the fact that in this design the phases are spaced at a minimum distance of 14-ft. 3-in. centers, which necessitates supporting columns on about 50-ft. centers. An increase of 25 per cent to 50 per cent over this figure to take care of the clearances for operating mechanism means a material addition in ground space and in supporting structures.

These switches were built by the Pacific Electric Manufacturing Company of San Francisco and are now installed at the Vaca-Dixon substation of the Pacific Gas & Electric Company.

Causes and Remedies of Meter Creeping

BY R. G. THYSE
Meter Department, Otter Tail Power Company, Fergus Falls, Minn.

IMPROPER lag coil, light load adjustments and puncture or short circuit of the current coils are among the factors that cause a watt-hour meter to creep. All watt-hour meters are provided with a lag coil consisting of one or more turns. Proper adjustment of this coil will change the shifting field so that the phase displacement between the series current flux and the potential current flux is 90 deg. when the power factor is not unity. Overlagging or underlagging will cause the rotating disk to creep. When the light load adjustment is set so that the meter over-registers, the disk is liable to creep forward at no load. If, on the other hand, it is set so that the meter under-registers, the disk may creep backward.



METHOD OF STUDYING METER CREEPING

A puncture or short circuit on one of the series coils will cause the disk

to creep. In the accompanying diagram is shown a series-coil pole punching wound with double layer coils. If a short circuit or puncture occurs at *A*, there will be a closed electrical circuit through the coil on pole *N*. The current induced in the turns of this coil by means of potential circuit flux will produce a magnetic flux of its own, which, out of phase with potential circuit flux, causes the disk to creep. The punctures are caused by lightning, while short circuits occur when the insulation in the current coil is poor or has become damaged.

Extracts from an Operating Code*

Maintenance of Rotating Electrical Apparatus

DETAILED instructions for cleaning and setting brushes, keeping commutators and slip rings smooth and for renewing oil in bearings are given below. By keeping brushes clean and properly set to the commutator, heating and wear on the brushes and commutator can be reduced to a minimum.

Brushes

1. If possible, clean brushes daily to remove any dust or dirt from their sides and any accumulation of copper from the contact surfaces.
2. Inspect to see that they move freely in the holders and that the lifting mechanism (where one is provided) raises all except the pilot brushes.
3. The shunt connections (pigtails) to the brushes and brush holders must be tight.
4. The brush pressure must be adjusted to the value specified by the manufacturer.
5. A slight beveling of the edges of the brushes may be necessary to prevent the breaking off of small pieces from carbon or graphite brushes or the formation of a wire edge on metal composition brushes; also to prevent the sheathing of sheathed brushes from coming in contact with the commutator.
6. On metal composition brushes groove the sides of the brushes.
7. Bevel each pilot brush to the width of one commutator bar.
8. Stagger direct-current brushes so that they will cause even wear on the commutator. The proper method of staggering is to stagger, not alternate brush rows, but alternate pairs of brush rows; i.e., if the brush holders of a machine are numbered consecutively around a commutator, Nos. 1 and 2, 5 and 6, 9 and 10, etc., will have their brushes set in the same position on the commutator, while Nos. 3 and 4, 7 and 8, 11 and 12, etc., will have their brushes set over one-half the width of a brush if possible, or, if not, as much as the length of the commutator or of the brush holder will permit.

Stagger slip-ring brushes so that they will cause even wear on the rings. For proper staggering of slip-ring brushes the outer edge of the extreme brushes should be set approximately at the midpoint of the travel of the edge of the ring, when the end-play device is in operation.

8. Whenever new brushes are applied or when resurfacing of commutators or slip rings is done, grind the brushes to the correct curvature before operating the machine.

Note.—This is done by drawing a strip of sandpaper back and forth underneath the brush while it is in the holder and being held tight against the commutator. The cutting stroke should be in the direction in which the machine normally rotates. In resurfacing metal composition brushes it may be necessary, because of their hardness, to use carborundum paper instead of sandpaper.

A commutator to function properly must be smooth, even and clean. Keeping the commutator clean prevents short-circuiting of the bars, thereby reducing both the tendency to spark and the burning of the surface.

Commutators

1. Clean the slots of all undercut commutators with a brush and scrape them with a fiber or orange stick when the accumulation of dirt cannot be removed with a brush.
2. Remove the burrs which form along the edges of the bars with the tool provided for the purpose. Short-circuiting of commutator bars will result from failure to observe these instructions.
3. Care should be taken to see that the mica on undercut commutators is kept well below the level of the bars. In slotting the depth of the cut should not exceed $\frac{1}{32}$ in. and the work should be done with a standard commutator slotting tool.
4. If it is necessary to remove rough or burned spots, sand the commutator, using sandpaper fastened to a block. Never use emery cloth instead of sandpaper, as particles of emery become embedded in the commutator.
5. When the commutator becomes generally rough or uneven, but not sufficiently so to require turning or grinding, it may be resurfaced by means of a commutator stone. Before sanding or stoning lift the brushes from the commutator to prevent wearing them down. Special precaution should be used to cover windings and bearings as a protection from dust.

Slip rings to operate properly must be smooth and even so that the brushes, if properly fitted, will make good contact and reduce the heating to a minimum.

Slip Rings

1. Keep the edges of the rings rounded and free from burrs.
2. If necessary to remove rough spots, sand or stone the rings according to rules 4 and 5 under "Commutators." (Note.—Sanding or stoning of rings must not be done with voltage on the machine.)

In self-oiled bearings, if the oil is used too long it will break down from oxidation and deteriorate as a lubricant. The products of the breaking down are a thick sludge which clogs the oiling system and a petroleum acid which corrodes the metal parts. In high-speed bearings in which the oil is water-cooled the principal trouble that is likely to develop is emulsification due to the entrance of water into the oil.

Bearings

1. Renew the oil in all bearings once in about every six months, unless local conditions show that a shorter interval is more desirable. Before filling, draw off the old oil and run enough kerosene through to wash out the dirt and sediment which has collected in the bottom of the bearing.
2. Do not fill the bearing higher than the specified level, to prevent oil from being thrown out. Great care must be taken in filling bearings not to overflow or to splash oil on the commutator or windings.

*Abstracted from the operating code of the Philadelphia Electric Company.

Operating Small Turbines on Auxiliaries

WHEN starting small turbines on auxiliaries all drains should be opened on the exhaust and steam lines to drain out condensate which may have formed in the pipes during the time when the machine was shut down. The governor valve should be pushed to a closed position to determine whether the governor will operate in case of emergency. The following rules should be followed when starting and shutting down small turbines:

Starting

1. See that the reduction gear case has enough but not too much oil.
2. See that the exhaust valve is open.
3. See that all drains are open.
4. If an emergency trip is provided, see that it is set.
5. See that the overload nozzle valves are closed.
6. Open the throttle slowly and run the unit at slow speed.
7. Close all drains.
8. Inspect the strainer of the oil pump.
9. Inspect the bearings to see that the oil rings are revolving and delivering oil.
10. Bring the turbine up to speed.
11. Test the governor valve by pushing it to the closed position to see whether this will cause the turbine to slow down.
12. Overload nozzles are to be used only when necessary.

Shutting Down

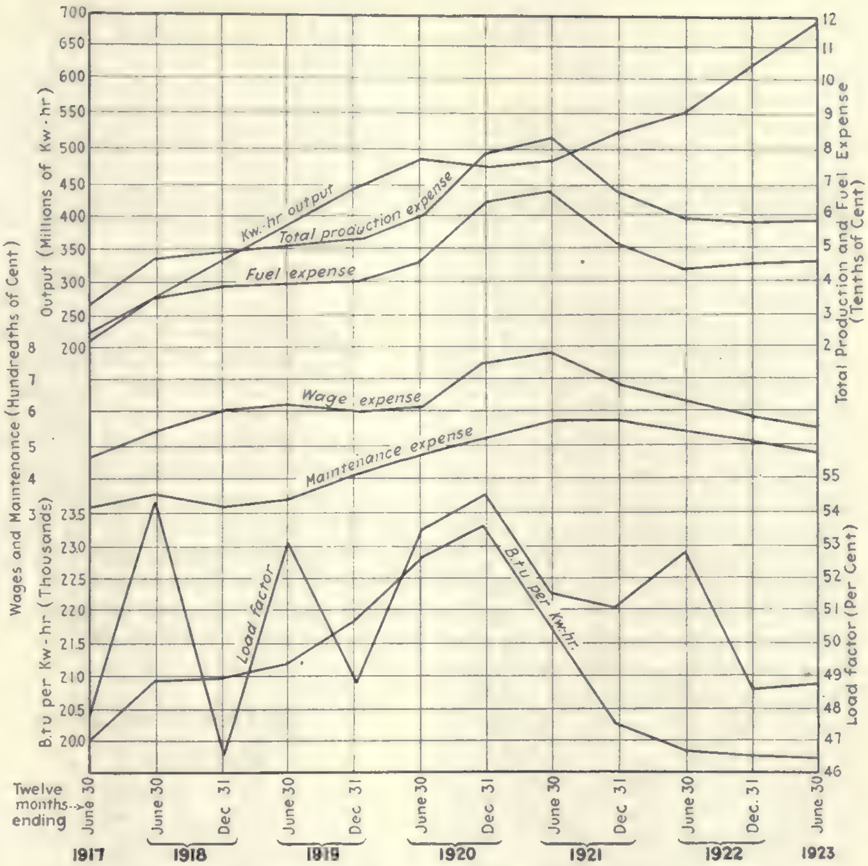
1. Close the throttle valve.
2. Shut off the oil system when unit comes to rest. (Note.—If the machine is to be dismantled, close the exhaust valve).
3. Open the drains.

Production Expenses at Connors Creek

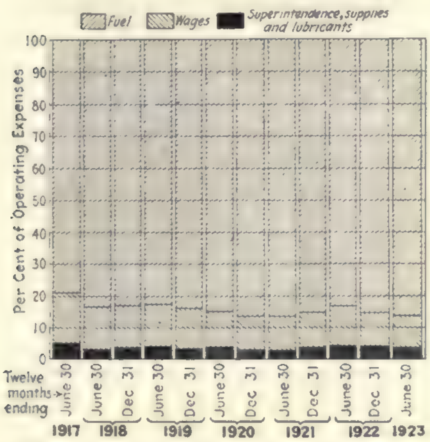
THE operating costs of the Connors Creek station for the twelve-month period ended June 30, 1923, are again available with those of former years through the courtesy of Alex Dow, president of the Detroit Edison Company. Mr. Dow points out that the record shows the best thermal efficiency yet reported by the plant, the improvement over the immediately preceding periods being due to closer attention to details and more unform quality of fuel, and not to any basic change. Another feature to be remembered is that the station is still without economizers. The output figure given in the accompanying tabulation is net metered output to the transmission system, all station and yard uses of energy having been deducted. The output is measured at the transmission voltage of approximately 24,000.

The plant economy, 19,600 B.t.u. per kilowatt-hour, is better than last reported (see ELECTRICAL WORLD for March 17, 1922, page 635), when the figure was 19,660. The maximum demand has increased almost 10 per cent, to 158,500 kw., while the total output has increased 10.3 per cent, to 676,907,100 kw.-hr. The average load throughout the year was 77,300 kw., or an increase of 10.4 per cent. The load factor is practically the same as in the previous twelve-month period, being 48.8 per cent. In this respect it should be noted that the Connors Creek plant is not a base-load plant and takes its share of the fluctuations in load drawn by the entire system.

The tendencies in production expenses, economy, load factor, etc., are shown in one of the illustrations, while the relation between fuel, wages and superintendence expenses is illustrated in the other.



TENDENCIES IN PRODUCTION EXPENSES, ECONOMY AND LOAD FACTOR AT THE CONNORS CREEK PLANT



RELATIONS BETWEEN FUEL, WAGE AND SUPERINTENDENCE EXPENSES

COMPARISON OF PRODUCTION EXPENSES PER KILOWATT-HOUR OF OUTPUT FOR CONNORS CREEK POWER HOUSE OF DETROIT EDISON COMPANY

	Twelve-Month Periods Ending										
	1917	1918	1919		1920		1921		1922		1923
	June 30	June 30	June 30	Dec. 31	June 30	Dec. 31	June 30	Dec. 31	June 30	Dec. 31	June 30
OPERATION:	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Superintendence	0 010	0.009	0.010	0.010	0.010	0 012	0.015	0.014	0.013	0.012	0.011
Wages	0.047	0.055	0.062	0.060	0.062	0.076	0.079	0.069	0.065	0.058	0.055
Fuel	0.240	0.368	0.394	0.407	0.471	0.652	0.682	0.532	0.438	0.448	0.461
Water	. .		.	....	....	.	...	...	.	..	...
Lubricants	0.001	0.001	0.002	0.002	0.001	0.002	0.002	0.002	0.001	0.001	0.001
Station supplies and expense	0 005	0.006	0.010	0.007	0.011	0.012	0 010	0.010	0.010	0.007	0.007
Total	0.303	0.439	0.478	0.486	0.555	0.754	0.788	0.627	0.527	0.526	0.535
MAINTENANCE:											
Station buildings	0 011	0 008	0.008	0.011	0.010	0 011	0.012	0.011	0.012	0 001	0 010
Steam equipment	0.019	0.025	0.024	0.029	0.036	0.038	0.043	0.045	0.041	0.037	0.035
Electrical equipment	0 001	0.002	0.001	0.001	0.001	0.003	0 003	0.002	0 002	0.004	0 003
Total	0.031	0 035	0.033	0.041	0.047	0.052	0.058	0.058	0.055	0.051	0.048
Total production expense	0.334	0.474	0.511	0.527	0.602	0.806	0.846	0.685	0.582	0.577	0.583
Output in kw.-hr.	210,039,700	280,814,700	383,252,000	445,535,500	488,060,600	479,425,900	485,189,500	527,121,200	555,896,300	613,263,100	676,907,100
Maximum demand in kw. (30-minute period)	50,000	59,000	82,000	104,000	104,000	100,000	107,500	118,000	120,000	144,500	158,500
Average load (kw.)	23,900	32,100	43,700	60,800	55,600	54,600	55,300	60,200	63,500	70,000	77,300
Load factor	0.478	0.544	0.533	0.488	0.534	0.546	0.515	0.510	0.529	0.485	0.488
Coal per kw.-hr. (lb.)	1 52	1.63	1.67	1.73	1.83	1.92	1.78	1.62	1.55	1.57	1.58
B.t.u. per kw.-hr.	20,040	20,930	21,200	21,800	22,800	23,300	21,800	20,250	19,700	19,660	19,600

Steam Seal Makes for Easy Starting

BY FREDERICK L. RAY
Superintendent Power Plants, Union Traction Company of Indiana, Anderson, Ind.

WHEN starting the low-pressure turbo-generator at the North Anderson (Ind.) plant of the Union Traction Company of Indiana much difficulty had been experienced with the water-sealed glands of the turbine. Sometimes an hour's work was necessary in order to bring the vacuum up to a point where the turbine would start. The trouble was due to the failure of the steam siphon to overcome the air leaks around the water-sealed glands in order to maintain a vacuum high enough for starting. This difficulty became so annoying that a steam seal was finally installed, to be used only when starting. The steam seal can also be used to operate continuously if there should be failure of the water supply. After the machine gets up to speed the water seal holds up as it should. The equipment for the steam seal cost $475, which, added to the necessary labor charges, gave a total cost of $550. With this arrangement it is now necessary to know only about five minutes before starting that the turbine is required.

Derrick of 2-Ton Capacity for Distribution Truck

BY V. D. BARR
Metropolitan Edison Company, Reading, Pa.

HEAVY, unwieldy objects such as 75-ft. poles have been handled with greatest ease and the work has required only a few men since the portable derrick shown here has been used by the Pennsylvania Edison Company at Easton, Pa. The derrick, which was designed by E. L. Tirrell, automotive engineer of the company, is operated by a motor winch hooked directly to the transmitting gear of the truck, with the control at the driver's seat. The same motor that drives the truck turns the winch and raises or lowers the steel derrick boom. The lifting device is attached to the rear of the truck and is securely bolted to the chassis. It has a rated capacity of 2 tons, but this limit is frequently exceeded in actual performance.

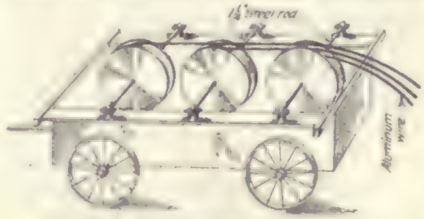
The derrick is mounted on a 3-ton truck chassis, which is equipped with large pneumatic tires, enabling it to move rapidly from place to place. Erection of large wooden poles at one time required the services of from twenty to thirty men, who worked for approximately half an hour in planting one pole. In a recent speed test the portable derrick lifted a pole and planted it in the ground in less than one minute and the job was done by three men.

THIS PORTABLE DERRICK HAS LIFTED A POLE AND PLANTED IT IN LESS THAN A MINUTE

Reeling Out Wire from Hayrack

BY N. T. BUTLER
Superintendent Electrical Department, Bloomington Railway & Light Company, Bloomington, Ill.

IN STRINGING the conductors for the 6,600-volt rural transmission line from Lincoln to Atlanta, Ill., a hayrack was employed to hasten construction. On this hayrack frame a pair of trusses was first mounted which supported a steel bar 1¼ in. in diameter parallel to the axles. This bar was run through three spools of wire and then mounted on the trusses. But the character of the country and the weight of the three spools soon bent the steel bar so badly that any further reeling out of wire became impossible. To allay this difficulty, three trusses were then built so that the spools were in tandem—that is, all along the center



PLACING WIRE SPOOLS IN TANDEM ON HAYRACK SPEEDS UP LINE CONSTRUCTION

line of the wagon. This method proved very successful, because it kept the center of gravity in one plane and also because it was much easier to load one spool on each steel bar than to place all three spools on one bar. With this final method the reeling out of wire was considerably hastened.

Transformer Installation Costs in 1922

FROM the cost sheets of a Massachusetts central station are drawn the accompanying industrial data applying to the material and labor requirements in purchasing

ITEMIZED INDUSTRIAL TRANSFORMER INSTALLATION COSTS

Three 60-cycle, 1,000-kva., 13,800/600-volt transformers with 3,060-gal. oil	$7,600.00
Locks, two, at $3.185	6.37
Teaming	463.50
Payroll labor	469.68
Angle-iron, 100 lb., at 5 cents	5.00
Machine steel	4.63
Filter paper	0.80
Washers, bolts, etc.	0.28
Bus wire supports, forty-three, at $3.44	147.92
300-amp., 15,000-volt disconnecting switches, nine, at $15	135.00
1¼-in. boiler elbows, four, at $0.0868	0.35
Oil switch	198.04
Clamp terminals, nine, at $3.31	29.79
Machine bolts	1.40
½-in. hexagonal nuts, eighteen, at $0.0097	0.17
Lag screws, forty, at $0.0152	0.61
Ground clamps, six, at $0.0975	0.59
½-in. shields, forty, at $0.066	2.64
12-in. hacksaw blades, twelve, at $0.0803	0.96
No. 2 bare stranded wire	2.30
Tape	6.76
Soldering paste, three boxes, at $0.1033	0.31
Stick solder, 15 lb., at $0.1937	2.91
No. 6 Transil oil, 14 gal., at $0.4389	6.14
3-ft. x 2-in. ebony boards, six, at $7.50	45.00
4-in. Thomas porcelain wall tubes, ten, at $4.78	47.80
Gasoline, four gal., at $0.25	1.00
Rubber gloves, pair	3.26
Total	$9,131.21
Per kva.	$3.04

and installing three 1,000-kva. transformers at a mill substation. The work included installing an oil switch, disconnecting switches and connections complete beyond the cable pothead.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Selling the Utility to the Public*

An Appraisal of One Year's Work in Spreading Public Utility Information—How the Commercial Man Fits In

By M. S. Sloan
President Brooklyn Edison Company, Brooklyn, N. Y.

IT IS coming to be generally recognized that a public utility company is just as good as its public relations, but never any better. The company, or the industry of which it is a part, may be sound and in good condition financially. It may be giving good service, from the operating end, and able to continue to do so. It may have excellent engineers and lawyers. Its management and owners may be thoroughly satisfied with its condition and yet it may lack the most important element for continued success, the good will and approval of the public.

If for any reason it lacks that element, the foundation is built on shifting sand. The importance of the public's good will cannot be overestimated. There was a time when this was not the prevailing opinion in the utility industry, as I feel sure it is today. In those days the public, so far as its opinions—and I might even say its rights—were concerned, did not enter greatly into the calculations and operations of the utilities. That was the period of organizing and floating the utilities, when electricity was a venture. The chief concern in those days was to get franchises and financial structures which would enable the utilities to pay profits to their organizers and the bankers who backed them. And in even a later period, when the properties had become larger, and, for the most part, strong financially, when they were giving good service—for those days—the participation of the public consisted in supplying the revenue.

The public got tired of this, and I can't blame it. After all, our companies exist by grace of the public. Our franchises, granting us the right to use public property which is essential in our operations, impose on us the duty of very definite service and carry with them the responsibility of establishing and retaining the good opinion of the people who have our existence in their keeping. It would be unwholesome and a reflection on the intelligence of any person connected with the utilities if he lost sight for one moment of the fact that the public tells us, and has the power and the right to tell us, just how to run this industry. Literally, though perhaps not so directly, we are as much public employees as any elected official, and it behooves us not only to satisfy but to please this big boss of ours, the public.

> DISCUSSING the closely related subjects of public relations and advertising after presenting his paper, Mr. Sloan made three very definite points which he believes central-station men must recognize and act upon.
>
> [1]
>
> The utilities must advertise more, they should spend at least 1 per cent of their gross income on publicity if they expect to build up and hold the good will of the public.
>
> [2]
>
> It is largely up to commercial men to convince their executives of the necessity for such an advertising appropriation.
>
> [3]
>
> It is the duty of every central station to tell the story of the public utility and the truth about water-power development if the industry is to remain free of state or government ownership.

When we get to talking about the public and what it wants and what it will do if it doesn't get what it wants, we sometimes visualize the public as a mysterious, rather malign force. It isn't. The public is just people—you and I, our friends and neighbors and a lot of others just about as good and as bad as we are. We know we're fair and reasonable—if somebody doesn't rub us the wrong way. That's just as true of all the other millions who make up this group the public. Therefore, to satisfy and please the public, there are three things every utility must do: Give as good service as possible; give as cheap service as possible; tell the public all about it. And there is one big thing no utility ever should do: Rub the public the wrong way in any phase of its activities.

Obviously good service and as cheap service as possible are essentials to the maintenance of good public relations. There is no debate on that. But telling the public about it is equally important. The light that is set on a hill cannot be hid. People come to accept good service as a commonplace, without thinking of all the work and worry which go to produce it. It is an important part of the duty of every utility company, and of the industry as a whole, to keep telling the people —lest they forget.

For a year now the gas and electric industry in New York has been telling the story of the utilities to the public through the New York State Committee on Public Utility Information, and the committee has been endeavoring to stimulate the individual companies to tell their own story in all ways possible. The enterprise has been successful. I don't mean that it has been a 100 per cent success. It couldn't be, and we didn't expect it would be. But we feel that the results obtained have amply justified the effort and the expense involved. The amount of matter reprinted from the Utility Bulletin issued by the committee has been considerable. No one item in any paper has been important in itself; but the effect of many items, printed week by week around the state, has been unquestionably valuable to the industry. The newspapers themselves have registered

*From a paper presented at the Commercial Section meeting of the Empire State Gas and Electric Association at Briarcliff Manor, N. Y., June 28 and 29.

this effect. Many papers which in the first part of the year did not use any of our material fell into line later. Moreover, after several months of this work, a change began to be apparent in the editorial columns of some newspapers. Some of the material appeared as editorials; in other cases newspapers wrote editorials based on the Bulletin matter which were distinctly favorable and helpful to the industry.

THE COMMERCIAL MAN'S PART

The commercial men of the utilities have an important part to play in this work. You men come into contact with the public of your communities and with newspaper men, as we executives do not. If the newpapers of your community are using Bulletin stories of their own accord, well and good. If they are not, there is a way to dress up the material by giving it a local twist which ought to make it just what they are looking for. Perhaps some of what you read in the Bulletin strikes you as old stuff—you've heard it so many times, presented in so many different ways that you've lost interest in it. You are in this business. The editor isn't, and his readers aren't, so that what seems old stuff to you may be very good stuff to them. When you read the Bulletin, think how the articles in it apply to your own company. Most of them could be localized by quoting one of your local officials as saying what the Bulletin article says, or by substituting local statistics about growth, investment, tax payments or whatever the subject of the article might be. The Bulletin is intended not only to supply general material about the industry, but to make it easy for companies to supply their own facts to their own papers.

Another way in which you can help the committee—notify our office of conventions or meetings where addresses on utility topics could be made. If we can get the opportunity, we'll furnish the speakers. We have done considerable work of this nature, and it has been highly successful. There is no better way of telling the public the information that we have to give about our industry.

Now we need your understanding and your co-operation. The executives are committed to the publicity program and we've got to go to it and make it pull. Building good will for our industry doesn't mean fine words by the heads of some of the companies; it means consistent and persistent effort by all of us all along the line to hold high standards of responsibility and service, to live up to them, and to talk about them and what we are accomplishing in living up to them. You are at the receiving end, and we must rely on your efforts in considerable part to see that what we produce gets where it will do the work—into the columns of the newspapers.

Electric Tractor Does Fourteen Men's Work in Circus

THE versatility of the electric truck as a time and labor saver was well illustrated in a recent demonstration which led to the purchase of a battery tractor for moving circus wagons. While Ringling Brothers and Barnum & Bailey's circus was showing in Newark, N. J., this summer, the general manager of the circus was prevailed upon by the Terminal Engineering Company of New York to try out an electric truck for moving equipment about the grounds.

Accordingly the vehicle shown in the accompanying cut was supplied and it was used to haul the trained animal cages to and from the arena during the performances. There were three polar bear cages, three lion cages and three tiger cages, making nine in all, to be moved in and out twice each day. The bears weighed about 500 lb. each, twelve bears to a cage, making a total load, including the cage, of 8,000 lb. The usual method of hauling these cages had been to have fourteen or fifteen men pull and push them into the arena. With the truck the cages were moved in half the time and with the assistance of only one man.

This demonstration so thoroughly convinced the general manager and master mechanic of the circus that when it moved and the circus opened up in Boston the truck was purchased.

ELECTRIC TRACTOR HAULING TRAINED POLAR BEARS INTO CIRCUS ARENA DOES WORK OF FOURTEEN MEN IN HALF THE TIME

Form 534. 12-5-19-2000

..................19

Application for Class of Service, Entrance and Meter Location

For.................................
Name

....
Address

The connected load is estimated to be..........k. w., consisting of
(Give size and number)
Lights.................................
Appliances.................................
Motors.................................

Remarks.................................

....

Signed.................................

Address.................................

Inquiries regarding the above should be addressed to 66 Faraday Street.

Form 529 11-1-19

ADDITIONAL LOAD

WORCESTER, MASS.,..................19......

At.................................
Address

For.................................
Name

Additions will be made which will increase the connected load about.....
..........kw.,........phase,..............volts, as follows:

Lights:.................................
Give No. and Watts of each size

Appliances:.................................
Give Kind, Watts and Volts, each

Motors:.................................
Give H. P. Volts and Phase, each

Remarks:.................................
Outlets added, etc.

....

Signed.................................

Address.................................

Inquiries regarding the above should be addressed to SERVICE department

CARDS SUPPLIED TO CUSTOMERS TO FILL OUT WHEN MAKING APPLICATION FOR NEW SERVICE OR THE INSTALLATION OF ADDITIONAL EQUIPMENT

Cleveland Company Discontinues Customers' Deposits

BELIEVING that its most valuable asset is customer good will, the Cleveland Electric Illuminating Company has furthered its promotion among residential consumers by announcing the discontinuance of the practice of requiring deposits with applications for service. The deposits, which have been only small amounts, will not be replaced by any other form of guaranty.

Some six thousand checks representing $100,000 in deposits plus interest are being mailed out to existing customers. Because comparatively few of the company's older customers have preserved the deposit receipt its surrender is not required. Patrons living at the same address as that recorded in the original application received their checks the day following the announcement. Others are receiving their checks as soon as identification is completed.

The company does not anticipate any loss as a result of this policy but expects to see an improvement in collections, as many customers have allowed themselves to become delinquent believing that the deposit was sufficient to prevent cutting off of service. In the event of disconnection for non-payment the company will continue to charge $1 for reconnection, but such disconnections are very few.

The plan also provides for the elimination of much routine clerical work with a consequent reduction in overhead expense.

The company has also gained much favorable comment from its customers by making meter installations within a few hours of application. Patrons who change their address, removing to a residence where a meter is already installed, find service immediately available, as the company leaves the meter and service connected with the removal of the former resident even though he has notified the company of the vacancy of the premises. Meter readings are recorded on the date of disconnection and any difference in the reading when the new customer moves in is borne by the company. Loss has been negligible.

Advising Customers Regarding Current Supply

BY E. D. LEARNED
Power Engineer Worcester (Mass.) Electric Light Company

NO LITTLE interest attaches to the letters in the May 26 and July 14 issues of the ELECTRICAL WORLD regarding the furnishing of information about current supply to builders of small electrical machinery. We have had very little trouble in this respect and believe that the difficulty is due mainly to the fact that the salesman for the machinery or the purchaser of it does not get into touch with the proper individual in the power company. In our particular case all such inquiries are referred to our service department, which maintains a force of field investigators who issue a written report on each individual case. By providing our prospective customers with the cards shown here we have found a very satisfactory solution.

We should also like to call attention to the fact that the "prospect" does not always give due importance to the fact that the exact address must be known, as any one familiar with the distribution system of the company knows that a condition which would give a certain current for the location on one side of the street might not exist—in fact, it usually happens that a different condition does exist—on the opposite side of the street.

Recently a customer moved from one side of the street to the other without giving any notice to the company and was very much disturbed when he found it was necessary to pay the line extension charge. Considerable waste of time and money for both the customer and the company was incurred.

What Other Companies Are Doing

Greenfield, Mass.—The Greenfield Electric Light & Power Company, one of the pioneers in issuing stock to employees, is now preparing to make an issue of customers' stock, as approved recently by the Massachusetts State Department of Public Utilities. The issue is in shares of $25 each, on which the company agrees to pay dividends on a cumulative basis of 6 per cent, free from state and normal federal income taxes. Each customer may subscribe up to 100 shares.

Ladysmith, Wis.—As a good-will feature and aid to merchandising, lectures and cooking schools will be conducted by the Lake Superior District Power Company here. Similar work will be carried on at the same time at Ironwood and Bessemer, Mich. Invitations have been mailed to the company's customers inviting them to attend and an electric range campaign will follow.

Dayton, Ohio—The Electrical League of Dayton is co-operating with the Dayton Power & Light Company in a special appliance campaign which will be started shortly. The idea is to have persons desiring to buy electrical appliances do so at the stores of the dealer members of the league and pay for them on their electric bills at the utility office on a monthly basis.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Hydro-Electric Development and Steam Equipment

Wabash River Station of Indiana Electric Corporation.—F. S. CLARK.—The first section of a 100,000-kw. plant is now being constructed close to coal fields. Among the outstanding features are 350-lb. steam pressure, high boilers, stage bleeding, house turbine for emergency only, evaporators and special provision for 31-ft. rise and fall of river.—*Power*, June 26, 1923.

Hydro-Electric Power Development in Wales.—T. V. HUGHES.—A general description of the 5,500-kw. hydro-electric station at Cwm Dyli in Wales. Water for this plant is taken from a lake 1¼ miles away, contained in a dormant volcanic vent. Power is generated at 10,000 volts and transformed to 20,000 volts and to 34,600 volts for transmission. Distribution stations connected to the lines are described.—*Electrical Review (England)*, July 6, 1923.

Effect of Feed-Water Heating on Plant Economy.—G. G. BELL.—Studies conducted by the author of a plant equipped with 30,000-kw. units are described which clearly show the advantage of bleeding the main turbine for feed-water heating.—*Mechanical Engineering*, July, 1923.

Generation, Control, Switching and Protection

Magnetizing Current of Transformers.—M. VIDMAR.—The author claims that the phenomena taking place in the magnetic circuit of a transformer are not fully known. The designing engineer bases the calculation of the magnetizing current upon the direct-current magnetizing curve, divides its value by the square root of 2 to get the effective value, and assumes its sine-wave character. The testing engineer knows, on the other hand, that he measures in almost all cases a smaller magnetizing current than the calculated value. The fact is that the magnetizing current is not of a sinusoidal form, and that this deviation becomes more pronounced the higher the magnetizing density which is chosen. A third harmonic and a fifth harmonic will be of more or less prominence, amounting in percentage of the fundamental for single-phase transformers to:

Magnetic Density Lines per Cm²	Third Harmonic, Per Cent	Fifth Harmonic, Per Cent
10,000	21.4	5.34
14,000	27.5	11.50
20,000	69.2	35.80

Taking these harmonics into account, it will be found that the usual formula for the magnetizing current gives a value which is at least 5 per cent too high. In three-phase transformers, which are connected from three banked single-phase units with the neutral carried out, the same conditions will be found. In delta-connected three-phase units the third harmonic cannot enter the windings and the magnetizing current becomes sinusoidal. The flux of triple frequency will endeavor to close itself through the air or through the steel wall of the tank in oil-immersed transformers, where it will cause additional losses. Actual measurements on a 20-kva., 50-cycle, three-phase transformer gave these no-load losses: Y-Y-connected, 454 watts; Y-delta-connected, 296 watts; Y-delta-connected, but out of the tank, 256 watts. These additional losses in the tank wall may become serious, but can be avoided or at least reduced by either operating with a smaller iron density or by a short-circuiting ring of copper surrounding all three phases inside of the oil tank.—*Elektrotechnik und Maschinenbau*, June 17 and July 8, 1923.

Method of Calculating the Petersen Reactor and its Practical Application.—BASILIO FOCACCIA.—Considering first the principles involved in different devices suggested to protect transmission lines from overvoltages, the author explains how the stated value of the self-induction of the Petersen reactor is but an approximation. How to arrive at a better determination of it is discussed, taking into consideration the characteristic factors of both the line and the machine, but avoiding complicated calculus and showing the practical limits between which the value of the self-induction must be chosen. Many numerical examples and charts accompany this paper, which concludes by saying that the Petersen reactor can be successfully used in short transmission lines of a relative low tension but is unfitted for long high-tension lines.—*Elettrotecnica*, June 25, 1923.

Transmission, Substations and Distribution

Voltage and Phase Transformation with Autotransformers.—The main advantage of the autotransformer where it can be used is that it is cheaper than the two-winding transformer. The efficiencies of an autotransformer, when based upon the amount of energy transformed, are at times exceedingly high. The reactance of the autotransformer is also low, and in some applications this may become somewhat embarrassing—when, for example, it is desired to have the impedance sufficiently high to withstand short-circuit conditions. The author analyzes the autotransformer and works these points out in detail as applied to the various voltage and phase transformations. Equations and curves permit an engineer to make a quick estimate as to the size of the autotransformer (in terms of the two-winding transformer) which will be required to make almost any transformation which will arise in practice. *Electric Journal*, May and July, 1923.

Natural Cooling of Tanks of Oil-Immersed Transformers.—GINO REBORA.—The author, after considering the three modes of heat transmission—i.e., radiation, convection and conduction—takes up the special case of the natural heat transmission of the various types of tanks of oil-immersed transformers. The theoretical valuation of the temperatures and their experimental determination are fully treated. Tables, charts and illustrations accompany this paper, concluding with practical formulas.—*Elettrotecnica*, June 25, 1923.

General Adoption of Automatic Substations at the Mines.—J. E. BORLAND.—Application of automatic features to mine substations and its economic advantages such as saving in power, attendance and maintenance are considered, and a description of automatic operation is given. A wiring diagram showing the complete control and protective equipment is included. A detailed account of all the protective relays, showing where they are placed and what their particular duty is, is given. It is claimed that the operation and protection of automatic equipment is much more reliable than in the case of manually controlled equipment.—*Coal Age*, July 12, 1923.

Units, Measurements and Instruments

Small Plant Equipped for Extensive Tests to Check Weekly Performance.—J. W. GEIGER and H. L. SOLBERG.—Economizers and feed-water heaters used in connection with four 3,000-sq.ft., 150-lb. boilers are equipped for frequent testing. The weekly calculation of boiler performance is checked by extensive tests from time to time.—*Power*, July 10, 1923.

Impulse Electric Motor for Driving Recording Instruments.—W. F. JOACHIM.—A synchronous motor has been developed and is described which is capable of driving the film drums of the recording aircraft instruments now in use. The motor consists of four spool-type field coils, a reciprocating armature, a ratchet wheel and two pawls. The field coils, operating in pairs, alternately pull the armature from one pair of pole faces to the other pair. This reciprocating motion is transmitted to the ratchet wheel through the two pawls, motion in either direction producing a positive advance of the wheel. Rotation of a very regular character is thus obtained. This motor produces approximately 6.0×10^{-5} hp. with an efficiency of 1.0 per cent. The speed range is from 0 to 35 r.p.m., the torque being 0.234 pound-inch at the lower speeds with 8 volts applied.—*Journal of the Franklin Institute*, August, 1923.

Illumination

Highway Lighting.—W. R. HUNTLEY.—Rural line extension, increased load and the vauable factors in promoting sales and good will are the subjects discussed in this article. A typical highway-lighting example is found in a town near Buffalo in which more than 100 miles of lines have been installed.—*Central Station*, July, 1923.

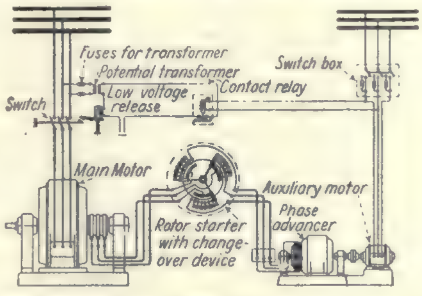
Co-operation Between the Architect and the Electrical Engineer.—J. W. BEAUCHAMP.—The object of this paper is to arouse discussion upon the relation between the architectural and electrical engineering professions and to explore the possibilities of closer joint working and the means of keeping each profession advised of the needs and developments of the other. The rapid development of electricity in the field of heating and cooking is dealt with and also the factors determining the extent to which that medium can usefully be employed at different competing rates or prices for fuel, gas or electrical energy. The varying restrictions and conditions covering electricity supply in different districts are considered, and also the modern movement toward simplified tariffs and methods of charging. Suggestions are made as to the work of the architect in providing for the use of electricity in buildings and in allowing for extension, greater variety in use and the arrangement of cables and ducts. The influence of electricity on the design and cost of buildings and probable developments in the near future are also discussed.—*Journal of the Institution of Electrical Engineers (England)*, July, 1923.

Motors and Control

Repairing and Rebuilding Electrical Equipment.—J. D. ZOOK.—Repair methods and routine of handling the work in the plant of the Gregory Electric Company, which has specialized for thirty years in rebuilding all kinds of industrial equipment, are described.—*Industrial Engineer*, August, 1923.

Auto-Synchronous Motors.—A. LINDSTROM.—The first part of this continued article is mainly concerned with an explanation in rather detailed form of the meaning of power-factor correction. The author then gives a short description of the design of the auto-synchronous motor, explaining its more important characteristics.—*Electrician (England)*, July 6, 1923.

Phase Compensator.—M. SEIZ.—To improve the power factor of large induction motors when they are running under a fractional load a three-phase exciter set is recommended. It consists of a direct-current armature which is driven by a small motor upon the commutator of which are brushes connected to the slip rings of the main motor. It is also possible to mount this exciter upon the extended shaft of the main motor. An electric interlock has to be provided in case of separate drive of the compensator to prevent switching it on the main motor when standing still. Such a compensator leaves the main motor its asynchronous character, so that at higher load its speed will decrease. It also prevents hunting or falling out of step. The compensator does not operate at "no-load" of the main motor, because in this case the rotor current is zero. But at about one-quarter full load its action will compensate the power factor to unity. Great simplicity, reliable service and quick amortization because of the great



CONNECTIONS OF AN INDUCTION MOTOR WITH PHASE COMPENSATOR

savings which it affords are among the chief advantages claimed for the compensator. The accompanying diagram shows its connection to motor and line.—*Brown-Boveri Mitteilungen*, July, 1923.

Heat Applications and Material Handling

Records of Elevator Cable Operation Show Wide Differences in Life of Cables.—G. B. GARRISON.—The author gives careful records of cable operation kept over a period of nine years and the results of tests made on a number of cables to determine their condition. These records were kept on a building 495 ft. high, served by twelve elevators. The wear of the cables was determined by using a micrometer on the individual wires, and their reduction in size due to wear was noted. Lubrication of the cables is essential and prolongs their life, as it reduces friction in the cable strands as they pass over the sheaves. If a cable has been in service for a period of six months or so and does not show a sufficiently oily appearance, it is good practice to apply a cable lubricant free from acid and prepared especially for the purpose.—*Power*, July 24, 1923.

Traction

Train-Control Devices.—Tests of an automatic train device have been constructed on the St. Louis division of the Cleveland, Cincinnati, Chicago & St. Louis Railroad at Avon, Ind. The apparatus was tried out in freight-train service to demonstrate its effect on tonnage trains. These tests have been very satisfactory. Details of the speed-control mechanism and its operation are given.—*Railway Age*, July 21, 1923.

Narrow-Gage Direct-Current Electric Locomotives for Japan.—P. L. MARDIS.—The regenerative-braking and multiple-unit operation are important features provided in the design of direct-current locomotives rated at 1,200 hp. and 30,250 lb. tractive effort to be used by the Imperial Government Railways of Japan. The electrical equipment, control apparatus, auxiliaries and general layout are considered.—*Railway Review*, June 16, 1923.

Telegraphy, Telephony, Radio and Signals

Radio Extension of the Telephone System to Ships at Sea. — H. W. NICHOLS and L. ESPENSCHIED. — The development of a two-way radio telephone system and its use in extending the Bell Telephone System to connect with ships at sea is described in this forty-six-page article. The electrical considerations and the experimental work involved in determining the system design of the radio link are discussed. The operation of the combined radio and wire system is explained, particularly in respect to the transmission characteristics.—*Proceedings of the Institute of Radio Engineers*, June, 1923.

Most Economic Heating of Vacuum Tubes.—H. BARKHAUSEN.—Just as in the case of incandescent lamps, the cost of renewal of burned-out vacuum tubes must vary proportionately with the cost of the heating energy supplied. Consequently the life of the much more expensive vacuum tube should be considerably longer than that of an ordinary light bulb. A much lower filament temperature with resulting longer life is therefore essential for the economic operation of vacuum tubes. Heavier and longer filaments should be used in all cases where tube renewal is more expensive than the cost of the heating energy.—*Elektrotechnische Zeitschrift*, June 8, 1923.

Use of Labor-Saving Apparatus in Telephone Systems.—J. N. KIRK.—The author describes some of the more important developments in labor-saving machinery for the telephone industry, such as the application of different types of derricks and trailers for various kinds of work, earth-boring machines, numerous applications of air compressors and compressed-air tools, etc. In some cases the author contrasts the latest types of equipment with former manual methods of carrying out similar operations.—*Electrical Communications* (published by the International Western Electric Company, New York, N. Y.), and *Bell System Technical Journal*, July, 1923.

Formulas and Tables for the Calculation of the Inductance of Coils of Polygonal Form.—F. W. GROVER.—The cases treated are triangular, square, hexagonal and octagonal coils. It was found that a circular coil inclosing the same area as the polygonal coil, the length and the number of turns being the same in both cases, has nearly the same inductance as the polygonal coil.—*Scientific Paper No. 468 of the Bureau of Standards.*

Short Radio Waves.—E. F. NICHOLS—The author describes in detail his experiments with wave impulses so short that they span the gap between the heat waves and radio waves. The waves produced were about 0.01 in. long.—*Popular Radio*, July, 1923.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Detroit's Municipal Plant

Horizontal Cross-Drum Boilers Selected After Protracted Investigation by the City

IN SELECTING the type of boiler for the new municipal plant the public lighting commission of Detroit made an extended investigation which resulted in giving preference for the city's particular requirements to the horizontal water-tube boiler of the cross-drum type. In accordance with this decision the engineers employed to carry out the project, Smith, Hinchman & Grylls, sent out specifications on Jan. 8 of the present year calling for boilers of this type. Bids came back on six different boilers, and a seventh bid on semi-vertical bent-tube boilers was received and tabulated with the others. Matters of finance delayed action until June 1, when the commission gave attention to the various propositions submitted, and on July 31 it requested permission of the City Council to award the contract for eight boilers and eight superheaters to the Babcock & Wilcox Company.

With the variations in the figures shown in the accompanying table, there were objections from the lower bidders, so that the Council granted a public hearing on Aug. 13 at which the merits of the different boilers were expounded. To settle the controversy the Council appointed a committee, consisting of W. B. Mayo, T. H. Hinchman and J. C. McCabe, which reported back a week later in favor of the award, so that the Council took action accordingly.

The contracts were let on the basis of the table, but it should be explained that a reduction in the size of the boiler to 13,700 sq.ft. reduced the B. & W. boiler bid by $40,128, making the net amount for the eight boilers $332,456 and, in addition, $66,960 for the superheaters.

Settle Tentative Program for World Power Conference

By Cable to ELECTRICAL WORLD

FOLLOWING conferences with O. C. Merrill, secretary of the Federal Power Commission of the United States, and J. B. Challies of Canada, the officials of the World Power Conference have agreed upon a tentative program. Participation of all western Europe except Germany is now assured. It is planned to feature a concise statement of the existing situation in each country and to discuss conditions under which capital of one country can be invested in utility enterprises in another. All papers to be presented will be printed in advance. In addition to the conferences in London, Mr. Merrill and Mr. Challies discussed power matters with French officials. The tentative program drawn up for the conference is printed in full on the opposite page.

SCHEDULE OF BOILER BIDS FOR DETROIT MUNICIPAL PLANT

Bidder	Lb. per Hr.	Babcock & Wilcox Co.	% Tolerance	D. Connelly Boiler Co.	% Tolerance	D. Connelly Boiler Co.	% Tolerance	Heine Boiler Co.	% Tolerance	Geo. T. Ladd Co.	% Tolerance	Wickes Boiler Co.	% Tolerance	Springfield Boiler	% Tolerance
Address		New York		Cleveland		Cleveland		St. Louis		Pittsburgh		Saginaw, Mich.		Springfield, Ill	
Price—six boilers		$279,438 00		$204,900 00		$195,900 00		$290,200.00		$164,500.00		$203,051 00		$206,000.00	
Price—eight boilers		$372,584.00		$273,200 00		$261,200.00		$377,800.00		$215,100.00		$270,382.00		$273,000.00	
Delivery time		First boiler 21 weeks, one boiler per month thereafter		28 wks.	20	28 wks.	20	52 wks.	10	32 wks.	10	30 wks.	20	22 wks.	20
Erection time		Six boilers within 40 weeks from delivery of first boiler		36 wks.	20	36 wks.	20	68 wks.	10	4 wks.	10	8 wks.	20	9 wks.	50
Net weight per boiler, lb.		297,000	.....	280.000	10	.....	...	380,000	.....	210,000	5	230,000	10	270.000	5
Water-holding capacity, cu.ft.		1,761	....	2,260	5	.....	..	925	.....	1,700	1	1,720	5	1,314	5
Maximum moisture in steam at nozzle, evaporation 110,000 lb. per hour		1%	.....	1%	15	1%	15	0.75%	.....	1%	None	1.5%	30	None	None
Draft loss (inches of water) through boiler when weight of flue gas is	85,000	0.17 in.	10	0 10%	15	0.10%	15	0.14%	5	0.25%	2.5	0.20%	15	0.20%	25
	173,000	0.84 in.	10	0.43%	10	0.43%	10	0.60%	5	0.55%	2.5	0.40%	15	0.55%	36.4
	260,000	1.75 in.	10	1.43%	5	1.43%	5	1.60%	5	1.20%	2.5	0.65%	15	1.25%	28
Flue-gas temperature at outlet when furnace temperature is 2,400 deg. and weight flue gas is	85,000	480°F.	10	460°	5	460°	5	509°	5	490°	2.5	485°	10	475°	2.1
	173,000	570°F.	10	535°	5	535°	5	569°	5	550°	2.5	520°	10	530°	4.7
	260,000	675°F.	15	640°	5	640°	5	632°	5	680°	2.5	575°	10	600°	6.6
Efficiency boiler and superheater when furnace temperature is 2,400 deg. and weight of flue gas is	85,000	76.7%	0.5	77°	2	77%	2	77%	3	78.8%	2.5	92.2%	2.5	79.5%	1
	173,000	74.5%	0.5	74.5°	2	74.5%	2	74.3%	3	75.2%	2.5	90.3%	2.5	76.5%	1
	260,000	70.5%	0.5	67.5°	3	67.5%	3	71.8%	3	71.5%	2.5	87.3%	2.5	73.5%	1
Type boiler		Horizontal Water Tube, One Cross Drum		Horizontal Water Tube, Two Cross Drums		Horizontal Water Tube, One Cross Drum		Horizontal Water Tube, One Cross Drum		Vertical Water Tube, Three Cross Drums		Horizontal Water Tube, One Cross Drum		Horizontal Water Tube, One Cross Drum	
Type header and material		Sectional, Forged Steel		Sectional, Cast Steel		Sectional, Cast Steel		Sectional, Cast Steel		....		Box, Steel Plate		Sectional, Cast Steel	
Heating surface, sq.ft.		15,920		15,956		......		15,740		15,300		15,630		15,800	
Size drum, in.		54		44		54		54		Two 42 in. One 48 in.		54		54	
Thickness drum, in.		1.125		1		....		10,625		42 in.-1.5 48 in.-1.6875		....		1.125	
Size tubes, in.		4		4		4		3.5		3.25		4		3	
Gage tubes, b.w.g.		No. 7		No. 7		No. 7		No. 8		No. 9		....		No. 9	

Program of the First World Power Conference

Division I: **Power Resources.** ***Division II:*** **Power Production.**
Division III: **Power Distribution.** ***Division IV:*** **Power Utilization.**
Division V: **General.**

Division I

Section A: National Review of Power Resources.
1. General Survey.
2. Investigation of National Resources.
3. Power Resources Available and Utilized.
4. Administration.
5. Electrical Power Market.

Division II

Section B: Water-Power Production.
Section C: Preparation of Fuels.
Section D: Steam-Power Production.
Section E: Internal-Combustion Engines.
Section F: Power from Other Sources.

Division III

Section G: Power Transmission and Distribution.

Division IV

Section H: Power in Industry and Domestic Use.
Section J: Power in Electrochemistry and Electrometallurgy.
Section K: Power for Transport.
Section L: Power for Lighting and Illumination.

Division V

Section M: Economic, Financial and Legal.
Section N: 1. Research.
2. Standardization.
3. Education.
4. Health.
5. Publicity.
6. General.

Division I

Power Resources

Section A:

National Review of Power Resources:

This division is of interest to the whole conference and will comprise for each country:

1. *General Survey of National Power Resources, Developed and Undeveloped*:
   - (a) Water power, fuel power, transportation, etc.; present practice and future developments.
   - (b) Short historical review of development.
   - (c) Attitude of governments toward development; short summary of legislation.
   - (d) Financial policy regarding state and private ownership.
   - (e) State encouragement in the development of cheap power.
2. *Investigation of National Power Resources*:

   National and local organizations for collecting data, functions and scope.
3. *Power Resources Available and Utilized*:
   - (a) Water Power—Physical characteristics of available resources, developed and undeveloped.
   - (b) Fuel—(1) Coal, (2) lignites, (3) peat, (4) oil, (5) gas. Review of uses to which resources are put, costs of power, location of industries.
   - (c) Other Resources—Power used in: (1) Electric generation, (2) industry generally, (3) rail transport, (4) sea transport.
4. *Administration of Power Resources*:

   Administrative responsibilities, national and local.
5. *Electrical Power Market in*:
   - (a) Central-station activities.
   - (b) Industry generally.
   - (c) Electrochemistry and electrometallurgy.
   - (d) Pulp and paper industry.
   - (e) Railway electrification.

Division II

Power Production

Section B:

Water-Power Production:

- (a) General principles, conditions and requirements.
- (b) Recent practice in civil engineering features.
- (c) Recent practice in mechanical engineering features.
- (d) Recent practice in electrical engineering features.

Section C:

Preparation of Fuels:

1. *Distillation of coal.*
2. *Pulverized coal.*
3. *Distillation of shale.*
4. *Oil refining.*
5. *Peat.*
6. *Et cetera.*

Section D:

Steam-Power Production:

1. *Steam Generation:*
   - (a) Better utilization of solid and liquid fuels.
   - (b) Boilers for higher pressures and superheating.
   - (c) Any other useful aspect.
2. *Steam Utilization:*
   - (a) Rotary engines, e.g., turbines.
   - (b) Reciprocating engines, e.g., uniflow engines and other forms.

Section E:

Internal Combustion Engines:

1. *Crude-oil engines.*
2. *Gas and refined oil and spirit engines.*
3. *Any other form of internal-combustion engine, e.g., gas turbine.*

Section F:

Power from Other Sources:

1. *Wind power.*
2. *Et cetera.*

Division III

Power Transmission and Distribution

Section G:

Power Transmission and Distribution:

1. *Alternating-current transmission and distribution:*
   - (a) Alternating-current generators and motors.
   - (b) Alternating-current transformers.
   - (c) Alternating-current switchgear.
   - (d) Superpower stations—present and future.
   - (e) Transmission lines and systems, with special reference to line design, transforming and regulating equipment.
   - (f) Local distribution systems, design and operation.
   - (g) Standardization of voltages and frequencies.
   - (h) Underground cables for high voltage.
   - (i) Submarine cables for power transmission.
2. *High-voltage direct-current generation, transmission and distribution.*
3. *Low-voltage distribution and electrical storage.*

Division IV

Utilization of Power

Section H:

Power in Industry and Domestic Use:

1. *Development of the use of power in industry and for domestic purposes with particular reference to electrical power.*
2. *Mechanical distribution and utilization of power.*
3. *Hydraulic and pneumatic distribution and utilization of power; distribution by steam.*
4. *Power in agriculture.*

Section J:

Power in Electrochemistry and Electrometallurgy:

1. *Developments in the use of power in electrochemistry and electrometallurgy, with special reference to electric power.*
2. *Applications of heat to evaporation, distillation and refrigeration.*
3. *Applications of electricity to:*
   - (a) Electrostatic precipitation.
   - (b) Electric furnace work; smelting, steel manufacture, carbide, nitrogen fixation, alloys, abrasives, etc.
   - (c) Electrolytic work; aluminum, iron, etc.

Section K:

Power for Transport:

Development in the use of power for transport.

1. *Land Transport—Prime movers and systems of transmission for rail and road.*
2. *Water transport—Prime movers and transmission of power to propeller, e.g., reciprocating engines, turbines, Diesel engines, gears, direct drive, electric drive and other systems.*
3. *Air Transport—Prime movers and systems of transmission.*

Section L:

Power for Lighting and Illumination:

1. *Development in the use of power for lighting and illumination, with special reference to electric power.*
2. *Recent developments in electric lamps.*
3. *Recent developments in illumination.*

Division V

General

This division comprises a number of subjects which are likely to be of primary interest at the conference, but do not readily lend themselves to classification in the previous divisions. In many cases they are merely special aspects of the subjects already mentioned, and papers thereon will naturally fall in the appropriate section.

Section M:

Economic, Financial and Legal:

1. *Public and private ownership and operation; special conditions which have led to each; results achieved.*
2. *Policy and practice in the public regulation of power development, transmission, distribution and utilization.*
3. *Financial problems in power development, at home and abroad.*
4. *International problems in the development of power on international boundaries and in the interchange of power and fuels; power import and export.*

Section N:

General:

1. *Research:* Papers on research work and probable future developments are among the most important submitted to the conference and in general will be read in conjunction with the appropriate section.
2. *Standardization*:
   - (a) International standardization.
   - (b) Standard specifications for performance, quality and dimensions.
   - (c) Standard conditions and specifications for testing; national testing codes.
   - (d) Value of standardization.
3. *Education*:
   - (a) Education of the artisan
   - (b) Education of the engineer.
   - (c) Education for commerce.
4. *Health*:
   - (a) Industrial conditions.
   - (b) Fatigue.
   - (c) Psychology.
5. *Publicity*:

   Various aspects.
6. *General*:
   - (a) Any subject of national importance or general interest presented by any national committee.
   - (b) International co-operation.
   - (c) Permanent organization.

Federal Commission Resumes Sessions

License Granted to Pike Rapids Power Company on Upper Mississippi—J. B. Girand Presses Diamond Creek Project—Decisions on Various Schemes

ADOPTING the opinion of its engineering staff that the plans presented by the Pike Rapids Power Company conform to the best scheme of development, the Federal Power Commission at a meeting on Aug. 16, the first since Secretaries Work and Wallace left with President Harding for the Alaska trip, granted a license to that corporation for a hydro-electric development on the Upper Mississippi River, about 70 miles north of St. Paul, and rejected the conflicting application filed by the Little Falls Water Power Company. The project will develop approximately 24,000 hp.

The original decision by the commission in this case was in favor of the Little Falls company. Through a defect in advertising, the case was reopened and a hearing was held June 7 last. Other factors being equal, the engineers recommended the plan of the Pike Rapids Power Company, which proposes a single dam, as preferable to that of the Little Falls Water Power Company, which proposed two dams, the plan of the former being held to be considerably the cheaper and also better from the engineering standpoint.

In accordance with the recommendation of the engineering staff, the commission granted a preliminary permit to the Louisville Hydro-Electric Company to develop power at the proposed government dam at the Falls of the Ohio at Louisville and rejected the application of the municipality of Louisville for rights at the same site. The reasons for this recommendation have been previously reported in detail in these columns.

DIAMOND CREEK PROJECT UP AGAIN

A letter was presented from J. B. Girand, who has a preliminary permit for a project on Diamond Creek, on the Colorado River, which has long been held up because of the negotiations for a seven-state Colorado River convention, in which he urged action on his application for a license or that a hearing be given to him. The chief engineer was directed by the commission to notify Mr. Girand that if he has anything new to present a hearing will be granted him; otherwise not. The application for a license has been pending since March, 1922.

A license was granted Frank M. Wilson of Oakland, Cal., for a minor project on Camp and Wilder Creeks in Humboldt County, Cal., in the Klamath National Forest.

C. B. Johnson of Bishop, Cal., was granted a license for a project of 130 hp. on Saw Mill Creek, Inyo County, Cal., within the Inyo National Forest and the Piute Indian reservation.

Acting on the report of the chief of army engineers that the project would affect navigation of the Delaware River, the commission assumed jurisdiction in the declaration of intention by the Pennsylvania Power & Light Company to construct a dam 50 ft. high in Willin Pau Paugh River, storing 206,600 acre-feet of water and developing about 63,000 hp.

The commission also assumed jurisdiction in the declaration of intention by C. Boise to construct a dam and power house in Big Pigeon River, near Watertown, at the North Carolina-Tennessee line. The applicant already has filed an application for a license, anticipating this action by the commission.

CANCELLATIONS AND EXTENSIONS

A preliminary permit granted March 9, 1922, to W. R. Banks of Lamar, Mo., for a project on the Osage River in Missouri, was canceled for noncompliance with the provisions in relation to stream gaging. The preliminary permit granted to George C. Hazelet of Cordova, Alaska, for a proposed project on Silver Lake was canceled on notice that he has abandoned the project. The commission also canceled the preliminary permit granted J. G. Galvin July 17, 1922, for a project on Arrons Creek, in the vicinity of Wrangle, Alaska, for failure to carry out investigations.

An extension of a year was granted the city of Boise, Idaho, on its preliminary permit for proposed developments on the North and South Forks of Fayette River; the Connecticut River Company, Hartford, was granted an extension of a year for further engineering investigations, and C. B. Hawley, Washington, D. C., was granted one year for further work on a proposed project in New River at Sandstone Falls. The Southern Sierras Power Company was granted an extension until Aug. 16, 1925, of the time to begin construction of a project on Snow Creek, for which it holds a license.

Public Service Company of Colorado Formed

Organization of the Public Service Company of Colorado, which will have an authorized capitalization of $40,000,000, to succeed by merger to the properties of the Denver Gas & Electric Light Company, the Western Light & Power Company and the Lake Side Construction Company, which is now building the new twelve-million-dollar generating plant near Valmont, to serve both the other companies named, has been announced, the directors of all three companies having ratified the merger at special meetings.

The consolidation, which will be completed before Oct. 1, is to be effected through the exchange of securities of the old companies for 7 per cent cumulative preferred stock in the new organization, according to Clare N. Stannard, vice-president and general manager of the Denver Gas & Electric Light Company. Mr. Stannard, it is announced, will remain in the same capacity with the Denver company, and C. A. Semrad will continue as a vice-president and general manager of the Western Light & Power Company. Henry L. Doherty of the Cities Service Company will be president of the combined companies.

NEED FOR MORE POWER

Owing to the extremely rapid growth of the business of the two older companies, they have been forced for years to purchase hydro-electric energy at wholesale from another company. This source of supply is insufficient to meet the demands of the Denver territory, where further enlargement of the local steam plant is impracticable because of a shortage of water for condensing purposes. The previous interconnection with the hydro-electric company will be maintained, it is believed, as a matter of convenience and protection as evidenced in the transmission line to be built from Boulder Canyon to the new plant at Valmont.

"The formation of the Public Service Company of Colorado," said Mr. Stannard, "means a great deal to the future of Colorado. With the adequate power supply which the new company will be able to furnish new industries will be attracted to the city and state."

Columbia Gas & Electric Buys Two Companies

The purchase by the Columbia Gas & Electric Company, Charleston, W. Va., of the Ohio Gas & Electric Company of Middletown and the Hamilton Service Company of Hamilton, both in Ohio, foreshadowed in the ELECTRICAL WORLD of Aug. 11, has been completed. The newly acquired properties will be operated by the Union Gas & Electric Company of Cincinnati, thereby extending its facilities to fifteen communities in the state previously served by the purchased companies.

Brockton (Mass.) Plant Damages Exaggerated

Press reports greatly exaggerating the damage at the East Bridgewater (Mass.) generating plant of the Edison Electric Illuminating Company of Brockton appeared in the Massachusetts dailies as the result of a short interruption of service a few days ago. Ten coal cars delivering fuel to the station got out of control, colliding with a locomotive crane belonging to the company. The boom of the crane short-circuited a 13,000-volt line serving Abington, North Easton and Bryantville substations. This opened the plant circuit breakers, but service was restored in four minutes to Brockton and to Abington, the main load centers of the system being thus interrupted for but a short time. In about two hours the North Easton and Bryantville line was again in service. The total damage was only about $1,000.

Western Water-Power Development Projects

A proposal to erect the largest reservoir in Colorado and a power house with an initial capacity of 12,000 hp. has been made public by the Steamboat Service Company. The power house is to be erected on the upper Yampa River, about 15 miles south of Steamboat Springs, and the dam at the upper end of the canyon above Pleasant Valley, according to the announcement. A permit from the Federal Power Commission has been applied for.

The Eastern Oregon Light & Power Company recently filed a request with the State Engineer of Oregon for two permits to develop 6,200 hp. from the two forks of the Wallowa River above Wallowa Lake. The company has its head offices in Baker. H. H. Huson, engineer of Portland, has made four filings on water powers in Marion and Linn Counties. One of the filings relates to the proposed construction of the Santiam Reservoir for the storage of 1,500 acre-feet of water and another to the construction of what would be known as Marion Lake Reservoir to store 7,500 acre-feet. The Oregon State Engineer also received a request from Albert Anderson of Grant's Pass for permission to construct the Anderson Reservoir on the South Fork of the Coquille River to store 18,500 acre-feet of water and develop 13,200 hp. F. K. Masters of Portland filed an application for a permit to develop 22,500 hp. by taking 300 sec.-ft. from Fish Lake, Clear Lake, Lava Lake, Lost Lake and McKenzie River. It is rumored that all of these applications except that of the Eastern Oregon Light & Power Company are for speculative purposes.

As the result of a recent decision of the Division of Water Rights of the California Department of Public Works granting the Electro-Metals Company permission to proceed with its proposed development on the Klamath River, company officials announce tentative plans calling for the erection of a 250-ft. dam at Ishi Pishi Falls. The company contemplates an extremely large ultimate development. According to officials of the Electro-Metals Company, the Klamath River is an excellent location for electrometallurgical and electrochemical industries.

Utah Power & Light Starts Work at Soda Point

Construction work has been started by the Utah Power & Light Company on a fifth hydro-electric development on the Bear River in Idaho, known as the Soda Point development. The development will consist of a concrete dam 110 ft. high with a power house built on the downstream face of the dam. Two 9,400-hp. generating units will be installed and the project when completed will have involved an expenditure of about $3,000,000. A force of five hundred men is now engaged on the job and construction is being pushed as rapidly as possible.

The dam and power house will be built on the Bear River about 50 miles below Bear Lake. Between this location and the point where Bear River empties into the Great Salt Lake the company has four plants now in operation with a combined capacity of approximately 125,000 hp. Other plants on various streams in Utah, Idaho and Colorado have a total capacity of about 100,000 hp. In addition, the company, as previously recorded, contemplates a large hydro-electric development at Flaming Gorge on the Green River.

The new dam at Soda Point will have a storage of 13,500 acre-ft. and will constitute a secondary reservoir for the storage of Bear Lake, where the company's Lifton pumping plant is put into operation when the surface of the lake is below the level of the river channel. This pumping plant is capable of delivering 3,000 acre-ft. of water a day, thus equalizing the flow of Bear River during the entire year. This not only permits the operation of the plants on Bear River at a high load factor but is of great importance to the farmer, many thousands of acres of land depending upon the waters of Bear River for irrigation.

Decrease in the Enrollment of Engineering Students

A decrease of 644 in the number of students of electrical engineering enrolled in 129 technical schools of the United States for the year 1922-23 as compared with 1921-22 is shown by figures compiled by Walton St. John of the United States Bureau of Education, the respective totals being 13,275 and 13,919. Similar decreases are shown in the registration for other branches of engineering study, civil engineering, with an enrollment of 12,802, showing a loss of 1,590; mechanical engineering, with an enrollment of 14,453, a loss of 1,561; chemical engineering, with an enrollment of 7,054, a loss of 1,668, and mining and metallurgical engineering, with an enrollment of 2,895, a loss of 234. The percentage of loss has, it is thus seen, been least in the electrical engineering courses, where it is about 4.6 per cent as compared with approximately 11 per cent for civil engineering, 9.7 per cent for mechanical engineering, 19 per cent for chemical and 7.3 per cent for mining and metallurgical.

Outdoor-Type Generating Plant for Idaho Power Company

TWO 7,500-kva. units are being added to the present 3,000-kw. plant of the Idaho Power Company at American Falls on the Snake River in Idaho. The generating plant will be of the outdoor type, and a gantry crane will be installed to lift the steel hoods off from the generator in case it is necessary to remove any of the heavier parts of the generators or waterwheels for repairs. Water for the new units will be diverted from the company's present dam and the turbines will operate under a head of 55 ft. The total cost of this work will be about $1,200,000, and the new generating equipment will, it is expected, be placed on the line about Nov. 1, 1923.

Expansion at Pittsburgh

Extensive Equipment to Be Added to Colfax Station by Duquesne Light Company

TWO 30,000-kw. turbo-generator units with surface condensers and auxiliaries and necessary transformers and switching equipment have been purchased from the Westinghouse Electric & Manufacturing Company by the Duquesne Light Company of Pittsburgh as additional equipment for its Colfax power station. Dwight P. Robinson & Company of New York City are the consulting and erecting engineers.

Each unit consists of a single-cylinder turbine directly connected to a 35,000-kva., 85 per cent power-factor generator with a 1,562-kva., 60-cycle auxiliary house generator directly coupled to the main generator. The unit operates at 1,800 r.p.m. The main generator is designed for 12,000 volts, three-phase, while the auxiliary generator is designed for 2,300 volts, three-phase, operating at 80 per cent power factor.

The turbine is of the latest design Westinghouse combination impulse and reaction type. It is designed to operate with 265 lb. steam pressure, 175 deg. superheat and 29 in. vacuum. Its most economical load point is at 25,000 kw. and it is capable of developing an ultimate capacity of 35,000 kw. The turbine is of the single-flow, single-exhaust type. The high-pressure stage consists of a two-row impulse element which is followed by reaction blading. The conical arrangement of this reaction blading with the absence of abrupt changes in diameter of the rotor or bore of cylinder-blade rings between the stages reduces the losses in the passage of steam through the blading to a minimum. The last three rows toward the exhaust end are of the multiple-exhaust type, which permits the efficient handling of large volumes of steam at high vacuum and at the same time keeps the working stresses of the blades and the rotor within moderate and conservative values. The single large exhaust opening with internal guide vanes reduces the leaving losses and distributes the exhaust steam uniformly over the entire tube surface of the condenser.

Each turbine is arranged with four openings at various stages, so that steam can be extracted for the purpose of heating the boiler-feed water. At the 30,000-kw. load the pressure at these bleeding points is approximately 126 lb., 59 lb., 15 lb. and 3.75 lb. absolute.

AUXILIARY EQUIPMENT

The auxiliary house generator, which is driven by the main unit, supplies the energy for driving all of the auxiliaries for the particular units, all of these auxiliaries being driven by motors.

Excitation for both the main generator and the auxiliary house generator will be obtained from a three-element motor-driven exciter set. This special exciter set consists of one 350-kw. direct-current generator to supply excitation current for one or both of the main generators and a 50-kw. direct-current generator to supply excitation current for one or both of the auxiliary house generators. Both the 350-kw. and the 50-kw. generator are driven by one induction motor.

The turbo-generator units will be served by two 55,000-sq.ft. radial-flow, two-pass surface condensers. The water boxes will be divided to permit cleaning one-half of the condenser while the other half is in operation. Two circulating pumps will be provided for each condenser and will have a capacity of 70,000 gal. per minute when both pumps are operating together. Two condensate pumps of the two-stage type will also serve each condenser.

Union Electric Light & Power Reduces Rates

Louis H. Egan, president of the Union Electric Light & Power Company of St. Louis, has announced that a new schedule of rates is being filed with the Public Service Commission of Missouri which will effect a reduction of about $700,000 a year in the company's revenue. About 140,000 customers, both domestic and commercial, will be benefited by this reduction, which is to be effective Sept. 1. The reduction has been made voluntarily by the company.

Financing of Hydro-Electric Developments in Vermont

The Massachusetts Department of Public Utilities has authorized the New England Power Company to finance hydro-electric developments upon the Deerfield River by the issue of preferred stock and bonds not exceeding $5,048,500, applying to the construction of a storage basin and the so-called No. 7 station of the company near Readsboro, Vt.; to the hydro-electric station at Searsburg, Vt., and to the lines to connect the plant with the existing transmission system. The Searsburg development was completed in the winter of 1921-22 and has since been in operation. Its actual cost was $2,093,467. This station is a 5,000-kva. automatic plant operating upon an average head of 210 ft. (See ELECTRICAL WORLD, May 19, page 1143.) The estimated cost of the Davis Bridge (No. 7) plant, including storage facilities, is $8,817,000. It is to have an initial installation of 32,000 kva., with a mean head of 350 ft. (See ELECTRICAL WORLD, June 16, page 1410.)

The decision authorizes the company to issue 27,000 shares of 6 per cent preferred stock at $90 per share and accrued dividend (par value $100), the difference between the issue price of $90 and the par value to be amortized out of earnings semi-annually before the payment of common-stock dividends of 5 per cent of the foregoing amount annually for ten years. It also approves the issue of bonds, at not less than par and accrued interest, to the amount of $2,800,000, bearing interest at the rate of 5 per cent and maturing in 1951.

Lighting to Be Emphasized by New England N. E. L. A.

Supplementing the outlined program of the forthcoming convention of the New England Division of the N. E. L. A. at Swampscott, Mass., as published last week, that part of the proceedings under the auspices of the Lighting Sales Bureau will include the following addresses on Sept. 6: "Store and Show Window Lighting," A. L. Powell, Edison Lamp Works of the General Electric Company, Harrison, N. J.; "New Highway Lighting," C. A. B. Halvorson, Jr., General Electric Company, Lynn, Mass., and "The Hartford Window Lighting Display," Fred Gorman, Hartford Electric Light Company.

Program of Iron and Steel Electrical Engineers

The titles and authors of papers and reports to be presented at the Buffalo convention of the Association of Iron and Steel Electrical Engineers, to be held concurrently with the iron and steel industries exposition in the Broadway Auditorium in that city, Sept. 24 to 28, have been made public and are as follows:

"High-Pressure Steam Boilers," Dr. D. S. Jacobus, consulting engineer Babcock & Wilcox Company, New York.

"Automatic Engine Stops," Walter Greenwood, safety engineer Carnegie Steel Company, Youngstown, Ohio.

"Electric Furnaces," E. T. Moore, electrical engineer Halcomb Steel Company, Syracuse, N. Y.

"The Tempering of Coal," T. A. Marsh, chief engineer Green Engineering Company, Chicago.

"Surface Combustion," W. N. Hepburn, vice-president Surface Combustion Company, New York.

"Electrification of the Iron and Steel Foundry," L. W. Egan, consulting engineer, Cleveland.

"Skip Hoists," A. C. Cummins, electrical engineer Carnegie Steel Company, Duquesne, Pa.

"Boiler Troubles from the Operating Man's Standpoint," Carl Smith, fuel engineer Inland Steel Company, Indiana Harbor, Ind.

"Special Control for Ore Bridges with Special Reference to Wind Velocities," Paul Canney, electrical engineer Minnesota Steel Company, Duluth.

"Systematizing the Work of the Electrical Engineering Division," P. T. Vanderwaart, electrical engineer New Jersey Zinc Company, Palmerton, Pa.

"Electric Transportation in Steel Mills," F. O. Schnure, electrical superintendent Bethlehem Steel Company, Sparrows Point, Md.

"Economical Use of Fuel in the Steel Plant," H. C. Seibert, fuel engineer Bethlehem Steel Company, Bethlehem, Pa.

"Electrically Operated Centrifugal Pumps," B. A. Cornwell, electrical engineer Carnegie Steel Company, Youngstown, Ohio.

"Slip Regulators," D. M. Petty, electrical engineer Bethlehem Steel Company, Bethlehem, Pa.

"Electrical Developments," W. Kennedy, power engineer Worth Steel Company, Claymont, Del.

"Standardization," F. W. Cramer, engineer of tests Bethlehem Steel Company, Johnstown, Pa.

"Safety," Walter Greenwood, safety engineer Carnegie Steel Company, Youngstown, Ohio.

Brief News Notes

Iowa Has 27,697 Electrified Farmhouses.—A report of the Iowa State Board of Agriculture shows that on the 213,021 farms in the state there are 27,697 farmhouses now equipped with modern lighting systems.

Substantial Increase in Power Rates Granted to Georgia Company.—The Georgia Light, Power & Railways Company has been granted an increase of 20 per cent in its power rates by the Public Service Commission of the state. On the basis of last year's business this should result in an increase of $120,000 in gross earnings.

Southern Sierras Company to Build Plant on Mill Creek.—Plans for building a 3,000-hp. hydro-electric plant, to cost about $500,000, on Mill Creek above Redlands, Cal., have been announced by the Southern Sierras Power Company. Construction work will start as soon as a transmission line can be built to the site of the plant to furnish power for construction purposes.

New York's Electrical Show.—With more than 80 per cent of the space already contracted for, the Electrical and Industrial Exposition to be held at the Grand Central Palace, New York, on Oct. 17 to 27 promises to surpass any of the preceding shows, according to Lincoln Bancroft, the general manager. The exhibits will occupy three floors of the big building, the third floor being given over to government displays.

Memphis Has New "White Way."—Memphis has inaugurated a new "white way" lighting system on Union Avenue which will be as brilliant as those on Main and Madison Streets, though not so long. The new installation will light the principal retail business section. One carload of the 20-ft. single-lamp gray granite lighting standards designed and manufactured especially for this project have arrived and have been distributed.

St. Louis Opens New Street-Lighting System.—On Aug. 4 the new street-lighting system for the down-town section of St. Louis went into operation. This system includes 125 600-cp. series lamps with "Novalux" fixtures. The poles are 12 ft. high and are staggered every 75 ft. Three circuit breakers are used since all the lights are not turned off at midnight. The installation was made by the Welchermeyer Electric Company.

North Coast Power Company to Raise Line Voltage.—The North Coast Power Company Division of the Puget Sound Power & Light Company will spend $30,000 in raising the voltage of its transmission line between Tenino and Woodland, Wash., from 22,500 to 45,000 to afford better service in the district served by this line. New transformers will be placed at five different locations and 50 per cent of the line insulation will be replaced.

Mountain States Power Company Purchases Small Company.—The power plant and other property of the Lebanon (Ore.) Electric Light & Water Company has been taken over by the Mountain States Power Company of Albany, Ore. An 11,000-volt line is under construction from Tangent to Lebanon to tie the plant in with the existing system of the purchasing company.

Puget Sound Company Acquires Olympia Utility. — The Puget Sound Power & Light Company, Seattle, has acquired control of the Olympia (Wash.) Light & Power Company, which supplies electric railway, lighting and power service to the capital city of the state. The Olympia company's earning's for 1922 were about $200,000. Stone & Webster, Boston, are managers of the Puget Sound company.

Mayor Hylan Wants Lower Rates.—Mayor John F. Hylan of New York City has ordered proceedings instituted before the New York Public Service Commission to establish a maximum lighting rate of 5 cents a kilowatt-hour for the New York and Brooklyn central-station companies. The Mayor declares that the commission has been remiss in its duty in permitting the present charges of these companies, which he professes to consider "outrageous" in the face of the companies' own reports.

Milwaukee Company to Build New High-Tension Line. — The Milwaukee Electric Railway & Light Company will erect between Plymouth and Granville, Wis., a distance of 50 miles, a 132,000-volt transmission line with steel towers carrying three cross-arms each. The new line, which will cost several hundred thousand dollars, will deliver power to the Eastern Wisconsin Electric Company at Plymouth as well as serve the Milwaukee company's own needs north of Milwaukee. The Milwaukee company's system extends to within a few miles of Fond du Lac.

Cities Service Company Buys Adrian (Mich.) Utilities.—The purchase by Henry L. Doherty & Company, managers of the operating subsidiaries of the Cities Service Company, of the Citizens' Light & Power Company and the Lenawee Gas & Electric Company has been announced. Both the plants are established utilities in Adrian, Mich. Their purchase, according to the Doherty company, is a further step in the expansion of the latter's utility interests in the industrial areas of the country. The purchase price of the properties is not mentioned, but is said to be in the neighborhood of $1,000,000.

Kentucky Public Service Company Obtains Franchises. — It is authoritatively announced that the Kentucky Public Service Company of Bowling Green, Ky., has obtained franchises in all the territory in southern Kentucky and northern Tennessee covered by the proposed complete tying in of its transmission system with that of the Kentucky-Tennessee Light & Power Company and that the work of laying out the projected lines, totaling 95 miles, has begun. The work is in charge of the engineering department at Bowling Green in conjunction with the J. G. White Management Corporation.

Virginia-Western Power Company Expanding. — The Virginia-Western Power Company of Clifton Forge, Va., which is extending its operations to include the plants at Charlottesville, Staunton, Buchannan and Covington, Va., and several towns in West Virginia, has filed with the Virginia State Corporation Commission an amendment to its charter increasing its capital stock from $4,000,000 to $10,000,000. Contract for a double-circuit steel-tower high-tension line from Charlottesville into West Virginia has been let, and it is expected that the work will be finished in three or four months.

Project of the Wolverine Power Company.—The Wolverine Power Company, Edenville, Mich., recently organized, has plans in progress for the construction of four hydro-electric power plants on the Tittabawassee and Tobacco Rivers, the output to be utilized by the Consumers' Power Company. The new plants are estimated to cost close to $3,000,000, including dams, and are expected to be ready for service late in 1924. The Consumers' company will expend about $800,000 for substations and transmission lines, including a large transforming substation to operate in conjunction with the present plant at Milwaukee.

Lansing Street Lighting Extended.—Lansing, Mich., has ordered 575 more "Novalux" lighting units for the extension of its new street-lighting system. The first order consisted of 350 units. The plan adopted provides for the use of standards that are of the same architectural family and will harmonize with one another and with their surroundings. When the installation is complete, the lighting system will be uniform in appearance throughout the city. Lansing claims to be the first city in the United States to adopt a plan providing for an architecturally uniform system of street-lighting units in all districts.

Iowa Mayor Favors Hydro-Electric Development by State.—Recommendations that a committee be appointed to present at the next session of the

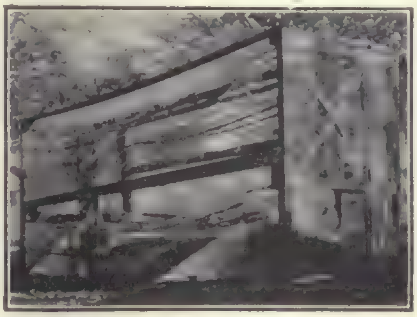
Legislature a bill providing for the state acquisition, development and operation of hydro-electric power resources in Iowa were made by Mayor R. S. McNutt of Muscatine, in his address as president of the Iowa League of Municipalities before its annual convention at Ottumwa. Mayor McNutt pictured many states as moving in the direction he favored—including among them California, Wisconsin, South Dakota, Nevada, New York, Colorado, Arizona and New Mexico—and urged Iowa not to delay.

San Joaquin Corporation Will Purchase Merced Power When Dam Is Built.—The Exchequer Dam, which is to be built on the Merced River in Mariposa County, Cal., by the Merced Irrigation District, will be 320 ft. high, the arch span at the top being 840 ft. The thickness at the crest will be 12 ft. while the dam will be 128 ft. thick at the base. Two hundred and eighty thousand acre-feet of water will be stored. This volume of water together with the natural flow of the Merced River will supply water to irrigate 250,000 acres of land. The project embraces the construction of a power house with a capacity of 25,000 kw. The district has entered into a twenty-year contract to wholesale nearly all of the power to the San Joaquin Light & Power Corporation.

Southern Pacific Opposes Electric Railway Project for Southwest.—The Southern Pacific Company has filed a protest with the Interstate Commerce Commission against the approval of William L. Staley's application for authority to construct an electric railroad system in Colorado, New Mexico, Arizona and California. The Southern Pacific says that any project which might reasonably tend to develop Arizona, New Mexico or any territory in which it has large investments would receive its support rather than its opposition. "This protest, however," it says, "is filed only in the belief that applicant's project could not be a success, that the territory would receive no material benefit from such failure, and that both public and private prejudice would result from the granting of the application."

New Orleans Not in a Hurry Over Proposed New Franchises.—No date has yet been fixed by the Commission Council of New Orleans for hearings on applications for two additional light and power plants as set forth in ordinances recently offered by request. Both ordinances await the action of Commissioner of Public Utilities Maloney, to whom they have been referred for investigation and report. Meanwhile the idea seems to be gaining ground that it will be the part of wisdom for the city to go slow before committing itself to propositions which in a measure run counter to agreements already entered into. The *Times-Picayune*, for instance, holds that to favor the applications would be neither wise nor consistent and would disorganize the theory of "controlled monopoly" to which the city is committed under the agreement entered into with the Public Service Inc.

Cable-Eating Bugs.—Steps have been taken by the Bureau of Entomology, Department of Agriculture, to study the habits of the bugs that eat telephone cables and devise means for their extermination, and experiments have been conducted on a liberal scale at the government experiment station at Falls Church, Va., followed by others in California. They involve the use of cages inclosing the cables under observation. One of these cages is shown here. The cables are suspended by various types of rings to permit study of the protection to be afforded by suspension. Some of the cables passing through the cage have a direct current of electricity and some are not energized. Some are treated with



various repellents and some are normal. Glass sides make it possible for science to study the habits of several thousand insects released in these cages. On the smooth surface of the cables the beetles make few attacks, but where the lead sheathing touches any other surface, such as the suspension ring, the holes are numerous. The experts report that practically all of the boring is done near these rings. One result of the experiments is the conclusion that beef tallow affords a good deterrent to damage. The tallow softens in the sun, when the beetle is most active, sticks to the borer and causes his death from suffocation.

California Oregon Power Company Buys Canals.—As a result of the sale of the Ankeny and Keno Canals to the California Oregon Power Company by the United States Reclamation Service, the company plans to build a 3,000-kw. power plant near Klamath Falls, Ore. The estimated cost of the new plant is $500,000. Klamath Falls and the surrounding territory are now served over a transmission line from the Copco plant of the same company. During the last four years there has been considerable litigation over the ownership of the canals and also over the price that should be paid for them. An appraisal committee valued the property at about $120,000, and it is understood the power company's bid was slightly in excess of this figure.

Associations and Societies

American Electrochemical Society to Discuss Brass-Furnace Practice. — A "round-table" discussion on the use of the electric furnace in the brass foundry will be a prominent feature of the fall meeting of the American Electrochemical Society in Dayton, Ohio, Sept. 27, 28 and 29. The discussion will be presided over by H. W. Gillett, chief alloy chemist of the United States Bureau of Mines. Among the more important phases of this subject which will be considered are these: Troubles—of any kind or description; applicability of different types of furnaces to different jobs; two-shift or three-shift operation of furnaces; induction furnaces in jobbing foundry work; large versus small electric furnaces, and refractories. Other topics will be "Electrochemistry of Gaseous Conduction," "Development and Future of Electrodeposition," "Organic Electrochemistry" and "Utilization of Chlorine."

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

American Institute of Mining and Metallurgical Engineers—Montreal, Aug. 30.

New England Division, N. E. L. A.—Swampscott, Mass., Sept. 5-8. Miss O. A. Bursiel, 149 Tremont St., Boston.

Pennsylvania Electric Association — Bedford Springs, Pa., Sept. 5-8.

Electrical Supply Jobbers' Association, Pacific Division—Gearhart, Ore., Sept. 5-7. A. H. Elliot, 502 Flatiron Bldg., San Francisco.

Pennsylvania State Association of Electrical Contractors and Dealers—Wilkes-Barre, Sept 12-13. M. G. Sellers, 15-18 Sansom Street, Philadelphia.

Conference of Electrical Leagues—Association Island, Sept. 16-19. Society for Electrical Development, New York.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 17-19. O. A. Weller, 900 15th St., Denver.

Association of Edison Illuminating Companies—Dixville Notch, N. H., Sept, 17-21. P. S. Millar, 84th St. and East End Ave., New York.

Michigan Electric Light Association—Grand Rapids, Sept. 18-20. Herbert Silvester, Detroit Edison Co., Ann Arbor.

Illuminating Engineering Society—Lake George, N. Y., Sept. 24-28. S. G. Hibben, 29 West 39th St., New York.

Association of Iron and Steel Electrical Engineers—Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

International Association of Municipal Electricians—Reading, Pa., Sept. 25-28. C. R. George, Houston, Tex.

Indiana Electric Light Association—French Lick Springs, Sept. 26-29. T. Donahue, Northern Indiana Gas & Electric Co., Lafayette, Ind.

American Electrochemical Society—Dayton, Ohio, Sept. 27-29. Colin G. Fink, Columbia University, New York.

American Institute of Electrical Engineers—Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

Empire State Gas and Electric Association—Lake Placid, N. Y., Oct. 8-9. C. H. B. Chapin, Grand Central Terminal, New York.

Association of Electragists International—Washington, Oct. 8-13. Farquson Johnson, 15 West 37th St., New York.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Oct. 19-20. Herbert Smith, Robson-Prichard Bldg., Huntington.

Commission Rulings

Vested Right of Municipality to Acquire Utility Controls.—In authorizing the Borough of Conneautville to acquire the Eckels Heat, Light & Power Company, the Pennsylvania Public Service Commission declared that its legal or contractual right to do so, coupled with a special interest, could not be made subservient to equities held outside the community which were given with notice of their probable cancellation if the municipality should exercise its right to take over the property.

Advance Payment for Fixed Amount of Energy Does Not Warrant Lower Rates than Paid by Others.—The Michigan Public Utilities Commission has disapproved a schedule of three optional rates drawn up for a summer resort by the Indiana & Michigan Electric Company, based upon the consumers' guarantee of a certain amount per season payable in advance. The commission said that if the utility felt that it should properly give a long-hour user a lower net rate, this should be accomplished by providing a sliding scale of charges.

Enforcement of Commission's Rules for Power-Line Crossings Over Railroads.—A complaint against the unauthorized construction of a transmission line across railroad tracks was dismissed by the Illinois Commerce Commission in Chicago & Alton Railroad Company vs. Spring Valley Utilities Company. The railroad company complained that the utility company refused to execute a contract requiring it to maintain the crossing in accordance with commission rulings and to provide an indemnity in case of the wires falling on the railroad company's wires. The commission said that there was nothing in the Illinois Commerce Commission law nor in any of the commission's rules which would require the railroad company and the wire-crossing company in this case to enter into an agreement covering the crossing. Whether or not the railroad company was able to require the electric company to enter into such an agreement was a matter to be established in a court of competent jurisdiction and was not a question to be answered by the commission. In so far as the purpose of such an agreement might be to require that the crossing be constructed and maintained in accordance with the commission's rules, an agreement did not appear to the commission to be necessary, since the rules must be complied with whether or not an agreement between the parties is executed, and failure to construct or maintain any crossing in accordance with the standards prescribed would have consideration whenever brought to the commission's attention.

Legal Procedure Need Not Govern Permission to Intervene.—In permitting the intervention of a party not originally concerned in a complaint brought by one Koelsch against the Capital Water Company, the Idaho Public Utilities Commission said: "The commission acts upon facts and has the power of its own motion in proper cases to make inquiries to develop the facts before taking action. Matters of law may in some cases be controlling and require the action of a court for final determination. But after an examination of the complaint in intervention and the matters set forth therein we are of the opinion that there is presented a matter of which the commission in this case should take cognizance, and that the complainant should be permitted to intervene and present all of the relevant facts in order that the commission may be fully informed for such action as it may find proper to take."

Recent Court Decisions

Point of Water Diversion May Not Be Changed to Injury of Other Appropriators.—The Wood River Power Company brought suit against Corjia Arkoosh, who had attempted to put a dam in the tailrace of the company's plant, a flume which formerly conveyed water across the tailrace having fallen into disuse. The defendant claimed that she could not otherwise irrigate her high land and that she had a prescriptive right to the water. The Idaho Supreme Court confirmed a judgment for the defendant company, holding that a point of diversion may not be changed if it will work injury to other rightful appropriators, even if they be subsequent in time to the appropriator desiring the change, and that where a contract granted the right to carry certain designated water through a ditch other water than that designated in the contract may not be carried through the ditch. (215 Pac. 975.)*

Damages for Fear Superinduced by Proximity of Wires Not Recoverable.—The Supreme Court of Appeals of West Virginia (in Karcher vs. Wheeling Electrical Company) has affirmed the action of the lower court in sustaining a demurrer to a suit brought by a lot owner to recover damages because of the erection in the street by the company, under municipal franchise, of an 80-ft. steel tower within about 9 ft. of the home of the lot owner. The latter averred that she was damaged by impairment of ingress and egress superinduced by fear of danger from the proximity of the wires over the street, but she made no charge of negligence or ulterior motive against the company. The use of the street complained of was not, the court held, an additional servitude on the easement for which an abutting landowner can, *ipso facto*, recover damages against the licensee or the municipality. (118 S. E. 154.)

Electric Company Justified in Cutting Off Service to Merchant Buying Business of Insolvent Debtor and Not Notifying Company.—In a Municipal Court case brought in New York City by one Becker against the Brooklyn Edison Company plaintiff sought to recover an amount paid by him under protest in settlement of a debt for service owed the company by an insolvent merchant whose stock plaintiff had purchased and whose place of business he occupied. The court dismissed the complaint, holding that, no notice of the transfer of the business having been given to the company, as required by statute, the company was entitled to cut off service, as it had done, until the debt was paid. (200 N. Y. S. 319.)

Instruction to Jury to Consider Electric Condition of Railway Track Not an Error.—Damages having been awarded in Montfort vs. Indianapolis & Cincinnati Traction Company because plaintiff's horse ran away owing, as alleged, to receiving an electric shock from an imperfectly bonded rail, the defendant claimed that the trial court made an erroneous charge in instructing the jury to pass under review the electric condition of the railway track as to whether the earth near the crossing was charged with electricity, and whether the electric current would leak from the rails if the bonding was in good condition, and whether sparks and flashes issued from the joints, and, if so, whether that indicated a defective bonding. The Appellate Court of Indiana held that, these matters having been shown in evidence, there was no reversible error. (139 N. E. 677.)

Proper Procedure of Illinois Courts on Appeal from Commission Order.—Setting aside a rate-fixing order of the state commission (in People's Gaslight & Coke Company vs. City of Chicago), the Supreme Court of Illinois added instructions that certain evidence be admitted, saying that the statutes provide that, on appeal, the court is to make an original judicial investigation from the evidence, and confirm the decision or set it aside, according to whether it determines it is or is not lawful and reasonable, and is authorized to remand the cause only where it appears the commission improperly rejected evidence, and then with instructions to receive such evidence and reconsider the case in view thereof, and so may not merely reverse and remand, with directions for the commission to make specific findings showing the basis of its conclusion, as the lower court had done. (139 N. E. 867.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

G. H. Wilmarth Heads Byllesby Wisconsin Interests

George H. Wilmarth, who has been appointed vice-president and general manager of the Wisconsin-Minnesota Light & Power Company, recently acquired by the H. M. Byllesby organization, as was announced in the Aug. 18 issue of the Electrical World, has been manager of the Muskogee division of the Oklahoma Gas & Electric Company since 1918. Mr. Wilmarth has been an active civic worker in that city. He was president of the local Rotary Club, a chairman of the new-industries committee of the Chamber of Commerce and a past-member of the board of directors of that organization.

G. H. Wilmarth

Mr Wilmarth was born in Jackson, Mich., in 1876, but a year later his parents moved to Aurora, Ill., where he attended the common and high schools. After being graduated from the University of Wisconsin he took charge of the Chicago Electric Traction Company line as a representative of B. J. Arnold and changed that system from battery to trolley operation. After this work was completed he became assistant superintendent for the Meyers Construction Company, Chicago, in building the Canton-Akron electric line, leaving this work to become superintendent at De Kalb. In 1904 he became general superintendent of the Fort Smith Light & Traction Company. Subsequently Mr. Wilmarth built power plants for the Illinois Traction Company as construction engineer, and in 1910 he first joined the Byllesby organization as superintendent of the Red River Power Company at Grand Forks, N. D. In 1912 he was transferred to Sapulpa, Okla., as manager, remaining there until 1918, when he went to Muskogee.

Ross B. Mateer A. I. E. E. Chairman in Quaker City

Ross B. Mateer of the Philadelphia Electric Company was recently elected chairman of the Philadelphia Section of the American Institute of Electrical Engineers. Mr. Mateer is a graduate of Lafayette College, Easton, Pa., and has also completed the apprenticeship course given by the Westinghouse Electric & Manufacturing Company. He became associated with the Denver Gas & Electric Light Company in 1902. After ten years of transmission, distribution and commercial engineering with subsidiary properties of the Cities Service Company—during which period he introduced the three-phase distribution system and installed the first polyphase induction motor in Denver—Mr. Mateer yielded again to the call of the West and entered the employ of Pacific Coast utilities, engaging in transmission and distribution engineering and in load-factor building. It was upon his return from the army, where he was commissioned as a captain of engineers, that he allied himself with the Philadelphia Electric Company, concentrating on transmission engineering and load analysis. Mr. Mateer has taken an active part in the affairs of the Philadelphia Section, having served for five years as its secretary and treasurer, and is at the present time a member of the committee in charge of the supervision of the Institute's midwinter convention, to be held in Philadelphia early in February.

R. B. Mateer

E. W. Shepard New President of Credit Association

Elmer W. Shepard, who was elected president of the National Electrical Credit Association at the convention of that organization held recently in Boston, is well known in electrical trade circles among the younger leaders in executive posts. Mr. Shepard is a native of Winona, Minn., and was educated in the Middle West. Prior to his entrance into the electrical industry he worked for the Chicago Great Western Railway and then for the Armour Packing Company at St. Paul, spending three years in the latter organization. From 1902 to 1906 he was employed by the Merchants' Loan & Trust Company at Chicago and in the latter year entered the auditing department of the Western Electric Company in the same city. Two years later he was made credit manager at Indianapolis, Ind. In 1911 he returned to the Chicago credit department, but left to become credit manager at Cleveland in 1913. In 1918 Mr. Shepard was appointed to his present position, general credit manager, with headquarters at New York.

E. W. Shepard

F. R. Winders, formerly associated with W. J. Canada in the engineering department at the National Electric Light Association headquarters in New York, has resigned to accept an appointment in the engineering department of the Cleveland Electric Illuminating Company. A. B. Campbell, formerly engineer of the Railroad Commission of Iowa, has been selected to succeed Mr. Winders with the N. E. L. A.

Ray C. Underkofler has been appointed to succeed T. F. Keefe as manager in charge of the electric and gas properties of the Wisconsin Power, Light & Heat Company at Baraboo, Wis. Mr. Underkofler is particularly well fitted for his new position, having served the company in every department for the past seven years. He will be assisted by W. G. Kimball, in charge of sales, and A. H. Voeck, in charge of the electric department.

Dr. Addison Retires as Pacific Coast Manager of General Electric Company

Dr. Thomas Addison, often called the father of the electrical industry in the West, has retired as Pacific Coast manager of the General Electric Company and will be succeeded by J. A. Cranston, formerly Northwestern manager. Dr. Addison had been with the company for thirty-three years, and held his present position since 1892.

His great contribution to electrical progress has not been confined to the advancement of his own company. He has taken an active part in the upbuilding of other branches of the industry besides his own and has shown a warm interest in the formation of local technical and commercial organizations and their development to their present importance.

A detailed account of Dr. Addison's career was given in the frontispiece which appeared in the March 3 issue of the ELECTRICAL WORLD.

Arthur Williams, general commercial manager of the New York Edison Company, has recently been appointed by State Industrial Commissioner Bernard L. Shientag to head the committee on plan and scope organized to aid in the formation of an educational council which is to co-operate with the Labor Department of New York State in carrying on a campaign to cut down industrial accidents in the state. Mr. Williams is at present in Europe and will not return to this country until Sept. 10.

C. E. Blee has resigned as assistant engineer of the California Oregon Power Company to become chief assistant to E. E. Carpenter, recently appointed consulting engineer of the British Columbia Electric Railway Company. Mr. Blee was engaged on the construction of the Copco dam of the California Oregon Power Company in 1916 and has been with the company since that time with the exception of a year when he served as assistant professor in the department of civil engineering at Stanford University.

Robert C. Coffy, formerly manager of the central division of the Oklahoma Gas & Electric Company, with headquarters at Sapulpa, has been appointed vice-president and general manager of the Fort Smith (Ark.) Light & Traction Company, succeeding D. C. Green, who recently resigned. Mr. Coffy has been identified with the public utility industry since 1908, when he became associated with the Oklahoma Gas & Electric Company at Oklahoma City. Four years later he moved to Tacoma, Wash., to become general bookkeeper with the Tacoma Gas Company, and subsequently was appointed treasurer and auditor of the company. In 1915 he was transferred to the property at Everett as manager. It was in January, 1918, that he became manager of the central division of the Oklahoma Gas & Electric Company at Sapulpa, the position he occupied at the time of his recent promotion. Mr. Green's resignation marks nearly fifteen years of successful service in the public utility business, during the last seven of which he held the position from which he just resigned. He has not announced his future plans.

T. F. Kennedy New-Business Manager of Doherty Properties

Thomas F. Kennedy, who was recently appointed new-business manager of all of the Cities Service properties, with headquarters in New York, is one of the best known men in the Doherty organization. Mr. Kennedy's association with the Doherty interests dates back to 1901, when he joined the Denver Gas & Electric Light Company as a meter reader. In 1903 he entered the new-business department of the company as assistant new-business representative, and a year later he was promoted to the position of territory representative of that department. During the war, when Henry L. Doherty assumed a great burden of work for the government in Washington and other parts of the country, Mr. Kennedy carried on some special war work for him both at Washington and elsewhere. His untiring efforts in performing the duties at hand and the facility with which he absorbed new responsibilities led in 1920 to his selection as manager of the new-business department of the Western Light & Power Company, with headquarters in Boulder, Col. In July, 1922, he came to New York as assistant to George Williams, whom he now succeeds as head of the new-business work of the Doherty organization.

T. F. KENNEDY

L. M. Elliott, assistant superintendent of electrical construction of the Havana Electric Railway, Light & Power Company, has resigned to supervise the electrification of the sugar mills of the United Fruit Company at Central Preston and Central Boston, Cuba.

Obituary

Thomas Ellis Brown, for many years chief engineer of the Otis Elevator Company, died at his home in Morristown, N. J., on Tuesday, Aug. 14, as a result of a heart attack. Mr. Brown, who was recognized as an authority on the electric elevator, developed the original elevator in the Eiffel Tower, Paris.

Harold Wayne Arnold, who had been with the Arnold Company, engineers and constructors of Chicago, for the last seven years, died on Aug. 3 after an illness of five weeks. He was some time ago a salesman with the Sprague Electric Company and also served in that capacity with the Western Electric Company. Mr. Arnold, who was a brother of Bion J. Arnold, was forty-nine years of age.

John A. Kurtz, chairman of the Missouri Public Service Commission, died on June 17 while playing golf. Judge Kurtz was born near Hillsboro, Jefferson County, and entered the Missouri State University in 1903, whence he was graduated with honors in both the academic and the law school. From 1908 to 1921 he practiced law in Kansas City. In 1920 Governor Hyde named Judge Kurtz to fill the unexpired four months' term of Commissioner Kennish, resigned. When the four months expired Judge Kurtz was reappointed and named chairman.

Edward P. Irving, president and treasurer of the Faries Manufacturing Company, Decatur, Ill., maker of electric fixtures, died on Thursday, Aug. 16, at his home in that city, after an illness dating from last March. Though a native of New York State, Mr. Irving had lived in the Middle West since childhood. After his graduation from Illinois College he was identified with business colleges in Peoria, Jacksonville and Decatur. In 1894 he entered the office of the Faries Manufacturing Company. From that time he was associated with the Faries interests, and upon the death of the president, Robert Faries, was elected to succeed him. He was sixty years of age.

John C. Temple, hydraulic engineer and manager of the Chicago office of the S. Morgan Smith Company of York, Pa., for the past fifteen years, died suddenly on Wednesday, Aug. 8, at the Black Hawk Hotel, Davenport, Iowa. Mr. Temple's entire business career was devoted to water-power engineering and the manufacture and sale of hydraulic turbines and accessories. His many years' experience in the engineering profession in Philadelphia, New York and Montreal and the exploration of undeveloped water-power possibilities in Mexico and Central America, followed by twenty-odd years of service with the S. Morgan Smith Company, gave him a broad knowledge of matters pertaining to hydraulic power development. Mr. Temple was sixty-five years of age.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Obtaining Better Credit Information*

How to Strengthen Mercantile Agency Service by Greater Thoroughness and Promptness in Co-operation—More Careful Team Play Will Benefit the Entire Industry

By J. S. Thomas
Credit Manager Elliott-Lewis Electrical Company, Inc., Philadelphia

MERCANTILE agency reports have reached a high standard in recent years, but there is still much room for considerable improvement both in the preparation of reports and in their interpretation by our electrical manufacturers and jobbers who use them. This must come first from the agency itself and, second, from a little better co-operation by credit granters. To obtain satisfactory service we must give and receive the more complete and detailed information that is necessary.

Credit Reporters Must Penetrate Further

A mercantile agency report consists of three features: "Who is he?" "What has he?" "How does he pay his bills?" We should analyze these reports and classify them. It is the easiest thing in the world to read a mercantile agency report and come to the conclusion that it is a favorable report when it is not—if it has not been carefully analyzed.

Many reports read: "Previously employed by others. He established this business Jan. 1, 1923." There will hardly be an agency man who could answer us if we as credit men said to him: "What line of business was this fellow in, or, rather, what particular function did he perform in this line of business?"

But if a man is starting in the electrical contracting business it may be possible that he was a bookkeeper, he may have been a salesman, or he may have been a journeyman. We are entitled to that information. We are entitled also to know how long he was in that particular line of business. In other words, a man who had been in the electrical business for a year would not be qualified to conduct a business in comparison with a man who had had ten years in that particular field. It does not take much work on the part of a reporter to get those details.

We find that all of these reports which we are required to analyze are not about the little fellow. Some of them are about the big corporations. It is just as important to have details regarding the officers of that corporation as it is to have information regarding a man who is in business individually. In credit work we should be inquisitive to know who the leading spirit in a corporation is. That will save us lots of suffering, because if the man whose ideas are being reflected in a corporation has a bad record ninety-nine times out of one hundred we will know what will happen to that venture. So it is necessary for us to be very careful with this history of the officers of a corporation and to see that it is complete.

A Case in Point

For illustration, the two largest agencies were both writing a report on a new venture. A statement had been submitted to both agencies showing a net worth of about $50,000 and practically no liabilities. One agency wrote a report and assigned a rating of from $35,000 to $50,000, first-rate credit. The other agency wrote an unfinished report, and when it had finished this report it assigned a blank rating as a report which would not be issued from the office, the agency stating that we as credit men would have to go there and read it.

Now, the difference in those two reports was simply that one reporter wanted the history of these men and he could not get any information. They were foreigners and they pleaded that they could not talk English and tried to shield themselves. Finally the reporter found out that they had been very unsuccessful in another city. As a matter of fact, their enterprise there was closed as a fraud. The result was that one agency had a very favorable report and the other agency had a very unfavorable report. This enterprise went out of existence within a period of two months, during which time it had been enabled to purchase thousands of dollars' worth of merchandise.

Definite History Vital

History is important in a new enterprise. For instance, if a venture has been established for twenty years and a splendid record has been maintained over that period of time, we are not interested to know whether the credit seeker was previously a bookkeeper or what he was. But if this enterprise has just started, then we ought to know the history of the man or his partners or the officers of the corporation.

In the case of a partnership we are very often fooled because we bank on the reputation of one of the partners and this partner himself is fooled about the other fellow. The result is that that venture goes to "smash" in a very short period of time owing to the activities of the partner about whom we know nothing and with whom the reputable man has associated himself without looking up his record. Such history is immensely important.

The average man, when a reporter goes in to see a subject whose assignment he has from the office and says to him, "What line of business were you in previously?" answers, "I was employed." Perhaps the reporter goes a little bit further and says, "Whom were you employed by?" "I was employed by the Blank Electric Company." Now, he may have been employed there for a year.

Return Incomplete Reports

When a report is incomplete, return it to the agency. The agency wants this done and requests every subscriber to return incomplete re-

*From an address before the National Electrical Credit Association, Boston, Aug. 10, 1923.

ports. You will accomplish two things by doing this—you will let the agency know its shortcomings and we shall all get better reports.

Very often financial data will be summed up with the statement, "Authorities consulted offered no estimate of his net worth." Now, an agency is obligated to visualize as far as possible the business investment. There are all classes of stores, for instance. Some are well stocked, some are very slightly stocked, with some the stock is apparently in excellent condition, with others the boxes are scattered around pell-mell. We are entitled to that information, and the reporter should give us as nearly as possible a picture of that establishment. It does not cost him any more to do it. He has gone in there and seen it. Perhaps it will make him use his eyes a little more, but it is his duty to pass along to us who are in the business a statement containing just as much information as he can possibly give us.

You have seen reports that read somewhat after this fashion: "The property occupied is assessed in his name at $8,000. He carries a fair stock and parties consulted estimate him worth between $5,000 and $10,000." Now, there must be a relationship between the rating which is assigned and the meat which is in that report. If there is not, do not "bank on it." The information that a property stands of record in our name does not give us the least idea whether it is clear of all encumbrances or whether there is a mortgage of $7,000 on it.

If the stock on the shelves is estimated as worth $10,000, we do not know that there is not $8,000 of indebtedness that has not been paid against it. So when you see a rating linked up with indefinite information place no dependence upon it.

Appearances Deceitful

We might say that a basis for a rating may be derived in two ways, either by the reporter obtaining a statement or by his interviewing an authority who has one. Surface appearances are very deceiving. One can see a splendid big factory with a building covering a square and yet from a credit standpoint it may be absolutely without responsibility. One can see a little dingy contractor's store, even poorly lighted, and yet he may have five or six properties clear of encumbrance. It is not our province to guess from surface appearances.

Many times there has been a vital discrepancy between the rating assigned and an analysis of the financial statement. Now, a man is a good credit risk according to the ratio of his quick assets to his quick liabilities. Machinery and fixtures and tools and real estate will not pay bills. Very often the reporter is not so capable as you are of analyzing a statement. In other words, there is a statement with plenty of assets, but when it is boiled down these are perhaps found to be quick assets, say, in a moderate case of about $5,000 and liabilities of about $3,000, and one cannot expect to get his money very promptly in a case of that kind. Perhaps the real estate will help out in paying a fair dividend, but as regards paying for the merchandise shipped today it will not be of very much avail.

Trade Opinion

The all-important feature of trade opinions is then reached. If there is one weakness in the average agency report, it is in this paragraph on trade opinions of payments. You have read in some reports: "No criticism is heard regarding his manner of payments." Now, the reporter could have put that in this phraseology: "We have not been able to locate any houses that are extending him credit." That is really their parallel. That is the same condition. When the reporter says that no criticism is heard it means that he has not discovered the supposed source of supply.

You have also read in many reports: "He is meeting his local obligations promptly." That is equivalent to saying he is paying his stationery and telephone bills and incidental matters of that kind. Now, if one is selling to an electrical contractor in some small town, he knows that the contractor does not buy anything locally, that his source of supply, if his busines is in some community in the vicinity of Boston, is in Boston. We know that "locally" does not mean a thing. So in this matter of trade opinions you are entitled to sufficient information to give you a clear line on how the contractor is paying his important bills.

Agencies Eager to Help

The agency canvasser is just as strong for improvement in the service as credit managers are. He says to the credit man that he should insist in every case where a man is doing a business of any moment that anywhere from three to five good clean-cut trade opinions be included in that report.

I believe that incomplete reports come chiefly from the country districts, the outlying districts. The reason for that is this: A city reporter will complete his whole case. He will call on the subject and he will call on the trade and get the trade opinions, but a traveling reporter will go into a small community and he will analyze the whole town by seeing perhaps the bank and one leading authority in the place. The reporter may have one pet authority there whom he thinks knows everybody and on that basis gets out a type of report that does not possess the proper details in the matter of trade opinion.

One of the agencies has a form which is bringing splendid results in reports on merchants in outlying districts. The report does not ask for a financial statement. You can picture the average contractor when he gets this form from the agency sitting down and making out a financial statement. Many of them have no idea themselves how they stand. How, then, are they going to pass information along to the agencies? The agency referred to has found that condition to exist among the small enterprises, especially as regards the average small contractor, and it has a form which simply requests this man to send it the names of three or four of those from whom he is making his principal purchases. This is bringing results.

Clearing Plan

Another agency has a system which is going to bear splendid fruit. Instead of asking the subject for the information, the agency is having all of its branch offices that have issued that report to subscribers send the names of those subscribers to the central office, which is in New York, and it is clearing information in that way. I have seen reports with as many as seventy-five trade opinions in them. Of course, they are large concerns.

The agencies are making more of an effort to improve their service today, I believe, than they have ever done before, and it behooves us as credit granters to isolate the incomplete reports and return them to the agency with request for the minimum data. If we do that, we will bring about a reform in mercantile agency reports that we all have the right to expect.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

NO PRICE reductions or advances in the important electrical commodities are reported in any part of the United States during the week. Increased business in central-station equipment is in evidence, with the demand for poles and high-tension equipment continuing equal to the level of last month. In general the whole market is in a waiting mood. Jobbers expect unusual business to develop in the next two weeks in the residential construction field, manufacturers are proceeding at high production rates, and exporters' sales are gradually increasing. The General Electric Company expects that it will soon employ more labor than it did at peak production during the war.

Vehicle Manufacturers Expect Lower Battery Prices and Easier Market

WITH the recent drastic reductions in the prices for general lines of automobile and radio storage batteries, which in some instances amounted to 30 per cent by the leading manufacturers, electric vehicle makers are expecting like reductions in the prices of the expensive storage batteries which they must sell with their products. One of the greatest struggles in merchandising their vehicles, they state, is to make the purchaser invest from $1,500 to $2,000 for storage-battery equipment above the price of the chassis and motor, which together average $3,500. Because of the high prices for batteries, they feel that an easier selling market will come when the prices of vehicle batteries are reduced in proportion to the reductions so lately granted to the automobile and radio battery users.

A number of vehicle manufacturers are complaining of the disadvantage to which they are subjected by the old practice inherited from former years whereby batteries are first sold as part of the new vehicle, but when replacements are necessary, after two and one-half years' service, the owner of the truck must buy from the battery maker, with no commission to the manufacturer of the vehicle.

A strange turn in the market is just taking place as orders for numerous trucks from the gasoline and oil companies are coming in. One of these companies which makes many short-haul trips in New York City and its suburbs has shown extraordinary interest in the electric truck. It has sent men to the N. E. L. A. electric vehicle school, purchased six trucks and has made special research in lubrication for the electric vehicle industry as a whole. Meanwhile few orders for electric trucks are coming from the central stations, which should naturally be their greatest advocate and utilize them for all appropriate service. One maker pointed out that if each central-station company in the United States ordered just one truck, the manufacturers would be taxed to capacity for at least fifteen months.

Good Outlook in Stoker Field Despite Powdered Fuel

ADOPTION of equipment for burning powdered fuel in a number of prominent public utility generating stations of late has led to considerable discussion as to the present and future prospects of the stoker manufacturers. Out of it come several interesting sidelights on the general situation in the stoker field.

Stoker manufacturers state that powdered fuel is here to stay in some form and in some localities, but that the equipment necessitated for its use is still in the development stage. In localities where it is difficult to obtain a uniform grade of coal and where varying qualities are received the pulverizing of the fuel eliminates many difficulties and offers advantages. Moreover, in territories far distant from the coal fields, where the cost of transportation makes it expensive to pay freight for hauling ash and slate, powdered fuel will also offer economies, and manufacturers agree that it is to the interest of the industry that these economies be developed as speedily and effectually as possible.

Some stoker manufacturers are adding powdered-fuel equipment to their line of products to serve those installations admittedly suited for this system of firing. Powdered fuel has also had an effect in stimulating developments in stokers, and many improvements are being produced.

Stoker manufacturers confidently believe that the bulk of the demand for coal-handling equipment will continue to be for standard fuel and proved stoker apparatus. There has been no let-up in the market for stokers, and the expansion program of the central stations throughout the country has placed a heavy demand upon the stoker manufacturers. The general business outlook is exceedingly good, with a trend toward larger stokers and higher rates of combustion in keeping with the increasing size of station units and the diminishing demand for small private-plant equipment.

Price conditions in the stoker field are satisfactory. Manufacturers do not contemplate that the adoption of the eight-hour day in the steel industry is going to put up prices and force them to follow suit. The fact that the steel industry has selected this time to meet the growing demand for a standard day is taken to be the best possible evidence that continued good times are ahead, particularly as the steel industry has been purchasing considerable equipment recently.

English June Electrical Exports Were Lower

ENGLISH electrical exports in June amounted to £62,883,559, comparing with the much larger figure for May, which was £71,554,864. Compared, however, with the figures for June, 1922, there was a rise of nearly £10,000,000. With regard to exports of electrical goods and apparatus, they were £651,915 for June, as against £717,324 for May and £519,911 for June, 1922. The table is reproduced below.

The value of exports of electrical machinery for June was £274,916, as compared with £342,151 in April.

Imports of electrical goods during June were: Goods and apparatus, £179,527; electrical machinery, £89,019. These figures show a slight reduction under those of May.

Now that the first half of the year is closed, some better idea of the trend of trade may be gained. The export figures are: Electrical goods and apparatus, £4,146,632; electrical machinery, £1,944,482; total, £6,091,114.

For the first six months of 1922 the figures were £6,153,080, and for the

EXPORTS FROM GREAT BRITAIN OF ELECTRICAL GOODS AND APPARATUS

	Month Ending June 1921	1922	1923
Electric wires and cables insulated:			
Rubber-insulated (not being telegraph or telephone wires or cables)..	£77,631	£ 48,901	£ 68,897
Insulations other than rubber (not being telegraph or telephone wires or cables)	150,424	65,669	66,259
Telegraph and telephone wires and cables (not being submarine cables)	115,342	26,975	72,856
Submarine telegraph and telephone cables	63,338	44,821	51,230
Telegraph and telephone instruments and apparatus (except wireless valves)	157,237	143,168	145,504
Carbons, electric (*number*)	1,672	2,446	4,442
Electric lamps and parts:			
Electric glow lamps (*number*)	35,905	28,646	30,999
Arc lamps and electric searchlights (*number*)	1,882	161	2,069
Parts thereof (except carbon rods)	£690	£1,025	£201
Batteries and accumulators, including parts	40,488	42,867	42,329
Electrical instruments (other than telegraphic and telephonic); commercial (including ammeters, voltmeters, etc.), house service meters and scientific	50,014	19,120	27,969
Switchboards (other than telegraph and telephone)	19,999	12,967	9,078
Electrical goods and apparatus, all other sorts	162,568	83,145	130,082
Totals	£877,190	£519,911	£651,915

corresponding period of 1921 £10,139,-275. It will be seen that the totals for 1923 and 1922 are very similar, but inasmuch as values have fallen steadily the actual quantity of goods shipped abroad has probably been greater.

Import figures are: Electrical goods and apparatus, £1,105,593; electrical machinery, £553,543, which is a total of £1,659,136.

This figure compares with £1,277,340 in the first six months of last year and £1,682,928 in the first half of 1921. Little information is given in the returns relative to the class of goods imported, but it is said that in the half year 5,181,228 electric glow lamps and parts thereof and 2,044,433 electric carbons were imported.

Wire Production Active—General Outlook Here and Abroad

MANUFACTURERS of rubber-covered and weatherproof wire are running their plants actively as the summer draws to its close, and in well-informed circles the opinion is expressed that an excellent volume of business will be handled this fall. The demand for bare copper wire is not so active now that the orders of utilities for 1923 transmission work are pretty well filled. Interconnection and the building of new trunk lines between new generating plants and load centers have had a helpful effect upon the market for bare wire this year, in addition to the considerable amount of replacement business coming each year from electric railways.

Little complaint is heard as to inability to procure labor, but wage levels are high and the quality of service rendered is far from exceptionally good. There is a marked trend in this branch of the industry toward the increasing use of automatic and semi-automatic machinery to meet the requirements of mass production without sacrifice of quality of output. In the rubber-covered field the exactions upon the manufacturer are somewhat more severe, owing to the requirements of insulation centering, care needed in material working and electrical standards of insulation demanded. A somewhat better quality of labor is reported at work in this branch. Motorization of wire plants is making further headway.

Relations between wire producers and distributors are much concerned with price fluctuations in the copper market, and in some quarters at least it is reported that the maintenance of consigned stocks of wire by manufacturers at the distributors' warehouses is working out well. The value of these stocks varies with the market, and by adjusting prices to distributors upon this basis the average return to both manufacturer and jobber appears to be reasonably satisfactory. The policy of buying raw materials for factory use in fairly regular quantities and the shipment of reasonably even volumes of product to distributors appear to work toward a fair stability of prices and more satisfactory delivery conditions. Of course, the detailed handling of raw-material purchases, factory production and distribution vary widely according to the size and type of the wire which is being manufactured. Proportional material, labor and overhead costs vary widely with the type of wire.

At present the outlook for overseas sales of wire is none too good. European credits are badly disturbed by the failure of Germany to meet her reparations obligations with an honorable attempt to liquidate patently established indebtedness. The use of diversified wire gages in this country and abroad hampers American manufacture for foreign shipment, especially to South America. The introduction of manufacturing orders for the production of gages of wire not standard in America tends to congest factory machinery and space on this side of the water and to interfere with the regular production of shipments demanded by domestic users. Large as many American wire plants appear to be from a superficial standpoint, the space requirements of producing, inspecting and shipping hundreds of thousands of feet—perhaps millions—a day are a vital consideration. As regards Oriental wire sales, the present situation is characterized by small orders apparently placed for imitational production. British wire manufacturers have a strong hold upon the current Australian market, it is reported by official circles.

Increasing Demand for Medium-Sized Industrial Heating Equipment

INDUSTRIAL electric heating equipment of moderate size is at present undergoing rapid development, and as the economic fields of different designs of apparatus become more clearly defined a broader demand is being felt for such devices by manufacturing interests. Last week a representative of the ELECTRICAL WORLD discussed the outlook for this class of business with an Eastern manufacturer and distributor who is at present confining his activities largely to installations within a radius of about a hundred miles from the factory, and noted that there is a decided tendency for equipment designed for a particular application to find a place, with some modifications perhaps, in varied industries. Small furnaces, ovens and muffles that have found increasing application in the jewelry manufacturing industry are being investigated by other metal-working organizations, and it seems likely that within the next year or two this line of products will become deservedly popular and perhaps approach the stable class.

The larger manufacturers of electric heating equipment are finding inquiries multiplying and sales increasing over a much wider area, so that on both local and national scales business is picking up along healthy lines. Development work is proceeding in many fields, notably in connection with the annealing of wire, the closer control of varnish heating and the design of incubator equipment for bacteriological research. The producers of this class of equipment are making more effort to obtain field service data and economic information bearing upon industrial heating applications, and the recent N. E. L. A. courses in industrial electric heating at leading factories in the East and Middle West have stimulated much interest in this growing branch of electrical service.

Atlanta Reports Fair Demand for Fans and Generator Sets

THE unusually long spell of hot weather has resulted in all jobbers reporting an excellent movement in fans, though the volume is not so large as had been expected and there will be a carry-over. Jobbers handling oil-engine generator sets report very satisfactory orders for the larger-size machines from municipalities in Florida and Alabama. A manufacturer of farm-lighting equipment and water-supply systems reports an approximate 40 per cent increase in orders for these lines over the same period last year, the business in North Carolina being especially gratifying.

Construction under way in this section assures prosperity in electrical circles. Statisticians give out the figure of $30,890,700 in actual construction for the first seven months of this year in Atlanta and within a 10-mile radius. If building activities are sustained for the remainder of the year, the total figure should approximate $40,000,000.

Collections to date for August show an increase over July, with accounts being liquidated within the average of fifty days. Industrial purchasers in a large number of instances are discounting their bills, and the municipal bodies are much more prompt than has been the case for the past two years.

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.0337	$0.037	$0.0278
Cold finished shafting, per lb.	0.0428	0.048	0.0365
Brass rods, per lb.	0.1741	0.1825	0.1650
Solder (half and half), per lb.	0.276	0.276	0.221
Cotton waste, per lb.	0.1231	0.1231	0.11
Washers, cast iron (½-in.), per 100 lb.	4.66	4.66	4.00
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.08	3.08	3.11
Machine oil, per gal.	0.349	0.349	0.36
Belting, leather, medium, off list	37%	42½%	46⅔%
Machine bolts, up to 1-in. x 30-in., off list	44½%	44½%	59%

San Francisco Notes Sensible Buying and Excellent Deliveries

BUSINESS in electrical commodities is better and there is an easier feeling for the future because of sensible precautions and the curbing of wild buying. Present factory deliveries generally are excellent and the only serious shortages are in such keystone items as poles and lead-covered cable. Three-inch rigid conduit and nearly all sizes of fiber conduit are temporarily short, but confidence in the continuance of heavy building is shown by enormous local stocks of schedule material. The Pacific Gas & Electric Company last week reported that only about a thousand San Francisco homes, or 1 per cent, are unwired. About this same number are completely equipped with household appliances.

No serious losses of fruit through shipping delays are anticipated because of additional car equipment and the double-tracking of railroad sections.

Chicago Business Generally Slow; No Price Changes Announced

BUSINESS in the Chicago territory remains the same as last week. Stocks, with the exception of conduit, are normal and the demand for most commodities is slow. Cedar-pole sales have been good for the month so far, and sales of high-tension equipment have remained strong. Pole-line hardware demand is rather slow.

No important price changes were announced this week. Conduit prices are firm, apparently not affected by the eight-hour day in the steel mills, although it was expected that the price of conduit would advance following the shortened working day. Evidently some adjustments and shakedowns must take place before any price reductions can appear.

Flexible armored conductor price is fluctuating, although $42 has been announced by the larger manufacturers. Large stocks are available and concessions are being made in some cases to move them. Building activity has tapered off the first two weeks of this month.

Eastern Orders Continue Steady; Manufacturing Activities Increase

INQUIRIES and sales in New England run on from week to week without much change in volume, although inquiries are more active among jobbers and deliveries are lengthening on all but the more commonly used sizes and classes of wire and cable. Electrical manufacturing plants are very active, for the most part, the large apparatus factories being heavily loaded with orders and in some cases spending substantial amounts in building expansion and alteration programs. Central-station outputs continue to grow without ceasing. Railroad buying is better and the effect of electrification programs, both in this country and abroad, is sure to prove helpful to the industry's manufacturing schedules. In the New England cotton-textile field a turn for the better is evident through increasing orders for next season's goods, although many mills will continue to curtail operations until after Labor Day.

Prices are firm in electrical circles, without much change last week. Buying continues on a hand-to-mouth basis in many quarters, although jobbers' stocks are far from full in not a few lines. Outside construction and building plans appear to have passed their peaks for the year. In the appliance field a vigorous fall business is anticipated, and manufacturers are in excellent shape to meet the pre-holiday demand that will soon set in.

The Metal Market

A LITTLE better inquiry for copper was reported last week, particularly from the wiredrawers, although the inquiries were not spread broadcast nor did they specify large tonnages. Sellers expect no genuine revival in buying until after Labor Day and will therefore be satisfied if they can keep prices from dropping below 14 cents.

Business in copper and brass products is dull. Prices of those products have dropped back to the levels of the latter part of last year.

NEW YORK METAL MARKET PRICES

	Aug. 15, 1923 Cents per Pound	Aug. 22, 1923 Cents per Pound
Copper, electrolytic.	14 25	14.25
Lead, Am.S.& R.price	6.50	6.50
Antimony........	7.75	7.75
Nickel, ingot........	27.00 to 32.00	27.00 to 32.00
Zinc, spot...........	6.10	6.20
Tin, Straits........	39.00	39.00
Aluminum, 98 to 99 per cent..........	26.00 to 27.00	26.00 to 27.00

The conti..ued improvement in the volume of copper sales both in this country and abroad was reflected yesterday in the demand for the shares of copper companies, a demand which was of good proportions for the first time in several weeks. But the buying of copper has not been sufficiently large to cause any important price changes, and it may be some time before the industry is satisfied that the improvement is permanent so that higher prices will be warranted.

A very interesting side of American sales of copper abroad is to be found in the figures covering exports for the first half of this year. These disclose that while our exports to England as a whole were somewhat below the aggregate for the same period last year, the amount of copper taken by our British neighbor in the same half-year was three times as great as a year ago.

Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

G. E. Expects Record Employment in Schenectady

At the present rate of employing new men a record will be established at the Schenectady plant of the General Electric Company in the near future. The total number of employees is close to 24,000, which is slightly less than the peak reached during the war. The payroll is reported to be larger than ever before. More than $1,000,000 is being expended in construction at the Schenectady plant, including new buildings, additions and alterations.

Orders keep coming in at the same satisfactory rate, and plant officials are optimistic over the outlook for the fall and winter. All of the departments are sharing in the general business boom.

Westinghouse Expands Capacity to 100,000,000 Lamps

Title to the seven-story concrete building at 35 Steuben Street, Brooklyn, has recently been acquired by the Westinghouse Lamp Company. This purchase of an additional 100,000 sq.ft. of floor space brings the total owned space of the lamp company up to 1,500,000 sq.ft., representing an annual production capacity of more than 100,000,000 lamps.

Since 1917 the lamp company has rented five floors of this building, known as the Dick building, and it manufactures there many types of miniature and special lamps. The daily output of this plant is approximately 50,000 miniature lamps. No immediate change in the manufacturing policy at the plant is contemplated.

Awards $12,250,000 in Orders

The Public Service Electric Corporation, Newark, N. J., has awarded contracts for a portion of the primary equipment to be installed at its proposed power plant on property recently acquired on the Hackensack River, Kearny, estimated to cost close to $12,250,000. Other orders, including those for auxiliary equipment, will be placed in the near future. Existing contracts include three steam turbo-generators, General Electric Company, and two such turbo-generators, Westinghouse Electric & Manufacturing Company, the five units to have a rated output of 200,000 kw.; fifteen water-tube boilers, each with a capacity of 2,300 hp., Babcock & Wilcox Company; nine fifteen-retort stokers, Sanford-Riley Stoker Company, and six sixteen-retort stokers, American Engineering Company; two surface condensers to

provide a total of 50,000 sq.ft. surface, Allis-Chalmers Company, which concern will also supply eighteen 15,000-kva., 132-volt power transformers. The new plant will be constructed by the Public Service Production Company, an affiliated organization of the Public Service Electric Corporation.

Uehling Instrument Orders

The California Cyanide Company has just purchased sixteen Uehling CO_2 indicating units for its new plant at Huntington Park, Cal. The General Chemical Company has purchased three Uehling CO_2 recorders for its East St. Louis plant. It has three units at its Cleveland plant, two at its Edgewater (N. J.) plant and eight at its Marcus Hook (Pa.) plant.

The Johns-Manville Company, which has Uehling equipment at its Manville (N. J.) plant, has also just ordered a five-unit equipment for its new plant at Waukegan, Ill. Uehling Instrument reports considerable demand for this equipment from other chemical companies, including the Atlantic Tar & Chemical Company, the Chemical Company of America, the Butterworth Judson Company and the Vulcan Detinning Company.

Irrgang Joins Cowan Truck

William F. Irrgang, for seven years president of the Warren & Irrgang Company, manufacturer of factory trucks and trailers at Springfield, Mass., has joined the Cowan Truck Company, producer of electric lift and hand lift industrial trucks and tractors at Holyoke, Mass., beginning his new duties Aug. 20, as designer of equipment to take care of special needs of industries and railroads in material handling. This departure is said to mark entrance upon a broadened range of production at the Cowan plant and is a further development from the step taken by the company a year ago in establishing a division of engineering in material handling with Keith A. Wood as its head. Mr. Irrgang carries numerous patents to the Holyoke concern.

Radio Corporation Manager Is Conducting Trade Research

Pierre Boucheron, advertising and publicity manager of the Radio Corporation of America, is making a tour of the Middle West, where he is visiting the leading corporations, jobbers and dealers in an endeavor to obtain a cross-section of opinions and views on the tendency of radio trade in that territory.

Mr. Boucheron in conducting research in this territory is particularly interested in gaining information for the guidance of the corporation in its future relations with the trade. The results of these observations he will incorporate in an information service to radio dealers, to be known as "How to Sell Radiolas."

Electric Storage Battery Orders Run Well Into 1924

The demand for automobile, telephone and radio batteries is so heavy that the old plant of the Electric Storage Battery Company in Philadelphia is running at capacity. While some departments are doing extra work, the new Crescentville plant is operating to the full extent possible from the machinery installation. An official of the company said last week that present orders would carry it well into next year, as there is an increasing use of automobiles, telephones and radio outfits, and it is considered likely that the company this year will have the largest gross earnings in its history. More than four thousand persons are now employed.

Important Business Awarded to McClellan & Junkersfeld

The board of trustees of the University of Pennsylvania has awarded to McClellan & Junkersfeld, Inc., 45 William Street, New York City, a contract for the design and construction of a new boiler plant to supply the university buildings, including the hospital, with steam heat.

The plant will be on the Schuylkill River. The plans for construction were recently decided upon, following an investigation of conditions made by the engineers, and the initial installation will be 2,600 rated boiler-horsepower. H. T. Campion, vice-president of McClellan & Junkersfeld, will be in direct charge of the work.

Announcement is also made that the Standard Underground Cable Company of Pittsburgh has awarded to McClellan & Junkersfeld the contract for the design and construction of a 1,200-hp. boiler installation at its Perth Amboy plant. Construction work will start immediately.

Bates Expanded Steel Truss Reports Tripled Sales

According to Walter A. Bates, vice-president of the Bates Expanded Steel Truss Company, sales by his company for the first six months of 1923 were three times greater than those for the same period in 1922. June was the best month this year. Inquiries at the present time have slowed up a bit, as have the July sales; but the outlook for the rest of the year remains very favorable.

While the distribution of sales is quite uniform, a good deal of this material is being sent to foreign countries. During the past month a foreign order was placed for 1,700 poles to operate on a system of 110,000 volts. Africa and India furnish a good portion of this company's business, and during the last three months an order for 1,200 poles was shipped to Africa. This was for an extension of a line built in 1921. One interesting factor which accounts for the popularity of steel poles in India is that this type of pole stands up much better against the wood-eating insects and ants.

Manufacturers report no indication of a price change, since the steel industries are allowing a better coverage in the price of raw materials than they did formerly. With the pending electrification of many of the steam roads, there should be an active call for this type of equipment. The labor situation furnishes no apparent cause for worry since the supply is ample.

Western Electric New Wire Plant to Start at 41,000,000-Lb. Rate

One of the largest copper wire mills in the world, with an ultimate capacity of 70,000,000 lb. of copper wire a year, is expected to be completed late this year when a group of buildings now under construction at the Western Electric Company's plants at Hawthorne is finished. The buildings and machinery will cost $2,500,000 and will have a floor area of 96,000 sq.ft. The output of copper wire will be devoted exclusively to telephone apparatus. The wire-drawing machines will start with a combined capacity in excess of 41,000,000 lb. of wire a year.

Frank Adam Electric Orders

The Frank Adam Electric Company, St. Louis, has recently received a number of large orders for lighting circuit panels, some of the largest orders being for the Masonic Building in Detroit, the Scottish Rite Cathedral in St. Louis, the city of Memphis Auditorium and the Roosevelt High School in St. Louis. Many orders have been received on which it will take from three to nine months to finish deliveries, and both inquiries and orders are keeping up well for this time of the year.

Day & Zimmermann, Inc., engineers, announce the removal of their Philadelphia offices to 1600 Walnut Street. The other offices are at 2 Wall Street, New York City, and the Harris Trust Building, Chicago.

The Power Specialty Company, manufacturer of "Foster" superheaters, economizers and oil heaters, announces that its Philadelphia office will be in the Atlantic Building, at Broad and Spruce Streets, after Oct. 1, 1923.

Hirst & Warner, agents for the Hazard Manufacturing Company, Wilkes-Barre, Pa., have changed their Philadelphia address from 102 North Second Street to 1004 Race Street. Their new location gives them larger warehouses and better handling facilities.

The Irvington Varnish & Insulator Company, Irvington, N. J., has taken over the selling agency of the output of the Harvey Wire Company, Newark, N. J., manufacturer of enameled, silk-covered and cotton-covered wire.

The American Nickel Corporation has moved its sales office from the Oliver Building, Pittsburgh, to the main works at Clearfield, Pa.

Foreign Trade Notes

ELECTRIC AND TELEPHONE SERVICE TO BE ESTABLISHED AT HEISHAN, MANCHURIA.—Arrangements are being made, according to Commerce Reports, for the installation of electric light and telephone systems at Heishan, Manchuria, China, plans for which have been approved by the civil governor. Plans are now being made by Pai Feng-mao for a subscription of joint capital by officials and merchants to carry out the projects.

PROPOSED ELECTRIC AND ICE PLANT FOR BLUEFIELDS, NICARAGUA.—The construction of an electric and ice-making plant, according to *Commerce Reports*, is being considered by a group of business men in Bluefields, Nicaragua. The rights of the present concessionnaire expire in August, but another citizen has the option of obtaining these rights.

AUTOMATIC TELEPHONE SYSTEM FOR DELHI, INDIA. — Work will soon begin, according to *Commerce Reports*, on the laying of 60 miles of cables required for the telephone system in the new Delhi. The automatic exchange at the new city will be designed for a maximum capacity of 3,000 subscribers. The initial installation will provide for 1,500 subscribers. Later it is proposed to provide a similar exchange for Delhi itself.

CHANGE PROPOSED IN LAW CREATING STATE MONOPOLY OF ELECTRIC SUPPLY IN URUGUAY.—A bill has been introduced in the Uruguayan Legislature, according to *Commerce Reports*, amending the law creating a state monopoly of the supply of electricity for light and power throughout the republic. Under the proposed new law the municipalities would be permitted to grant concessions for the right to install electric generating plants in places where a publicly owned plant is not already in existence.

A NATIONAL COMMISSION FOR MOTIVE POWER FOR MEXICO. — The organization of a National Commission of Motive Power (Comisión Nacional de Fuerza Motriz), according to *Commerce Reports*, has been announced by the Mexican government for the organization, development, planning and supervision of the commercial exploitation of the natural power resources of the republic. It is also planned to exercise control and supervision over hydro-electric plants already in operation, with the view of possibly revising the concessions which authorized the establishment of these plants. Studies will be made of the legislation in other countries relative to the developments of hydro-electric power and the generation and sale of electricity.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in London, England (No. 7,503), for electrical domestic appliances.

Purchase is desired in Palermo, Italy (No. 7,492), of electrical household appliances, such as washing machines and cooking devices.

An agency is desired in Bombay, India (No. 7,493), for lamps, decorative ornaments, electric signs and fancy shades.

An agency is desired in Jubbulpore, India (No. 7,514), for wiring supplies.

An agency is desired in Zurich, Switzerland (No. 7,491), for wiring supplies and fixtures, metal conduit, armored cables and fittings and electrical household appliances.

Purchase is desired in Calcutta India (No. 7,506), of electric flashlights and batteries.

NEW POWER STATION IN BRAZIL.—The Empreza de Forza e Luz de Ribeirao Preto, *Commerce Reports* states, is asking for bids for its proposed Dourado power station. The cost is estimated at $100,000.

PROPOSED NEW POWER STATION FOR JOHANNESBURG, SOUTH AFRICA.—The Town Council of Johannesburg, South Africa, it is reported, has voted in favor of the proposed new power station, to cost about £500,000. It has also recommended the installation of a 10,000-kw. generator adaptable to the new conditions. This would be installed in the old power station, on temporary foundations, in the period which must elapse before the station is completed and would be eventually removed to the new power house. The new station will be equipped with two 10,000-kw. generators, together with two generators from the present station, giving it a total capacity of 39,000 kw. G. M. Clark is consulting engineer.

APPROPRIATION FOR THE NORWEGIAN POWER STATION.—Recommendations for an appropriation of 2,300,000 crowns (one crown equals $0.268 at normal rate of exchange) to be expended on the Nore power plant have been made by the forest and waterfalls committee of the Norwegian Storting. An additional sum of 25,000,000 crowns will be required to complete this plant. The transmission line from Nore it is estimated, will cost about 20,700,000 crowns. The power generated will be used on the Numedals railroad.

New Apparatus and Publications

LIGHTING SUPPLIES.—The Benjamin Electric Manufacturing Company, 847 West Jackson Boulevard, Chicago, has published a new price list, covering its dome reflector sockets, elliptical angle reflectors and two-way plug.

ELECTRIC WATER HEATER.—"Better Water Heating" is the title of a four-page folder distributed by the Cutler-Hammer Manufacturing Company, Milwaukee, which describes and illustrates the "C-H" electric water heater.

AUTOMATIC CONTROLLERS FOR PRESSES.—The Monitor Controller Company, 500 East Lombard Street, Baltimore, is distributing a four-page folder, covering the "Monitor" alternating-current and direct-current controllers, standard equipment for Kelly presses.

METER.—Bulletin No. 623 issued by the Esterline-Angus Company, Indianapolis, Ind., announces the addition of a new graphic frequency meter to the line of the "Esterline-Angus" instruments.

AIR COMPRESSORS AND VACUUM PUMPS.—The Pennsylvania Pump & Compressor Company, Easton, Pa., is distributing bulletin No. 104, covering the "Pennsylvania" straight-line air compressors and vacuum pumps.

GRINDERS, BUFFERS AND DRILLS.—The Stow Manufacturing Company, Binghamton, N. Y., is distributing bulletin G-3, covering the "Stow" motor-driven grinders, buffers, drills and die-sinking tools.

OIL CIRCUIT BREAKERS. — Bulletin 445-2 issued by the Condit Electrical Manufacturing Company, South Boston, Mass., describes and illustrates its type D-17-A and D-17-B oil circuit breakers.

COMMERCIAL LIGHTING UNIT.—Folder No. 4 519-A issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes and illustrates the various styles of "Sol-Lux" luminaries and also contains information on the general subject of commercial lighting.

CONDUIT AND FITTINGS.—The American Wiremold Company, Hartford, Conn., is distributing advance sheets of its new catalog, now in preparation, covering its new series of "wiremold" fittings for use with its large size "Wiremold" conduit No. 700.

VALVE GRINDER.—The A. H. Petersen Manufacturing Company, Milwaukee, has placed on the market a new type of valve grinding machine, known as the Petersen "Double-Action" valve grinder.

SOLDERING TOOL.—A soldering tool for use by electricians and contractors for soldering ceiling splices has been brought out by the Carich Company, Darien, Conn.

DUPLEX BAND SAW.—A combination wood and metal-cutting portable saw with electric motor operating on a lighting circuit has been developed by the Racine Tool & Machine Company, Racine, Wis.

RESISTANCE WIRES.—The Standard Alloy Wire Company, Elizabeth, N. J., has brought out two resistance wires. One is a nickel-chromium wire, used for electric heaters and high-resistance purposes. The second, "Novar," is used for rheostats, starting boxes, water heaters, etc.

METAL-CLEANING MACHINE. — The Crescent Washing Machine Company, New Rochelle, N. Y., has brought out an improved model of its machine for cleaning metals. The machine can also be used for rinsing, drying, lacquering and slushing.

CHARGING EQUIPMENT FOR ELECTRIC VEHICLES.—"Charging Equipment for Vehicle Motor-Power Batteries" is the title of bulletin No. 43,976, issued by the General Electric Company, Schenectady, N. Y., covering its apparatus for charging motive-power batteries for electric vehicles.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

EAST FAIRFIELD, VT.—The business men of East Fairfield, Fairfield Center and Bakersfield are considering the question of installing electric street lamps, electricity to be obtained from the Fairfax plant of the Public Electric Light Company.

GREENFIELD, MASS.—Work is under way by the Greenfield Electric Light & Power Company on remodeling the old steam plant on Power Court for a new substation, at a cost of about $250,000. A new aërial power line will be erected from the Cabot station at Montague City to the new station.

WOONSOCKET, R. I.—A power house will be built in connection with an addition to the Woonsocket Hospital, to cost $250,000. K. Taylor & Company, 142 Berkeley Street, Boston, are architects.

DANBURY, CONN. — The Danbury & Bethel Gas & Electric Light Company is considering an issue of $600,000 in bonds, part of the proceeds to be used for extensions to its system.

Middle Atlantic States

AMSTERDAM, N. Y.—Plans for the proposed new textile mill of the Mohawk Carpet Mills, Inc., include power plant. F. P. Sheldon & Sons, Providence, are engineers.

BUFFALO, N. Y. — Electric equipment, traveling ovens, conveying machinery, etc., will be installed in the proposed new baking plant of the National Biscuit Company, Ellicott Square, to be erected on Urban Street, to cost about $800,000.

BUFFALO, N. Y.—Plans have been completed by the du Pont Engineering Company for a power house for the local works of E. I. du Pont de Nemours & Company.

ITHACA, N. Y.—The New York State Gas & Electric Corporation has petitioned the Public Service Commission for permission to issue bonds for extensions and improvements to its system, including the installation of a 600-kw. generating unit at its power station at Collierville, the erection of a 44,000-volt transmission line between Collierville and Oneonta, and a 60-cycle line between Clintonville and Cooperstown.

MOUNT VERNON, N. Y.—The Board of Water Supply plans to install electrically operated pumping machinery in connection with a new pumping plant to be located at Oak and North West Streets.

NEW YORK, N. Y.—Bids will be received by C. S. White, purchasing agent New York Central Railroad Company, 466 Lexington Avenue, until Oct. 6 for one oil-storage barge, a 2,000-kw. synchronous motor-generator set and appurtenances, and fence wire. (Serial contract No. 23, 1923.)

NEW YORK, N. Y.—Bids will be received by C. S. White, 466 Lexington Avenue, purchasing agent New York Central Railroad Company, until Aug. 30, for one 20,000-kw. turbo-generator and surface condenser for the Fort Morris power station. (Serial contract No. 24, 1923.)

PLATTSBURG, N. Y.—The Saranac River Power Corporation, recently organized, has tentative plans for the construction of a power plant and transmission system. Dunmore, Ferrus & Dewey, Utica, N. Y., are representatives.

AMPERE, N. J.—The Crocker-Wheeler Company plans to build an addition to its power house.

CLEARFIELD, PA. — The Westover Borough Clearfield Public Service Company, recently organized, plans to erect a transmission line for local service. C. C. Savering, Johnstown, is treasurer.

PHILADELPHIA, PA.—Plans for the proposed new mill of the Colonial Knitting Mills, Inc., to be erected on Clearfield Street, to cost about $200,000, include a power house.

ROCK GLEN, PA.—The Sherman Lumber Company plans to build a power house in connection with a new mill in the Beaver Valley section.

SMETHPORT, PA.—The Borough Council contemplates the installation of electrically operated pumping machinery at the municipal waterworks.

BALTIMORE, MD.—The United Railways & Electric Company plans to erect four automatic substations in different sections of the city, with total capacity of 12,000 kw., to cost about $750,000. Energy will be furnished by the McCalls Ferry plant of the Pennsylvania Water & Power Company.

ELKTON, MD.—The Northern Electric Company plans extensions to its transmission system. Improvements are contemplated at the Gilpin Falls hydro-electric plant, recently acquired by the company.

HAGERSTOWN, MD. — The Eastern Sewer Pipe & Brick Company, recently formed, plans to build a power house at its proposed plant on the Opequon River, to cost about $150,000.

BLUEFIELD, W. VA.—Bids will be received by City Manager Ridley until Aug. 31 for the installation of an ornamental lighting system on various city streets.

CHARLESTOWN, W. VA. — The City Council contemplates the installation of electrically operated pumping machinery at the South Hill municipal waterworks.

GRAHAM, VA.—Plans are being considered for the installation of electrically operated pumping machinery at the municipal waterworks.

HAMPTON ROADS, VA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 4, for seventy-five electric fans, for use at the local navy yard. (Schedule 1229).

NORFOLK, VA.—Bids will be called at once by the Supply Officer, United States Navy, for 7,000 ft. double conductor cord. (N. S. A. Req. 85.)

North Central States

ADRIAN, MICH. — The Cities Service Company has purchased the properties of the Citizens' Light & Power Company and the Lenawee Gas & Electric Company, operating in the Adrian district. The properties will be merged and extensions and improvements are planned.

DETROIT, MICH. — A power plant to cost about $500,000 will be built at the automobile works of Dodge Brothers, Inc., in connection with extensions to cost about $5,000,000.

DUNDEE, MICH.—The Detroit Edison Company plans to install a system in Dundee Township for which a franchise has been granted.

LAINGSBURG, MICH.—The Consumers' Power Company, Jackson, is planning to extend its transmission line here, and install a local system.

MENOMINEE, MICH.—The installation of electrically operated pumping machinery in connection with extensions to the municipal waterworks is under consideration. A bond issue of $100,000 will be submitted to the voters on Aug. 31.

DEFIANCE, OHIO. — Steps have been taken by the Defiance Commerce Club for the installation of an ornamental lighting system in the business section of Clinton Street.

ST. MARYS, OHIO. — Extensions and improvements are contemplated by the Western Ohio Railway Company, to cost about $100,000. The proposed work will include the erection of a new transmission line from the local power house to Lima and the installation of a 2,500-kw. and a 4,000-kw., 60-cycle generator.

PEMBROKE, KY. — Work has been started on the rebuilding of the local distribution system and street-lighting system and also on the 11,000-volt substation of the Kentucky-Tennessee Light & Power Company.

TAYLORVILLE, KY.—The engine room of the Taylorville Electric Company was recently destroyed by fire.

GARY, IND. — Extensions are contemplated by the Gary Street Railway Company, including the installation of additional equipment in the power house. The cost is estimated at about $1,000,000.

HOPE, IND. — The erection of high-tension transmission line from Edinburg to Hope, via Flatrock, is under consideration by the Interstate Public Service Company. Indianapolis. The installation of an ornamental lighting system. consisting of twenty-nine standards, is under consideration, also extensions to the lighting system in the residential section. The town has been without street-lighting service for some time.

ARLINGTON HEIGHTS, ILL. — Plans are being prepared for the installation of a new street-lighting system in the business district.

FREEPORT, ILL.—Plans are being prepared by J. R. and R. E. Low, First Central Building, Madison, Wis., for a power plant for the W. T. Raleigh Company. 101 South Liberty Avenue, to cost about $200,000.

KEWANEE, ILL.—Bids will be received by Leonard P. Quinn, commissioner of public property, until Aug. 28 for furnishing and installing one 300-kw. and one 500-kw. turbo-generator with condensers and switchboard, and also for furnishing material and installing an electric street-lighting system.

SPRINGFIELD, ILL. — Tentative plans have been prepared by the Department of Public Works and Buildings, Springfield, for a new state-owned cement manufacturing plant, to cost about $3,000,000, including a power plant. Edgar A. Martin, 304 South Wabash Avenue, Chicago, is architect. C. A. Miller is director of the department.

BEAVER DAM, WIS. — Arrangements have been completed by the Wisconsin Power, Light & Heat Company for the erection of a three-phase, 13 000-volt transmission line from Horicon to Hustiford a distance of about 9 miles, to cost about $16,000.

MADISON, WIS.—Bids are being asked by the Chicago & Northwestern Railway Company, care B. R. Kulp, 2015 South Blair Street, for a power house, to cost about $100,000.

MARSHFIELD, WIS. — The Light and Water Commission has authorized the installation of street lamps in the vicinity of Columbia Park and on the north side of the city.

MENOMINEE, WIS. — The Wisconsin-Minnesota Light & Power Company plans to extend its transmission line to Wilson Creek Valley in the near future.

PLYMOUTH, WIS. — The Milwaukee Electric Railway & Light Company is planning to erect a 132 000-volt transmission line between Plymouth and Granville, a distance of 50 miles.

WEYAUWEGA, WIS.—The installation of an ornamental lighting system in the business district is under consideration by the Village Board and local business men.

CEDAR FALLS, IOWA.—The City Council has authorized bids calling for a Diesel oil engine and an electric generator for the municipal electric plant. A building will be erected to house the new equipment. The entire cost is estimated at between $80,000 and $90,000.

KANSAS CITY, MO. — The American Brake Shoe & Foundry Company, 30 Church Street, New York, is reported to be planning to construct a power house in connection with a proposed plant at North Kansas City, to cost about $350,000.

UNION STAR, MO.—The local electric plant, owned by George H. Star, was recently damaged by fire.

DICKINSON, N. D.—Plans are being considered for the construction of an electric light and power plant by the City Council.

DUNSEITH, N. D.—Bids will be received by the State Board Administration, Bismark for the construction of a power house, to cost about $40,000. Keith & Purke, Equity Building, Fargo, are architects.

FARGO, N. D.—A one-story power house will be erected at the St. Luke's Hospital, Eighth Avenue and Broadway.

KENESAW, NEB.—The Council is considering erecting a transmission line, to connect with the system of the Central Power Company. The cost is estimated at $15,000.

WOLBACH, NEB.—The Council is considering erecting a transmission line to Cedar Rapids to secure electricity to operate the municipal electric system.

KANSAS CITY, KAN.—Plans are being arranged for the construction of a power house at the Central Park School. Squires & Ross, 628 Kansas Avenue, are architects.

LEAVENWORTH, KAN. — Preliminary plans are being prepared by the Kansas Electric Power Company for a concrete spray pond, to cost about $32,500.

Southern States

BETHEL, N. C.—The town officials are considering closing down the local plant and purchasing electrical energy from the Carolina Power & Light Company. It is proposed to erect a transmission line to Greenville to connect with the lines of the company there.

WILMINGTON, N. C. — The Carter's Production Works, Inc., South Front Street, it is reported, contemplates building of a power house in connection with a new local lumber mill.

DARLINGTON, S. C.—The Nu-Idea Desk Company, recently formed, contemplates the construction of a power house in connection with a new local furniture plant.

SUMMERVILLE, GA. — The Georgia Railway & Power Company plans to build a local substation, to cost about $90,000.

OLDSMAR, FLA.—The Oldsmar Weather-proof Furniture Company, St. Louis, contemplates the construction of a power house at its proposed new local plant.

PAHOKEE, FLA.—The construction of a municipal ice-manufacturing plant is under consideration by the Council, and also the installation of electrically operated pumping machinery in connection with the new municipal waterworks.

CASWELL, TENN.—The Southern Railway Company, Richmond, Va., plans to build a power plant in connection with its new local freight yards and shops, to cost about $2,500,000

CHATTANOOGA, TENN.—The Tennessee Electric Power Company has applied to the Federal Power Commission for authority to build three hydro-electric plants, two on the Clinch River, one of 80,000 hp. and the other of 60,000 hp.; and one on the Power River, a tributary of the Clinch, to develop 20,000 hp. It is planned to begin work on the first project on the Clinch River in 1925.

ERWIN, TENN.—Steps have been taken by the City Council for the installation of an ornamental lighting system in the business district.

LAWRENCEBURG, TENN. — Bonds to the amount of $80,000 have been voted for construction of a dam and power plant at Shoal Creek. Freeland, Roberts & Company, Independent Life Building, Nashville, are consulting engineers.

MEMPHIS, TENN.—The Plough Chemical Company contemplates the construction of a power house, in connection with a new local plant, to cost about $500,000.

BON SECOUR, ALA.—The Bon Secour Lumber Company, recently organized, plans to build a power house in connection with a new lumber mill, to cost about $150,000.

SPEIGNER, ALA.—The Alabama Power Company, Birmingham, has been awarded a contract to supply electricity to the State manufacturing plant at Speigner, which will involve the erection of a transmission line 10 miles long.

MONROE, LA.—The Owens Bottle Company, Toledo, Ohio, plans to build a power plant in connection with its proposed local glass works, to cost about $1,000,000.

NEW ORLEANS, LA.—A company is being organized by A. H. Johnes and associates, New Orleans, with a capital stock of $5,000,000, to construct and operate a power plant on local site, to cost about $1,000,000. The new company will be affiliated with the Citizens' Light & Power Company, and it proposes to enlarge the present power plant of this company.

OAKDALE, LA.—The electric plant and ice factory of the Oakdale Ice & Light Company was recently destroyed by fire, causing a loss of about $50,000. The plant, it is understood, will be rebuilt at once.

SLIDELL, LA.—S. T. Aleus & Company plan to install electric power equipment in connection with the erection of an addition to their lumber plant on the Pearl River, to cost about $175,000.

CLAREMORE, OKLA.—The city officials have entered into an agreement with the Sand Springs Power, Light & Water Company whereby the latter will extend its transmission line from Collinsville to Claremore, a distance of 14 miles, to supply electricity here.

MINCO, OKLA.—The Chickasha Gas & Electric Company plans to erect a transmission line to Pocassett, about 20 miles, to cost about $25,000.

OKLAHOMA CITY, OKLA.—The Oklahoma Gas & Electric Company plans extensions and improvements in the system of the Southern Oklahoma Power Company, Ada, recently acquired.

AUSTIN, TEX.—Plans are being considered for the installation of electrically operated pumping machinery in connection with extensions and improvements in the municipal waterworks, to cost about $450,000.

DALLAS, TEX.—Contract will soon be awarded for the installation of an ornamental lighting system, maintained by underground wires, around the driveway of the Fair Park race track.

DALLAS, TEX.—The Dallas Power & Light Company plans to build a substation at North Dallas.

DALLAS, TEX.—The Texas Power & Light Company is planning to erect a transmission line, 150 miles long, to connect Hillsboro, Brandon, Frost, Corsicana and Palestine, to cost about $730,000.

DENISON, TEX.—The establishment of a municipal electric light and power plant is reported to be under consideration.

Pacific and Mountain States

ASTORIA, ORE.—The Hammond Lumber Company is considering the construction of a power house in connection with a new plant, to cost about $400,000.

GRANT'S PASS, ORE.—Application has been made to the State Engineer by Albert Anderson, Grant's Pass, and associates for permission to construct a 13,000-hp. hydro-electric plant on the Coquille River, to cost about $500,000.

DINUBA, CAL.—Plans are under way for the installation of an ornamental lighting system on several streets and Sierre Way. Charles E. Sloan, Santa Fé Building, San Francisco, is engineer.

LOS ANGELES, CAL. — The California Tube & Tire Company, Baker-Detwiler Building, recently organized plans to build an electric substation at its proposed local plant, to cost about $450,000.

MERCED, CAL.—Arrangements are being made by the Yosemite Portland Company, recently organized, for the construction of its new plant, to cost about $800,000. The plans include a power house. Leigh Hunt, Kansas City, Mo., is engineer.

MODESTO, CAL.—The City Council has granted the Modesto Irrigation District a permit to use the streets of the city for its electric transmission and service lines for a period of twenty-five years.

OROVILLE, CAL.—Tentative plans for the construction of hydro-electric plant, 2 miles from Oroville, have been announced by L. A. Bartlett, who represents the Golden Feather Power Company. It is proposed to form a municipal utility district to purchase power at wholesale from the company.

RIVERSIDE, CAL. — Arrangements are being made by the Southern Sierras Power Company for the construction of a 3,000-hp. hydro-electric power plant on Mill Creek above Redlands, to cost about $500,000. Work will begin on the proposed plant as soon as a transmission line can be erected to the site of the plant to furnish power for construction purposes.

SAN FRANCISCO, CAL.—Preparations are being made by the Pacific Gas & Electric Company for extensions to its substation on Eighth Street, between Howard and Mission Streets, to cost about $500,000.

SANTA ROSA, CAL.—The Pacific Gas & Electric Company is planning to build a new power plant in Santa Rosa.

IDAHO FALLS, IDAHO. — The Utah Power & Light Company is planning to build a 20,000-hp. hydro-electric plant at Sand Point, Idaho, to cost about $3,000,000.

CASA GRANDE, ARIZ.—The board of directors of Power District No. 2 has approved an appropriation of $354,000 for the erection of a transmission line from the Roosevelt Dam.

Canada

MEAFORD, ONT. — The Hydro-Electric Power Commission is negotiating for the purchase of the plant of the Georgian Bay Power & Milling Company. The town has voted to adopt the Hydro system.

PARIS, ONT.—The Town Council has passed a by-law appropriating $15,000 for extensions and improvements to the Hydro system.

JONQUIERE, QUE.—The Town Council is considering an extension to the hydro-electric power development, to cost about $75,000.

MONTREAL, QUE.—Preliminary surveys are being made by the Canadian Pacific Railway Company, Montreal, for the electrification of the Mountain Division in British Columbia. The project will include water-power developments, etc. J. M. R. Fairbairn is chief engineer.

ST. ALBAN, QUE.—The Portneuf Hydraulic Company, Deschambault, contemplates the purchase of two generators, motor and turbine for its local power development.

WAPPELLA, SASK.—The town officials are considering the installation of an electric light plant.

Electrical Patents

Announced by U. S. Patent Office

(Issued Aug. 7, 1923)

1,463,795. TRANSLATING CIRCUITS; J. R. Carson, New York, N. Y. App. filed Oct. 10, 1918. Carrier-current signaling system.

1,463,796. TRANSLATING CIRCUITS; J. R. Carson, New York, N. Y. App. filed Oct. 10, 1918. High-frequency oscillations modulated by signaling waves.

1,463,797. OPTICAL TELEGRAPHY; L. A. Charbonneau, Lacken, Brussels, Belgium. App. filed July 9, 1920. Utilizes infra-red rays made visible by extinguishing phosphorescence of phosphorescent substance.

1,463,807. TREATMENT OF MAGNETIC MATERIALS; W. Fondiller, New York, N. Y. App. filed Sept. 3, 1920. Method of adjusting permeability of magnetic materials to signaling currents.

1,463,810. HEAD SET; A. F. F. Gilson, Norwood, N. J. App. filed Dec. 26, 1919. Helmet for holding telephone receivers.

1,463,813. ELECTRON-EMITTING CATHODE AND PROCESS OF MANUFACTURING THE SAME; J. W. Harris, Montclair, N. J. App. filed Dec. 29, 1916. Process of manufacturing cathodes for electron tubes.

1,463,815. TELEPHONE SYSTEM; E. M. Hinrichsen, New York, N. Y. App. filed Dec. 18, 1919. Connections established under substation control.

1,463,830. VIBRATION DETECTOR; J. P. Maxfield, Millburn, N. J. App. filed April 25, 1919. Converting sound waves into current variations in electrical circuit.

1,463,831. ELECTROMAGNETIC DEVICE; D. D. Miller, New York, N. Y. App. filed May 5, 1921. Polarized relay.

1,463,834. WINDING MACHINE; F. F. Parks and C. A. Brink, Providence, and G. N. Taylor, East Providence, R. I. App. filed Feb. 26, 1919. For winding electrical coils.

1,463,860. ELECTRON DISCHARGE DEVICE; W. Wilson, Maplewood, N. J. App. filed July 22, 1920. Three-electrode type.

1,463,864. PROCESS OF MAKING STORAGE-BATTERY ELEMENTS; L. N. Bent, Holly Oak, Del. App. filed May 24, 1922. Mixing nitrocellulose with solvent for separators.

1,463,903. HEATING UNIT; H. W. Mitchell, New York, N. Y. App. filed Nov. 12, 1921. Electrical resistance conductors supported by core.

1,463,920. FUEL VAPORIZER FOR INTERNAL-COMBUSTION MOTORS; T. H. Jameson and L. G. Martin, Wichita, Kan. App. filed Feb. 27, 1922. Electrical heating element.

1,463,945. PROTECTIVE DEVICE; G. R. Folds, Evanston, Ill., App. filed March 19, 1920. Lightning arrester for communication lines.

1,463,947. CONTROL SYSTEM; A. A. Gazda, Chicago, Ill. App. filed Feb. 7, 1921. Automatic starter for elevator motors.

1,463,951. ELECTRICAL HEATING UNIT; F. J. Groven, Highland Park, Mich. App. filed Nov. 12, 1920. For soldering irons.

1,463,956. IGNITION SYSTEM; J. H. Hunt, Dayton, Ohio. App. filed Jan. 2, 1918. Prevents ignition upon the reversal of engine.

1,463,958. MAGNETO IGNITION SYSTEM; C. F. Kettering, Dayton, Ohio. App. filed March 25, 1920. Flywheel magneto.

1,463,959. PROCESS FOR OXIDIZING PHOSPHORUS; B. G. Klugh, Anniston, Ala. App. filed June 14, 1920. Treating gases emanating from electric smelter.

1,463,970. DRAW-OFF FOR ELECTRIC FURNACES; F. Pope, New York, N. Y. App. filed Nov. 20, 1920. Removing slag without interrupting operation.

1,463,972. AUTOMATIC TELEPHONE SYSTEM; W. T. Powell, Rochester, N. Y. App. filed Aug. 25, 1920. Fast and slow releasing relays employed to distinguish between various impulses.

1,463,982. TELEPHONE-EXCHANGE SYSTEM; H. W. Ulrich, East Orange, N. J. App. filed Sept. 5, 1919. Method of making connections between manual and automatic systems.

1,464,025. PRESSURE RHEOSTAT; H. L. Bradley, Milwaukee, Wis. App. filed July 13, 1922. For controlling electron-tube filament current.

1,464,051. OSCILLATING MACHINE; J. L. Waite, Middletown, Ohio. App. filed Jan. 17, 1921. For oscillating electric heaters.

1,464,072. TELEPHONE-EXCHANGE SYSTEM; E. W. Hancock, New York, N. Y. App. filed March 21, 1921. Machine-switching apparatus.

1,464,076. DEPOSITING METAL BY THE ELECTRIC ARC; E. H. Jones, Canonbury, London, England. App. filed Sept. 29, 1917. Metal rendered free from blow holes.

1,464,078. SELECTIVE SWITCH; O. H. Kopp, Brooklyn, N. Y. App. filed Sept. 9, 1920. For automatic and semi-automatic telephone systems.

1,464,083. RECEIVING APPARATUS FOR HIGH-FREQUENCY SIGNALING; S. Loewe, Berlin, Germany. App. filed March 19, 1921. Arrangement for producing heterodyne reception in telegraphy with or without wires.

1,464,084. TELEPHONE-EXCHANGE SYSTEM; A. E. Lundell, Chicago, Ill. App. filed June 9, 1920. Indicating mechanisms at operators' positions to identify designations of desired lines.

1,464,086. METHOD OF AND MEANS FOR SECRET SIGNALING; W. E. Beatty, Bayside, N. Y. App. filed Dec. 27, 1918. Carrier waves modulated in accordance with signals.

1,464,087. MACHINE-SWITCHING TELEPHONE-EXCHANGE SYSTEM; W. W. Carpenter, Brooklyn, N. Y. App. filed Dec. 31, 1919. Step-by-step type.

1,464,088. ELECTROMAGNETIC DEVICE; G. C. Cummings, East Orange, N. J. App. filed Sept. 27, 1920. Vibrating relays or telegraph systems.

1,464,090. SIGNALING SYSTEM; J. C. Field, East Orange, N. J. App. filed July 14, 1919. Party-line service.

1,464,096. SECRET SIGNALING; R. V. L. Hartley, East Orange, N. J. App. filed Aug. 28, 1920. Modulation and control of carrier waves used in secret telephony.

1,464,097. TWO-WAY SIGNALING SYSTEM; R. A. Heising, East Orange, N. J. App. filed Aug. 7, 1920. Transmitter and receiver both permanently associated with same circuit.

1,464,101. COATING FOR ELECTRIC LAMPS; M. Luckiesh, Cleveland, Ohio. App. filed Nov. 6, 1919. Made of talc, zinc oxide and sodium silicate.

1,464,104. SELECTIVE APPARATUS FOR SIGNALING CIRCUITS; A. McL. Nicolson, New York, N. Y. App. filed July 26, 1917. Electron-tube set for receiving wireless signals.

1,464,109. AUTOMATIC TELEPHONE-EXCHANGE SYSTEM; L. Polinkowsky, Antwerp, Belgium. App. filed Sept. 10, 1919. Automatic switching apparatus.

1,464,111. ELECTRIC CIRCUITS; H. S. Read, New Haven, Conn. App. filed Dec. 23, 1919. Method of reducing distortion in amplifier circuit.

1,464,112. ELECTRICAL IGNITION SYSTEM; C. E. Reddig, Richmond Hill, N. Y. App. filed April 28, 1921. For small engine-generator sets.

1,464,118. MACHINE-SWITCHING TELEPHONE-EXCHANGE SYSTEM; R. L. Stokely, Floral Park, N. Y. App. filed Nov. 28, 1919. Applied particularly to multi-office system.

1,464,119. FAULT LOCATOR FOR ELECTRIC CABLES; H. M. Stoller, New York City, and E. M. Matthews, Jamaica, N. Y. App. filed Dec. 8, 1920. Exploring-coil type.

1,464,120. ELECTRICAL IGNITION SYSTEM; H. M. Stoller, New York, N. Y. App. filed Sept. 15, 1921. For small engine-generator sets.

1,464,123. DYNAMO-ELECTRIC MACHINE; F. P. Whitaker, Rugby, England. App. filed Nov. 1, 1920. Commutating machines of high speed and output using multiplex windings.

1,464,124. THERMIONICALLY ACTIVE SUBSTANCE AND METHOD OF MAKING THE SAME; W. Wilson, East Orange, N. J. App. filed July 26, 1917. Platinum-coated filaments for electron tubes.

1,464,145. ELECTRIC WELDING APPARATUS; C. B. Waters, Montclair, N. J. App. filed July 2, 1918. Self-regulating current-controlling device.

1,464,149. PROCESS FOR THE PRODUCTION OF GLOSSY-METAL COATINGS ON METALS; A. Classen, Aachen, Germany. App. filed Nov. 8, 1921. By electrolytic bath.

1,464,156. SOUND-PRODUCING MECHANISM; F. B. Little, Chicago, Ill. App. filed April 2, 1920. Electrically operated hammer for striking vibrant body.

1,464,168. ANTENNA SYSTEM; W. T. Booth, East Orange, N. J. App. filed July 9, 1917. Wireless signaling system for airplanes.

1,464,184. ELECTRIC MOTOR; F. P. Mansbendel, Brooklyn, N. Y. App. filed March 31, 1921. Flat type suitable where restriction in axial direction is imposed.

1,464,207. ASSEMBLING AND WELDING JIG; J. Ledwinka, Philadelphia, Pa. App. filed Dec. 17, 1921. For welding parts of automobile bodies.

Electrical World

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A Notable Service to the Industry

MEN of every class in the electrical industry are agreed that the welfare and progress of the central-station companies affect them all. This is a close-knit industry with a community of interest that is conspicuously evident. There is an interdependence between the electric service company, the manufacturer, the jobber, contractor and dealer that binds them together and is freely acknowledged.

It is an encouraging thing to see how recognition of this fact is beginning to find public expression in voluntary and gratuitous support, interpretation and praise of the central station by large electrical manufacturers and others. Within recent years on several occasions extensive advertising campaigns have been diverted from the direct promotion of a product to give tribute and publicity to the quality and extent of the public service which is being rendered today by the central-station industry. This "goodwill" advertising has been a strong, far-reaching influence in the upbuilding of public confidence and appreciation.

NOW comes another notable example of such creative co-operation. The Wagner Electric Corporation of St. Louis has recently produced several large folders presenting in a series of short essays or editorials, attractively illustrated, a most interesting and impressive picture of the place of the central station in modern society and its importance to the home, to business and to industry. Depicting the high order of genius and responsibility that has distinguished the men who have developed and now guide the electric power service of the country, a frank appeal is made for public support.

These folders, each copy bearing the name of the recipient printed upon it, were to the number of many thousands sent to members of the United States Senate, the House of Representatives and the Cabinet, to governors, mayors of large cities, prominent jurists, publicists, editors, state public-utility commissioners, bankers and others who influence public opinion. Moreover, toward the end of the series, went a personal letter from the president of the Wagner Electric Corporation asking for an opinion as to the comparative merits of municipal or private operation of public utilities.

THE result has been a very remarkable correspondence. Senators, congressmen, governors have written that the facts presented had given them a "broader viewpoint." Judges refrained from expressing a direct opinion, but said that they had found the folders "instructive" and were keeping them "for reference." Bankers and commissioners lauded the service that this publicity was rendering to the light and power industry by "preparing the minds of the public, who would otherwise have little knowledge." Mayors and legislators said they were "much interested." In many replies came opinions preponderantly in favor of private operation of utilities. "You are doing a splendid work for the industry" was the repeated compliment — which all electrical men will heartily indorse.

This does undoubtedly constitute a notable service to the entire industry and a striking example of the opportunity which lies at hand. For every manufacturer, jobber, contractor and dealer and every independent electrical engineer, if he will, can contribute to the advancement of the common interest in the same way, by actively and intelligently interpreting and befriending the central station, not alone by the printed but also by the spoken word.

Arthur Elmer Silver

An electrical engineer who believes in co-operative work and grasps the future possibilities in power transmission.

FORTUNATELY for the electrical industry, its engineering leaders have been broad-minded and unselfish men who believe in co-operative work to develop the industry as a whole. Notable achievements have been made by these co-operative efforts, of which an outstanding example is the work on inductive co-ordination.

Arthur Elmer Silver has taken a leading part in this work and at the same time has carried on with great success his duties as the electrical engineer for the Electric Bond & Share Company. In addition he has visioned the future and through his studies in high-voltage transmission has materially aided in the development of the art.

Born in Maine in 1879 and reared in surroundings that brought him into intimate contact with lumber-mill operation, Mr. Silver early in life developed a fondness for things mechanical and sought an engineering education at the University of Maine, where he was graduated in 1902. After completing the test course at the General Electric Company he went, in 1904, to the Raleigh (N. C.) Electric Company and rapidly rose to the position of electrical engineer and electrical superintendent in the Carolina Power & Light Company, which absorbed the Raleigh property.

The success of Mr. Silver in his work brought early recognition. In 1910 he became electrical engineer with the Electric Bond & Share Company, and he has been connected with the engineering and construction departments of this organization for the past thirteen years. In 1919 he was made consulting electrical engineer of the company. His special attention is now devoted to high-voltage transmission and substation engineering, and he has presented some notable papers on those subjects before engineering societies and in the technical press.

Aside from his duties with the organization, he has been very active in the work of the N. E. L. A. and has served as chairman of the overhead systems committee and the inductive co-ordination committee. While chairman of the inductive co-ordination committee he was largely instrumental in organizing and developing a systematic study of the inductive interference situation which paved the way for the extensive co-operative work in this field which is in progress, and he continues to be an active participant in co-ordination studies.

He participates actively in the work of the A. I. E. E. and finds time for social pleasure through his membership in the Railroad Club of New York and various clubs in Montclair, N. J., where he resides.

Electrical World, September 1, 1923
Volume 82 Number 9

Editorial Comment

A New Rate of Growth Indicated by 1923 Records

IF THE second half of 1923 shows as rapid a growth of the industry as the first half has done, some astounding figures will be recorded for the year. Reports received by the ELECTRICAL WORLD for the first six months of the present year, recorded in detail elsewhere in this issue, indicate that during this period central-station companies sold a total of 32,480,000,000 kw.-hr. of electrical energy, a gain of 25.4 per cent over the energy sold during the first six months of 1922. If this increase is maintained during the remainder of the year, the output of the central stations of the country for 1923 will total slightly over 66,000,000,000 kw.-hr., as against approximately 53,000,000,000 kw.-hr. during 1922.

The industry has become so used to playing with large growth figures that it has lost to a great degree a sensitiveness to their real value. To double the operations of an already large industry inside of four years is a stupendous undertaking, requiring foresight, steadiness of purpose and the good will of the investing public. It is safe to say that such a thing has never occurred in any primary industry of the country, unless for emergency or temporary purposes such as arise in war. The central stations and the electrical industry as a whole have a large task to perform in meeting the ever-increasing demand for energy and electrical apparatus and supplies. The industry was never in a more favorable position in the mind of the investing and consuming public. All that is required is clear thinking and a strong grasp of the problems of manufacture, generation and distribution as they come to hand.

Lighting the Streets Under Present-Day Conditions

TEN or a dozen years ago illuminating engineers were seriously and emphatically debating whether the street-lighting intensity on residence streets should be equal to that of half moon or quarter moon, or at least about those relative values. The greater use of electricity for illumination was being urged. The small unit was just beginning to make inroads into what had been admittedly the arc lamp's field. While there was some inkling of the possibility of developing a scientific illumination of the average street at relatively high intensities, and while there had been several examples of "white ways"—largely for advertising purposes, however—rash indeed would the man have been who dared to predict street-lighting practices of the kinds which are even now in a state of obsolescence.

Street lighting, or street illumination, has assumed a different character recently. In early days the principal object was to provide enough light to enable pedestrians to walk without colliding with obstructions or with other persons, and to find their homes, and to permit horse-drawn vehicles safely to navigate the more or less quiet thoroughfares and side streets. Today the problem of handling with safety the ever-increasing auto traffic, the value of high illumination as a police safety precaution, the importance of well-lighted streets in forming public opinion regarding the desirability of certain districts, together with other modern factors, all serve to focus the attention of others besides illuminating engineers and central-station men on the problem of adequate street illumination. The result has been an awakening of interest which has brought about new ideas of proper illumination intensities, which has developed new methods of installation and of design and spacing of units, and which has made city authorities study street-lighting budgets on a basis other than that of a necessary evil. True, the average American city still expends not much, if any, over half of the per capita amount which, it is estimated, should suffice to produce an adequate illumination to meet conditions in 1923. There is still much to be done to educate city authorities, and the public, as to what a proper solution of the street-lighting problem really is. Meanwhile, illuminating engineers are making substantial progress in the technique of doing the job wherever they have an opportunity to demonstrate it.

Utilities and Their Relation to Community Affairs

PUBLIC utilities have frequently been charged with having no interest in their communities beyond the money they can get out of the people. In some instances the charge has undoubtedly been true, but the usual basis for the accusation has been a lack of vision on the part of the management and a consequent failure to seize opportunities for community service that would make the charge a foolish one. Two outstanding instances of the sort of service that refutes these charges will serve to illustrate the point. Last year the individuals who had been supporting grand opera in Chicago decided that the burden had grown too heavy, and for a time it was a serious question whether opera could be longer sustained. Samuel Insull stepped into the breach, and out of his efforts has grown the Chicago Civic Opera Company. But the effort was not wholly an individual one, for not a little of the credit for its success is due to several members of the Commonwealth Edison organization who took part in the movement. An activity further from the practical every-day activities of a utility organization could hardly be imagined.

Another instance is the part taken by the Texas Power & Light Company in the effort to establish cotton mills in Texas. John W. Carpenter, the general manager of the company, has in the last few months indelibly linked both his own and the company's name with that enterprise. The reward of the company in this case

will depend entirely on the growth of population because of the efforts that have been made and on the position thus gained by the company as an institution working for the development of Texas.

These two achievements are not the only ones of the kind, but merely happen to have attracted widespread attention because of their unusual character. Many other central-station organizations are taking part in similar movements. Unfortunately there are yet a great many men in executive positions who do not discern the value of such work and who are overlooking opportunities every day to put their companies in a position that would manifest company interest in community affairs in a way that could not be misunderstood. If a community turns to the executives of its local utilities for help when important community affairs are to be handled and then realizes that a fair share of the credit for community development is due the men responsible for utility management, political attacks on the utilities of that community are not so likely to be successful. Public-spirited aid to community enterprises, regardless of whether or not they promise a direct return to the company, will refute in a way that all can appreciate the accusation of selfish indifference to civic progress.

Farm Electrical Equipment Must Be Developed

AS HAS been stated before, the secret of successful electrification of the American farm lies in the development of equipment designed for use with the electric motor and to take advantage of the economies that use of electrical energy has shown possible in other fields. Belting a standard motor to any one of the present pieces of farm equipment that can be motor-driven is no more the solution of the problem than was a similar course the solution of the problem of electrifying industrial establishments. Twenty years ago central-station men were running tests in factories to determine how the electric motor could be substituted for the steam engine. Many a long argument took place as to the relative merits of the two sources of power. In many if not most cases a motor was belted to the main-line shaft, and then the fun of finding why the calculations as to the cost of operation were not met began. Since that era there has been a tremendous development of equipment for industrial use. The electric motor and industrial equipment have been adjusted and readjusted to each other until the ensuing economies have made the question of the relative merits of the two forms of power obsolete. It has taken twenty years or more to reach the present stage of progress in the industrial field and utilize to a reasonable degree the inherent advantages of electrical energy.

The same sort of development must be gone through in the agricultural field. A glimpse of the steps that are being taken in Europe was given in an article by August Petri in the issue of the ELECTRICAL WORLD for July 21, page 123. One of the interesting things described is the general-purpose motor used in Germany that can be adapted to a number of small power uses by transfer from one machine to another. Similar motors are appearing in this country, but as yet it seems that there is too much adherence to past practice. New paths must be broken if the conditions under which equipment must be used are to be fully met and the greatest advantage of electrical energy is to be gained. A number of American manufacturers are, however, working at the problem and making progress. In fact, much electrically driven farm equipment of merit is available now, and there is reason to believe that the same development will occur in farm applications as occurred in industrial fields.

Will Artificial Lines Be as Helpful in Power Transmission as in Telephone Research?

THE facility with which any given values of resistance, inductance and capacity may be realized in the laboratory early led to the use of artificial lines for the study of all types of transmission problems. Investigations of this character have proved of enormous value in the fields of telegraphy and telephony, and it is not too much to say that the present high state of development of these arts is in large measure due to the artificial line as an instrument of research and as an auxiliary to operation. It was with the aid of artificial lines that Pupin developed his method of loading with inductance for increasing the distance of transmission, and, following him, Kennelly, and recently Hoyt and others, have developed the theory of these fictitious lumpy lines and their approximation to the smooth lines of actuality, thus indicating the importance in the communication field still attaching to this powerful instrument of progress.

As an aid to the solution of power transmission problems, however, the artificial line has not been nearly so helpful. This condition is in large measure due to the fact that in communication research the artificial line may be studied while operating under the exact conditions of practice, while in the study of power transmission problems both current and voltage are of almost infinitesimal magnitude as compared with the values pertaining to the problems under investigation. As a consequence, artificial power lines up to this time have been used principally for checking the theory of lines in their steady state, as regards progressive voltage and phase changes, standing waves and the like. The most important problems of power transmission, however, are those of the effects of transients arising in load changes, short circuits, lightning discharges, and their effects on equipment. It appears doubtful whether it will be possible to go very far in the study of these problems through the use of artificial lines, because not only are the high values of current and voltage eliminated, but it is questionable whether the ordinary circuit constants, reproduced in fixed values in the artificial line, retain their values on the actual line at the high frequencies pertaining to many types of transients.

Interesting progress in the study of transmission-line transients by means of artificial lines is shown in the papers presented by F. S. Dellenbaugh, Jr., and by V. Bush at the recent A. I. E. E. convention. The former describes a new form of construction whereby the inductance and capacity are uniformly distributed and the latter describes experiments with steep-wave pulses on both artificial and actual lines. It is probable that the oscillograms shown are the first ever obtained of the successive reflections of rectangular waves of current and voltage from the ends of open and closed lines. However, the author notes that the shapes of the wave fronts taken on his artificial line differ somewhat from those predicted by his theory, and at this point he runs into one of the important open questions of this prob-

lem, namely, as to how the normal values of resistance, inductance and capacity are affected by the high frequencies pertaining to transients. Do they remain constant, even in an artificial line, and are there even greater changes in lines carrying high values of current and voltage? Here, then, in a question of theory, there appears a most promising opportunity for the artificial line, and it is to be hoped that further results of study of this character will soon be forthcoming.

Small Steam-Plant Design Practice Changing

THE development of the stoker and the turbine greatly improved the operation and economy of small steam stations, and for several years past these stations have been pretty well standardized as regards both equipment to be used and methods of operation. But the very great activity in steam-plant design practice for large stations is now making its influence felt on the smaller stations. The paper by G. T. Shoemaker in this issue reflects the new kind of design thinking and practice that should be considered even in building small stations and thoroughly outlines the very detailed study of costs, equipment and heat-balance methods that must be made if the best possible installation is to be obtained.

Increased economy is needed in energy production, but in the present developmental stage of design an immense task confronts engineers in obtaining their objectives. It is no longer good practice to do as the other fellow did and issue a blanket specification for a station. It is now imperative that analyses be made and each station studied very carefully. Such design studies call for experienced and competent engineers well versed in thermodynamics and with a sense of economic balance. The complexity of the heat-balance analyses required is rather staggering, and no rule-of-thumb designers can attempt the task of working them out.

Some interesting departures from existing practices were made in the plant designed by Mr. Shoemaker. The use of turbine stage bleeding at three points and the use of the high-pressure bleed point to get steam for auxiliary operation may open a new field of study in auxiliary practice. Moreover, the use of the high-pressure heater to heat the feed water after it leaves the economizer is a departure in small-station design. Preheating the air for the boilers is another rather unusual practice for stations of the size considered, and many variations of the scheme used can be suggested for study.

It is interesting to note that the design considered in the paper embraces practically all known devices used in the large stations with the possible exceptions of turbine gland heaters and evaporators. The only criticism of the design that may occur will be with reference to the operation of a small plant having so many heat-saving devices. The personnel must be very carefully trained if operation is to be kept properly tuned to achieve continuously the maximum from the equipment. It would seem that station designers and station operators must both do some hard studying to grasp the newer principles of design and operation, and more studies of station designs embodying these new principles should be made available to the electrical industry.

Better Specifications for Pole Treatment Needed

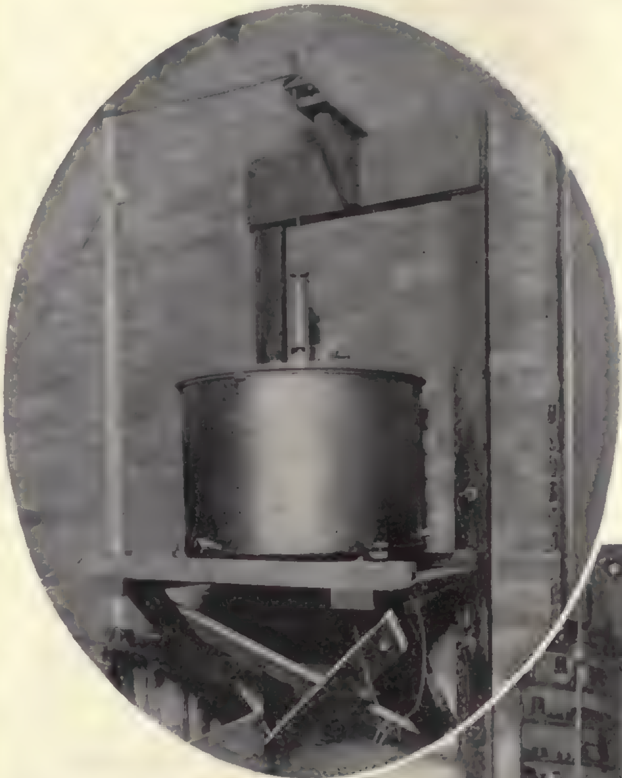
TREATMENT specifications for wooden poles have been fairly well developed so far as the preservation of wood is concerned. But there are several other factors, dealing principally with the differences in the characteristics of the wood to be handled, that apparently have not been so well covered. Western and Northern cedar and chestnut poles, having a fairly long life when set in the ground untreated, generally receive a butt treatment, the open-tank method being the one most used. To the Southern yellow pine and other types of wood which must be treated in order to be used successfully, because of the tendency of the untreated wood to decay rapidly, a complete treatment by some one of the pressure or vacuum processes is given. It is desirable in all cases that the wood to be treated shall be well seasoned.

In the case of the butt-treated poles, even with the best of seasoning, the producers cannot guarantee a complete penetration of the relatively thin sapwood because of the limitations in the available practical methods of treatment. The pine poles and any others that come under the head of completely treated poles are, in many cases, of a kind that is nearly all sapwood, the so-called heartwood, even in poles twelve inches in diameter, being in a large part of the timber available merely a small core. Penetration of the sapwood, even with the deep saturation produced by the closed-tank processes, cannot be guaranteed. In spite of the limitations placed on the treating processes many buyers insist on getting complete sapwood penetration.

In the case of the completely treated pole it is desirable that the poles be roofed, gained and bored in the producers' yards before being put into the treating tanks—something not thought of in connection with cedar or chestnut poles. Some of the telephone interests have developed a specification covering both the wood-treating and the construction processes that must be included in the pole treatment. Central-station companies using these poles have almost as many framing specifications as there are buyers. Owing to the character of some of the wood used, the time between the cutting of the poles and the setting in of rapid deterioration is relatively short, and if the poles are to be sold at all, they must be treated before that deterioration sets in. Moreover, a good job of framing is possible only when the pole is newly cut. Consequently central-station buyers sometimes find themselves in the position of having to take poles that are not framed as they wish them or of waiting until better poles can be produced. In some cases where special haste is requisite the poles may be artificially seasoned in the dry kilns, making a rather costly process. The important element in this particular situation is that there be some uniformity of specifications for the framing of poles used for definite transmission or distribution work, before treating, so that the producers can keep stock for light and power uses in reserve as is now done to some extent with poles intended for telephone lines.

Any work on the development and adoption of pole specifications that does not take into consideration these differences, and perhaps many others that must be found by investigation, will fall short of being the complete job that ought to be done. Conservation of the supply and prevention of waste ought to be one of the objects of a good set of pole specifications.

Twenty-Million-Ohm Fixed Resistance Used for Measuring X-Ray Voltage at Columbia



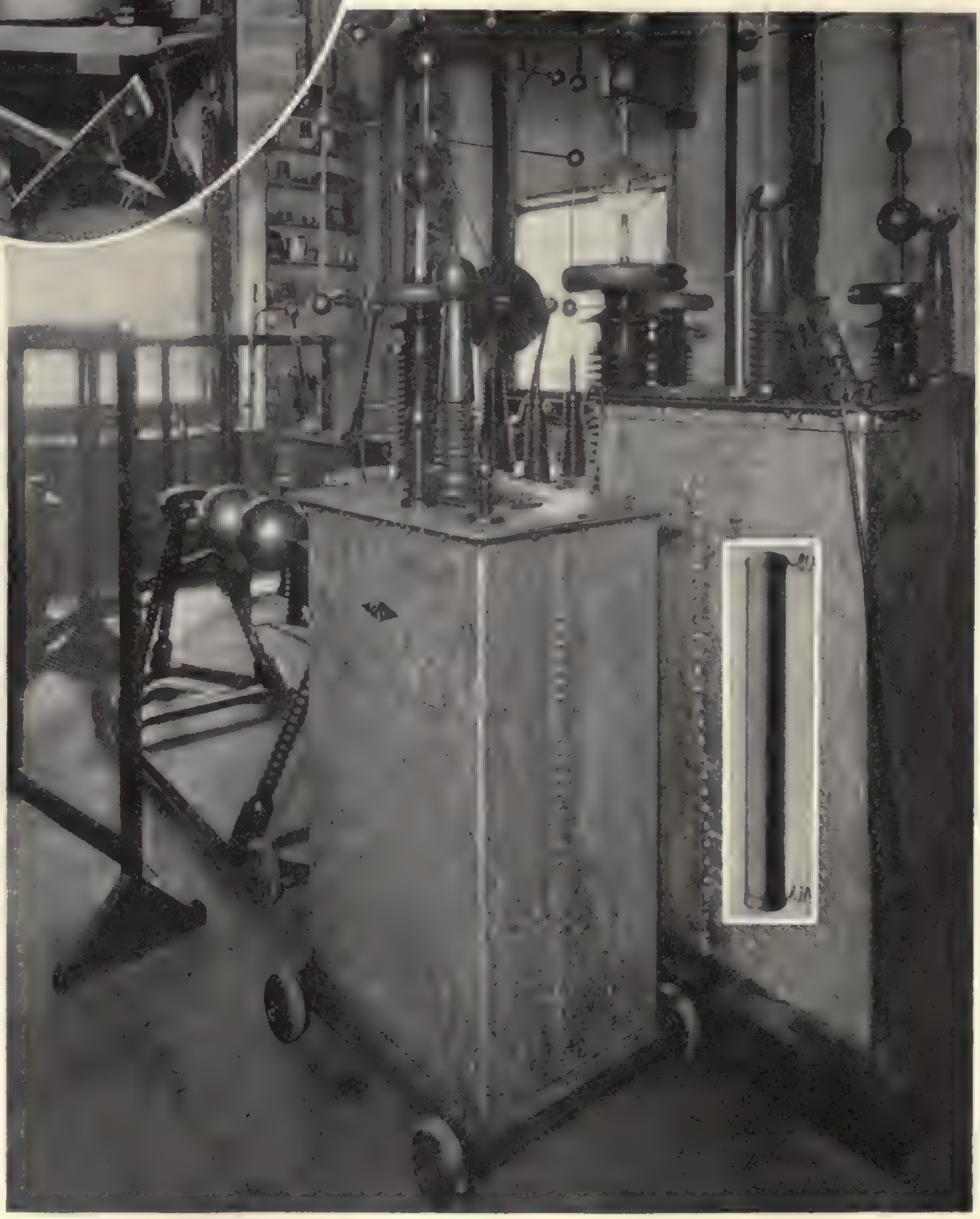
PUBLIC interest in X-ray research has been greatly stimulated of late by widely circulated newspaper reports of cancer treatment by high-voltage X-rays. At the present time important investigations along these lines are being conducted at Columbia University, New York City.

In this work, as in all other branches of X-ray research, it is highly necessary that effective means be provided for establishing as exactly as possible the potential at which the X-rays are generated. For this purpose a special 20,000,000-ohm fixed resistance, designed by Prof. Bergen Davis, professor of physics at Columbia, is employed by the university investigators to calibrate a special electrostatic voltmeter, also designed by Professor Davis.

The smaller tank, shown in the oval, incloses the 200 resistors comprising the resistance above referred to. These resistors are of the standard cylindrical "Vitrohm"-enameled "D" type (as shown herewith), each resistor consisting of a porcelain core on which the resistance wire is wound and covered with vitreous enamel which is then fused at white heat, the resistance element being thus sealed in a hard, glassy insulating envelope permanently impervious to moisture or other corroding vapors or gases.

The resistors, each of which has a capacity of 100,000 ohms, are arranged in series and mounted on Bakelite rods supported by iron brackets, the entire resistance being submerged in oil. The complete unit as shown was built to specifications drawn by Professor Davis.

The electrostatic voltmeter, also shown in the illustration, governs the motion of a beam of light from a projector, this light beam moving along a scale the calibrations of which are converted into voltage readings by use of a curve empirically constructed with the aid of the large resistance.



Causes and Prevention of Explosions in Power Transformers

Chief Hazard from Hydrogen Liberated from Oil by Arc—Must Prevent Liberation or Avoid Mixture with Oxygen to Prevent Explosion—Inert Gas Over Oil Serves the Purpose

By O. H. ESCHHOLZ*

General Manager Pittsburgh Chemical Company, Pittsburgh, Pa.

IT IS now quite common knowledge that evolved hydrogen is chiefly responsible for potential hazards residing in oil-filled apparatus.† While the history of transformer operations discloses few destructive failures from this cause, nevertheless the large investments represented in modern structures demand adequate insurance against what may have been justly considered in the past as remote contingencies.

In service transformers are subject to a number of conditions which facilitate arc formation either below or at the oil level, such as sludge‡ deposition on warm coil sections, insulation breakdown by excessive voltage or overloading, deterioration of insulation by entrapped moisture, or low oil level.

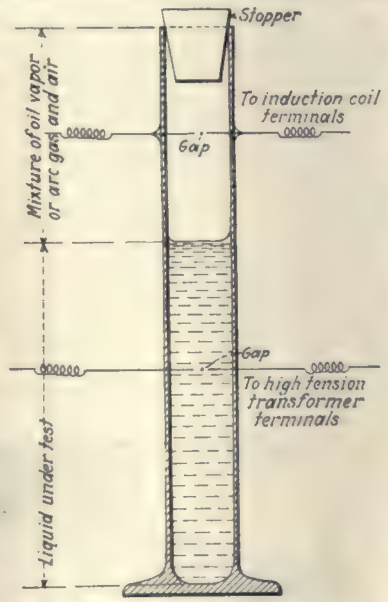


FIG. 1 — APPARATUS FOR TESTING EXPLODABILITY OF MIXTURES OF ARC GASES AND AIR OR OIL VAPORS AND AIR

Arc-Gas Constituents.—When an arc is drawn in a mineral oil the chief products of decomposition are carbon and hydrogen. Some heavier gases and vapors are produced as the result of partial cracking of oil in contact with the outer surface of the arc stream, and a small quantity of occluded gases is liberated during the heating and disintegrating processes attending arc maintenance. Below is given a representative analysis of gases evolved upon maintaining a submerged low-current, high-voltage arc in a characteristic grade of transformer oil:

Constituents	Per Cent	Constituents	Per Cent
Hydrogen	59.1	Methane	4.20
Carbon monoxide	19.21	Oxygen	1.36
Nitrogen	10.10	Carbon dioxide	1.17
Heavy hydrocarbons	4.86		

The hydrogen content depends to some extent upon the magnitude of the arc current. For short-circuit currents of the order of several thousand amperes a value of 70 per cent is more representative. Attention is directed to the fact that this analysis shows conclusively that oxygen and nitrogen are present in the oil, either dissolved or occluded, in considerable quantities and that most of the liberated oxygen combines with the arc-gas constituents. Without doubt an appreciable quantity of water was also formed as the result of the combination of hydrogen and liberated oxygen, but it was not recorded as the method of collection and analysis of arc gases gave only the permanent gas constituents.

Arc-Gas Evolution.—Assuming a relatively short arc length and an average arc-gas temperature in air space after passing through an oil head of 300 deg. C. the rate of gas formation in the common type of transformer mineral oil is of the order of 300 l. (10.6 cu.ft.) per second. Such gas evolution constitutes a hazard only when an explosive mixture is formed with "air-space" oxygen and subsequently ignited or when a sufficient hydrostatic pressure is developed in a unit completely filled with oil to cause the ejection from some weakened section of hot, inflammable gas, vapor and liquid to the atmosphere.

Explosive Limits.—The explosive limits of the major arc-gas constituents and air, as determined by numerous investigations, are as follows:

Constituents	Ratios of Gas and Air that Cause Explosion (per Cent) Lower	Upper
Hydrogen	7.9	69.4
Carbon monoxide	15.3	74.9
Methane	5.4	13.7

While these data would indicate extreme theoretical limits of 5.4 per cent and 74.9 per cent for arc-gas mixtures with air, experience has shown that in practice the range is much smaller. Observations of the performance of numerous explodable mixtures secured by heavy arcing in oil have led to the conclusion that a conservative range is 20 to 60 per cent and that the probable range for developing large pressures is from 25 to 50 per cent. This decrease in limits of explodability is attributed to the irregular diffusion of the gaseous constituents, the cooling effect of suspended liquid and the difficulty of ignition as well as the small forces developed in the region of the theoretical laboratory-established limits. The very infrequent occurrence of true explosions, despite the prevalence of conditions promoting hydrogen evolution, confirms the conclusions on a small range of explodability. In this connection, it is desired to point out that hazards caused by the development of a large hydrostatic pressure

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†"Characteristics of Transformer Oils," O. H. Eschholz, *Electrical Journal*, February, 1919.

‡"Transformer Oil Sludge," C. J. Rodman, *A.E.S.*, October, 1921.

should not be confused with those resulting from arc-gas ignition within the structure.

Arc-Gas Ignition.—Although the existence of an arc-gas mixture in the air space should be avoided, explosive forces cannot develop unless such gases are properly ignited. In some forms of construction static or dynamic arcs in the air space are facilitated and on their occurrence ignite the gaseous mixture. However, modern power transformers are either equipped with grounded shields or with suitably disposed and proportioned leads to reduce potential gradients so that this possibility is extremely remote and the hazard exists only under the abnormal circumstance of low oil level.

Other causes leading to arc-gas ignition are deflection of arc stream into air space and transportation of incandescent particles with evolved gases into the air space. The first of these appears to be extremely rare, owing to the interference of oil head, blow-out fields and adjacent structures with arc movement.

With reference to the second cause, however, C. J. Rodman has shown that under suitably controlled laboratory conditions it is possible to ignite critical mixtures of arc gas and air in the presence of copper oxide at a temperature of 270 deg. C. However, when dealing with large gas volumes developed during internal arcing or short circuits in transformers, a temperature of at least 550 deg. C. is required in the air space if violent explosions are to be had. It is obvious that this temperature cannot be achieved during normal operation.

A gas explosion may be reproduced (Fig. 1) by first passing an arc across the lower terminals, submerged in oil, and then striking an arc across the upper terminals situated in the mixture of accumulated arc and air-space gases. It will be found that mixtures of hot oil vapor and air are not explodable in the usual sense, while mixtures of arc gases and air ignite with considerable pressure development.

Conservator Construction.—One of the first methods adopted to restrict the development of excessive pressures consisted in completely filling the transformer tank with oil. Since the volume changes in oil under the usual operating conditions are large, this method necessitates the use of an overflow or reservoir chamber to assure a completely oil-filled tank at oil temperatures. This construction eliminated the transformer "air space," reduced contact between oil and air, decreased sludging and thus very materially reduced pressure hazards.

Although the ignition of a mixture of atmospheric oxygen and arc gases within the tank was thereby positively prevented, the cushioning effect of the "air space" was lost. The need for such a space during the evolution of large volumes of arc gases under the condition of a submerged arc is obvious since no relief is provided from the rapidly increasing hydrostatic pressures in the characteristic oil-filled structure. In the perhaps unusual event of a long arc duration resulting from inadequate breaker functioning, excessive relay setting, etc., such pressures will be sufficient to eject at high velocity from a displaced gasket, ruptured seam or fractured cover a mixed stream of hot arc gases, vapor and liquid. Although the probability that this material will ignite is small, being dependent upon the volume of gases generated and the location of the failure, the advantages inherent in a cushioning space consisting of an inert gas above the oil level warranted further study of the problem of eliminating hazards.

FIG. 2—SOLVENT ACTION OF "CHLORINATED" OILS ON TRANSFORMER INSULATION

Chlorinated Oils.—Such an inert cushioning space may be secured by adding to the oil a constituent of high vapor pressure that displaces the atmospheric gases with a non-inflammable vapor. The equivalent reduction in explosion hazard may also be secured by making additions which on disintegration do not form explosive mixtures with air-space gases.

A preliminary survey of the properties of known insulating liquids by the research laboratory of the Westinghouse Electric & Manufacturing Company resulted in the elimination of all but halogenated organic compounds, owing either to chemical instability, low dielectric strength or prohibitive cost. To determine the practicability of employing such liquids, the performance of transformers under operating conditions was observed with additions of hexachlorethane, carbon tetrachloride and tetrachlorethylene. It was found that greatly to reduce fire and explosion hazards approxi-

FIG. 3—SLUDGE FORMATION ON TRANSFORMER COIL IMMERSED IN A "CHLORINATED" OIL

mately 25 per cent of the halogenated compound should be added to the mineral oil and that such additions in most cases caused a rapid sludge formation and oil deterioration. While there was a marked difference in the performance of the various "chlorinated" oils, it was concluded that the utilization of non-inflammable halogenated organic additions would be impracticable as it would necessitate a radical change in insulation material and insulation distances.

Inert Gas Supply.—A more practicable means for maintaining an inert cushioning space may be secured by feeding into the "air space" various inert gases such as nitrogen or carbon dioxide. While this method is positive in character, it necessitates the development of a suitable reducing valve to permit transformer

FIG. 4—SUBSTATION DESTRUCTION CAUSED BY EXPLOSION IN AN AIR-SPACE TRANSFORMER DURING A SEVERE LIGHTNING STORM

Manhole cover was shot through roof, returning within a few inches of its original position.

breathing without gas wastage and the admission at low pressure of the inert gas from a high-pressure supply. It was felt that the reliability of the devices considered for this purpose was not sufficient to provide the degree of protection desired.

Deoxidizer.—The logical development of the inert-gas-supply method is in the direction of providing means integral with the transformer tank that will generate from atmospheric gases a suitable nitrogen supply. The simplest of such means would serve to remove the oxygen from the air trapped in the cushioning space or drawn into the tank upon contraction of the oil volume.

Numerous "deoxidizing" materials may be employed for this purpose, such as phosphorus, calcium, amalgams, metallic dust, etc., the choice depending on methods required for activation, rate of combination with oxygen, control of reaction, temperature achieved, manipulation and cost.

In the commercial structure the "clean-up" material, an alkaline-earth metal alloy, functions as both a deoxidizer and a dehydrator. It is introduced into a chamber attached to the side of the tank and communicating directly to the top of the tank and also to the external atmosphere through a novel type of liquid-seal reducing value. When the internal pressure exceeds atmospheric by approximately 3 lb., owing to oil expansion, etc., excess cushioning gas is allowed to escape. When the internal pressure has fallen more than ½ lb. below atmospheric, owing to oil contraction, air is drawn into the tank through the dehydrator and deoxidizer, leaving in chemical combination with these atmospheric moisture and oxygen.

This pressure range has been so chosen that during normal operation only a slight exchange of nitrogen will occur, for the purpose of conserving the active material. The usual procedure in placing a transformer in service will consist of completely filling the tank with oil and then allowing the oil to reach its proper level with the air passing through the deoxidizer. In case the manhole cover is later removed for inspection or some other purpose and atmospheric gases are allowed to enter, the deoxygenation rate of the clean-up material may be greatly accelerated, if desired, by passing current for a few moments from a dry cell through a wire embedded in the deoxidizer. This will produce a local hot spot sustained by the energy released from the succeeding reactions until all of the oxygen shall have been removed.

Although this method of transformer protection is quite simple, its use adequately prevents sludging (by avoiding contact between air and oil), explosions (by the absence of occluded oxygen in the oil and air space) and the development of large hydrostatic pressures (by the maintenance of a suitable gas cushion). The incorporation of the "inertaire" principle in transformer construction, it is therefore felt, will practically eliminate known causes for pressure, fire and explosion hazards.

Repulsion Motors Extensively Used

THE Saxon textile industry has adopted to a considerable extent the use of special electric motors on spinning machines and this is gradually increasing. For connection to three-phase power lines repulsion motors or three-phase commutator motors are used extensively. Both types are especially adapted for use in spinning mills. They are totally inclosed and well protected against dust and damage. The smooth and simple construction of the motors enables easy cleaning and attention. Cooling air is provided through underground ducts, the circulation being produced by fans inside the motor. Where air ducts are not possible, water cooling is provided for three-phase commutator motors.

The switching on, starting and regulating of the speed is arranged by only one hand lever fixed to the motor. Speed regulating is achieved by brush shifting, i.e., without ohmic losses in regulating resistance. In the spinning-technical sense the two types of control are of equal value. They differ only in their interior power factor, phase shifting, etc., and the cost of production. Which of the two types is more adaptable in the shop depends on individual requirements.

The repulsion motor which is used most extensively may be connected to single-phase, two-phase or three-phase networks operating at voltages up to 550 without intervening transformer.

Charging Transmission Lines

Desirable Excitation Features of Generators Used on Long Transmission Lines —Analyses of Armature Reaction and Excitation Characteristics— Effect of Transformers and Synchronous Condensers

By A. W. COPLEY
General Engineer Westinghouse Electric & Manufacturing Company

IT IS well known that the armature current in an alternating-current synchronous generator reacts upon the field and, depending upon its phase relation with respect to the generated voltage, the effect may be such as to assist or to oppose the magnetic field set up by the direct current in the field winding. Lagging current flowing from the generator tends to demagnetize and leading current to magnetize it.

In charging a transmission line with no load at the receiver end the receiver voltage will be higher than at the generator end on account of the leading current flowing through the reactance of the line. Likewise, the voltage at the high side of the step-up transformers will be relatively higher than that at the generator terminals on account of the same effect of leading current flowing through the transformer reactance. Therefore, to hold the receiver voltage to normal the generator terminal voltage must be less than normal.

The adaptability of a given generator for connection to a transmission line can be more clearly indicated by the use of curves showing the terminal voltage plotted against armature current magnetization and the net line charging current plotted against generator voltage (Fig. 1).

In this curve *oa* represent the generator characteristic with zero field current. *bb'* is the generator characteristic with enough field current to give a terminal voltage of 20 per cent of normal on open circuit. *oc* and *od* are line characteristics for two different lines, that is, the charging current for given terminal voltages. If the generator with curves *oa* and *bb'* were connected to a line with the characteristic *oc* and no direct-current field were applied to the generator, it could not be self-exciting at any point. On the other hand, if a line characteristic *od* were connected to this generator, even with no field, the charging current would excite the generator and its voltage would rise until the point was reached where line *od* intersected *oa*.

Now, if some generator field is used—for instance, enough to give 20 per cent voltage at no load on open circuit—the generator would be self-exciting when connected to a line whose characteristic is *oc*, but only up to point *x*, as above this point the charging current of the line for a given voltage is less than that required to excite the generator to produce that voltage in conjunction with the applied direct-current field excitation.

The line characteristic is a straight line; that is, the charging current increases directly as the voltage except for extreme conditions when the line is considered by itself. When transformers are connected to the line at the receiving end the curve no longer is a straight line, as the magnetizing current is lagging or opposite in phase to the charging current.

In order to determine the demand for leading current on the generator, the magnetizing current of all transformers connected to the line may be subtracted from the charging-current requirement as indicated by the line characteristic. The magnetizing current of transformers connected to the receiver end becomes of considerable importance if it is possible to allow the receiver voltage to rise somewhat at no load, as the magnetizing current of transformers with overvoltage applied increases rapidly. For instance, if the magnetizing current of a transformer at normal voltage is 6 per cent, it is roughly double this, or 12 per cent, at 10 per cent overvoltage.

Effect of Transformers on Characteristics

When the transformer magnetizing current is taken into consideration, the line characteristic, therefore, departs very materially from a straight line and becomes curved (Fig. 2). A generator with characteristic *oa* connected to this line will be self-exciting up to point *x* with no field excitation, or to point *y* with field excitation, which will give 20 per cent voltage at no load. Whereas, if the transformer magnetizing current were not present, it would be self-exciting to points *x'* and *y'* respectively.

As previously suggested, the characteristics of the generator may be modified by design changes. Increasing the air gap relatively decreases the effect of the armature ampere-turns by increasing the field ampere-turns. This necessitates a heavier field construction as more field ampere-turns are connected to supply the magnetization and it tends to increase the cost of the generator. A normally designed machine—that is, one which gives most economical design and best performance, leaving out of account the charging characteristic —has the ratio of

$$\frac{\text{field current to give full voltage at no load}}{\text{field current to circulate rated current on "short"}}$$

close to unity. A machine with a short-circuit ratio of 1.5 costs approximately 15 per cent more than a normally designed machine.

The magnetizing effect of the armature ampere-turns may be counteracted by negative excitation when the generator is being operated on an unloaded line, but the difficulties in operation, due to the unstability which exists with negative excitation, are such that it is always avoided in modern stations. Regulation schemes have, however, been applied to bring the field current very close to zero without danger of reversal.

With the well-known vibrating type of generator voltage regulator, with the secondary relays energized by the exciter voltage, it is possible to operate over an exciter voltage range of only approximately one-half to full voltage. With the relays energized by a separate constant-potential source, such as a storage battery, it is possible to operate over a range from full maximum voltage to the residual voltage of the exciter with no field. This latter value is in the neighborhood of 10 per cent of the maximum value.

A regulator for such operation is known as a broad range regulator. Consideration of the curves illustrated shows that it is desirable to obtain still lower excitation than this if possible, and to meet this need an extended broad-range regulator has been developed which is a combination between a vibrating type of regulator operating to change the exciter voltage and a face-plate regulator operating to change the resistance in the generator-field circuit. The face-plate regulator comes into service only at very low exciter voltages and serves to reduce the voltage across the generator field to a value considerably below the residual voltage of the exciter.

In designing generating equipment for use on long lines of 150,000 volts and above it is essential to take into consideration the charging-current characteristics. On many lines the charging kva. of a single line is greater than the capacity of a single generator and it is out of the question so to design the generator as to take care of this condition even with zero field current. In such cases operating conditions should be adjusted so as to allow the use of a generator of normal design.

Synchronous condensers are generally used in connection with long lines to provide for voltage regulation at the receiving end. At times of heavy load the condensers are operated with strong fields so as to take leading current and hold up the voltage. Under the light-load conditions the field current is reduced so that the "condenser" takes a lagging current or, in other words, supplies charging current to the line. An automatic generator voltage regulator used on a condenser gives exactly the effect desired on the charging-current demands made by the line on the generator.

SYNCHRONOUS CONDENSERS HELP REGULATION

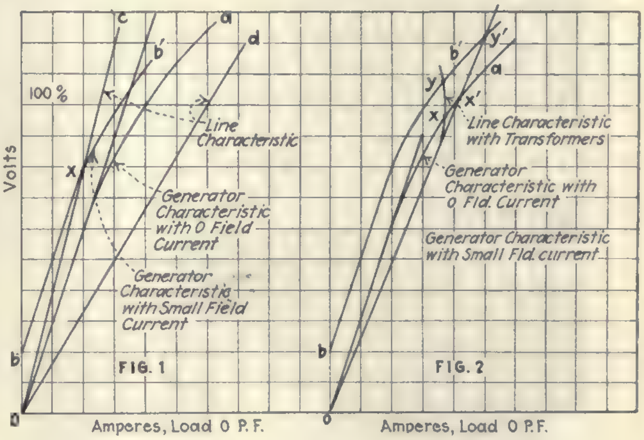
A 200-mile, 220,000-volt transmission line requires about 40,000 kva. charging current. The economical transmitting capacity of this line is in the neighborhood of 150,000 kw., and a condenser capacity of at least 75,000 kva. at the receiving end is required to obtain good voltage regulation. To use the line most economically, therefore, synchronous apparatus with a capacity of roughly 225,000 kva. is required, and it is not unreasonable to ask that operating conditions be so arranged that there will always be as much as 60,000 kva. connected at all times. The charging-current difficulty would practically disappear and normally designed generators could be used.

In the early stages of growth of any particular high-voltage system, before the load has grown, the total installed kva. may, however, be so small that it is difficult to assure 60,000 kva. in synchronous apparatus being at all times connected, and it is to tide over during this period that special attention must be paid to the generator characteristics. In some cases abnormal designs are necessary. As the generator capacity grows, it becomes easy to assure the proper amount of generating capacity being connected, and, therefore, the additional later machines added to the system can be of normal design.

The Pacific Gas & Electric Company is developing the Pit River power for use on a 220,000-volt system. There are at present installed in Pit No. 1 power house two 35,000-kva. generators which can supply 90 per cent full-load current at zero power factor leading, at 82 per cent voltage. Connected to the power-house bus are two 12,500-kva. generators, one being in Hat Creek No. 1 and one in Hat Creek No. 2 plant. Arrangement is made for stepping up from the bus voltage at Pit No. 1 power house by means of transformers to 220,000 volts, and two 200-mile circuits will then carry the power to Vaca substation, where the voltage is stepped down and two 20,000-kva. synchronous condensers are installed. These condensers can take lagging current of 12,500 kva. each. The total charging current required for the 220,000-volt lines is about 40,000 kva. per line.

Before the lines are operated at 220,000 volts, Pit No. 3 power house, with approximately 81,000 kva. in generating capacity, will be completed, so that at the Pit River end of the line there will be a total of about 175,000 kva. available in generators. It is possible to charge one line with one 35,000-kva. generator in Pit No. 1 in connection with one 20,000-kva. condenser at Vaca.

The Southern California Edison Company is bringing power from the Big Creek group of plants to Los



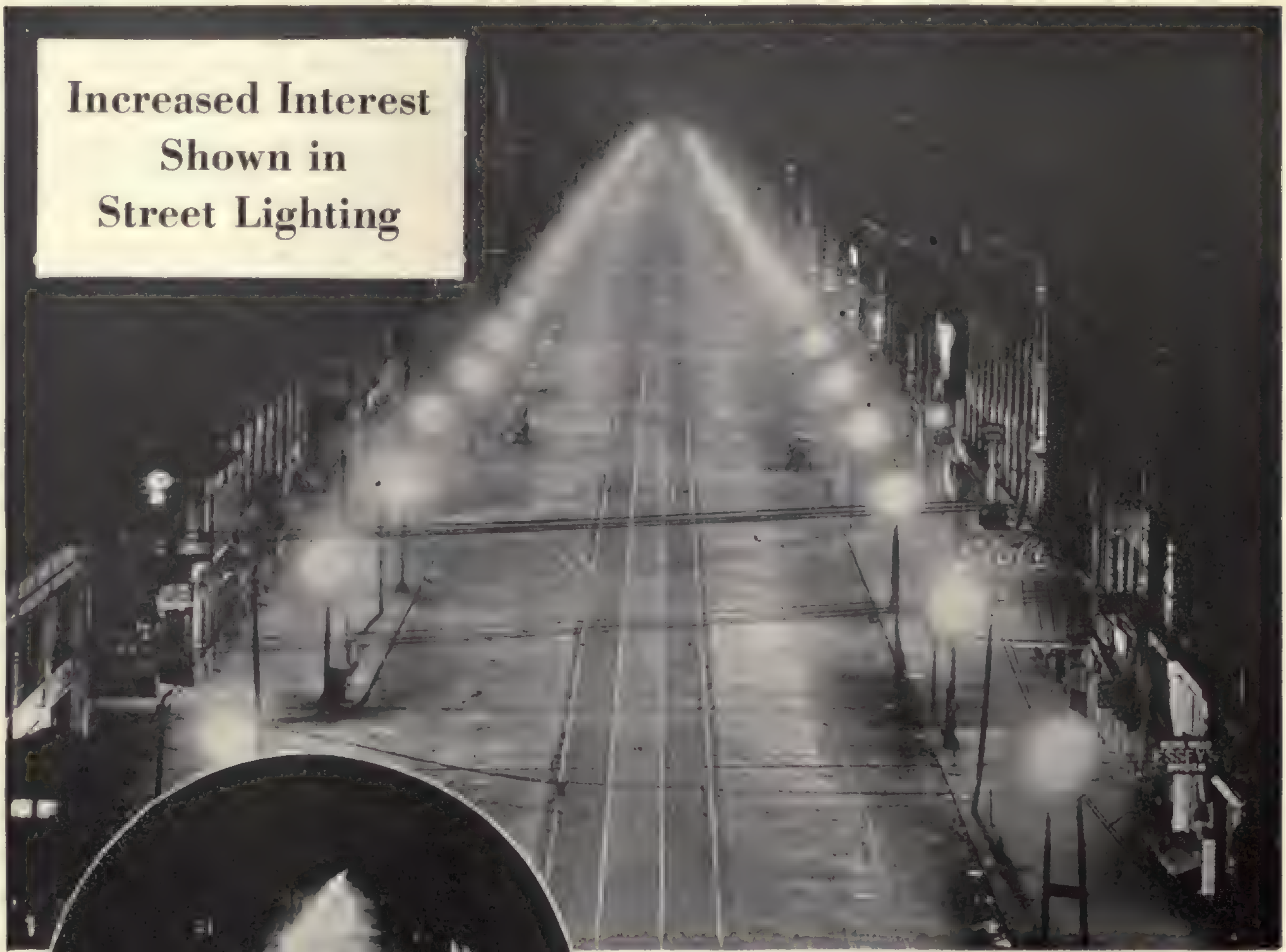
CHARGING CONDITIONS MAY PRODUCE SELF-EXCITATION IN GENERATORS

Angeles at 220,000 volts. At Big Creek No. 1 there are two 17,500-kva. generators and a third is being installed. At Big Creek No. 2 there are three 17,500-kva. generators. At each of these plants the voltage is stepped up from the bus voltage to 150,000 and then by auto-transformers is stepped up to 220,000 volts to connect to the two 275-mile transmission circuits. Big Creek No. 8, with a single 25,000-kva. generator, steps up directly to 220,000 volts, and Big Creek No. 3, now being equipped with three 28,000-kva. generators, does the same.

At Vesta substation, about 100 miles from the Big Creek plants, is a synchronous frequency-changer set of 15,000-kva. capacity. At Eagle Rock, the present terminus of the 220,000-volt line, there is 60,000 kva. in condensers. At Laguna Bell substation, which is at present being installed and which will be connected to the 220,000-volt line, there will be a 30,000 kva. condenser. This gives a total capacity in synchronous apparatus on the system of approximately 320,000 kva. About 50,000 kva. is required for charging each of the two existing circuits from the Big Creek plants to Eagle Rock, and the extension to Laguna Bell will bring this up to approximately 60,000 kva. each.

Therefore, both in the case of the Pacific Gas & Electric Company and that of the Southern California Edison Company, the margin of available capacity over the charging-current requirements is considered sufficient so that future generators can be applied without altering the design from normal for the purpose of increasing the charging-current characteristics.

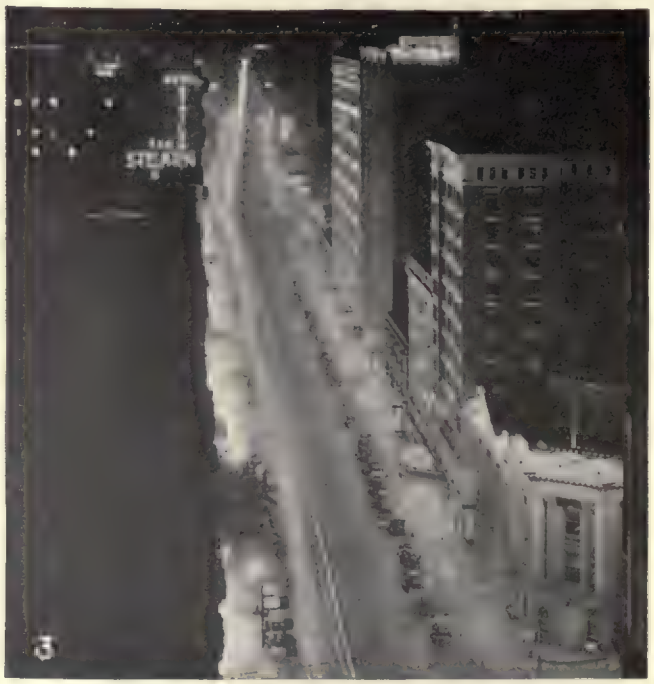
Increased Interest Shown in Street Lighting



Nos. 1 and 1A.—Cleveland, Ohio. Old and new lighting on Woodland Avenue. The new system consists of 1,000-cp. "Mazda" C" lamps in General Electric "Novalux" lanterns. Spacing, 100 ft.; lamp mounting height, 15 ft.

No. 2.—East Cleveland, Ohio. Population, 28,000. 1,600-cp. "Mazda C" lamps in General Electric bracket-style "Novalux" refractor fixtures. Length of bracket arm, 6 ft.; staggered spacing, one lamp per 140 ft. of street; mounting height, 20 ft.

No. 3.—Cleveland, Ohio. Population, 900,000. Euclid Avenue: 1,500-cp. "Mazda C" lamps in General Electric "Novalux" lanterns. Spacing, 85 ft.; mounting height, 15 ft.



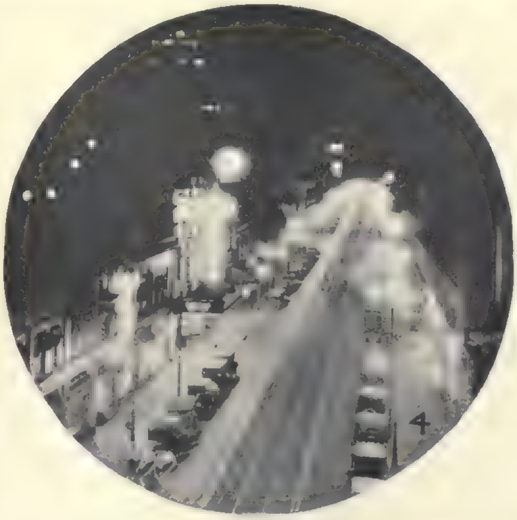
THE present unprecedented activity in street lighting—a natural result of the logical policy of postponement adopted by municipalities during the period of inflated costs—clearly reflects the general acceptance by those interested in civic betterment of four basic facts:

1. That the safety and convenience of modern high-speed traffic dictates a standard of illumination substantially superior to that which met the needs of horse-drawn vehicles.

2. That effective street illumination at night is wholly compatible with a pleasing daytime appearance of the lighting system.

3. That the design of a street-lighting installation is an engineering problem requiring the services of an experienced illuminating engineer.

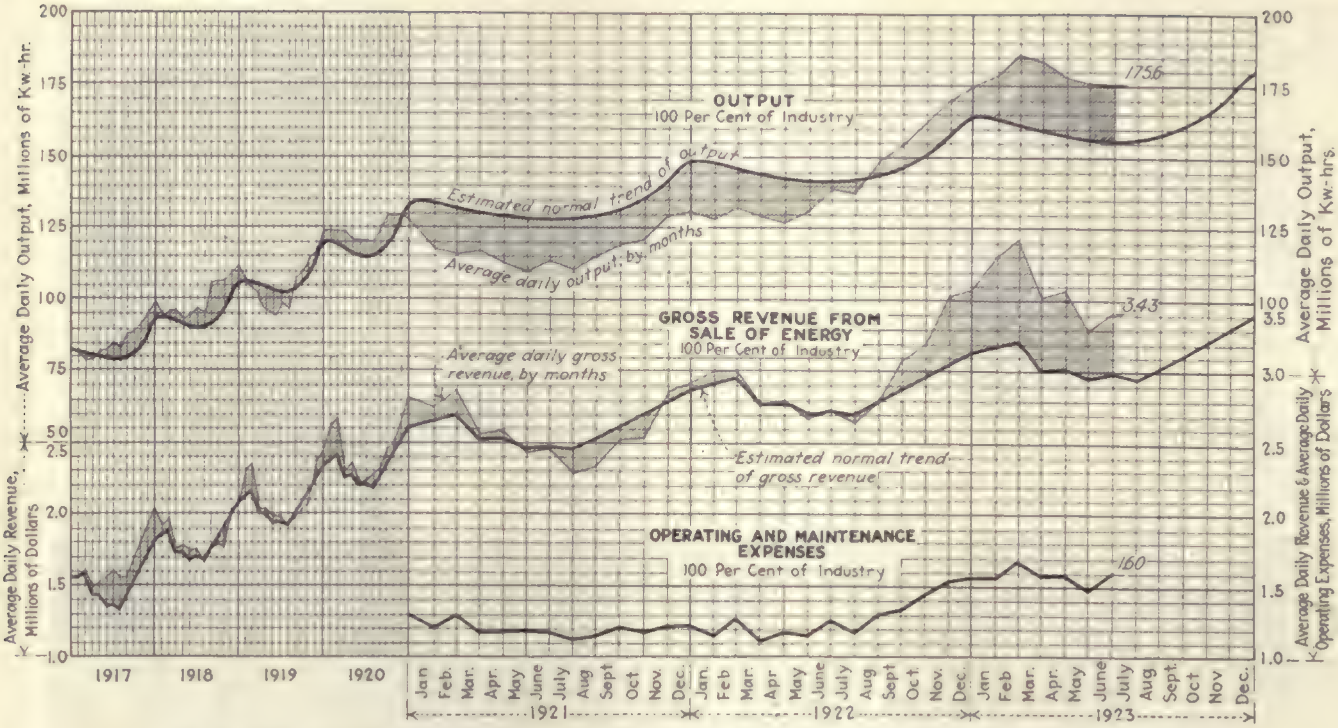
4. That the town of a few hundred inhabitants has relatively as much to gain from adequate street lighting as the city of several hundred thousand population.



No. 4.—Toledo, Ohio. Population, 245,000. 300-watt (approximately 500-cp.) "Mazda C" lamps in rippled globes; refractor fixtures, two per pole. Spacing, 100 ft.

No. 5.—Fremont, Ohio. Population, 13,000. "White way" lighting; 600-cp. "Mazda C" lamps in General Electric "Novalux" units. Spacing, 85 ft.; mounting height, 13½ ft.

No. 6.—Sebring, Ohio. Population, 3,600, 600-cp. "Mazda C" lamps in General Electric "Novalux" fixtures. Spacing, 90 ft.; mounting height, 13½ ft.



THE CENTRAL-STATION OUTPUT DURING JUNE WAS 10.9 PER CENT ABOVE NORMAL AND THE GROSS REVENUE WAS 14.7 PER CENT ABOVE NORMAL

Six Months' Output Shows Gain of 25.4 per Cent Over 1922

REPORTS received by the ELECTRICAL WORLD for the first six months of the present year from central generating and distributing companies representing 75 per cent of the installed generator rating of the country indicate that the energy sold by the electric light and power industry during this period totaled 32,480,000,000 kw.-hr., a gain of 25.4 per cent over the energy sold during the first six months of 1922. If this increase is maintained during the remainder of the year, the output of the central stations of the country for 1923 will total slightly more than sixty-six billion kilowatt-hours. The largest output for any month during the first half of the present year was that reported for March, with 5,720,000,000 kw.-hr.

The reports on revenue from the sale of energy for the first six months of the year are also most interesting. The revenue of the industry for this period totaled $649,300,000, as against $542,900,000 for the first six months of 1922, or a gain of 19.5 per cent. If this increase is maintained during the remainder of the year, the revenue of the central stations of the country for 1923 will total very close to $1,300,000,000. The record figure for revenue for the six-month period was that reported during January, showing a total of $117,-400,000.

The total operating and maintenance expenses for the first six months of the year, exclusive of interest, taxes, depreciation or sinking fund, totaled $286,170,000, an increase of 21.0 per cent over a similar period for 1922. If this rate of growth is maintained for the remainder of the year, the operating expenses for 1923 will total very close to $600,000,000.

Reports for the month of June indicate that the average daily output totaled 175,593,000 kw.-hr., which is slightly below the output reported for May. A study of the accompanying diagram indicates that the central-station output during June was about 10.9 per cent above what would have been the seasonal energy requirements if the industry had been normal. The average daily revenue from sale of energy during June was $3,426,000, which was slightly above the revenue reported for May. This is 14.7 per cent above what would have been the revenue if growth in the industry had been normal. The revenue reported for January of this year was 13.7 per cent above the estimated normal revenue for that month.

The "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" which appeared in the Aug. 18, 1923, issue of the ELECTRICAL WORLD indicated that during June the electrical industry as a whole was operating at 11.5 per cent above the point of normal demand. It would appear, therefore, from the above figures that activity in the electric light and power branch of the industry during June was slightly below that of the electrical industry as a whole in so far as sale of energy was concerned, although the abnormal revenue would tend to reverse that statement.

CENTRAL-STATION RETURNS FOR THREE MONTHS

Mos.	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting) 1923 Thousands	1922 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting) 1923 Thousands	1922 Thousands	Per Cent Increase
April..	73	3,894,871	3,072,907	26.8	68	$73,485	$60,990	20.5
May..	74	4,038,622	3,301,715	22.3	69	70,660	58,922	20.0
June.	75	3,950,920	3,300,189	19.7	69	70,934	59,883	18.5

Mos.	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies Reporting) 1923 Thousands of Dollars	1922 Thousands of Dollars	Per Cent Increase	Operating Ratio: Steam Plants 1923	Steam Plants 1922	Hydro Plants 1923	Hydro Plants 1922	Combined Systems of Steam and Hydro 1923	Combined Systems of Steam and Hydro 1922
April..	56	26,347	21,274	23.9	48.2	49.0	30.8	28.8	44.7	42.0
May..	57	26,322	21,906	20.2	51.3	52.5	29.4	25.6	44.2	43.5
June..	58	27,848	23,653	17.7	50.2	54.2	28.0	26.4	43.7	44.9

Producing Synthetic Gray Iron in the Electric Furnace

Experiments by Hartford Electric Light Company Indicate Commercial Possibilities for Use of Excess Off-Peak Hydro-Electric Energy—Iron Foundry Industry Offers New Field for Electric Furnace Application

By EDWIN L. WILLSON
Consulting Engineer and Metallurgist, Hartford, Conn.

IN THE fall of 1922 the unusually large differential in price between pig iron and steel scrap at New England points presented an opportunity for making an experimental run of synthetic gray iron. The Hartford Electric Light Company was interested in obtaining cost and metallurgical data on the process, and as the plant of the Connecticut Electric Steel Company, containing two 2-ton Heroult steel furnaces, was available, the experiment was begun on Nov. 16, 1922, under the supervision of the writer.

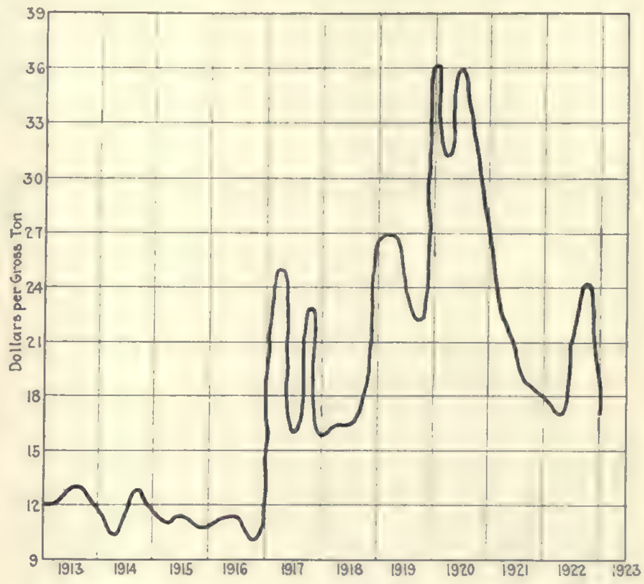
As regards costs there were two objects, the first being to determine the commercial possibilities for a central station to produce synthetic pig iron from steel scrap, utilizing off-peak power at a price to compete with the blast-furnace product used by iron foundries. The second object was to determine the relative cost and metallurgical characteristics of synthetic gray iron made direct into castings as compared with those produced in iron foundries by the cupola process.

Economic Factors in Problem

The economic factors which govern the possibilities of synthetic iron are the relative costs of pig iron delivered in a given district and the net value of steel and iron scrap produced in that district—in other words, localities sufficiently removed from the large steel and iron districts for the freight cost on pig iron purchased from and scrap sold for shipment to the steel centers to be considerable. The price differential between No. 2X foundry pig iron and steel scrap at Hartford is shown graphically in the accompanying illustration.

The term "synthetic iron" has been applied to gray iron which is produced by raising the carbon content of steel by the addition of a carbonizing agent such as coke or charcoal to a point approximating 3½ to 4 per cent, which is the average carbon content of blast-furnace iron. The term has been extensively used in articles on this subject, but is slightly misleading, as it implies the use of chemical reactions to produce a complex chemical compound from elementary substances. The term is applicable as regards the elements iron and carbon while the metal is in the molten condition, but the analogy is less apparent after solidification, when gray iron becomes in reality an admixture of an alloy steel with graphite. The raw material used in these experiments was principally basic open-hearth steel scrap of about 0.20 per cent carbon. Large tonnages of this material are available in New England as a byproduct from the many industries in which duplicate parts are produced by stamping from cold-rolled strip steel.

The process used was similar to melting steel scrap for steel castings, the cold charge being first melted



PRICE DIFFERENTIAL BETWEEN NO. 2X PIG IRON AND STEEL SCRAP, 1913-1923

as in making a steel heat. The carbonizing agent was then added to the surface of the bath and the latter thoroughly agitated until the required amount of carbon had been absorbed. The desired percentages of silicon, manganese and phosphorus were obtained by the addition of these elements in the form of their ferro alloys.

Energy Consumption by Acid Method

The test was started with the furnace lined with acid refractories, and a total of 111 heats was made by the acid process, 505,446 lb. of material being charged with a power consumption of 148,386 kw.-hr., which includes energy necessary to burn in the bottom and may be summarized as follows:

	Kw.-hr.
Initial power	148,386
Add power used for other purposes (cranes, air compressor, etc.)	12,796
Total power consumed	161,182
Deduct power not used for melting	17,396
Power used for melting only	143,786
Power consumed per gross ton charged	714.3
Power consumed per gross ton charged (melting only)	637.4

This is a simple melting operation, as the acid slab does not permit of refining reactions to reduce the impurities, the resultant percentages of such impurities being the accumulated amounts present in the material charged. The analysis taken of typical heats of the various grades of iron produced is given in Table I.

TABLE I—RECORD OF CHEMICAL ANALYSIS, ACID PROCESS

Heat No.	Total Carbon	Si.	Man.	P.	S.
1	2.27	2.67	0.77	0.03	0.048
2	2.122			.....	.....
3	3.04	2.55	1.04	.....	.....
4	3.438	3.05			
5	3.252	3.39	0.99	0.056	0.056
6	3.434	2.43	1.00	0.035	0.067
7	.....	3.02		0.475	0.074
8	.....	1.74	0.93		0.056
9	2.976	2.02	1.02	0.596	
12	2.584	2.44	1.16	0.673	0.045
13	2.824	3.30		.....	0.045
17	2.366	.....	1.15	.....	.....
18	3.142	.....	.....	.....	
19	3.212			.....	0.048
20	3.320	2.57	1.05	.....	.....
23	3.266	2.78	.....	.....	
28	2.460	2.23	.....	.....	0.065
43	3.182	1.57	.....	.....	.....
44	3.092	2.46			
52	2.688	2.44	0.74	0.375	0.058
59	.....	3.10	0.97		0.067
66	2.388	2.46	0.81	0.578	0.080
70	2.85	1.55	0.99	0.042	0.071
76	Transverse test bar broke at 6,200 lb.				
80	3.650	2.08	.....	.....	.....
82	3.180	2.05			
83	3.44	2.23	0.80	0.064	0.062
87		2.27	0.88		0.056
94	2.444	2.04	.....		0.044
99	3.026	2.92	.....		0.021
102	3.214	2.55	0.84		0.054
105	3.536	2.32		.....	

The experience gained by this run of the acid process leads to the following conclusions:

1. If scrap of high quality as regards analysis is available, together with low sulphur coke, gray iron of excellent quality may be produced by the acid process.

2. If the iron is to be poured direct into castings, it may be produced on an acid hearth with medium sulphur coke, and the sulphur content of the resulting castings will be lower than the average run of cupola iron.

3. The acid process is not sufficiently flexible for the production of synthetic iron in the form of pigs for remelting in the cupola on account of the danger of running too high in sulphur.

4. The control of carbon, silicon and manganese can be held within close limits, and iron with practically any percentage of these elements may be made at will.

5. For the production of foundry iron for remelting in the cupola requiring phosphorous content of 0.40 per cent or higher for fluidity, the cost of adding ferrophosphorus is too high to make the addition commercially practicable.

6. It was demonstrated that very small intricate castings of thin section could be poured from the electric furnace with synthetic iron in which the phosphorous content did not exceed 0.03 per cent. These castings were free from chill effect and their machining qualities in all respects were equal to cupola castings. The very much lower phosphorous content resulted in increased strength and resistance to shock as compared with cupola melted iron.

TABLE II—RECORD OF CHEMICAL ANALYSIS, BASIC PROCESS

Heat No.	Total Carbon	Si	Man.	P.	S.
113	3.172	1.24	0.77	0.050	0.021
115	.....	3.15	0.77	0.68	*0.035
123	3.368	2.67	0.74	0.611	0.017
124	.....	3.44	0.70	0.038	*0.042
125	3.284	3.49	0.69	0.060	0.011
137	.....	1.03	.....	.....	0.019
145	2.868	2.67	0.77	0.578	0.025
149-152	.....	1.82	0.83	0.043	0.041
154	1.768	11.23	0.71	0.029	0.014

* Sulphur determined by evolution. A check on heat 124 by the gravimetric method showed sulphur 0.011.

RESULTS BY BASIC METHOD

In order to determine the possibilities of refining reactions, the furnace was relined with a basic hearth and forty-five heats were made by the basic process, 209,213 lb. of material being charged with a power consumption of 68,840 kw.-hr., including burning in bottom, which may be summarized as follows:

	Kw.-hr
Initial power	68,840
Add power used for other purposes (cranes, air compressor, etc.)	3,978
Total power consumed	72,818
Deduct power not used for melting	16,738
Power used for melting only	56,080
Power consumed per gross ton charged	780
Power consumed per gross ton charged (melting only)	600.4

The operation was carried on in the same way as with the acid method with the exception that the heat was held under a desulphurizing slag for varying periods to determine the possibilities of sulphur reduction. Typical analyses of the various grades of iron produced on the basic hearth are given in Table II.

The result of this experience with the basic process leads to the following conclusions:

1. On account of its superior refining possibilities it allows greater flexibility in the selection of raw materials, especially as regards sulphur content.

2. The control of the alloy constituents may be held to limits as close as those with the acid process.

3. The absorption of carbon is accomplished more readily than in the acid process.

4. The refractory cost is slightly higher per ton, which is more than offset by the lower power consumption and cost of raw materials.

In general the result of this test with both the acid and basic methods leads to the following conclusions:

1. In order for the production of synthetic pig iron for sale to iron foundries to be possible commercially, the differential between the delivered price of pig iron and the sale value of steel scrap must be greater than the normal spread found in New England. This condition exists in the Middle and Far West, where the freight on pig iron is high and that on scrap prevents its return to the steel-making districts. The process offers commercial possibilities for central stations having excess off-peak water power so situated that suitable steel scrap is available and in reach of a market for pig iron. The process is adaptable for this purpose in that it is not necessarily continuous, but may be operated to accommodate the periods of low load.

2. Synthetic gray iron may be produced in the electric furnace under favorable conditions at a price equal to or lower than that of the better grades of cupola iron.

3. The production of synthetic gray iron for castings offers a field for utilization of off-peak power in cases where the foundry operation can be rearranged so that the molds may be poured off at night.

4. Synthetic gray iron produces castings having physical strength and toughness far in excess of the best cupola iron, and its chemical analysis shows possible reduction of impurities far below the limitations of the cupola.

5. Reports from foundries which used the pig iron produced in this run indicate that the superior quality

of synthetic iron is largely lost when the iron is remelted in the cupola.

6. The use of the electric furnace for the production of synthetic iron offers a broad field for further development of irons of composition varying from the accepted standards which have been developed for the cupola product. The various percentages of carbon, silicon, manganese, sulphur and phosporus which have become standard practice in iron foundries are a compromise between the results desired and the limitations of the melting medium to produce these results. The electric furnace not being subject to the limitations of the cupola in that its atmosphere is reducing rather than oxidizing, the charge is not contaminated by contact with fuel and flux, and, being free from the relatively low limit of temperature, the furnace offers a melting medium of much greater flexibility than the cupola. The last few years have seen considerable interest in the possibilities of the electric furnace for the iron foundry as shown by the discussions before the technical societies, and it has been predicted that the electric furnace will soon occupy a field of importance in the iron foundry industry equal to, or greater than, its present position in the steel foundry.

The process of refining of molten iron delivered from the cupola, known as duplexing, has been rather thoroughly discussed and is being carried out to an increasing extent commercially. Although this process will, no doubt, develop rapidly owing to its aid in the solution of the sulphur problem, it would seem that the so-called synthetic-iron process also has a certain field of application.

Points in Modern Power-Plant Design*

Possibilities Which Inhere in Bleeding Steam from Turbines for Auxiliaries — Consideration of Economizers — Influence Exercised by Fuel Supply on the Selection of Equipment

By G. T. SHOEMAKER
United Light & Railways Company, Grand Rapids, Mich.

THE problems now confronting the designing engineer are somewhat different from those of a few years ago. We used to use a great number of small steam-driven auxiliaries on the assumption that the exhaust steam would be utilized for heating the feed water, and consequently high steam consumption per horsepower was of little moment. With this type of design there was often a considerable waste of steam because of the plant's inability to absorb it.

The object now is to get as much work out of the steam as possible and at the same time obtain all necessary heat for heating the water. The tendency is decidedly toward the use of electrically driven auxiliaries with suitable provisions for emergency. When using motor-driven auxiliaries it is necessary to procure the heat from sources which are more economical than the old ones.

Bleeding Steam for Auxiliaries

Present-day turbines are of such design that steam may be extracted from the different stages. It is possible to extract a sufficient amount for heat-balance requirements after the steam has been utilized for the most economical production of electricity. By extraction at different stages it is possible to get steam at different pressures to take care of the heating best adapted for that pressure. It is best to bleed the steam at the lowest possible stage, as a greater amount of work is obtained and the full latent heat is left for heat-balance purposes. Another thing to avoid in using a bleeder system is an unnecessary loss by giving up the heat in the exhaust steam to the circulating water, after which it cannot be recovered. As an actual example, a turbine under straight condensing operation would pass 195,000 lb. of steam to the condenser. The same turbine under the same load conditions but with bleeding, for which the plant is designed, would pass only 170,412 lb. of steam to the condenser. The latent heat of 24,588 lb. of steam per hour is lost under straight condensing operation, but by bleeding it is possible to conserve this amount of heat, minus some minor losses, by taking the steam out of the turbine before it reaches the condenser. The steam expands adiabatically to 0.5 absolute or 28.9 in. vacuum. The temperature would be 79.7 deg. F. In this particular case the steam quality would probably be 0.80. The latent heat per pound of steam would be 1045.9 B.t.u., or, in other words the total B.t.u. saved would be $1,045.9 \times 24,588 \times 0.80 = 20,550,000$ B.t.u. Allowing for the efficiency of combustion, assume that 7,720 B.t.u. is obtained from a pound of coal, or the total pounds of coal saved per hour $= 20,550,000 \div 7,720 = 2,660$ lb. per hour. For eighteen hours per day 300 days per year, with coal at \$3.50 per ton, the total saving would be $2,660 \times 18 \times 300 \times 350 \div 2,000 =$ \$25,137. This will certainly justify from \$20,000 to \$30,000 additional expenditure for equipment.

Method of Handling

In working up the heat diagram for any particular installation it is necessary to make certain assumptions and figure the diagram. It is usually necessary to make calculations for at least four different load conditions. To illustrate how these matters are handled, Fig. 1 gives an illustration of an actual problem which is figured on the basis of a 20,000-kw. load. The illustration shows how the steam is fed to the system and the different bleeding points. How it is utilized in the various pieces of equipment is also shown. The boilers supply a total of 225,378 lb. of steam per hour. This

*Paper presented before the Iowa Section, N. E. L. A., convention held at Mason City, Iowa, June 26-29, 1923.

steam will all enter the turbine. At a point below the impulse stage is a connection where it is possible to bleed steam at a pressure range from 70 lb. to 190 lb. and 180 deg. superheat. The impulse blading has really acted as a reducing valve and has availed itself of the useful energy in the steam from the maximum pressure and temperature down to this point. It is proposed to use this steam for some of the steam auxiliaries, avoiding auxiliary piping at high pressure and high superheat. The steam from this high-pressure stage will also be used for heating water at the higher temperatures. The second stage will supply steam under those load conditions at 59½ lb. absolute with 91 deg. superheat. This steam will be used for equipment requiring lower pressures and temperatures. There are also stages for extraction at 14.57 lb. and 3.442 lb. absolute. deg. to 204 deg. F., owing to the higher pressure and the corresponding higher temperature of the steam supplying the heater. At this point the water passes through the economizer and is increased to a temperature of 304.5 deg. F. In the past it has been considered sufficient to stop at this point. It is desirable to reuse as much of the steam as possible to avoid giving the heat up to the circulating water and thereby losing it entirely. In this installation a high-pressure heater will be used supplied with steam from the first-stage bleeder. By doing this the temperature will be raised from 304.5 deg. to 350 deg. F., at which temperature the water will enter the boiler.

Engineers have realized for a long time that they could make a material saving if they could preheat the air to the boilers. This has been tried a number of

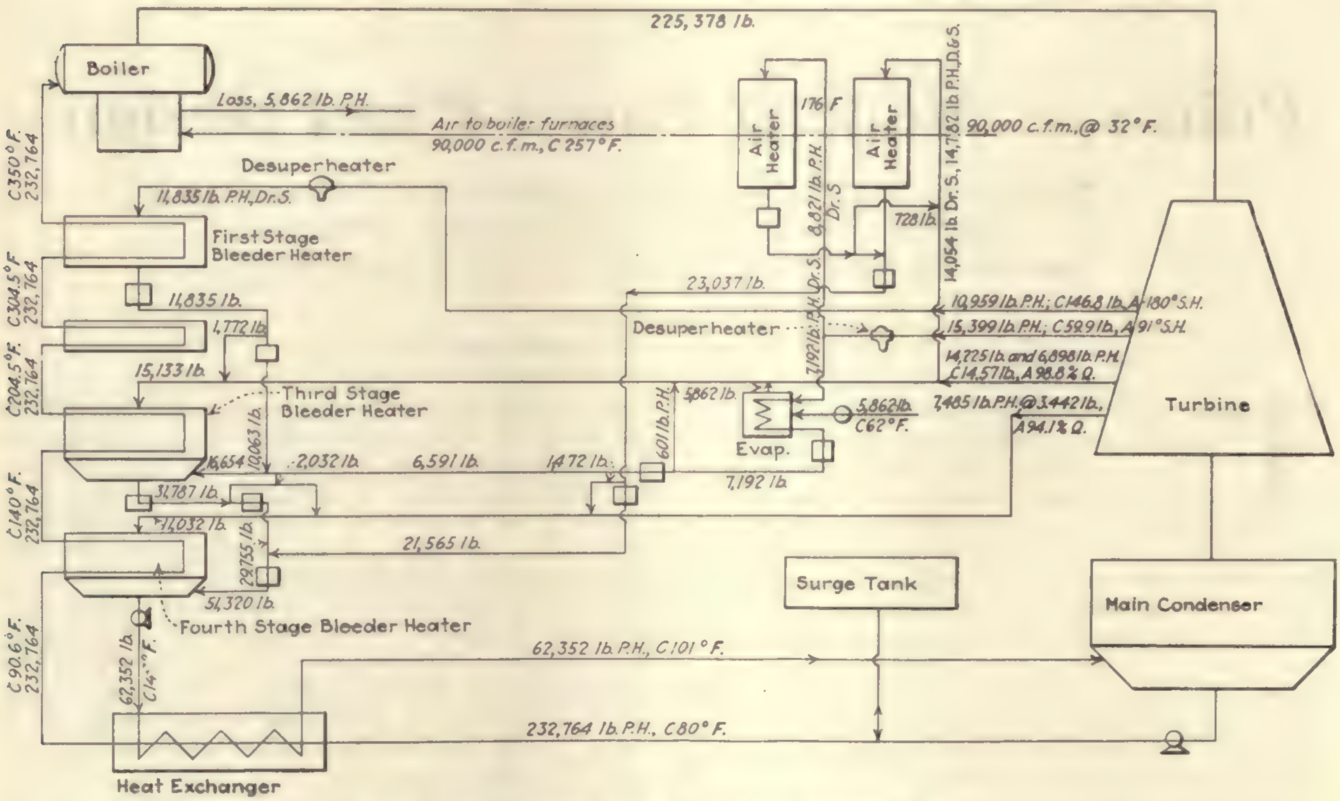


FIG. 1—HEAT DIAGRAM FOR 20,000-KW. PEAK-LOAD PLANT

Showing the amount and disposition of steam bled from various turbine stages and the amount of steam supplied to the turbines.

The object is to bleed the maximum amount of steam that can be used from the lower stages. In this way a greater number of kilowatts can be produced from the steam and at the same time the full benefits of the heat effect can be virtually assured. In this system there are three sets of heaters, two of which are low-pressure and the other high-pressure. According to estimates, there will be a total pumpage of 232,764 lb. of condensate per hour at 80 deg. F. This pumpage is materially increased by a certain amount of recirculation, brought about by putting the condensate from the heating system back into the condenser hot well to flash it and remove any air that might be entrained during the cycle.

Starting with the low-pressure heater, it will be observed that the temperature of the water is increased from 90.6 F. to a temperature of 140 deg. F. The third-stage heater increases the temperature from 140 times by having air heaters installed to absorb heat from the stack gases, as well as by using warm air generators. Either of the methods has its drawbacks as there are complications, especially when using the stack gases, from the extra drop in pressure and the difficulty in keeping the heaters cleaned for a proper heat transfer through the tubes. There is an excess capacity for bleeder steam, and it is proposed to heat the air after it leaves the forced-draft fans before entering the main duct to the stokers. It is estimated that it will require 1,405 lb. of steam to heat 90,000 cu.ft. of air per minute at a temperature of 32 deg. F. and a resultant temperature of 257 deg. The change in temperature of the air should make a great improvement in combustion conditions. The only difficulty that may be encountered is the possibility of increasing the operating temperature of the stokers to a dangerous point.

It will be of interest to study the possibilities of

capacity for bleeding steam and the effect on the total water rate for the turbine. In Fig. 2 curve 1 shows the water rate of the turbine operating straight condensing; curve 2 shows the water rate of the turbine when operating at the maximum bleed, and curve 3 the approximate water rate of the turbine under the conditions planned in this particular installation.

It will be observed by the difference between curves 2 and 3 that all of the possibilities for bleeding steam have not been absorbed. However, as much steam as possible has been used for various requirements around the plant.

Another interesting subject is the relative economies of small turbines, say of 2,000-kw. and 3,000-kw. capacity, and the larger units, say of 20,000-kw. capacity. The curves shown in Fig. 3 are taken from actual data on turbines installed or being installed in different plants. Curve *A* is the water rate for a 20,000-kw. turbine. Curve *B* shows the rate of a 3,000-kw. high-economy unit now on order. Curve *C* shows the economy of a 2,000-kw. turbine installed in 1918. At that time, for a unit of this size, a water rate of 14.1 lb. was considered real efficiency. With the 3,000-kw. unit, which is a fifteen-stage machine, there will be a saving of 4.4 lb. per kilowatt. We could not afford to operate the 2,000-kw. unit at any load within the range of either turbine, provided that the 3,000-kw. unit was in condition for service. To illustrate the possibilities with these small machines, the curves have been plotted as a comparison with that for a 20,000-kw. unit, now on order. This curve is based on a 350-lb. pressure and a total temperature of 636 deg. Since plotting this curve it has been decided to use 400 lb. at the throttle, which would improve its water rate. The large machine at its best point is only 2.1 lb. better than the 3,000-kw. unit at its best point. The 3,000-kw. unit, however, is 4.4 lb. more efficient than the 2,000-kw. unit of the earlier design. The smaller machine economies are based on 225 lb. and 125 deg. superheat. This illustrates plainly the strides being made in some of the smaller designs and shows the possibilities in superseding older equipment with installations of high-economy units.

Another item in the design of a new plant is the proper protection and installation of boilers and other combustion equipment. It is necessary to study the character of the fuel supply as this is the factor determining how boilers will be set and the type of stokers to be used. Under present conditions coal of various grades is likely to be received. Some stokers will perform satisfactorily under certain conditions, but when the coal of this certain quality is not available extreme difficulty is encountered in carrying load. It is quite essential that a stoker be proportioned to burn coal efficiently at both low and high rates of combustion.

Steam requirements and average load conditions must be analyzed. It is then time to determine the number of boilers required for the supply of steam, keeping in mind that as the usual thing it is necessary to have one spare unit available for repairs and maintenance. With the decision as to size of the boiler, the economizer should be kept in mind. It is really a part of the boiler, and if used, the size of the boiler should be cut down in proportion to the capacity of the economizer. In many plants it has been the practice to put in boilers of full capacity and then add the economizer. This means an unnecessary investment and in many cases, if properly capitalized, would not show the economizer to be economical. If recognition is given the equivalent boiler

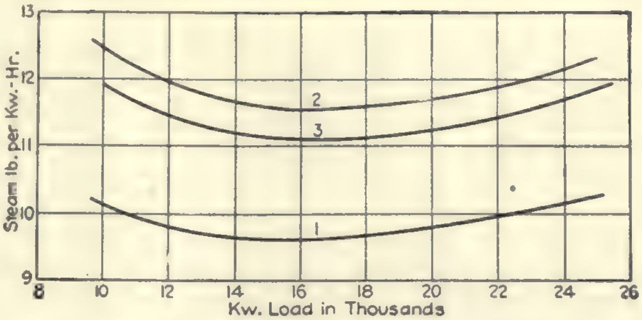


FIG. 2—EFFECT OF BLEEDING STEAM FROM 20,000-KW. TURBINE IN COMPARISON WITH THE STRAIGHT CONDENSING WATER RATE

Condition, 350-lb. gage, 250 deg. superheat, 29 in. vacuum. No. 1—Water rate, condensing. No. 2—Water rate, maximum bleeding. No. 3—Water rate, actual bleeding.

capacity provided by the economizer, investment in the boiler can be cut materially. This saving in boiler investment should be credited toward the investment in the economizer.

Fig. 4 shows some data plotted in connection with recent purchases. On the horizontal lines is plotted the steam generation in thousands of pounds per hour and on the vertical lines horsepower. Curve A shows the horsepower developed by the economizer under various ratings. Curve B shows the equivalent horsepower developed by the superheater. Curve C shows the horsepower developed by the boiler, curve D by the boiler and the superheater, and curve E is another combination, showing the horsepower developed by the boiler, superheater and economizer. This shows the relations between the three units, all of which should have careful consideration in selecting equipment.

Fig. 5 shows a study of temperatures. The first vital interest is the temperature of the gases leaving the boiler. Always strive for designs which will extract the maximum amount of heat from the gases by the time they reach the outlet of the boiler after going through the boiler and the superheater. The economizer is designed to absorb efficiently from gases heat which otherwise would be lost. There is a curve show-

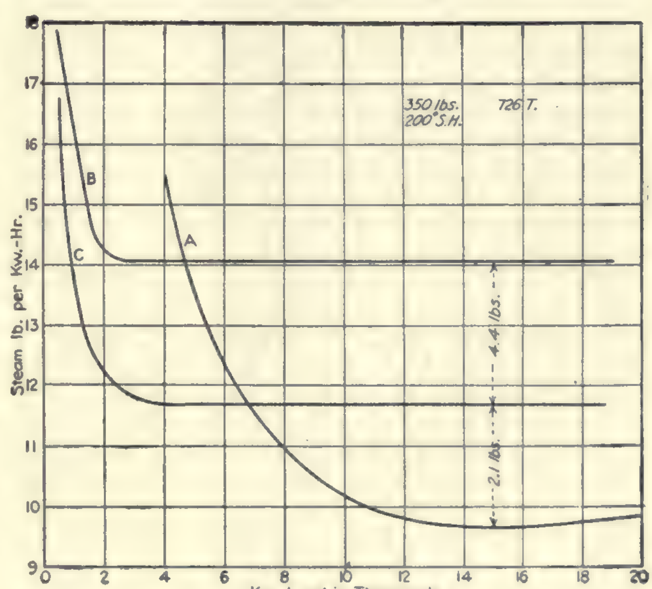


FIG. 3—COMPARISON OF WATER RATES OF TURBINES OF VARIOUS SIZES

Curve A is for a 20,000-kw. turbine operating at 350 lb. pressure, 725 deg. total temperature, 200 deg. superheat and 29 in. vacuum. Curve B is for a 3,000-kw. machine of recent manufacture and curve C for a 2,000-kw. machine installed in 1918.

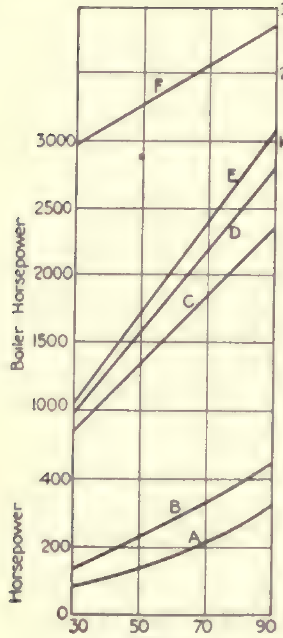


FIG. 4

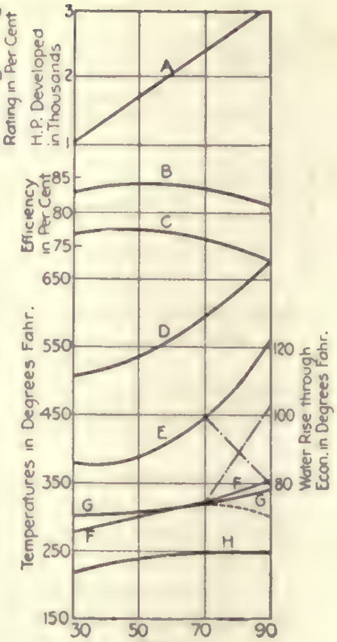


FIG. 5

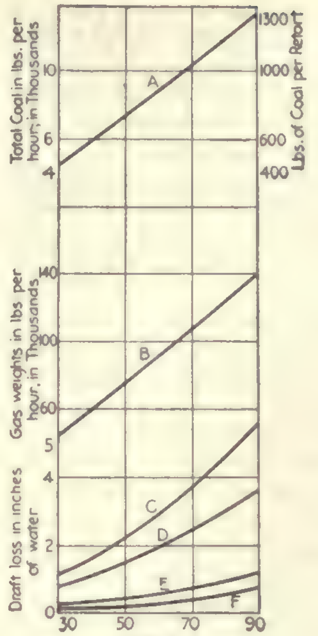


FIG. 6

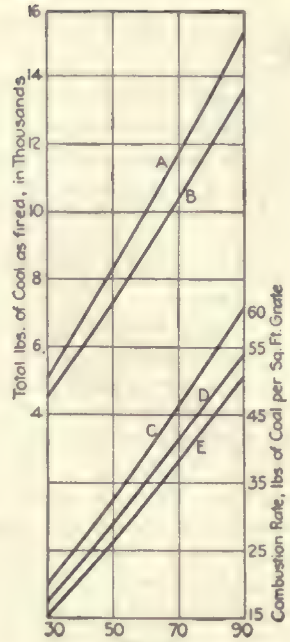


FIG. 7

Fig. 4—Curves Developed in the Study of Plant Design to Determine the Equipment to Be Used

The horsepower developed by the economizer and superheater are shown separately and in combined form with the boiler capacity to indicate the influence of this apparatus on the selection of boiler capacity. A is the horsepower developed by economizer; B, the horsepower developed by superheater; C, the horsepower developed by boiler; D, the horsepower developed by boiler and superheater; E, the horsepower developed by boiler, superheater and economizer, and F, the rating on boiler and superheater.

Anticipated results in operation of 1,024-hp. water-tube boiler, twenty sections wide, eight groups high, tubes 20 ft. in length, with 6,300 sq.ft. of heating surface; economizer seven elements wide and twenty high, each 15 ft. long. Curves are based on 9,300-B.t.u. bituminous coal (Fulton County), with combustion having 14 per cent CO_2 and combustible in ash not to exceed 15 per cent. Steam pressure, 375 lb. and feed water at 220 deg. F.

Fig. 5—Study of Temperatures of Gases and Water in the Boiler and the Important Efficiencies

A—Total horsepower developed by boiler, superheater and economizer. B—Combined efficiency of boiler, superheater, economizer and stoker. C—Efficiency of boiler. D—Temperature of gases leaving boiler. E—Water temperature rise in economizer. F—Temperature of gases leaving economizer. G—Temperature of water leaving economizer. H—Superheat.

Fig. 6—The Method Used in Analyzing Draft Conditions and Combustion Rates in Coal-Fired Boilers

A—Total coal as fired—combustion rate, pounds coal per retort. B—Gas weights. C—Total draft loss. D—Draft loss through the economizer. E—Draft loss through the boiler. F—Draft loss through the superheater.

Fig. 7—Method of Studying Combustion Rates with Different Grades of Coal and Different-Sized Stokers

A—Total coal as fired, 8,300 B.t.u. B—9,300 B.t.u. coal. C—8,300 B.t.u. coal, twenty-nine tuyères. D—8,300 B.t.u. coal, thirty-three tuyères; 9,300 B.t.u. coal, twenty-nine tuyères. E—9,300 B.t.u. coal, thirty-three tuyères.

ing the temperature of the gases leaving the boiler at the various steam capacities. It is interesting to note the temperature of the gases after going through the economizer. The temperature of the water leaving the economizer is shown, and another curve shows the rise in temperature in passing through the economizer. The temperature of the water leaving the economizer is higher than the temperature of the gases leaving the economizer at the lower rating. This is due to counterflow of the water and the gases, working on the same principle as the cooling water in the condensing system. Arrangements have been made for bypassing the gases around the economizer at the higher ratings to avoid the excessive drop in draft at these loads. Under general operating conditions operation should be at the lower points. It is not wise to increase the investment for draft equipment to handle the higher ratings as it is only in service for short periods. It is more economical to waste some heat during these short periods. It is also interesting to note the efficiency curve for the boiler and stoker, which in this particular instance was figured at 40,000 lb. of steam per hour at 77.6 per cent for the boiler and stoker alone, whereas at the same rating the combined efficiency of the boiler, stoker and economizer shows a total efficiency of 84.5 per cent. The equipment throughout is designed to be operated at 300 per cent rating when desired. Normally operation will be at 160 per cent, which is at a good point on the efficiency curve.

The curves in Fig. 6 are interesting as they show clearly the draft loss through the boiler, economizer and superheater. These data are essential in determining draft conditions.

Fig. 7 shows combustion conditions with reference to the stokers under consideration. Coals of 9,300 B.t.u. and 8,300 B.t.u. were considered, and stokers of twenty-nine and thirty-three tuyères length were analyzed. These curves show coal burned per square foot of grate surface at the various ratings. It has been our experience with low-grade Western coal that most satisfactory operation is obtained when the coal per square foot of grate is kept below 50 lb. If the rate of combustion exceed this point, the coal can be burned, but considerable difficulty is experienced with clinkers.

Austrian Electrical Industry Steady

THE Austrian electrical industry is withstanding the period of deflation better than most others in that country, according to reports to the Department of Commerce from Trade Commissioner Upson. One of the leading Vienna factories had been running, fully manned, until last November, since which time between three hundred and four hundred hands have been gradually discharged. Those remaining, however, are at present working full time. The wages of the workmen are now about 60 per cent of the pre-war amount, taking the crown at its exchange value, but in real purchasing value, according to the *Volkswirt* index of living costs, they are 95 per cent of pre-war wages. The official March index for living costs gives this same percentage of 84.5.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Systematic Analytical Procedure Essential to Engineering Research

To the Editors of the ELECTRICAL WORLD:

Referring to your recent editorial on the problem of insulation, as described in the report of the committee on electrical insulation of the National Research Council published in the *Journal of the A. I. E. E.* for June, permit me to add a few words for your readers concerning the plans and hopes of the committee.

The problem of insulation is as old as electrical science itself. Electricity was first discovered through a property of dielectrics, and throughout the whole period of electrical research and development many of the profoundest thinkers and investigators, from Cavendish, Faraday and Maxwell to the present, have devoted their efforts to the study of this great problem. Pure and applied scientific literature is teeming with the results of experiment and with speculation as to the nature of the phenomena observed. Yet the results of all this labor have not brought us very far. The principal properties of dielectrics are well recognized, and great masses of data as to their variation in different materials and under different conditions have been accumulated. But the ultimate nature of these properties is as yet unknown. Even so simple a question as whether or not a pure dielectric possesses the property of absorption cannot be answered with certainty. We now know a great deal about the electron, and especially that it is the essential electric constituent of all matter, but as to its function in the atom of the dielectric, what part it plays in dielectric displacement, absorption and conduction, we are still almost entirely in the dark.

Physicists in recent years appear to have lost their immediate interest in dielectrics and to have turned their attention to the atom in the gaseous state, probably realizing that through that path lies the ultimate shortest route to a true understanding of all properties of matter, including those of dielectrics. Not so the engineer, however. His interest in dielectrics is keener and more immediate than ever. Each day brings him problems demanding wider ranges of values of insulation constants and more varied combinations of properties to keep pace with the new demands and developments of all types of electrical equipment. He cannot wait for the more systematic and leisurely physicist and so he must, in his own way, be at the problem of insulation continually. With his direct studies of breakdown, loss and phase angle, he takes it, as it were, from the top and does not go very deep, while the physicist takes it from the lowest bottom he can find, upward. But in spite of their enterprise, energy and outpouring of effort and expense, the engineers are finding that their method is not yielding proportionate results. They do not yet know their insulation. They cannot design it to a certain performance.

Now the gospel that the committee on electrical insulation is preaching is that the engineers can succeed only if they will follow the methods of the physicist, using the while their own greater facilities and experience with high voltage, high frequency, current and energy in large values—things not usually at the disposal of the physicist, or at which he often balks. Combine the right method, scientific knowledge and engineering skill and resources, and big progress is sure to result.

The needs, then, are the right men and their time. Many of these men are in industrial research laboratories, some in colleges and universities, some in national and independent scientific bodies. Their combined effort is needed. How can their services be had? The first essential is a willingness, or rather desire, to take a hand. Given this, no matter where a man is, he can do something. But, wherever he may be, if he will make himself known, the committee will make a good effort to see that a suitable proportion of his time is made available for one of the most stimulating of all research problems. It is a call to those genuinely interested in research and also to those who have influence over or control of such men.

The plans of the committee call first for a systematic collection of data under the various headings of the report. Thus the first need is for a few men skilled in reading and abstracting scientific literature. Co-ordination, publication, experimental attack will then follow in their order. The committee will welcome not only volunteers, but all contributions and correspondence in connection with the problem of insulation.

J. B. WHITEHEAD, Chairman.

Johns Hopkins University, Baltimore, Md.

Architect and Electrical Engineer

To the Editors of the ELECTRICAL WORLD:

I have read with interest M. M. Samuels' recent article in the ELECTRICAL WORLD entitled "Architect and Electrical Engineer." The practice of drawing a detailed sketch of the method of suspension of luminaires for all classes of work is most excellent and not only gives the electrical contractor definite instructions as to the method of installation, but also prevents substitution of inferior material.

On specifications where the job runs to considerable magnitude it is always best practice to include sketches of fixtures with their method of suspension and refer to them in the plan as fixture types. This plan has been adopted by several large industrial organizations, such as the General Motors Company and the Durant Motors Company, at the instance of their consulting engineer, H. E. Somes.

D. H. TUCK, Electrical Engineer.

Holophane Glass Company, New York.

To the Editors of the ELECTRICAL WORLD:

What M. M. Samuels says with reference to co-operation between the architect and the electrical engineer is true. Strange to say, there are few buildings which demonstrate that the genius of both has been properly applied. In my estimation the proper lighting of the building is fundamental. As the modeling of all architecture depends on lights and shadows from the sun, it is equally true that the interior work needs the same application, which artificial lighting, if properly installed, can provide.

I certainly hope that the electrical industry will have continued success in bringing the electrical engineer and the architect closer together.

R. C. EDWARDS, Sales Department.

Radio Corporation of America, New York, N. Y.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Soil Temperatures and Cable Rating

Summer and Winter Ratings of Cables, Location and Method of Testings, Effect of Cloudiness, Snow, Range of Temperature and Cable Capacity Discussed

BY A. SMIRNOFF
Potomac Electric Power Company, Washington, D. C.

SURROUNDING soil temperature is one of the most important factors in calculations of the current-carrying capacity of underground cables. As virtually all of the information on soil temperatures previously collected has been gathered chiefly in the interest of agriculture, the soil temperatures obtained are not applicable. Usually this temperature has been assumed, so in order to obtain more accurate information the Potomac Electric Power Company of Washington, D. C., in co-operation with the United States Bureau of Standards, authorized an extensive investigation of soil temperatures. It was found that a cable may reach the provisionally accepted temperature limit of 85 deg. C. with a loading of 150 amp. in the summer or may be safely loaded up to 230 amp. in the winter without reaching the temperature limit. These figures are for a three-conductor No. 4/0 13,200-volt cable.

The warmest soil temperature exists under black asphalt, which, besides absorbing the sun heat, prevents the moisture from penetrating into the soil. By actual measurements, the temperature of the asphalt in Washington, D. C., repeatedly reached 75 deg. to 80 deg. C. at the surface last summer, despite the fact that the season was not exceptionally warm.

The apparatus used for testing consisted of three resistance coils 2.5 ft. long in waterproof covers, as shown in Fig. 1. These coils were calibrated, including their leads, and driven horizontally under the asphalt-paved streets. The depths selected were 18 in., 27 in. and 36 in., corresponding to the duct spacing, as shown in Fig. 3. The location was selected on a north-south street near a corner, so as to have maximum exposure to the sun and still be a sufficient distance away from other duct lines and underground construction to avoid their influence.

The resistance of the three coils was measured with a Wheatstone bridge in a substation 600 ft. away. These readings were taken every

FIG. 1—RESISTANCE COILS USED TO DETERMINE TEMPERATURE OF SOIL

three hours for a period of one year. At the same time other data were collected and recorded with the object of determining the influence of meteorological conditions on the soil temperature.

From the readings and information obtained the curves in Fig. 2

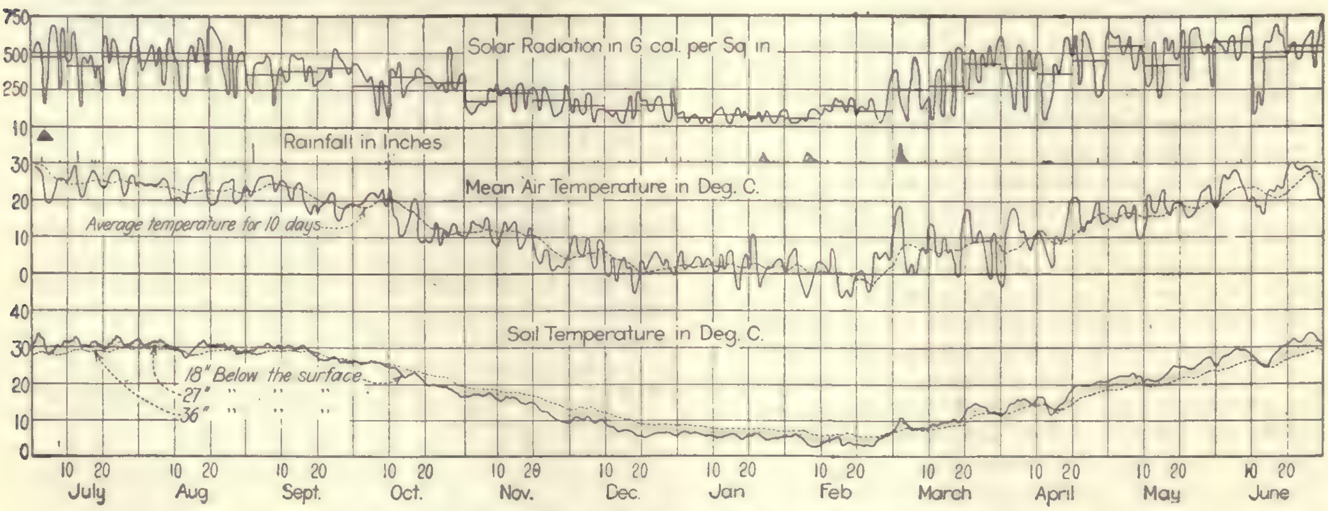


FIG. 2—SOIL AND AIR TEMPERATURE FOR ONE YEAR PERIOD

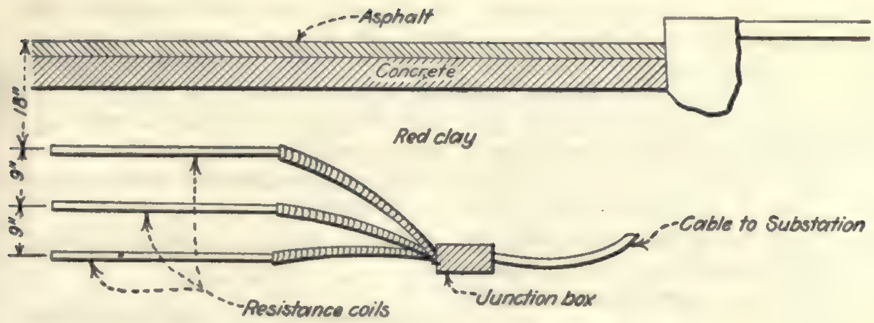


FIG. 3—RELATIVE LOCATION OF EACH RESISTANCE COIL

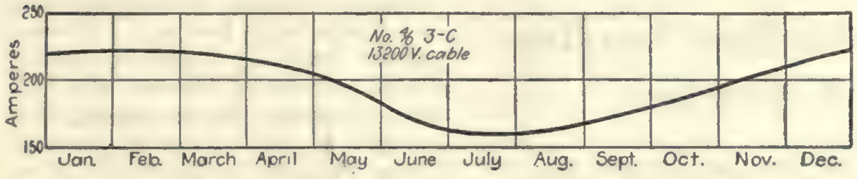


FIG. 4—CURRENT-CARRYING CAPACITY OF THREE-CONDUCTOR NO. 4/0 13,200-VOLT CABLES

were constructed. By analyzing this drawing it is found that the range of soil temperature at the depths recorded is from 3 deg. C. in the winter up to 35 deg. C. in the summer. As a result the current-carrying capacity of the cables varies considerably. Using the formula given by R. W. Atkinson in the *Journal of the A. I. E. E.*, September, 1920, a chart (Fig. 5) was prepared showing the variation of the current-carrying capacity of a few cables due to the variation in the soil temperature and the number of cables in the duct.

The average mean daily temperature when compared with the soil temperature was found to be 8 deg. C. lower than the soil temperature. Rain usually has no influence as it does not penetrate into the soil sufficiently, but emphasis should be placed on the total time of cloudiness of the day as shown by the amount of heat thrown on the surface. As asphalt readily absorbs the heat, especially during the summer, the temperature of the soil nearest to the surface shows big variations, closely corresponding to the amount of heat received by the surface. The heat-absorbing capacity of the asphalt is destroyed as soon as the streets are covered with snow and the result is a rapid fall in temperature.

Other interesting facts brought out by the investigation were that cables carrying heavy summer loads should be placed as deep as possible, whereas cables carrying heavy winter loads should be placed nearer the surface. The highest temperature of the soil for twenty-four hours is usually about 9 p.m., while the lowest is about 9 a.m., the variations being often as much as 4 deg. C. in the summer. Practical application of the investigation is shown in Fig. 4. This chart is drawn in accordance with the measured soil temperatures showing the limitations of three three-conductor No. 4/0 13,200-volt cables during the different months of the year.

Although these calculations pertain to Washington, D. C., they may be applied for any other city with certain changes in accordance with the meteorological conditions existing there. To arrive at the approximate soil temperature under the asphalt it is necessary to add 8 deg. C. to the mean weekly average temperature, and up to 12 deg. C. if the sky is mostly clear, making this allowance for accumulative heat. Regions covered for long periods with snow will naturally show a much lower temperature, but it must be considered that in most cities snow is soon removed.

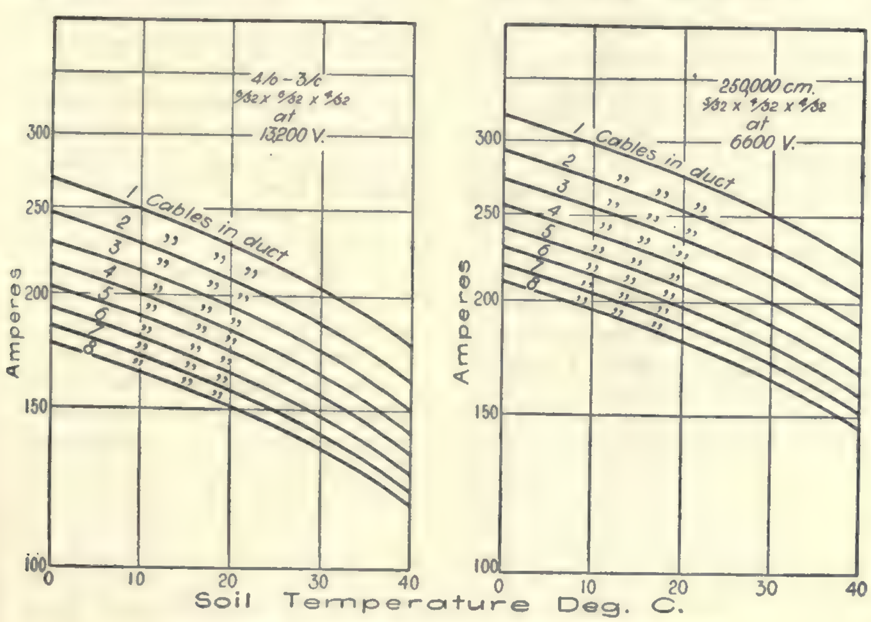


FIG. 4—CURRENT-CARRYING CAPACITY OF THREE-CONDUCTOR

Practical Utilization of Small Water Powers

AUTOMATIC or semi-automatic generating stations for economically utilizing the water power of small streams are receiving the attention of power companies of California, according to the technical sub-committees of the Pacific Coast Electrical Association. The Southern California Edison Company has fourteen plants, aggregating 15,000 kw., under semi-automatic operation. These plants would be economically impracticable if it were necessary to employ manual operation.

Operating experience with automatic equipment shows that it is possible to duplicate every operation of manual control, even to observing the operating conditions of an automatic station at some distant point. A system of supervisory control is being worked out by one of the large manufacturers by means of which it is possible to listen in over a single pair of wires on the operation of the station at some distant point and determine the position of circuit breakers, water level, load on the station, hot bearings, etc.

Most plants now in operation are semi-automatic rather than full automatic because it is necessary to have at least one man on the property as a watchman, and this man is

on duty at all times to start up the plant in case it is "kicked off" the line.

The present tendency in design of these plants is toward the use of induction generators, although the majority of plants now in operation are equipped with synchronous generators. The investigation of the apparatus committee indicates that the economic limit of the automatic generating plant is from 1,500 kw. to 2,000 kw. and below, or that it is suitable for plants where operating costs are relatively high in proportion to fixed charges. In larger plants with high load factor and relatively heavy fixed charges per kilowatt-hour, and where the capacity of the plant is such that a shutdown would seriously affect the capacity of the system into which it is feeding, manually controlled plants generally prove more economical and desirable.

Increasing Transmission-Line Loading by Power-Factor Correction

BY F. L. HUNT
Chief Engineer Turners Falls Power & Electric Company, Greenfield, Mass.

THERE are many advantages to operating companies in power-factor correction. One which may not always be realized is the possibility of increasing the loading of transmission lines by corrective measures. Most power-factor correction problems need to be worked out individually before a sound conclusion can be reached, but I am not sure that we always realize when we have a power-factor correction problem before us. I have discovered in recent months two or three cases where I thought we had a problem of increasing transmission or distribution facilities and where at some earlier time we had actually figured out that certain increases in loads would require certain additional circuits. Upon going into these problems again and carefully considering all the possibilities of power-factor correction, we discovered that the additional capacity required could be obtained at much less investment and more satisfactorily by power-factor correction than by additional circuits.

The capacity of most overhead circuits is limited by the voltage drop occurring in those circuits. When the voltage drop in a given circuit has reached the maximum that can be allowed and still maintain good service, then the circuit is for practical purposes loaded. If new business or other conditions make it desirable to double the load on that circuit, it may be taken care of by duplicating the circuit.

It is a question if all engineers realize that a No. 1/0 three-phase, 60-cycle overhead circuit operating at a voltage of 10,000 or more will carry twice as much load at unity power factor with a given voltage drop as it will carry at 75 per cent power factor at the same voltage drop. It may cost less to bring the power factor from 75 per cent to unity than to duplicate the circuit.

This point may perhaps be best illustrated by a concrete example. Two No. 1/0 circuits will deliver 20,000 kw. at 75 per cent power factor a distance of 40 miles at 66,000 volts, three-phase, 60 cycles, at an energy loss of 10 per cent and a voltage drop of 12.3 per cent in line alone. If one wishes to add 20,000 kw. more load at 75 per cent power factor, the same voltage can be maintained by building two more No. 1/0 circuits. Two No. 1/0 circuits, 40 miles long, built for operation at 66,000 volts, will cost at least $500,000.

Cheaper to Raise Power Factor

The power factor of this 40,000-kw. transmission is 75 per cent. We can raise the power factor to unity by the application of 36,000 kva. of wattless corrective effect. This synchronous condenser capacity installed would not cost more than $200,000, and the saving in transformer and generator losses and capacity in the system would more than compensate for the losses introduced by the condenser.

Likewise two No. 1/0 circuits operating at 13,200 volts, three-phase, 60 cycles, will carry 3,000 kw. at 75 per cent power factor a distance of 8 miles with a voltage drop of 10 per cent. If we wish to carry 6,000 kw. at 75 per cent power factor over the same distance, we may do it by duplicating the two circuits and hold our voltage drop at 10 per cent.

A two-circuit No. 1/0 line suitable for 13,200-volt operation will cost at least $3,500 per mile, or $28,000. The power factor of this load may be raised to unity by the application of 5,400 kva. of corrective wattless current. This synchronous-condenser capacity may be installed for $20,000 and the losses in the condenser will be made up by saving losses in generators and transformers in the circuit.

Smaller Margin of Gain at Low Voltages

A similar result will be obtained in applying this principle to lower-voltage problems. We recently had a case where the load on a 4,000-volt circuit could be doubled by power-factor correction cheaper than by adding another circuit, although the margin of gain is not so great at lower voltages, because the cost of power-factor correction increases as the size of units is reduced and the proportional cost of lines on short low-voltage circuits is less.

If power-factor correction has proved to be the most economical in a 4,600-volt circuit, it is probable that there are a great many cases at voltages between 4,600 and 66,000 where it should be adopted.

There are sometimes other reasons for increasing the number of circuits when an increase in load occurs on a transmission line, but in the absence of such necessity the points brought out above regarding the possibility of increasing the capacity of transmission circuits by raising the power factor are worthy of consideration.

The cheapest power-factor correction possible to get is that obtained through synchronous motors running at 80 per cent power factor or higher. The next best method is the use of so-called motor condensers carrying some load but operating at a power factor below 80 per cent. Where no motor application can be made, synchronous condensers offer the next cheapest power-factor correction down to units of from 300 kva. to 600 kva., depending on the cost of power for supplying losses. In most cases static condensers are the cheapest corrective apparatus in units of 300 kva. or less.

I should like to suggest to the manufacturers that they would assist the operating companies materially in making use of synchronous-condenser machinery if they could build high-speed condensers to operate more quietly than they do now. The excessive noise made by these machines prevents their use in some substations where they might otherwise be economically used.

STREET LIGHTS OUT

PROVIDENCE R. I. MONTH *Feb. 1923*

	MAGNETITE ARCS				INCANDESCENTS							
					ALL NIGHT				HALF NIGHT			
	UNDERGROUND		OVERHEAD		UNDERGROUND		OVERHEAD		UNDERGROUND		OVERHEAD	
	NO OF LAMPS OUT	HOURS OF OUTAGE	NO OF LAMPS OUT	HOURS OF OUTAGE	NO. OF LAMPS OUT	HOURS OF OUTAGE	NO OF LAMPS OUT	HOURS OF OUTAGE	NO. OF LAMPS OUT	HOURS OF OUTAGE	NO OF LAMPS OUT	HOURS OF OUTAGE
Out from circuit troubles	421	Hrs Min. 721 05	216	Hrs. Min. 365-50								
Out from lamp troubles	484	1335-30	267	750-35								
Totals	905	2056-35	483	1116-25								
Number of circuit troubles	8		5									

Thousands hours burned, arcs 562 23 — Total hours outage, arcs 3173.00

No. outages for lamp troubles, " 751 — Per cent hours out " 0 564

No " " " " per 1,000 hours burned, arcs 1336

OUTAGES PER 1,000 HOURS BURNED CONSTITUTE INDEX FIGURE IN SERVICE ANALYSES

Analyzing Causes of Outages in Street Lighting

MANY municipalities and utilities confine their analyses of street-lighting outage to the number of lamp-hours per month lost from the scheduled service. While this figure is a measure of the community's deprivation of highway illumination owing to apparatus failure, it does not give an adequate check upon the performance of the equipment. After an outage is reported by the police, the time required for the operating force to restore service varies widely and is inevitably a part of the outage period. To enable the working of the equipment to be checked more closely, and in the hope that others will establish and maintain similar comparisons, R. W. Eaton, public service engineer of the city of Providence, R. I., uses the accompanying tabular analysis of local street-lighting service. For convenience in emphasizing the arc-lighting results here given, the incandescent lighting data for the month chosen are omitted.

The Providence service is tabulated on the basis of the number of lamps out and the hours of outage for both overhead and underground supplied lamps, and the causes of outage, whether from circuit or lamp troubles, are also separately shown. The total number of hours burned, total hours of outage, number of outages for lamp troubles and percentage of hours out represented by arc-lamp outages are shown. From these data are computed an index figure of arc-lamp service, viz., the number of outages for arc lamp troubles per 1,000 hours burned, this being 1.336 for February, 1923, on the system of about 1,600 6.6-amp. magnetite-arc lamps without high-efficiency electrodes. This index figure is plotted from month to month for comparisons on a time basis, and it has been found that a seasonal variation exists, with a tendency toward more outages in winter than in summer.

Load Dispatcher's Control Board

By A. O. EVANS
Arkansas Light & Power Company, Pine Bluff, Ark.

IN ORDER to assist the dispatcher in checking operations on the central power system of the Arkansas Light & Power Company, Pine Bluff, Ark., the control board shown herewith was devised. Battery switches represent every switch on the main transmission lines and miniature lamps are placed at every substation and are so wired that they show actual operating conditions. Energy for the lamps is supplied by a small transformer.

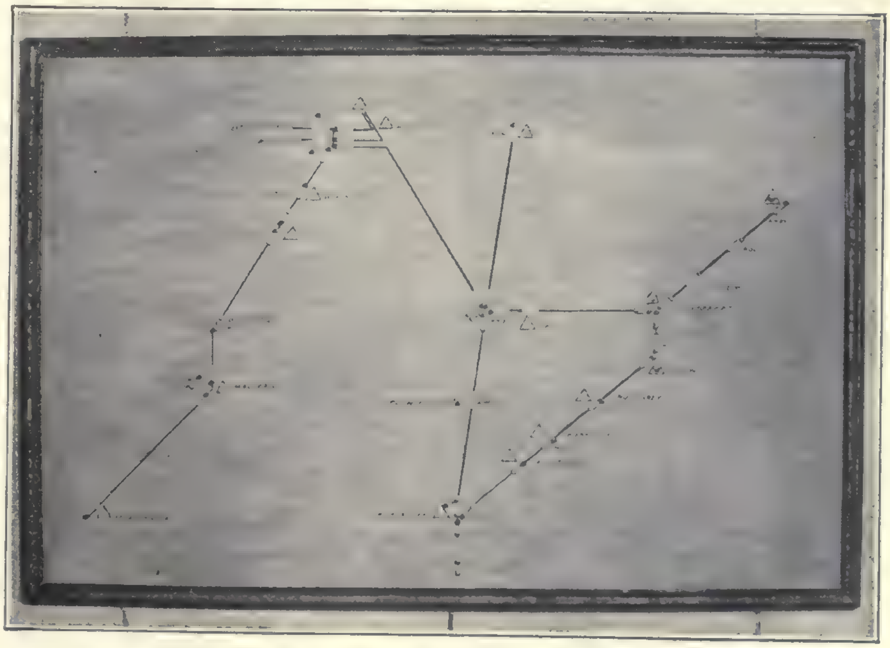
The use of this board affords the system operator, at a glance, a record of the position of all switches. This proves of most value during electrical storms, when switching must be effected rapidly, and aids in checking against throwing together without synchronizing two or more of the four generating stations that supply power to this system.

About twenty-six communities are supplied with electrical service from this system, which also supplies electricity for hundreds of irrigation plants in the rice-growing section of Arkansas. The generating stations are at Pine Bluff, Picron and Malvern. The Arkansas Light & Power Company recently completed a 66,000-volt line connecting the Pine Bluff-Picron system with the Arkadelphia-Malvern system. This line is being extended to the site of the Remmel dam and power station under construction on the Ouachita River by the company, which plans the building of a total of three dams and power stations to develop 120,000 hp.

Molten Additions to Steel

By FRANK HODSON
President Electric Furnace Construction Company, Philadelphia, Pa.

IT IS generally agreed that it is very desirable to make molten ferro-manganese additions to open-hearth and converter steels rather than to add cold unmelted metal. The electric furnace has made it possible to do this in a simple and efficient manner. A properly designed electric arc furnace with bottom contact to insure circulation in the bath and a large bath area to permit of proper slag manipulation



COMPLETE CONTROL OF SYSTEM FACILITATED BY THIS DISPATCHING BOARD

will solve many of the melting difficulties and insure at a low operating cost supplies of hot liquid ferro-manganese.

In addition to better quality of steel, smaller amount of ferro and absence of melting loss, savings can be made by the use of manganese ore and low-grade ferro-manganese. Both of these can be used in the electric furnace. In experiments made on a "Greaves-Etchells" furnace—which has the particular advantage of operation either entirely with top electrodes or with top electrodes and the whole of the furnace hearth—as much as 25 per cent of the charge was added in the form of manganese ore. The metallic melting loss rarely exceeds 3 per cent.

For proper metallurgical manipulation of ferro-manganese it seems highly desirable to use an electric furnace with a large open bath rather than a restricted channel as in the induction furnace, and also one in which there is a circulation from the bottom of the furnace. It was found that when only top heat was applied the manganese had a tendency to segregate out and sink to the bottom, where it would stick. When the bottom connection on the furnace was cut in this tendency ceased and the metal was uniform throughout in temperature and composition.

The voltage required on melting ferro-manganese differs considerably from that needed for steel, and in order to keep a steady arc, and if necessary to hold the furnace on low power imput, it is important to have a furnace in which each electrode operates independently and which can keep steady arcs with only 20 per cent to 25 per cent of normal electrode load. A four-electrode furnace with one phase attached to furnace hearth, giving slow circulation of metal from the bottom, is ideal for ferro-manganese or for any alloy or high-grade steel.

Extracts from an Operating Code*

Cleaning Transformers

AN AIR-BLAST transformer must be kept as free as possible from dust, especially the ventilating duct, so that the air can penetrate to all parts of the transformer that require cooling. With oil-insulated self-cooled units the oil must be tested periodically for moisture. In the case of oil-insulated water-cooled transformers the oil level must be carefully watched. Instructions follow:

Air-Blast Transformers

1. Blow out the interior of each transformer at least once per month. In dirty locations shorten the periods between cleanings. The pressure of the air used for blowing should not be greater than 70 lb. per square inch.

Always allow any accumulation of water in the compressed-air pipes and tank to be blown out before the blast is turned into the transformer. When the air chamber is arranged with compartments so that the air can be shut off from each one separately, blow the transformer first from the top, then clean the pit, and finally blow the transformer again from the bottom. If the air chamber does not have compartments and the air cannot be shut off, first clean the pit, then blow the transformer from the top, and finally blow the transformer from the bottom.

2. Wipe off the coils with a cloth and clean the air space between them with a brush or cloth fastened to the end of a stick.

3. Clean all connections, insulation and cable racks underneath the transformer and wipe the dirt from the casing.

4. At the time the transformer is blown make a thorough inspection for loose contacts, imperfect connections or any other defects likely to affect the operation of the transformer.

5. Where transformers are equipped with regulating mechanism for adjusting the voltage, inspect it monthly.

Oil-Insulated Self-Cooled Units

1. Keep the casings of all oil-insulated transformers clean and inspect the leads for oil siphoning and loose connections.

2. Inspect the percentage taps for loose connections.

3. Check the level of the oil frequently to see that it stands at the proper height in the gage.

4. Take samples of oil every six months and send them to the laboratory for analysis. These samples should be taken from the bottom of the transformer. If the transformer case is supplied with a clean-out valve at the base, this valve may be opened and a sufficient quantity of oil drawn off for a proper sample.

If no clean-out valve is supplied, a long tube of glass or fiber is used. Close the top end of the tube with the thumb and lower the other end through the oil until it reaches the bottom of the tank. Raise the tube about an inch. Remove the thumb. This allows the oil from the bottom of the tank to flow up in the tube. Replace the thumb over the top end and remove the tube from the transformer. The oil entrapped in the tube is a sample of oil from the bottom of the case.

Oil-Insulated Water-Cooled Units

1. Keep the casings of all oil-insulated transformers clean and inspect the leads for oil siphoning and loose connections.

2. Inspect the percentage taps for loose connections.

3. Check the level of the oil frequently, as a continuous rise in oil level indicates water leaks.

4. Clean out the cooling coils periodically.

5. Take samples of oil every six months and send them to the laboratory for analysis.

*Abstracted from the operating code of the Philadelphia Electric Company.

Making Overspeed Tests on Auxiliary Turbines

AT SPECIFIED intervals tests should be conducted to determine whether or not the overspeed devices on small auxiliary turbines are in satisfactory operating condition. In making these tests the governor should be blocked in some manner and the machine controlled by the throttle so that the speed may be increased above normal as desired. Following are the directions for making overspeed tests on small turbines:

1. See that the load of the turbine has been removed.

2. Apply a tachometer to the turbine shaft and note that normal speed is maintained by the governor at no load.

3. Continue to observe the speed by means of the tachometer and force the governor arm against the spring, allowing the turbine to speed up not exceeding 20 per cent above the normal speed.

4. Note the speed at which the overspeed device trips the throttle. If it has not operated when 20 per cent overspeed is reached, adjust the tripping mechanism to operate at a lower speed.

Barriers Prevent Squirrels from "Shorting" Lines

BY J. G. ALLEN
Vice-President Southern Wisconsin Electric Company, Lake Geneva, Wis.

SINCE seven of the nine service interruptions during one year on a 26,000-volt line of the Southern Wisconsin Electric Company had been caused by squirrels short-circuiting the conductors, the company decided to find some method which would prevent squirrels from climbing the poles. It was found that when an 18-in. strip of galvanized tin was nailed around the pole the squirrels were unable to climb over the tin. Consequently, during the past two years five hundred poles have been protected in this manner at a cost per pole of 65 cents. Of that amount, 52 cents went toward the cost of the material itself, which is so thin that a lineman's spur can penetrate it. Formerly trouble caused by squirrels was frequent on the open prairie lines as well as long wood lots, but no trouble has been experienced since this method of protection was placed in service.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Effect of Time Interval and Type of Load Upon Integrated Kilowatt-Hour Demand

IN MEASURING the demand of power loads the duration of the time interval and the type of load under consideration have all-important influences on what shall be taken as the demand for billing purposes under a demand and energy rate. How both of these factors affect the ultimate result in measuring demand is shown in the accompanying tabulation of integrated demands for different industries which has been compiled by William M. Carpenter, engineer for the Empire State Gas & Electric Association, New York.

To obtain this data graphic wattmeter charts of typical industries were taken at random as representing an ordinary day's work. From these the peaks were selected and the relation of values found by using the various time intervals as shown in the tabulation. The different industries have been grouped into three natural divisions: Steady, intermittent and heavy metal-working loads.

It will be seen that under the classification of steady loads there is not a great difference between the hourly maximum and the instantaneous demand, the greatest difference being shown by an electric furnace, while the average instantaneous demand for the group exceeds the hourly demand by only 14.3 per cent. The importance of the shorter time interval becomes more apparent with the intermittent loads where the fifteen-minute demand of a machine shop exceeds the hourly demand by 25 per cent, and the instantaneous demand shows an excess of 62 per cent. The average instantaneous demand of this group exceeds the hourly demand by 37.2 per cent.

The heavy metal-working loads show the widest diference between hourly and instantaneous demands, although the integrated peak over a two-minute period exceeds that of the hourly period by only 24.7 per cent. However, the average instantaneous demand of this group is 48.5 per cent more than the hourly demand.

The results of this comparison indicate the importance of a careful consideration of the time interval and kind of metering device which

INTEGRATED DEMAND AS MEASURED BY VARIOUS LENGTHS OF PEAKS COMPARED WITH ACTUAL USE IN MAXIMUM HOUR

Industry	1 Hour, Kw.	Per Cent of Hourly Demand	30 Minutes, Kw.	Per Cent of Hourly Demand	15 Minutes, Kw.	Per Cent of Hourly Demand	10 Minutes, Kw.	Per Cent of Hourly Demand	5 Minutes, Kw.	Per Cent of Hourly Demand	2 Minutes, Kw.	Per Cent of Hourly Demand	Instantaneous Kw.	Per Cent of Hourly Demand
Steady loads:														
Pumping plant	154	100	154	100	154	100	154	100	154	100	154	100	154	100
Flour mill	5,000	100	5,000	100	5,000	100	5,000	100	5,000	100	5,000	100	5,250	105
Flour mill	510	100	525	103	530	104	530	104	540	106	540	106	560	110
Refrigeration	930	100	940	101	965	104	980	105	1,000	107	1,005	108	1,020	110
Refrigeration (bottling works)	600	100	625	102	630	103	635	104	640	105	640	105	740	121
Refrigeration (ice-cream manufacturing)	128	100	130	101	132	103	132	103	132	103	134	105	137	107
Refrigeration (cold storage)	84	100	85	101	88	105	90	107	91	108	91	108	98	117
Refrigeration (cold storage)	130	100	135	104	138	106	140	108	145	111	146	112	148	114
Electric furnace	430	100	440	102	440	102	445	103	450	105	460	107	460	107
Electric furnace	370	100	378	102	380	103	380	103	380	103	380	103	385	104
Electric furnace	200	100	215	107	220	110	225	113	225	113	230	115	240	120
Electric furnace	110	100	110	100	110	100	110	100	115	104	120	109	150	136
Paper mill	4,250	100	4,500	106	4,550	107	4,600	108	4,700	111	4,800	113	5,150	121
Paper mill	750	100	760	101	785	104	790	105	790	105	790	105	840	112
Paper mill	520	100	590	113	640	123	660	127	670	129	670	129	680	131
Paper mill	455	100	480	105	500	110	500	110	500	110	500	110	520	114
Paper mill	360	100	380	105	390	108	382	109	400	111	400	111	410	114
Wallpaper manufacturing	410	100	440	107	440	107	445	108	450	109	450	109	460	112
Talc mill	1,070	100	1,170	109	1,170	109	1,170	109	1,170	109	1,170	109	1,170	109
Fertilizer mill	112	100	116	103	125	111	135	120	137	122	138	127	140	125
Average of group		100		103.6		106		107.3		108.6		109.3		114.3
Intermittent loads:														
Machine shop	1,150	100	1,160	101	1,180	102	1,200	104	1,210	105	1,220	106	1,300	113
Machine shop	355	100	355	100	360	101	370	104	372	105	375	106	425	120
Machine shop	168	100	200	119	210	125	215	128	220	131	220	131	272	162
Machine (railway shop)	108	100	113	104	118	109	120	111	126	116	130	120	140	130
Machine (railway shop)	74	100	90	107	97	115	98	117	100	119	100	119	112	151
Packing house	49	100	64	131	66	135	67	137	75	153	80	163	82	166
Office building (hydraulic elevators)	90	100	90	100	90	100	90	100	120	133	125	139	138	154
Lithographing shop	290	100	325	112	340	117	345	122	360	124	360	124	381	131
Evening newspaper	540	100	620	115	690	128	710	131	740	137	750	139	800	148
City street railroad	5,500	100	6,220	113	6,450	117	6,500	118	6,500	118	6,500	118	6,900	125
Foundry	140	100	145	103	148	105	149	106	149	106	150	107	165	118
Stone crusher	360	100	370	103	380	105	400	111	415	115	420	117	465	129
Lumber mill	550	100	560	102	600	109	615	112	620	113	640	116	760	138
Average of group		100		108.3		112.8		115.5		121		123.4		137.2
Heavy metal-working loads:														
Foundry with electric cranes	1,300	100	1,525	117	1,620	124	1,625	125	1,720	132	1,780	137	1,810	139
Brass rolling mill	3,600	100	4,100	105	4,200	108	4,250	109	4,300	110	4,350	111	4,600	128
Iron rolling mill	4,200	100	4,800	109	5,050	115	5,060	115	5,400	123	5,800	132	7,200	171
Iron rolling mill	1,600	100	1,600	100	1,700	106	1,800	112	1,900	119	1,900	119	2,500	156
Average of group		100		107.7		113.2		115.2		121		124.7		148.5

New Utility Office at Albert Lea

Figs. 1 and 2—The main floor in the new office building of the Central States Power Company. The customary grill work has been left off the counters. Note the portion devoted to the smaller appliance sales, with space in the foreground equipped with comfortable chairs and a settee.

Fig. 3—Accounting room on the second floor. An unusually well lighted and cheerful office room. Executives and department heads are at each end of the floor.

Figs. 4 and 5—Views of "The Daylight Corner."

Fig. 6 and 7—The assembly room and well-equipped kitchen in the basement, which have made the office of the company a center for community activities that are not usually thought of in connection with a public utility building. A very nominal amount is charged, which is so low that the lack of profit is evident.

should be adopted for measuring the demand. It should be borne in mind that there is a wide difference between the sustained and instantaneous demands, depending on the type of load. Generally speaking, the shorter the length of the time interval the lower should be the unit price per unit of demand. On the other hand with a long time interval many severe instantaneous or short peaks which might disturb the regulation of that part of a central station distribution system would not be recorded.

In establishing a basis for measuring the demand it appears advisable also to make a careful study of the various industrial loads in the community and the probable trend of future development. Where one type of load predominates in a territory the formulation of a suitable method of determining demand may be comparatively easy, but where industries are widely diversified it becomes a much more difficult problem to find a suitable combination of time interval and meter. The tabulation appears to bear out the experience of most companies that a fifteen-minute peak is the most satisfactory and representative of the average actual demand.

Utility's Quarters Made Community Center

Central States Power Company at Albert Lea, Minn., Equips Its Building for Community Activities—Assembly Room and Kitchen Provided for Use of Civic Clubs

AN UNUSUAL experiment in popularizing the use of the central-station company's office building for commercial and civic club activities has been undertaken by the Central States Power Company, Albert Lea, Minn. The property at Albert Lea, operated by the Southern Minnesota Gas & Electric Company, is a part of a system that is being built up in southern Minnesota and extending into northern Iowa for which the Central States Power Company is the holding company. A new office building has been constructed in the past year and has recently opened its doors. It is located on a conspicuous corner on the main business street, which because of its excellent interior lighting night and day and its exterior lighting at night has become known as "The Daylight Corner."

The main floor is devoted entirely to the handling of customers and the merchandising business. The appearance of this room may be seen on the opposite page.

The accounting rooms, including the consumers' billing, are located on the second floor and shown in Fig. 2. Unusually large windows are provided on the first floor, so that even on a dark day the natural light is strong, and at night, with the interior illuminated, the building stands out sharply.

A new and interesting idea has been worked out in the basement of the building. While a small part of the basement is devoted to appliance storerooms and a place is provided where second-hand appliances can be displayed for sale, the main part of the floor space is divided into two rooms, the smaller being a well-equipped kitchen with cooking equipment and a full supply of dishes and silverware. The larger room is an assembly room equipped with a moving picture machine and a Chickering piano with the best automatic playing equipment. While used partly for employee activities, it also is rented for a nominal amount to any local social or civic organizations that care to use it. The Rotary and similar clubs, women's clubs or like organizations use it for lunches, evening entertainments or any purpose that a general hall would be used for. Labor union organizations have used it for organization entertainment purposes.

It is not the intention of the company to make a profit from renting the hall as the charge for the basement rooms is so small that it does not return any profit. The thought is to make the company's office the center for such activities as have for their aim the advancement of community affairs and to fix the company and its business in a definite relation to such activities. The results so far are very gratifying to the management both because of the good feeling toward the company that has developed and in the attention that has been centered on electrical service and the merchandising activities of the company. Some one of the company's salesforce is on duty on the main floor at night when the basement rooms are being used and the guests are free to drift about, inspect the merchandise or ask questions.

Customers Increase Use and Gain 5.5-Cent Rate

SO SUCCESSFUL has the combined area and energy charge for residential service proved for the Hartford (Conn.) Electric Light Company that beginning July 1 the meter rate was reduced from 8 cents to 5.5 cents per kilowatt-hour, the area charge remaining at 5 cents per month per 100 sq.ft. of flood area. Per customer, the residential kilowatt-hours sold in June, 1923, was 20 against 17 for the same month in 1922 and 1921. The total residence kilowatt-hours was 693,395 for June, 1923, compared with 536,817 for June, 1922, and 497,845 for June, 1921. The combination rate went into effect Dec. 19, 1921, prior to which a 10-cent straight energy charge was in use. The area charge amounts to about 70 cents per month for the average residential customer. In the ELECTRICAL WORLD of April 21, 1923, an account was given of the rate and its application.

What Other Companies Are Doing

Illinois. — The Central Illinois Public Service Company sold more merchandise in one month this summer than ever before in a single month. Its sales for June amounted to $60,793, or 111 per cent more than for the same month last year. The company's merchandise sales for the six months ended June 30, 1923, were $250,627, an increase of $120,881 or 93 per cent over the sales for the first half of last year.

Monroe, Wis.—Causes of weak current and other spasmodic interruptions in electric service are made clear by an instructive window display at the office of the Wisconsin Utilities Company. It explains why the high-tension lines are kept free of trees and their branches. A stump in the window shows a spot which has been badly burned as the result of being near a line. Three insulators, the targets of schoolboys, are also displayed and the disastrous results of lightning are shown.

Worcester, Mass. — An "electric house" will be built during the coming fall and winter by the Electrical League of Worcester County, with the co-operation of the various branches of the industry in that section of Massachusetts in harmony with the plans of the Joint Committee for Business Development.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Hydro-Electric Development and Steam Equipment

English Station with a Rating of 42,375 Kw.—A description is given of the Radcliffe generating station of the Lancashire Electric Power Company in England. The coal-handling plant, ash-removal system, boiler house, turbine room, boiler auxiliaries and switchgear are covered, with some information about operating results. This station has one 2,500-kw., one 3,500-kw., one 4,375-kw., one 6,000-kw. and two 10,000-kw. turbines. The last two machines are standard multistage impulse machines running at a speed of 1,500 r.p.m. and are coupled direct to three-phase, 50-cycle, 11,000-volt generators capable of delivering 13,333 kva. each. —*Electrical Review (England)*, June 15, 1923.

Kansas City Company Adds 30,000 Kw. to System.—T. WILSON.—Increasing power demands necessitated a 30,000-kw. addition to the new Northeast Station of the Kansas City Power & Light Company. The boilers are of the latest design, supplying steam at the temperature of 650 deg. F., and are equipped with forced-draft chain grates and high-pressure counterflow economizers. Provision has also been made for plate-type air preheaters. Other salient features are submerged ashpits, great flexibility in coal handling and provision for rapid transfer to oil fuel.—*Power*, July 3, 1923.

Modern Hydraulic Turbines of Large Capacity.—H. G. ACRES.—The author discusses the subject with special reference to refinements in design, increased efficiency, improved test methods and advances in the general art which make the use of large turbines possible. —*Mechanical Engineering*, August, 1923.

Generation, Control, Switching and Protection

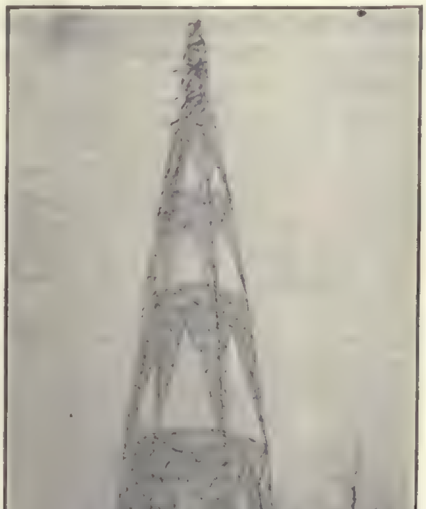
Development of Current Limiting Reactors and Their Shunting Resistors. —F. H. KIERSTEAD.—The author lays much emphasis on the value of shunted resistance as a means of dampening out disturbances. First he gives a brief history of the reactors and then gives the requirements of reactors to meet the exacting conditions met with in modern interconnected systems. — *General Electric Review*, August, 1923.

Polyphase Transformer Connections. —R. F. GOODING.—A comparison of the different three-phase connections of single-phase transformers showing characteristic advantages and disadvantages of connections commonly used. These connections include the delta-to-delta, delta-star, star-delta, star-to-star and three-phase to two-phase.—*Power*, July 24, 1923.

Short-Circuit Forces on Reactor Supports.—R. E. DOHERTY and F. H. KIERSTEAD.—An abstract of this paper may be found in the ELECTRICAL WORLD, report of the A. I. E. E. spring convention, May 5, 1923, on page 1031. —*Journal of A. I. E. E.*, August, 1923.

Transmission, Substations and Distribution

Unusual Transmission-Tower Design. —The 230-ft. transmission tower illustrated herewith is used for Rhine crossings in Holland for a two-circuit, three-phase, 50,000-volt transmission line. This line is part of the network which will ultimately transmit power from eleven provincial power stations to every community in that country.



UNUSUAL TOWER FOR TRANSMITTING ENERGY IN HOLLAND AT 50,000 VOLTS

The 50,000-volt line voltage is considered to be the most economical for the amount of energy that will be transmitted. For Holland it will mean the minimum total generation and transmission cost. — *Sterkstroom*, July 4, 1923.

Economic Design of High-Voltage Transmission Line.—M. SUZUKI.—The first part of this article considers formulas for tower height and weight and gives equations showing the relations between tower weight and span, conductor size and line voltage. The next part is devoted to an economic solution of a transmission line, giving the formula for the calculation of economical conductor size, transmission voltage and span. In the last part an analysis is made of the installation costs of a transmission line, giving unit costs of an up-to-date line. Most of the data are based on the 115,000-volt, 140-mile transmission line of the Inawashiro Hydro-Electric Power Company.—*Journal of Institute of Electrical Engineers of Japan*, June, 1923.

Motors and Control

Electrically Driven Wire-Rod Mill. —The mill described manufactures principally No. 5 and No. 6 gage wire. The building is approximately 560 ft. long by 190 ft. broad and has been equipped with modern devices for handling a large output of finished material. The whole layout and erection of the furnace and the design of the electrical driving equipment is a good example of modern mill practice.—*Electrical Review (England)*, June 15, 1923.

Development of the Steel Industry.—D. M. PETTY and A. J. STANDING.—A description is given of the enormous manufacturing activities of the Bethlehem Steel Company. Mechanical equipment has largely superseded the necessity for hand labor, and wherever an automatic control can be made operative it is found in service. The authors consider open-hearth furnaces, steel foundries, the forge department, machine shops and rolling mills and discuss the application of electricity to apparatus wherever possible.—*Blast Furnace and Steel Plant*, July 1, 1923.

Induction Motors Used as Synchronous Machines.—S. V. GANAPATI and R. G. PARIKH.—The object of this paper is to determine the overload capacity of an induction motor when operated synchronously and the pulling-in capacity at synchronism. The advantages of synchronous operation of induction motors are most pronounced at times of light load and up to about 70 per cent of full load. At heavier loads there is a loss of efficiency and only a slight improvement in power factor. Owing to the necessity of adjusting the excitation to the load, synchronous operation is unsuitable in the case of fluctuating loads.—*Journal of the Institution of Electrical Engineers (England)*, July, 1923.

Heat Applications and Material Handling

Quenched Arc Welds.—O. H. ESCHHOLZ.—In the process of arc welding an initially cold surface is raised to the melting temperature within the fraction of a second, a small quantity of molten metal is deposited thereon and the fused mass permitted to cool very rapidly. A few examples of this type of welding are given for the purpose of imparting information concerning a better control over residual stress, weld strength, ductility, stress distribution, shock and fatigue resistance.—*Journal of American Welding Society*, June, 1923.

Electric Heating of Finishing Rolls of Sheet and Tin Mills.—GORDON FOX.—The same advantages which accrue to electric heating in many other operations also occur in the application of electric heating to finishing rolls. The heat may be effectively and economically applied and readily controlled and any degree of heat desired may be obtained. The method described is clean, convenient and economical, and the application and operation can be so governed as to offer considerable possibility for decrease in roll breakage.—*Proceedings of Association of Iron and Steel Electrical Engineers*, July, 1923.

Improvements in Ferro-Alloy Electric Furnaces of High Power Input.—B. D. SAKLATWALLA and A. N. ANDERSON.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. spring convention, May 5, 1923, on page 1025.—*Journal of A. I. E. E.*, August, 1923.

Electrophysics, Electrochemistry and Batteries

Mathematical Development of Theory of Magnetomotive Force of Windings.—A. E. CLAYTON.—The mathematical theory of the magnetomotive force developed by armature windings is developed and presented in such a form that it is at once directly applicable not only to the more common cases, but also to abnormal cases, such as unbalanced windings, pole-changing windings, etc. The method of treatment adopted is to start from the Fourier series representing the mmf. distribution due to a single coil and to build up from this series the corresponding series for any complete winding. The effect of the value of the coil span is discussed and data relating to the various winding factors concerned are given in a simple graphical form applicable to the harmonics of any order whether odd or even. The resulting mmf. due to a number of coils carrying the same current is then deduced from the effect of a single coil. It is shown that all types of polyphase windings fall into one category, the treatment being general and directly applicable to all types of windings whether normal polyphase, full-pitch or chorded, or a winding intended for pole changing.—*Journal of the Institution of Electrical Engineers (England)*, July, 1923.

Valve Tubes Containing Rare Gases.—F. SCHRÖTER.—The value or rectifying action of neon or helium tubes containing metallic electrodes of widely different size is being exploited now commercially for a number of purposes. As a rectifier from alternating current to direct current to charge small batteries such a simple and inexpensive tube may be used for currents not exceeding about 0.4 amp. and voltages of between 100 and 250. Using a single tube gives an efficiency of about 50 per cent, which can be increased to more than 60 per cent if four tubes are connected in a bridge. Another promising field for these tubes is their use as a voltage reducer to operate, for example, doorbells or telephone circuits from a 110-volt house circuit instead of bell ringing transformers or dry cells. The tube reducer operates on either direct or alternating current. These tubes may also be used as effective overvoltage protectors. Up to a certain critical voltage the tube acts as an insulator, barring all passage of current, but beyond this tension the rare gas turns quickly into a good conductor, carrying the overvoltage to ground. Particularly on telegraph and telephone lines, these tubes have proved very useful as overvoltage protective devices. Tests showed that such a tube withstood safely 10,000 overvoltage punctures. Below their critical voltage the tubes have an internal resistance of about 1 megohm.—*Elektrotechnik und Maschinenbau*, July 22, 1923.

Traction

Developments of the Motor Coach.—C. E. BROOKS.—The renewed interest taken in this type of equipment and the reasons why railway officials have been forced to turn to it are discussed. Advantages and disadvantages of the various types of gasoline-engine, storage-battery, steam and gas-electric cars, with performance data for each type, are considered.—*Mechanical Engineering*, August, 1923.

Application of Storage-Battery Locomotives to Mining.—E. J. GEALY.—The author outlines the advantages and reasons for increased application of this type of locomotive to the mining industry. The storage-battery locomotive should be simple in construction, rugged and, above all, efficient. Sparkless commutation, great overload capacity and maximum torque per ampere are also important factors in the motor design. Other pertinent facts regarding the locomotive are discussed. The article concludes with a simple method for calculating battery capacity.—*Coal Age*, July 26, 1923.

Unified Transportation System for Chicago.—Details are given of the Kelker report just given to the City Council of Chicago to show possible extensions to the rapid-transit surface lines throughout the city. The time for carrying out the plan is divided into two periods in order to reap its benefits sooner. Time savings in all parts of the city are shown.—*Electric Railway Journal*, Aug. 4, 1923.

Telegraphy, Telephony, Radio and Signals

Directional Wireless Telegraphy in Aircraft.—C. K. CHANDLER.—The author deals with the operation of directional wireless telegraphy in aircraft where the directional aërials are installed in the aircraft. Curves are given showing the errors obtained, and formulas are developed showing the factors on which the errors depend. Methods of predicting and correcting the errors are given. Curves of variation in bearings of transmitting stations are given and discussed.—*Journal of Institution of Electrical Engineers (England)*, July, 1923.

Signal-to-Static-Interference Ratio in Radio Telephony.—J. R. CARSON.—Several general propositions are stated relative to the signal-to-static ratio, in single and double side-band transmission, indicating a superiority in practice for the former system.—*Proceedings of Institute of Radio Engineers*, June, 1923.

Progress in Automatic Telephony.—An example of the installation of an automatic telephone system for city service in England is described. The Siemens system is installed. Among the subjects discussed are the preselector, general operation, installation details, link distributing frame, power source and motor interrupter racks.—*Electrician (England)*, July 13, 1923.

Induction on the Communication Line Caused by Parallel Power Lines.—S. KUDO and S. BEKKU.—To prevent the dangerous voltage induced on the telephone and telegraph lines by accidental grounding of the power transmission line, high resistances are used in Japan for the connection of the neutral of the power system to the earth. Oscillographic experiments on communication lines were performed by the authors and are shown and explained. Virtually no danger will be produced on the communication line by the insertion of high resistance between the neutral and the earth.—*Researches of Electrotechnical Laboratory, Tokyo, Japan*, No. 121.

Miscellaneous

Construction of Concrete Fuel-Oil Tanks.—Concrete tanks are recommended for the storage of fuel oil when the specific gravity of the liquid is heavier than 35 deg. Baumé at 60 deg. F., but should not be ordinarily used for lighter oils. This paper was originally presented at the annual meeting of the American Concrete Institute. The following subjects are considered: design of tanks, concrete specifications, proportions and mixing of concrete, construction forms and details of construction.—*Canadian Engineer*, July 10, 1923.

Heat Utilization in Power Plants.—A. R. SMITH.—In this article, the fourth and concluding one of a series, the author discusses the utilization of heat in steam-electric power plants, dealing in great detail with the heating of air for combustion and with other features of heat utilization. He discusses the heating of feed water by fuel economizers, exhaust steam from steam-driven auxiliaries and extraction of steam from the main turbine. He points out that the same means may be utilized for the heating of the air in boiler furnaces with almost equal advantages.—*General Electric Review*, August, 1923.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Broadcasting Over Wires

Demonstration of Squier's System Made on Staten Island — Commercial Application Follows

DURING the last eighteen months the North American Company, through its subsidiary, Wired Radio, Inc., has been experimenting with a system of wired-radio "broadcasting" over electric lighting and power lines, under the basic patents of Major-General G. O. Squier. General Squier has granted an exclusive license to Wired Radio, Inc., for this purpose, and the system is being developed in co-operation with a number of large lighting and power companies. No transmitting or receiving aërials are used; instead, the sending apparatus is connected to one phase of the three-phase buses at the power house and the radio waves follow along the wires to the receiver, which is plugged into any electric lamp socket or convenience outlet in the home, just as an electric fan, iron or toaster is connected.

New types of simplified transmitting and receiving apparatus have been developed. One of the receivers is a combined tuner-amplifier and "loud speaker" in a small cabinet. Current for lighting the filaments is supplied from the 110-volt lighting mains through an ordinary lamp-cord connection which also carries the radio waves into the receiver, where they are amplified and converted into voice and music. No antenna, ground connection, storage battery or special wiring is required, and any number of receivers may be operated simultaneously in a home or apartment house without interference. An adjustment permits reception of the ordinary space-radio programs.

In co-operation with the Richmond Light & Railroad Company, which supplies electric lighting and power service to about 25,000 consumers on Staten Island, New York City, the first commercial wired-radio plant has been installed. The Wired Radio Service Company has been organized to conduct commercial operations and has been granted exclusive license for the local territory. Regular service on a 6,800-m. wave length will begin early in September. Receivers will be rented and the monthly charge will also cover cost of the program service. The rates are $2 monthly for a head telephone set, $3.50 for a small loud speaker and $5 for a large loud speaker.

A demonstration of the system was made on Aug. 29, and representatives of the press were much impressed by it. Simply by plugging into a convenience outlet in any of the wired homes on the island, the radio was received clearly and loudly.

A wired-radio program of a comprehensive kind is to be furnished which will be continuous from early morning until late at night. Later on the company expects to offer more than one program on various wave lengths, and tuning dials are provided on the receiving sets for this purpose.

C. W. Hough is president and R. D. Duncan, Jr., is chief radio engineer of Wired Radio, Inc., and J. Arch Mears is president of the Wired Radio Service Company.

Europe Is Now Showing America the Way

Owen D. Young in an Interview Cites the Present Progress of Water-Power Development and Railway Electrification Abroad as an Example We Should Heed

O. D. YOUNG

OWEN D. YOUNG, chairman of the board of the General Electric Company and of the Radio Corporation of America, lately returned from an extended trip abroad, has brought with him a deep impression that Europe is setting America an example today in the appreciation of electric power. In discussing the situation with a representative of the ELECTRICAL WORLD Mr. Young said:

"The present interest of the nations of Europe in the development of water power should have a particular significance for the electrical industry and the people of America. The water powers of Europe are being developed because the people of those war-torn nations cannot afford to be wasteful. This is the literal truth. For the economic pressure upon France, England, Italy and Germany is so intense that men's minds are impelled to seek ways and means of getting work done in less costly ways. In Italy and France, notwithstanding the financial stress, the development of water power is actively under way, and it is a recognized national policy that this great national resource shall be developed to contribute what it may toward relieving the difficulties under which the people are laboring. They recognize that water power is a source of public wealth which may be appropriated at this time for public relief, and they are devoting their energies to carrying out these projects in the belief that no matter how difficult it is to finance public works, the effort is justified by the need.

"What a contrast it is that America, a nation rich beyond comparison in history and with a wealth of national resources that staggers the imagination, should be content to let her water powers run to waste! The general increase in the cost of living has brought a universal demand for such economies and efficiencies as may be introduced into our scheme of living to reduce the burden on the people. Vast national projects for water-power development have been worked out in detail, planned to help in relieving the situation. Not only the electrical industry but the business men of the country and the men of government all frankly recognize, as a matter of theory, that our enormous water-power resources should be developed and applied in the public interest. Yet small progress is being made, that is, in proportion to the opportunities. We in this country have long been conscious of the importance of water-power development from an economic point of view, but as a nation have never really bestirred ourselves to make it a reality. Meanwhile, Europe, poor beyond comparison, has the courage to go ahead."

RAILWAY ELECTRIFICATION ALSO

Mr. Young was also particularly interested in the fact that under the impulse of necessity European nations are also forging ahead in the matter of railway electrification. "More rail-

way electrification is in process and in prospect in Europe today," he said, "than in the United States."

"Again we see stranded Europe going ahead," he continued, "and we, rich beyond measure, are willing to waste from 12 to 14 per cent of the capacity of our railroads in hauling coal to make their own power. It would seem that America is suffering from the weakening influence of its own great resources, while Europe, like the poor man who works hard because he must, is concentrating her strength on practical measures of economy that seem to offer her, through saving, profits with which she may restore her economic health."

Mr. Young expressed the belief that public opinion in Europe is becoming steadily more opposed to municipal operation of national resources and public utilities. "The rigid machinery of government," he said, "has nowhere proved an efficient agency for development, and Europe is beginning to appreciate this just as we do in America. The suddenly increasing need for private capital in the development of the water-power resources and the expansion and rehabilitation of other systems will tend to accentuate the importance of permitting the improvement of utility services under a liberal policy of public regulation."

THE GENERAL OUTLOOK ABROAD

Mr. Young expressed himself as decidedly encouraged over the general business outlook in Europe. While from a political standpoint the restoration of harmony among the nations of the Old World seems to be slow, business men are individually re-establishing business relationship and through contact and co-operation are building up anew a basis on which the work of the world may be done. Ultimately this will make it easier to clean up the political situation also. The electrical business in Europe appears to be very good at present, Mr. Young asserted. This is a natural result of the activity in the development of water-power resources, for to market this raw material brings a natural demand for all kinds of electrical manufactures. The domestic demand in all the nations of Europe seems to be strong, and, all in all, the industry is confident and making progress.

Electricity Aids Cincinnati's Fall Festival

To electrical activities of a varied character is due a large measure of the success of the million-dollar Fall Festival and Industrial Exposition now being held in Cincinnati, which opened on Aug. 25 and will close on Sept. 8, the halls and grounds covering ten city blocks. The principal inside attraction is the "Electrical Palace" in the south wing of Music Hall, where more than a hundred electrical exhibits are on display or in operation. Here the decorations, which give a picture of old China, are on an imposing scale.

The Electric Club of Cincinnati has taken an important part in the development of the plans, and its president, M. A. Curran, announces that there are 25 per cent more electrical exhibitors than in any previous affair of the kind held in that city.

In Washington Park, in the exhibition grounds, is the tower of jewels designed especially for the exposition by W. D'A. Ryan, director of the General Electric Company's illuminating engineering laboratory. The towers, which stand 90 ft. high and contain 5,000 miniature lights mounted on twenty standards, were illustrated in the ELECTRICAL WORLD for Aug. 4, page 245. They cost $50,000, and the rays from forty 18-in. searchlamps thrown upon the spectacle make it visible for many miles.

The president of the Cincinnati exposition is Warner Sayers, secretary and treasurer of the F. D. Lawrence Electric Company.

Dinner in Honor of F. R. Low, Editor of "Power"

For thirty-five years Fred R. Low has directed the editorial policies of *Power*, and in commemoration of this notable achievement and as a tribute to Mr. Low as an editor, engineer and friend a dinner was held in his honor at the Engineers' Club, New York City, Aug. 29. The chief editors of all the McGraw-Hill publications, the staff of *Power*, Martin Foss of the McGraw-Hill Book Company, Calvin W. Rice, secretary of the American Society of Mechanical Engineers; H. M. Swetland and James H. McGraw, president of the McGraw-Hill Company, attended the dinner and tendered their felicitations to Mr. Low. Mason Britton, vice-president of the McGraw-Hill Company, was toastmaster and introduced the speakers of the evening, Frank Wight of the *Engineering News-Record*, H. M. Swetland, president Class Journal Company; James H. McGraw, Calvin W. Rice and Jay Mason.

A silver cup was presented to Mr. Low by Mr. Mason on behalf of those present as a token of their appreciation of his accomplishments. Mr. Low in his response insisted on the credit due to his associates for their aid in making *Power* a great paper. Mr. McGraw paid tribute to Mr. Low as one of the half dozen great engineering editors this country has known and outlined the qualities of vision, courage and knowledge which have contributed to his success. Mr. Rice dwelt on Mr. Low's unselfish and unceasing work in the A. S. M. E. and told how he had gained the respect and affection of all his professional associates. Mr. Wight accented the position held by Mr. Low in the hearts and minds of his fellow-editors and gave expression to the warm feeling they entertain for their "dean." All joined in wishing Mr. Low a long and happy future in guiding *Power* to new achievements.

F. A. E. S. Coal-Storage Committee Meets in Chicago

Means whereby large industrial establishments may start a policy of storing large quantities of coal during the slack summer months were discussed in Chicago on Monday and Tuesday at a conference of the coal-storage committee of the Federated American Engineering Societies. This committee met in the office of its chairman, W. L. Abbott, chief operating engineer of the Commonwealth Edison Company. The final report of the committee will probably go to the Federal Coal Commission about Dec. 1 for publication on Feb. 1. Much study has been devoted to the subject of a base line of coal production and the consumption curve. The solution of one phase of the coal problem is thought by the committee to lie in the storage of fuel. This storage should be made in the summer months when coal is easily mined and distributed by both rail and water.

In refuting the contention that coal in storage disintegrates and deteriorates Dean S. W. Parr of the University of Illinois told of his twelve years of experimenting with coal at Urbana. He thought that the question was not so much a matter of finding storage space as of educating those who should store it in the proper methods of handling the fuel with little loss in heat units. Reports were presented by W. J. Jenkins, vice-president Consolidated Coal Company, on mine storage; E. S. Nethercut, secretary Western Society of Engineers, on the development of storage possibilities in Chicago; R. V. Norris, consulting engineer, on anthracite storage; R. F. Walker, dean of the School of Engineering, University of Kansas, and O. P. Hood, chief engineer United States Bureau of Mines.

Program of Bedford Springs Convention

Among the features of the convention of the Pennsylvania Electric Association to be held at Bedford Springs, Pa., on Sept. 5-8, in addition to reports from the various committees of the Technical, Commercial and Public Relations Sections, will be addresses by W. H. Johnson, president National Electric Light Association; E. A. Hirschman, secretary York (Pa.) Chamber of Commerce; J. S. S. Richardson, director Pennsylvania Public Service Information Committee, and by W. D. B. Ainey, chairman; Herbert Snow, chief engineer, and G. S. Call, chief of Bureau of Statistics and Accounts, of the Pennsylvania Public Service Commission.

At the commercial session on Friday these papers will be presented: "New-Business Policies with Special Reference to the Wiring of Old Houses," by M. C. Huse, Philadelphia Electric Company; "Rural Lines," by W. H. Horton, Jr., West Penn Power Company; "Store Lighting," by N. E. Underwood, National Lamp Works.

Outline of Michigan Association Program

With the electrical industry of Michigan pushing an expansion program in excess of $25,000,000, the greatest in its history, the annual convention of the Michigan Electric Light Association, to be held at Grand Rapids on Sept. 18-20, assumes greater importance than ever before. The training of metermen will be reviewed by Prof. Benjamin F. Bailey, head of the department of electrical engineering, University of Michigan, who will tell of the work at the meter school. Rural-line extensions will be discussed by G. C. Neff of Madison, Wis., and J. C. Martin of Chicago. M. K. Toeppen, engineer of the Public Utilities Commission, will deal with questions which have been raised about the standards of service put into effect by the commission. R. C. Longhead, chief engineer of the Michigan Inspection Bureau, will discuss "Wiring on Customers' Premises"; B. L. Huff, distribution engineer for the Consumers' Power Company, Jackson, will talk on "Overhead-Line Construction"; the advisability of forming an electrical league in Michigan will be presented by C. J. Litscher of Grand Rapids, and George Opp, safety engineer for the Detroit Edison Company, will deal with accident prevention and demonstrate the prone-pressure method of resuscitation.

Laguna Bell 220-Kv. Substation Placed in Service

The new Laguna Bell 220,000-volt outdoor receiving substation of the Southern California Edison Company, described in the ELECTRICAL WORLD for March 31, page 766, was placed in active service on Aug. 2. The station is a short distance southwest of Los Angeles in the center of the company's industrial load. All equipment is out of doors, on a plot of ground about 350 ft. wide and 600 ft. long, with the exception of a 30,000-kva. synchronous condenser and the switchboards for operating the station. Both of the Big Creek transmission lines, which were placed in operation at 220,000 volts on May 6 last, have been extended from the original terminus at Eagle Rock substation to Laguna Bell, a distance of 30 miles. Two banks of 220,000/60,000-volt transformers, each having a bank capacity of 60,000 kva., feed into a 60,000-volt bus, from which there are in all thirteen 60,000-volt outgoing feeders.

The Laguna Bell substation is unique in that it is the first 220,000-volt substation to be placed in service and because of the unusual type of bus construction. The bus consists of 4-in. iron pipe mounted on pillar insulator posts set on concrete pedestals with no overhead steel structure. The Laguna Bell station was completed at a cost of approximately a million dollars and will serve as an important distribution point for power from the Big Creek plants and for the rapidly growing industrial load in the vicinity of Los Angeles.

Milan R. Bump Made Chairman of Joint Committee

Meetings of executive and other committees of the various sections of the National Electric Light Association were held at the New York headquarters, beginning Friday, Aug. 24, and continuing through this week. Among the most important of the meetings was that of the Joint Committee for Business Development on Thursday, presided over by Chairman E. W. Lloyd and devoted to the discussion of reports covering the year's work.

S. M. Kennedy, vice-president of the Southern California Edison Company, recommended to the committee a serious study of the problem of local merchandising. He related in detail the experience of the Los Angeles central-station company in discontinuing some years ago the sale of household appliances in the interest of local contractors and dealers. The expectation that this would spur this branch of the industry to greater activity in merchandising has been disappointed. This year from 35,000 to 40,000 residential consumers will be added to the lines of the Southern California Edison Company, forming a large potential market for appliances, but nobody is going after them. The problem thus created is of serious importance to the industry, Mr. Kennedy said, and a generally approved policy concerning the proper position of the central station in marketing these devices must some day be determined.

Owing to the inability of Mr. Lloyd to give the time necessary to the discharge of the chairman's duties, the nominating committee named for that office Milan R. Bump, in whose administration as president of the N. E. L. A. the Joint Committee was launched, and he was unanimously elected.

Commission Will Hear Louisville Again

Execution of Permit to Hydro-Electric Company Delayed Till Sept. 6 —Power and Pulp Project in Alaska Favored—Contest Over 125,000-Hp. Development on New River

A LETTER has been received by the Federal Power Commission from the Mayor of Louisville, Ky., expressing surprise that action had been taken by the commission in the conflicting applications for a permit to develop power at the proposed government dam at the Falls of the Ohio near that city without opportunity having been given to hear more from the municipality. Inasmuch as the Louisville Hydro-Electric Company did not promptly accept its preliminary permit, opportunity for delay was given. The Mayor has been informed by the commission that it will hold up execution of the preliminary permit until Sept. 6 to afford opportunity for the municipality to make a further showing.

Alaskan Projects

The Forest Service has sold a large block of timber in the Cascade Creek region of Alaska to the highest bidders, who were Hutton, McNear & Dougherty. This firm holds a permit from the Federal Power Commission for a pulp and power project on Cascade Creek, which proposes an ultimate development of approximately 30,000 hp. and is one of the largest and best power projects in Alaska. Application for a license has been before the commission about seven months, action having been withheld pending completion of the sale of the timber. There is now nothing to delay the granting of the license, and it is anticipated that this action will be taken at the next meeting of the commission.

Another power project in Alaska which promises to go through is that of the Alaska Mineral Development Company on Bradford Canal. This company is affiliated with the Guggenheim interests. The project as originally planned, however, conflicted with the plans for the preservation of fish, and the permittee is applying to the commission for an extension for one year to enable it to complete modified plans which will be satisfactory to the Bureau of Fisheries of the Department of Commerce. The extension probably will be granted.

Conflict Over New River

The Federal Power Commission has written to the Appalachian Power Company and the Norfolk & Western and Chesapeake & Ohio railroads, which entered protests against granting the application of the West Virginia Power Company, a subsidiary of the Virginian Power Company of Charleston, that the engineering staff proposes to recommend granting the application to the West Virginia company for its proposed project on New River. The application was protested on the ground that the development would drown out the Appalachian's proposed Anderson Falls project and would put 20 ft. of backwater on the Glen Lyn steam plant of the Appalachian company and that the railroad beds would be flooded by the proposed reservoir. The commission's engineering staff takes the position that the project of the West Virginia company is more comprehensive and better than the Anderson Falls project and that the question of damages from backwater effect is one to be settled when the detailed surveys have been carried out. The project of the West Virginia

Power Company contemplates an estimated development of 125,000 hp.

The Governor of Arizona has written the commission asking that a date be fixed for a conference with a committee from Arizona to go over the Girand application and the general question of development of the Colorado River. As this would open a new phase in the effort to bring about a compact between the states concerned in developing the Colorado River, much interest attaches to the move.

Hydro-Electric Development in the Maritime Provinces

Work is progressing favorably on the Malay Falls development on the East River at Sheet Harbor, near Halifax, Nova Scotia, according to United States Consul-General Gunsauls. The initial installation of 5,600,000 kw.-hr. a year is being increased to 8,000,000 kw.-hr. The towns of New Glasgow and Trenton, which are to be supplied from this development, have voted for public ownership of their distribution systems. Stellarton is also to be served and will probably also vote for public ownership. Investigations have been made by the Nova Scotia Power Commission of plans for supplying the town of Truro with electrical power. The town of Amherst and neighboring places are considering entering into a contract for power from the Economy River in Cumberland County.

In New Brunswick the proposal that the province begin development of the Grand Falls of the St. John River, perhaps the largest cataract in inhabited territory east of the Niagara Falls, is being constantly urged. The town of Campbellton, faced with the necessity of soon enlarging its steam generating plant, is pressing actively for the production of hydro-electricity. The provincial government has at its command a million dollars for beginning work on the development if it decides to do so before the next session of the Legislature. The Premier of the province is known to be taking an active interest in the project, but his plans have not yet been announced.

New Atlantic Cable Landed at Far Rockaway, N. Y.

The American end of the new Atlantic cable of the Commercial Cable Company was successfully landed at Far Rockaway, N. Y., this week for connection with the cable station there. A heavy surf caused some difficulty and delay, one of the ropes used to haul the cable from the buoy to which it had been attached a few hundred feet from shore breaking under the strain. The other end of this section of the cable will be landed at Canso, Nova Scotia. From there the cable will be laid to the Azores Islands, connection thence being made with Waterville, Ireland, and from there with London. A new cable from the Azores to Havre, France, will be in place by the end of the year. This is the first Atlantic cable laid since 1910, and it will give the Commercial Cable Company its sixth transatlantic circuit. The total cost exceeds $15,000,000. The new cable will be the longest and fastest between America and Europe. It will have a capacity of 1,200 letters a minute—600 in each direction.

Prof. Michael I. Pupin of Columbia University, who is consulting engineer for the Mackay companies, made a short talk to guests of President Clarence H. Mackay who assembled at Far Rockaway about the comparative values of the radio and cable in the development of international communication systems. "The cable," said Professor Pupin, "will be the great carrier of business transactions in the future. The radio will in no way interfere with it, as it will not be so fast and will not be so trustworthy. The cable is the working tool of business. It transmits clearly and accurately the message, which is of particular service to business. It works whether there is a storm at sea or on land. Nothing short of an earthquake or a great electrical disturbance can break in on its performance, and that only for a short time."

Utility Financing Dull During August

ELECTRIC light and power utility issues to the amount of $48,507,800 were offered during the month of August. This figure denotes relatively light financing in comparison with the large amounts offered in the earlier months of the year, but compares favorably with July, when the total reached was only $23,080,000. The offerings were small in number—thirteen—but the two ten-million-dollar issues, the Cleveland Electric Illuminating Company's preferred stock, series of 1923, offered at par, and the Milwaukee 6 per cent gold bonds, helped to swell the volume. The average yield dropped from 6.58 in July to 6.30. Seven of the offerings represent applications for strictly new capital, two are for refunding purposes and four are for both refunding and capital expenditures.

Undoubtedly the security market is dull, but this seasonal slump is a normal condition. It is reported in financial circles that some large public utility issues are in prospect but that they are being held back pending a more active interest in the investment security market upon the close of the vacation period. That the electric light and power industry is at present enjoying a period of sound prosperity is evidenced by the fact that reports covering the total output of the central stations of the country for six months ended in June indicate an increase of 25 per cent over the same period last year.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN AUGUST

Name of Company	Amount of Issue	Period, Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Cleveland Electric Illuminating Co.	$10,000,000	..	Cumulative not-voting preferred stock, series 1923	Additions and refunding	6	100	6
Ottawa & Hull Power Co. (Ont.)	1,500,000	..	Cumulative preferred stock	Additions	7	99*	.....
Danbury & Bethel Gas & Electric Light Co. (Conn.)	600,000	25	Mortgage gold bonds, series A	Additions	6	100	6
North American Edison Co. (N. Y.)	8,000,000	25	Secured sinking-fund gold bonds, series B	Refunding	6½	98½	6 63
Oklahoma Gas & Electric Co.	2,100,000	3	Mortgage notes	Refunding and acquisition of control of another property	7	98¾	7 50
Alabama Power Co.	3,000,000	28	First mortgage lien and refunding gold bonds	Additions and extensions	6	99	6 07
Central Connecticut Power & Light Co.	300,000	5	Gold coupon notes	Construction and acquisition of stock	7	100	7
Dallas Power & Light Co.	1,000,000	26	First mortgage gold bonds, series A	Additions and extensions	6	100	6
Los Angeles Gas & Electric Corp.	4,000,000	19	General and refunding mortgage gold bonds, series G	Additions	6	99½	6.05
Ottawa Light, Heat & Power Co. (Ont.)	1,500,000	..	Cumulative preferred stock	Refunding	6½	100	6.50
Staten Island Edison Corp. (N. Y.)	3,807,800	30	Refunding and improvement mortgage gold bonds	To retire floating indebtedness and acquire $700,000 par value of underlying bonds	6½	99	6.60
Indiana Electric Corp.	2,700,000	30	First mortgage gold bonds, series B	Construction	6½	99	6.57
Milwaukee Electric Railway & Light Co. (Wis.)	10,000,000	30	Refunding and first mortgage gold bonds, series C	Refunding and to reimburse for additions	6	98½	6.10
Total	$48,507,800						

* Carrying a bonus of 25 per cent common stock.

Seattle's New Substation

lectrical Apparatus for the Receiving End of Skagit River System Under Order

WITH its Skagit River development well under way, the city of Seattle has begun the erection of a large substation, known as the North substation, to serve as the receiving end in the city for the development. The new station will be in a residential district and is designed to harmonize with its surroundings. There will eventually be installed in it a maximum of six banks of transformers with the necessary synchronous condensers and switching equipment.

The initial installation will include the equipment for one incoming transmission line at 154,000 volts, one transformer bank and one 15,000-kva. synchronous condenser. An order for this apparatus has been placed with the Westinghouse Electric & Manufacturing Company and it is now in course of construction. An electrostatic glow meter will be used for synchronizing on the 154,000-volt side. The stepdown transformer bank has three 10,000-kva. transformers with tertiary windings. Both the 154,000-volt and 26,000-volt lines are connected with permanently grounded neutrals. The 26,000-volt side is connected to a bus section on which there are three feeders. In the future each transformer bank will have a 26,000-volt bus section, all the sections to be tied together through reactors. At the present time two sections with a total of six feeders will be tied together without reactors and will be fed from the one transformer bank. The tertiary windings of the transformers are connected in delta at 6,300 volts and are connected to the 15,000-kva. synchronous condenser wound normally at 6,600 volts. Taps are brought out of the transformers for starting the condenser.

The high-tension oil circuit breakers are type G-2 400-amp., 154,000-volt; the 26,000-volt breakers are type CO-2, 1,200 amp., with mufflers, and the breakers for use with the 6,600-volt condenser are type CO-11, 1,600 amp., 25,000-volt. The auxiliary equipment consists of a 300-kva. transformer bank, a 100-kw. motor-generator set to be used for an extra exciter, for operating a crane or for charging the storage battery in an emergency; a 7½-kw. battery-charging set, and a sixty-cell storage battery for control purposes.

A type D-3 benchboard having a relay board in the rear with grill work at each end will be supplied. This desk will be used for controlling the condenser and the incoming line and is drilled for future apparatus for controlling the second line and the tie breaker between the lines. Two switchboards back to back with grill work between will be provided for controlling the 26,000-volt feeders and the voltage regulator equipment for the condenser.

There will also be a temperature-indicating board for indicating the temperature of the coils in the condensers and the temperatures in the individual transformers; a station service board for controlling the storage battery, station light and power, a spare motor-generator set and other miscellaneous circuits; a field control board, and a crane panel. Differential protection will be provided for the condenser and for the entire transformer bank. The 154,000-volt incoming line will be protected with type CR relays and a ground relay.

Acquisition of Superior (Wis.) Plant by City Halted

Efforts by the city of Superior, Wis., to acquire the property of the Superior Water, Light & Power Company (see ELECTRICAL WORLD, March 31, page 766) received a setback last week when the United States District Court handed down a decision denying the city's motion to dismiss the injunction proceedings started by the attorneys for the utility permanently to restrain the city and Railroad Commission from further action. Under this ruling the proceedings for the acquisition of the utility properties have been halted, though the case will still be in the courts for some time.

In denying the motion to dismiss the injunction proceedings the court said:

"It is an elementary rule of the law of eminent domain, and the proceedings in question are undoubtedly of that nature, that before title to property condemned may pass compensation must be paid or tendered. Where the state or municipality condemns, this rule is relaxed on the theory that the state or municipality is obligated to pay and all the taxable property therein is pledged to secure the former owner his compensation and he is thus sufficiently secured. But in this case, according to the bill, the city could not obligate itself nor be obligated to pay the compensation found. Hence the reason underlying the relaxation of the general rule is wanting and it seems clear that the general rule ought to apply. Clearly the uncertain result of the future issuance and attempted sale of bonds under the provisions of the Nye law does not afford to complainant that present security to which it is entitled for present taking of its property. Quite certainly the bill presents on its face a case where the due process clause of the Fourteenth Amendment to the federal Constitution is violated."

In reply to a petition to make this injunction permanent the city admits that on March 19, 1923, its financial condition was not such as would warrant the floating of a bond issue for the purchase of the properties in issue, but maintains that the city is at the present time "fully able to obtain sufficient funds to pay the amount of compensation which the Railroad Commission might fix on the plants" and that the city was able to do so at the time the award was made, on July 11, 1921.

Scramble for Wave Lengths

Communications Expert Tells Political Institute of Worldwide Contest Over Radio

SPEAKING before the annual political institute held at Williamstown, Mass., under the auspices of Williams College, which is participated in by well-known men of Europe as well as America, Walter S. Rogers, communications expert for the United States at Versailles, declared that private radio companies and numerous foreign governments are engaged in a general "scramble" for future monopoly of particular radio routes and wave lengths. The problem of priority rights, he said, has arisen in international as well as in domestic transmission by radio and presents a situation full of complexity.

"The problem that particularly confronts the United States is in reference to the wave lengths that are usable for transoceanic communication," Mr. Rogers asserted. "The number of wave lengths available for such communication is relatively limited, and in truth there is a scramble going on as between private companies and governments for obtaining, or rather making use of, as many wave lengths as possible, so that when this problem reaches the state of serious international consideration people can go in and assert that they have already established basic rights.

"Just as here in the United States we have not worked out legislation to determine the ownership of wave lengths, so internationally there is no agreement between the powers as to ownership of wave lengths employed in international communication. A conference was held in Washington in the fall and winter of 1919 and 1920 to deal with the subject, and one of the serious problems was the question as to who ultimately owns the right to use space for communication purposes. The delegates from the five powers that participated in the conference worked on the theory that the governments taken together held this ultimate right and that they might get together and allocate the various wave lengths for particular purposes and as between themselves for special services.

PRIVATE AND PUBLIC INTERESTS

"The private radio interests throughout the world fought the conception, because there is no question that certain private radio companies believed that by something analogous to what we call 'squatter's' rights they could obtain an actual out-and-out ownership of the right to use wave lengths. They do not want to get the right to use wave lengths through a license from any government or as a result of any international agreement. They want simply to acquire these rights complete. We cannot foresee the possible development of the transmission of energy through space, and really great stakes are being gambled for."

Brief News Notes

Kansas City Company Supplies Power for Fish Hatchery.—The Kansas City Power & Light Company has just completed a transmission line to supply electric service at the fish hatchery now in process of construction in Swope Park. The water used in this hatchery will be taken from the Blue River by an electrically driven centrifugal pump with a capacity of 1,000 gal. per minute.

McGraw-Hill Editors to Give Radio Talks.—The first of four radio talks to be given by editors of the McGraw-Hill Company publications in September will be made on Wednesday night, Sept. 5, by Earl E. Whitehorne, commercial editor of the ELECTRICAL WORLD. Mr. Whitehorne's subject will be "Who Has More Slaves than Pharaoh?—A Talk on Electricity."

"Institute News" Makes Its Appearance at Madison.—The *Institute News*, published by the Institute for Research in Land Economics and Public Utilities, of which Dr. Richard T. Ely is director, is being issued from the headquarters of that organization at Madison, Wis., to further the research which is indicated in the name of the body. Benjamin F. Wigder is editor.

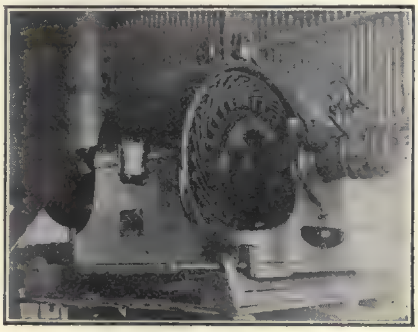
The Tombigbee as a Power Site.—Engineers of the State of Mississippi, after a superficial survey of the Tombigbee River in the vicinity of Columbus, assert that an ideal site for water-power development on the stream exists 3 miles north of that city at Plymouth Bluff. The engineers are so impressed with the site and its natural advantages that they have decided to make a minute and complete survey of the site.

Massachusetts Public Utility Law Compilation.—A compilation of the laws of Massachusetts relating to electric and gas companies is being published in a limited edition by Allan Brooks, assistant secretary of the Department of Public Utilities, State House, Boston. The compilation includes the law relating to the department's organization, duties and functions and includes various amendments to public utility statutes, including those passed at the 1923 legislative session.

Des Quinze Power Company Building Line to Porcupine Gold Mines.—The Des Quinze Power Company, a subsidiary of the Northern Canada Power Company, which is developing 20,000 hp. on the Quinze River, Quebec, has appropriated $1,500,000 for the construction of a transmission line from its power plant to the Porcupine gold fields, 125 miles distant. This line will, it is hoped, be completed by next March.

Asheville Light & Power Purchases North Carolina Electrical Power.—At a price understood to be $500,000, the Asheville (N. C.) Light & Power Company has purchased the properties of the North Carolina Electrical Power Company, also of Asheville, these properties including electric generating stations at Marshall, Big Ivy, Craggy and Owenby. Improvement and extensions are contemplated.

A Veteran Westinghouse Motor.—After twenty-seven consecutive years of service in the Sacramento shop of the Atchison, Topeka & Santa Fé Railroad a 15-hp. motor manufactured by the Westinghouse Electric & Manufacturing Company still stands up to its daily task. The machine, which is a Westinghouse Tesla type B alternating-current induction motor, with a rating of 1,200 revolutions per minute, three-phase, 60 cycles, 500 volts, was installed in 1896, only two years after this type of motor was developed. It has a rotating primary and a stationary secondary provided with a series of U-shaped resistance grids bolted to the rear ends



of the secondary bars for starting duty. When the motor is up to speed the secondary is short-circuited by moving the large lever at the top of the motor frame, which is connected to the large copper ring visible inside at the top of the frame. This ring mounts a number of fingers which make contact with the square bosses at the upper ends of the cross-connections.

Two More Oklahoma Municipal Plants Give Up.—The citizens of Cement and Minco, Okla., have voted to sell their municipal electric plants and grant twenty-five-year franchises to the Chickasha Gas & Electric Company. The vote in Minco was 132 to 17 and in Cement 143 to 10. The company will pump the city water and light the streets in both towns. The present plants will be closed down and service will be supplied from transmission lines.

A 60,000-Hp. Utah Project.—Supplementary to several irrigation filings made by A. H. Christensen of Salt Lake City is one for the storage of 150,000 acre-feet of water from an unnamed branch of Ferrom Creek, in Emery County, with which he expects to develop 60,000 hp. of electrical energy. The application is somewhat lacking in details, but the length of the diversion canal is given as 428,260 ft., slightly over 80 miles. Two power plants are proposed, one in Oak Creek, which will operate under a head of 2,100 ft., and one in Salt Creek Canyon, to operate under a head of 900 ft.

Byllesby Buys River Falls Power Company.—The River Falls Power Company, owning and operating electric light and power properties in Prescott, Wis., and Hastings, Minn., has been acquired by H. M. Byllesby & Company and will be consolidated with the Northern States Power Company system. This company has been serving a combined population of six thousand in the two places. They formerly were supplied with electrical energy by the Northern States Power Company on a wholesale basis.

Development of St. Francis River, Quebec.—Construction work on the Hemmings Falls development of the Southern Canada Power Company is about to be undertaken by the Foundation Company Limited of Canada. It is intended to develop 30,000 hp. at this site. The plant will be the second in a chain of six to be developed by the Southern Canada Power Company on the St. Francis River, to have an estimated aggregate capacity of 150,000 hp. More than half the rated output of the Hemmings Falls plant has already been sold, and it is thought possible that its entire capacity will be disposed of before operation begins.

Development of Hiwassee River.—Engineers of the North Carolina Geological and Economical Survey have just begun a complete survey of the Hiwassee River and its tributaries in order to obtain detailed information as to the storage possibilities of the river and work out a comprehensive plan for its development. As soon as these field data are collected they will be compiled and a comprehensive report along with plans for development of the river published. It is estimated that the section of the river in Cherokee and Clay Counties, N. C., is capable of developing 500,000 hp. of electrical energy. It is therefore one of the largest undeveloped streams in that section of the country.

A. B. Stickney Wins Westinghouse Turbine Design Prize.—The prize of $500 offered by the Westinghouse Electric & Manufacturing Company to the senior mechanical engineering student at the Sheffield Scientific School of Yale University producing the best turbine design along a combined impulse and reaction principle has been awarded to Alpheus B. Stickney II, St. Paul, Minn. Mr. Stickney's design calls for a turbine rated at 3,000 kw. capable of 20 per cent overload, operating at a steam pressure of 220 lb. per square inch, with a speed of 3,600 r.p.m. A feature of the design is the fly-ball and spring-governor action which works an oil relay, thereby moving the piston-valve opening or closing the parts to the nozzle

blocks. The steam consumption is calculated at 14 lb. per kilowatt-hour.

Accident at Paris, Ky.—The power plant of the Paris (Ky.) Gas & Electric Company was almost demolished on Aug. 24, when the flywheel, without any kind of warning, broke into a score of pieces, tearing down the front and rear brick walls of the power house and knocking a large hole in the roof. The wheel, which was 14 ft. in diameter and 26 in. in width, was constructed of cast iron. One piece, which was estimated to weigh at least 1,000 lb., was hurled a distance of 300 ft. through the side wall and floor of a near-by residence. This piece barely missed an occupant of the house who was lying in bed ill. R. B. Hayes, engineer of the plant, was thrown outside the engine-room door and rendered unconscious for a short time. Others in the engine room escaped injury. The accident, which was caused by the breaking of a drive belt, caused $10,000 damage.

The "Telehor," a Hungarian Invention.—After many years of experiment a Hungarian electrophysicist at Budapest has announced the invention of an electric "far-seer." The apparatus consists of two electromotors making 2,000 revolutions per minute, working independently of each other. For their synchronization a special apparatus has been constructed in connection with a metal relay which reflects the trivial resistance of the selenite plates as corresponding luminary alterations at the reproduction station. This metal relay is said to be of such an extraordinary sensitiveness that it registers 50,000 variations of the faint influences of the light per minute. The apparatus can, it is asserted, transmit pictures over long distances at a speed as great as ten per minute. Pictures, manuscripts, documents, signatures, etc., can be exactly reproduced.

Chamber of Commerce Establishes Bureau of Agriculture.—A move that is likely to have a bearing upon the efforts to take electricity to the farmers has been made by the Chamber of Commerce of the United States through the establishment of a Bureau of Agriculture under the management of William Harper Dean of Washington, formerly with the United States Department of Agriculture. "In keeping with the general policy of the national chamber," says the announcement, "the new bureau will make no effort to formulate on its own initiative any plans to offer for adoption by either agriculture or other industries, but rather to serve as an investigator of their common problems and to offer the results of these studies for such action as they may seem to warrant."

Oklahoma Company's New Plant at Harrah.—Construction of the Oklahoma Gas & Electric Company's 20,000-hp. plant on Horseshoe Lake, a mile north of Harrah, Okla., has been greatly handicapped by the fact that the site is above quicksand, necessitating the driving of concrete piles down to bed rock, but notwithstanding this the work is progressing rapidly. A huge coal pit is being sunk 40 ft. below the surface of the earth. The company has purchased a tract of 600 acres and as soon as the dam is finished will stock the lake with fish, construct summer cottages and make a summer resort for the benefit of its employees. The 1923 budget of the company for this plant and the similar one under construction at Muskogee, together with other improvements to the service now given to seventy-two towns and cities, has reached $10,000,000.

Electrical Progress in Yucatan.—The more important cities and towns contained in the Progreso (Mexico) Consular District have electric plants, principally for the furnishing of light, and incidentally for providing power to small industrial enterprises, according to a report to the Commerce Department from Consul O. G. Marsh, Progreso. Each plant is confined in its operations to its own immediate city or town. The complete absence of water power, the high cost of fuel—charcoal, wood and crude oil—the great area of the individual hemp plantations and the distances between cities and towns have limited the electrical development of this district. Its largest plant is in the city of Merida, the capital and largest city of the State of Yucatan. Merida has a population of 65,000 and is the principal market for electrical supplies. This plant, which has a capacity of 2,000 kw., supplying both direct and alternating current, furnishes light for the city streets and about five thousand houses and power for about three hundred electric motors.

Governing Water Release.—A report soon to be issued by the federal Bureau of Reclamation under the title "High-Pressure Reservoir Outlets" will describe the outlet works of the Arrowrock, Elephant Butte and Shoshone dams and the way in which the outrush of water is controlled by gates and valves of unusual design and capacity. There are in successful operation in the great government dams massive valves between 4 ft. and 5 ft. in diameter at the nozzle, operating under heads of 100 ft. to more than 200 ft. and controlling with perfect ease and security the tremendous force of the water as it is released from the reservoirs. The Arrowrock Dam, on the Boise River, Idaho, is supplied with no less than twenty needle valves, each with a nozzle diameter of 58 in., operating under a maximum head of 110 ft.; the Elephant Butte Dam, on the Rio Grande in New Mexico, contains four valves, each with a nozzle diameter of 60 in., operating under a maximum head of 120 ft., and the Shoshone Dam, on the river of the same name in Wyoming, has five such valves with nozzle diameters of 58 in., 48 in. and 36 in. respectively, operating under maximum heads of 220 ft. and over.

Associations and Societies

Electric Power Club.—The fall meeting of the Electric Power Club will be held at the French Lick Springs Hotel, French Lick, Ind., on Nov. 19-22.

National Safety Council.—The twelfth annual congress of this body will be held at the new Statler Hotel, Buffalo, on Oct. 1 to Oct 5. Sixty sessions of special and general interest will be held.

Institute of Radio Engineers.—This association will meet on Wednesday, Sept. 5, at the Engineering Societies Building, New York, when a paper on "Recent Developments in High-Vacuum Receiving Tubes," by J. C. Warner of the General Electric Company, and one on "Radio Transmission Measurements on Long Wave Lengths," by H. H. Beverage and H. O. Peterson of the Radio Corporation of America, will be presented.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

New England Division, N. E. L. A.—Swampscott, Mass., Sept. 5-8. Miss O. A. Bursiel, 149 Tremont St., Boston.

Pennsylvania Electric Association — Bedford Springs, Pa., Sept. 5-8. H. M. Stine, 212 Locust St., Harrisburg, Pa.

Electrical Supply Jobbers' Association, Pacific Division—Gearhart, Ore., Sept. 5-7. A. H. Elliot, 502 Flatiron Bldg., San Francisco.

Pennsylvania State Association of Electrical Contractors and Dealers—Wilkes-Barre, Sept 12-13. M. G. Sellers, 15-18 Sansom Street, Philadelphia.

Conference of Electrical Leagues—Association Island, Sept. 16-19. Society for Electrical Development, New York.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 17-19. O. A. Weller 900 15th St., Denver.

Association of Edison Illuminating Companies—Dixville Notch, N. H., Sept. 17-21. P. S. Millar, 84th St. and East End Ave., New York.

Michigan Electric Light Association—Grand Rapids, Sept. 18-20. Herbert Silvester, Detroit Edison Co., Ann Arbor.

Illuminating Engineering Society—Lake George, N. Y., Sept. 24-28. S. G. Hibben, 29 West 39th St., New York.

Association of Iron and Steel Electrical Engineers—Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

International Association of Municipal Electricians—Reading, Pa., Sept. 25-28. C. R. George, Houston, Tex.

Great Lakes Division, N. E. L. A.—French Lick Springs, Sept. 26-29. R. V. Prather, 305 Illinois Mine Workers' Bldg., Springfield, Ill.

Indiana Electric Light Association—French Lick Springs, Sept. 26-29. T. Donahue, Northern Indiana Gas & Electric Co., Lafayette, Ind.

American Electrochemical Society—Dayton, Ohio, Sept. 27-29. Colin G. Fink, Columbia University, New York.

American Institute of Electrical Engineers—Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

Empire State Gas and Electric Association—Lake Placid, N. Y., Oct. 8-9. C. H. B. Chapin, Grand Central Terminal, New York.

Association of Electragists International—Washington, Oct. 8-13. Farquson Johnson, 15 West 37th St., New York.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Oct. 19-20. Herbert Smith, Robson-Prichard Bldg., Huntington.

Commission Rulings

Municipal Plant Must Be Self-Supporting in the Public Interest.—In fixing rates for the municipal electric plant of Brookings the South Dakota Board of Railroad Commissioners declared that sound public policy indicates and the public interest requires that rates for municipal service be reasonable in and of themselves and sufficiently high so that the business will be self-supporting. The commission added: "The property, being municipally owned, is exempt from assessment and taxation, and to that extent the tax burden is shifted to other property. It is possible that, in a proper case, we would find it necessary and in the interest of sound public policy to give consideration to the establishment of rates to be charged by the utility that would be sufficiently remunerative so that the municipally owned plant or business would compensate the public treasury to the same extent that would be the case were the utility property owned privately. That issue is not before us in this case, however, and therefore we express no opinion in regard thereto."

Why Should Utilities Be Denied Full Enhancement of Value?—In proceedings affecting the Indianapolis Water Company the Indiana Public Service Commission, speaking by Commissioner Van Auken, said: "Peculiarly enough, it is never contended that the owner of any other sort of property than utility property should be denied the benefit of the full enhancement of value which may have occurred. Just why public utility property should be considered worth no more than its original cost is not explained, neither is it explained why utility property should be singled out from all other classes of property and its value considered to be what may have been paid for it at some distant day in the past. In this case the commission must say, 'How many dollars represent the value of this property at this time?' and not, 'How many dollars represent this value at some time in the past?' So-called 'enhancement of value' may occur, first, when there is no change in the purchasing power of the dollar by reason of various circumstances such as the natural increment of the land values in a growing city, and, second, by a decrease in the purchasing power or value of the dollar. . . . It is established by the evidence and is a matter of common knowledge that there has been such an enhancement of value during the course of the last few years. In other words, it takes a different number of dollars to measure the value of a property now from what it did ten years ago, although the inherent value may be the same. It is urged that the value of a public utility now is the number of dollars actually invested in the property. There is no reason why such a rule should be applied to public utility property, when it is never applied to the measuring of the value of any other kind of property. Any individual would be extremely aggrieved if it were suggested to him that the value of his farm or factory now should be measured and fixed on the basis of the dollar of ten or twelve years ago. It is not done, and the courts from the Supreme Court down have uniformly held that the purchasing power of the dollar at the time of the inquiry is material—that is to say, that the cost of reproducing the property at the time of the inquiry is an important element to be considered."

Recent Court Decisions

Discontinuance and Non-Payment.—Holding that the evidence showed the Springfield (Mo.) Gas & Electric Company to have waived its legal right to require written notice to discontinue service to the Landers Theater, the Springfield Court of Appeals reversed a judgment awarded in a suit of the central-station company against the Southern Surety Company of Oklahoma which was based on a card contract duly signed by an admittedly authorized agent. The Court of Appeals held that the contract was invalidated by the subsequent understanding between plaintiff and defendant. (250 S. W. 78.)*

Only Public Service Company May Have Review of Certain Questions.—Sustaining a finding for the defendant in City of Everett vs. Department of Public Works, the Supreme Court of Washington State refused to decree a review of the department's findings and orders affecting telephone rates, saying that, under the Washington statutes, while a complainant may have a review as to some findings or orders made by the regulating body of the state, only the public service company concerned may have a review of questions directly affecting the valuation of its property for fixing rates. (215 Pac. 1045.)

Powers of Ohio Commission. — The home rule provision of the state constitution is not effective to deprive the commission of its statutory jurisdiction in cases where the rates enacted by a municipality have not been accepted by the utility company and the contractual relation therefore has not been established, declared the Supreme Court of Ohio in City of Lima vs. Public Utilities Commission, a case in which natural-gas rates were concerned. Where a city by ordinance has provided that a company may fix and collect the minimum charge per month from each consumer, and the company has appealed from such ordinance to the Public Utilities Commission, the minimum charge is part of the rate appealed from, and the jurisdiction of the commission over the subject of rates includes the rate on the minimum charge. (140 N. E. 147.)

Valuation Procedure in the Light of the Supreme Court's Decisions.—In approving the granting of an injunction to the Monroe Gas Light & Fuel Company against the enforcement of rates prescribed by the Michigan Public Utilities Commission, the United States District Court reviewed the points at issue in the light of the many recent decisions of the United States Supreme Court that bear on the question of confiscation through rate schedules fixed by regulatory bodies. The District Court found that the Michigan commission had followed the lines indicated as proper in the subsequently recorded opinion of Justice Brandeis in the Southwestern Bell Telephone case, but pointed out that the majority opinion must now control, with all its necessary implications. Testing the commission's order by this and other findings of the Supreme Court, the Michigan tribunal declared that the rate fixed, which upon the commission's own figures would bring a return of less than 5¼ per cent on reproduction cost, was clearly confiscatory. Said the court: "We must construe the majority opinion as the minority of the court interpreted it, viz., as holding that, where it stands not impeached or attacked otherwise than it was in the Southwestern Bell Telephone case, the reproduction cost is the dominating element in the fixing of the rate base; and if a commission which leaves it substantially unimpeached fails to give it that dominating effect, there is an error of law which the court must correct. The opinion in the Bluefield Water case tends to confirm this construction of the Southwestern Bell case. The rate base made by the commission was set aside because due regard had not been given to reproduction cost. . . . Nor do we find anything inconsistent with this view in the opinion in the Georgia Power case. It affirms only that the reproduction cost at the date of the inquiry is not necessarily controlling. . . . Our Court of Appeals suggested in the Louisville railway case that a three-year period was about as short as should be contemplated when a rate is fixed. Clearly the commission should look forward to such a period, and if there is anything before it from which it may draw a reasonable conclusion that the average cost will be higher or lower than the present cost, it may give due weight to that conclusion, subject, of course, to correction if the future demonstrates an error; but we do not understand that a commission can make or act upon a finding of this kind, express or implied, unless there has been evidence thereon and the utility has a chance to be heard."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

J. C. Martin Joins Middle West Utilities Company

J. C. Martin, who has been Western editor of the ELECTRICAL WORLD stationed at Chicago since 1920, has resigned to accept a position with the Middle West Utilities Company in its Chicago office. Mr. Martin enters on his new duties Sept. 1. Before joining the editorial staff of the ELECTRICAL WORLD he had been identified with the engineering organizations of central stations for seventeen years. He entered the utility field in 1903, when he joined the Cedar Rapids & Iowa City Railway & Light Company. After serving this company for eight years in nearly every department he became engineer with the Pacific Power & Light Company of Portland, Ore., and was soon made assistant to the chief engineer and subsequently chief engineer. In October, 1917, the Electric Bond & Share Company, which controls the Pacific Power & Light Company, sent Mr. Martin to Allentown, Pa., to take charge of engineering work for all its properties in that state. For two and a half years previous to assuming his editorial duties in Chicago Mr. Martin engaged in consolidation and construction work with these companies.

Mr. Martin, in addition to his editorial activities, has contributed the results of his experience in many other ways to the electrical industry. Among other things, he has been an active member of the rural-lines committee, the overhead systems committee and the inductive co-ordination committee of the N. E. L. A. and also a member of the protective devices committee of the A. I. E. E. His past experience in the operating field and his opportunities to observe the practices in a large number of companies during his editorial work will give him a particularly useful background in his new position, where his attention will be devoted principally to operating problems.

C. S. Woodward, secretary of the Iowa Electric Company, Cedar Rapids, Iowa, has in addition assumed the duties of treasurer of the company.

E. B. Smith, assistant to the general auditor of the Oklahoma Gas & Electric Company, has been made manager of the central division of the company, with headquarters at Sapulpa. Mr. Smith has been associated with the Oklahoma Gas & Electric Company since 1918, when he was transferred from Pueblo (Col.) to Muskogee as auditor there. A year later he became auditor of the local division at Oklahoma City, and in October, 1919, he was advanced to the position he occupied at the time of his recent promotion. Mr. Smith is succeeding R. C. Coffy, who has gone to Fort Smith, Ark.

A. M. Perry Becomes Western Editor of "Electrical World"

Allen M. Perry, who has been a member of the editorial staff of the ELECTRICAL WORLD since February, 1913, at present holding the title of engineering editor, has accepted appointment as Western editor of the paper and will henceforth have headquarters at its Chicago office. Before taking up editorial work Mr. Perry was

A. M. PERRY

in the operating department of the Grand Rapids & Muskegon Power Company, which was later absorbed by the Consumers' Power Company, and also had had some experience in the design of electrical equipment. Mr. Perry's first connection with the ELECTRICAL WORLD was in the Chicago office, where he spent about a year. During the years he has been in the New York office he has contributed with ability to all of the departments of the paper, specializing since 1917 in engineering features. He has built up a large and intimate acquaintance among engineers and others as well. He has always endeavored to have the engineering articles reflect active problems in the industry and in searching the field for best practices has made first-hand studies and established points of contact in at least thirty states of the Union. His accomplishments in his past work, added to his general experience and his eleven years' intimate association with all divisions of the electrical industry, form an excellent background for undertaking the broader editorial responsibilities of the Western editorship, where his work will cover activities in the entire industry throughout the territory of the Central States.

Mr. Perry is a graduate in electrical engineering of the University of Michigan. He is a member of the American Institute of Electrical Engineers and the Illuminating Engineering Society. For several years he has been a member of the Institute's transmission and distribution committee, and he has also been a member of the publications and reciprocal relations committees and of the New York board of managers of the Illuminating Engineering Society.

L. A. Safford, formerly manager of the Pacific Power & Light Company at Kennewick, Wash., has been made manager of the Walla Walla branch of that company to succeed Charles Walters, who recently went to Asheville, N. C., as vice-president and general manager of the light and power company.

Frank Wampler of Indianapolis has been appointed a member of the Indiana Public Service Commission by Governor Warren T. McCray to succeed Glenn Van Auken, whose resignation was accepted by the Governor to become effective Sept. 1. The new appointee was formerly vice-president and general manager of the Indiana Bell Telephone Company and is well known throughout the state.

W. H. Crutcher, for the past five years general superintendent of the gas department of the Oklahoma Gas & Electric Company, has been made manager of the eastern division as successor to Mr. Wilmarth. For thirty years Mr. Crutcher has been associated with the Byllesby organizations, and during that period he has consistently won promotion and accordingly assumed increased responsibilities, culminating in his selection as managing head of the eastern division with headquarters in Muskogee.

Karl Jorgensen, industrial engineer and accountant, who since 1919 has been engaged in system and organization work for the Commonwealth Edison Company, the People's Gas Light & Coke Company and other Insull companies in Chicago, has severed his connection with the Bureau of Commercial Economics of that city. Mr. Jorgensen will practice industrial engineering and public accounting with offices in Los Angeles. His first engagement will be a survey for the Southern California Gas Company.

John L. Harper, vice-president and chief engineer of the Niagara Falls Power Company, spent more than two months in Europe this summer, visiting France, Italy, Switzerland, England and Norway. Mr. Harper looked over several of the most interesting water-power developments of the different countries. In Norway he visited, among other places, Tyssedal and Sauda, where American capital is invested. Passing through some of the most beautiful parts of Norway, he had an excellent opportunity of seeing the possibilities

of the country from the point of view of the tourist as well as the hydraulic engineer. Mr. Harper sailed for home from Liverpool on Aug. 10.

Vern Capple is the new chief engineer of the Pontiac (Mich.) property of the Consumers' Power Company. Mr. Capple has been acting vacation relief man on the Au Sable River.

Erwin Humes of the distribution department of the Empire District Electric Company has been transferred to the position of power salesman at Elyria, Ohio.

W. J. Parker, formerly associated with the Fort Smith (Ark.) Light & Traction Company, has been made manager of the Oklahoma Gas & Electric Company at Sulphur, succeeding W. B. Christie.

Clair V. Merriam, power salesman for the Puget Sound Power & Light Company at Seattle, Wash., has been appointed sales manager of the Eastern Texas Electric Company, with headquarters at Beaumont, Tex.

J. T. Boifeuillet has been made vice-chairman of the Public Service Commission of Georgia, succeeding J. A. Perry. Chairman P. B. Trammell was re-elected for another term of two years.

Fred Brown, who has operated at the Charlotte substation and at the Jackson steam plant of the Consumers' Power Company, was recently transferred to electrical construction work at the new Saginaw River plant.

S. W. Winge, formerly superintendent of the municipal light plant at East Grand Forks, Minn., is now connected with the power and light department of the Indiana Service Corporation, Fort Wayne, Ind.

Harold W. Hahn, formerly sales manager for the Duplex Lighting Works of the General Electric Company, has become sales manager of Cox, Nostrand & Gunnison, Inc., illuminating engineers of Brooklyn, N. Y.

Carl J. Sittinger, who for the past four years has been associated in consulting engineering work with John A. Stevens of Lowell, Mass., is now engineer in the electrical division of Stone & Webster, Inc., Boston.

Howard E. Batsford is now field engineer with the Utica (N. Y.) Gas & Electric Company in charge of ordering material and constructing substations. During the past two years Mr. Batsford has been engaged in maintenance work as wireman.

L. M. Smith, assistant chief engineer of power houses for the Tennessee Coal, Iron & Railroad Company, Ensley, Ala., for the past three years, has resigned to become connected with the engineering department of the Alabama Power Company, Birmingham.

Edward S. Mansfield, superintendent of the operating bureau accounts department of the Edison Electric Illuminating Company of Boston, has been appointed chairman of the electric transportation committee of the New England Division of the National Electric Light Association.

W. G. Schmauder, formerly assistant general manager of the Texas Power & Light Company, has gone to Cuba, where he will assist in the operation of a number of electric plants. Lee Schneitter and C. B. Oliver, also formerly of the Texas Power & Light Company, have become identified with the same Cuban properties.

E. M. Breed, assistant manager of sales of the Pelton Water Wheel Company, has been appointed sales manager of the company, with headquarters in San Francisco. Mr. Breed has had wide experience in hydro-electric work, having been connected with the Pelton Water Wheel Company in various capacities for the past fifteen years.

W. S. Berry, who for a number of years has been sales manager of the Western Electric Company at San Francisco, has been made manager of the San Francisco office. Mr. Berry has a wide acquaintance among the jobbers on the Pacific Coast and has been active in the Electrical Supply Jobbers' Association in that section.

C. C. Hillis, prominent jobber of San Francisco, formerly vice-president of the Electric Appliance Company, is now the president and general manager. Mr. Hillis has taken an active part in the Electrical Supply Jobbers' Association and the affairs of the California Electrical Co-operative Campaign.

Merrill E. Otis has been appointed chairman of the Missouri Public Service Commission to succeed the late John A. Kurtz of Kansas City. Mr. Otis has been chief assistant to Attorney-General Barrett and is a native of Nodaway County. After graduation from the Missouri University he engaged in the practice of law in St. Joseph, serving as assistant city counselor and later as assistant prosecuting attorney of Buchanan County.

Thomas H. Dooling has been appointed manager of the automotive battery sales division of the New England branch of the Electric Storage Battery Company, with headquarters at Boston. Mr. Dooling has been connected with the company since 1903 with the exception of the period when he served in the United States Signal Corps on the Mexican border and in the war. Recently he was stationed in the San Francisco office of the company.

J. F. Roche has been appointed Chicago district manager of the Apex Electrical Distributing Company, following his resignation as advertising director of the Edison Electric Appliance Company. Mr. Roche was for a number of years associated with the Billings (Mont.) office of the Montana Power Company, where he was very active in developing the sales of electric ranges. From there he went to Butte as district manager of the company and subsequently joined the Edison Electric Appliance Company. In performing the duties of his new office Mr. Roche will handle sales for eight Western states.

Fred Garrison, formerly connected with the engineering department of the Southern California Edison Company, has recently joined the engineering department of the General Electric Company in the Los Angeles office as assistant to E. E. Valk. Previous to his association with the Southern California Company Mr. Garrison was connected with the General Electric works at Schenectady.

Granville Lyon, formerly connected with the securities department of the Wisconsin Power, Light & Heat Company of Madison, has been appointed manager of the utilities' securities department recently organized by the Eastern Wisconsin Electric Company at Fond du Lac, Wis. Mr. Lyon not only heads the new department but he will also handle this branch of the company's business in Wisconsin. The rapid growth in the securities business of the company necessitated the formation of a separate department to take care of the stock and bond sales under the customer-ownership plan.

James E. Miller of Chicago, formerly a consulting engineer with the General Engineering & Management Corporation of New York City, has been appointed trade commissioner of the Department of Commerce at Calcutta, India, according to an announcement made by Secretary Hoover. For several years subsequently to his connection with the General Engineering & Management Corporation Mr. Miller was engaged with the Westinghouse Electric & Manufacturing Company, covering engineering construction and sales in the United States, Canada, England, France, Russia and South America.

E. F. Strong of Cleveland has been appointed general manager of the Shelby Lamp Division of the National Lamp Works of General Electric Company, succeeding C. C. Skiles, whose resignation took effect July 31. The Shelby Lamp Division moved recently from Shelby, Ohio, and is now located in Buffalo, N. Y. Mr. Strong has been engaged in the lamp business since 1905. Since 1906 he has held positions of sales and factory manager of various sales divisions and plants of the National Lamp Works. His long and varied experience makes him eminently fitted for his new position.

E. J. Spencer, secretary-manager of the St. Louis Electrical Board of Trade, has resigned to become vice-president and general manager of the Brown & Hall Supply Company, St. Louis. John A. Laird has been selected to fill the secretary-managership of the board. Mr. Laird, who is a graduate of Washington University in electrical engineering, was engaged as mechanical engineer on the construction of the St. Louis waterworks and was connected with the water department of that city until 1917, when he enlisted for service in the war. Since the close of the war he has been associated with R. W. Morrison and W. S. McCall in public utility work, with offices in St. Louis.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Remove This Obstacle to Appliance Use

Standardization of Terminal Plugs Must Be Supported by General Introduction of Interchangeable Cords for Old Appliances

BY ERNEST B. SLADE
President Beaver Machine & Tool Company, Newark, N. J.

THE leaders of the electrical industry have recognized that the attachment cord is vital to the popularity of the household appliance. The cord is naturally the part that gives out first because it receives more handling, more abuse and more actual wear than any other part. It is the weak spot in almost every appliance, the first source of trouble to the central station and the manufacturer.

But in addition it has been and continues to be the chief source of inconvenience to the householder, the owner. Because the various manufacturers each wished to make his product distinctive, they each equipped their flatirons, percolators and the rest with their own particular type of connecting device at the appliance end of the cord. As a result there have been an endless variety of appliance plug fittings and cords that are purchased with one appliance but cannot be used on another. In a home there may be six appliances with six cords of various colors—perhaps several the same color—yet no two are interchangeable. This is all common knowledge, and because of this condition the N. E. L. A. wiring committee has been working toward securing the acceptance of a standard appliance terminal post, a standard plug design for the appliance end of the cord, and with some success, since already one style of round prongs and one style of flat prongs have been made standard for all. It is the first step to meet the simple obvious necessity to make electrical appliances easy to use with any cord in any home.

E. B. SLADE

KEEP APPLIANCES IN USE

There remain two things to do—first, to secure the universal adoption of a single interchangeable appliance terminal post and plug by all manufacturers, and second, to sell the idea of the importance of this interchangeability to the central-station companies and dealers who sell appliances into the home. This will eventually lead to the complete interchangeability of appliances. In the meantime, however, there remains to be reckoned with the large diversity of appliances now in the home. These require either a large diversity of appliance-end plugs or some kind of a plug that is interchangeable and fits any appliance, no matter what kind of terminals it has, and that is safe for use with all. There are today several such interchangeable cords available, and at least one of them has been formally passed and approved by the Underwriters' Laboratories for use with ordinary heating appliances.

It would seem that the first step toward complete facility in the use of household appliances would be the introduction into the homes of the people of the greatest possible number of these interchangeable attachment cords. About 3,500 central stations, or 60 per cent of the light and power companies, are now maintaining retail departments for selling electrical household appliances. It is safe to say that these 3,500 companies comprise most of the larger light and power stations. This remarkable increase in appliance selling by utilities is in recognition of the profit value of the retail sales, the income value of this residence load and the public relations value of appliances. However, too many light and power company executives interested in this end of the business do not go any further. They do not realize that in order to complete their job they must keep those appliances in use, and that the attachment cord is just as important as the convenience outlet in making their use easy.

CORD REPLACEMENT PROBLEM

Now the first thing that gives out on most appliances, as I have said, is the cord, and when that happens the revenue from the appliance stops. It is therefore of vital importance that all cords be maintained in service on all types of appliances that may be on the lines. The companies should be prepared to furnish replacement cords for any device, no matter where or when it happened to be bought—a very difficult thing when one considers the number of varieties of connecting plugs that this now requires.

The making up of "home-made" heater cords is all right for the little dealer who has lots of spare time and figures that his own labor in assembling the cord "costs nothing." However, the light and power company's accounting department will undoubtedly figure that it costs something for it to provide a man who is capable of properly assembling appliance cords.

The difficulty or inconvenience of the situation has been felt, and most heating appliance companies sell replacement cords complete for their appliances. This, however, in turn, is possibly only less inconvenient than having to make up the cords "to order," because it necessitates the central station carrying in stock

different cords for all the different appliances they are selling. This need, however, is now cared for by the interchangeable appliance attachment cord which the manufacturer supplies in attractive cartons ready to hand out to the customer without any delay or questions as to what he wants or what kind of an appliance he wants it for.

End Cord Trouble Now

The stage is set, therefore, for the gradual elimination of cord complications — first through the use of an interchangeable cord and then through the adoption of a standard terminal post and plug by all manufacturers, and eventually by the elimination of all the old appliances with "maverick" terminals, as they become worn out and are discarded. The question is what can be done to speed the clearing up of the confusing situation as it exists today. Obviously, the vital step is for all manufacturers of household appliances with detachable cords to standardize their plugs on the appliance ends. Then I believe that they and all their jobbers and dealers should in addition endeavor to sell to every customer into whose home a new appliance goes an interchangeable cord as well, so that if they already are using some other device requiring a different appliance-end plug, this interchangeable cord will at once establish interchangeability in that home.

Central-station companies also must be induced to sell interchangeable cords wherever they run into cord trouble. No stone should be left unturned to introduce as many of these interchangeable cords into the homes of appliance users as possible, that this element of inconvenience, this ever-present and persistent obstacle to the free use of appliances, may be eliminated for all time.

Effect Upon Credit of New Lines of Merchandise Such as Radio*

By A. F. Hearl

Secretary and Treasurer American Electrical Supply Company, Chicago

The manufacturing and exploiting of new lines of merchandise always confront the industry as an essential of progress. As washing machines, vacuum cleaners and other appliances were added to our regular line of merchandise we faced new ideas in credit extension and relations with our customers were disturbed by departure from old and established credit terms. In our attempt to speed up and increase volume in sales of new appliances our sales departments succeeded in making time-contract and deferred-payment plans appear very attractive to the purchaser, who in many cases had no capital but would buy anything and everything that he could get "on time."

Our contractor customers became dealers and merchandisers. We helped them put on big sales campaigns, spent large sums for advertising, and before the credit department realized it were extending credits of $1,000 to customers who were previously being held to $100 limit on regular lines. While this departure from conservative credit principles increased sales, it resulted very often in over-expansion of capital, in consequent inability to liquidate obligations and in some of us absorbing the ultimate loss; so at least temporarily credit was affected by the addition of these new lines until we had learned our lessons and worked out ideas of financing time payments by using the bankers' money instead of our own. Things were commencing to look natural again, when—along came radio.

Radio Still Needs Watching

In my humble opinion, radio is here to stay, but is as yet more or less in the experimental stage, not only as to radio itself, but as to the proper handling of it from a credit standpoint. We will meet this new line fairly and squarely as it develops, because it may become a very important part of the electrical industry, and if credit is extended on ethical and sound principles, there need be no further effect exerted upon credit by this new line of merchandise.

Washing machines and vacuum cleaners were household necessities. They were adopted slowly, however, and we did have a chance to think between sales. Radio, on the contrary, struck like lightning out of nowhere. Unmistakably thousands of men embarked in this new line without capital, without business qualifications and without the least bit of knowledge of radio. They were intoxicated by the anticipation of handsome profits that came with this new line. We saw the fall of many of these mushroom firms last year, but there are many still here, and seeds have been sown where still more will crop up next season. Not only are the new dealers to be watched, but many of our old steady customers are losing their balance and investing in radio stocks to such an extent that credit is threatened by their tying up capital in something that may be obsolete by the time it gets on the shelf, or the value may decrease quickly from competition, now so common; but if the customer has been fairly prompt in meeting his obligations in the past, it is difficult for the credit man to know where or when to draw the line.

Credit Counsel Will Help

We have had in radio many conspicuous examples of the effect of new lines on credit, and I think that besides affecting credit sometimes these new lines disrupt the policy of buying too. Early last year radio material was hard to get. Demand exceeded supply, and to get any kind of a shipment at all buyers were placing orders with jobbers far in excess of what they needed or ever expected to receive. Quite naturally the jobber made large commitments with the factories. There was a happy condition then for the credit man, because he could ship C.O.D. or even receive cash in advance; but soon another situation developed. Contrary to our old-established lines of merchandise, radio proved to be a seasonable business. Buyers became fewer during certain months, factories caught up with their orders, new factories started up, competition arose and prices came down. Then we saw breach of promise, cancellation of orders, refusal of C.O.D. shipments and default of many kinds. A lot of money was lost, confidence betrayed, and no matter how or why it occurred, the credit department came in for its share of the blame and many firms suffered a loss trying to cope with conditions incidental to adding a new line of merchandise.

Granted that radio is going to develop from a toy to a necessity and become an established line of merchandise in our industry, let us not lose our balance in the handling of

*From a paper presented before the twenty-fifth annual convention of the National Electrical Credit Association at Boston, Aug. 9-10, 1923.

credit. Before many weeks the craze will be on again in full swing. Let us resolve that radio, or any other new line, is just a commodity to be sold either for cash or to persons of approved credit, as we sell any other electrical merchandise. Then, just because it is radio, that mystifying, hypnotic, irresistible thing that attracts every one, let us keep an eye on where it is being sold, and if we find that any of our good contractor customers are forgetting how to wire a house and are hooking up radio sets let us go to them—and if they are worth selling to, they are worth our counsel. Let us tell them what we know about how this new line affects their real activity, or advise them how to handle it conservatively so as to show profits on the sales. The credit man's sphere is unlimited. Let him do his share in the development of this wonderful new line just added to our business in any way he can.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

BUSINESS in electrical commodities has been well sustained throughout the country this week, but there have been no spectacular developments. While the building industry is still actively engaged on the large volume of construction undertaken this year, new projects are beginning to fall off and many jobs are nearing completion and this market does not engage the attention of electrical manufacturers so strongly as in the recent past. On the Pacific Coast bare and weatherproof wire have fallen off a little in price and schedule material generally is selling at a low figure, but business is fair, with much activity in the lighting and industrial power fields.

Trade has been quiet in the Middle West, with pole line hardware and high-tension equipment in rather active demand and appliance sales holding up well in spite of the fact that fall buying has not begun. In the East appliances have been rather quiet, with active selling of motors, meters and transformers. Manufacturing facilities seem to be fully occupied. Considerable construction work that has been delayed by other trades has been starting up and contractors are buying to relieve depleted stocks. Competition for orders seems to be active throughout the country, with a tendency toward conservative ordering and careful price adjustment to local trends. Collections are apparently normal.

Price Trends Reflect Cost Fluctuations

PRICE movements in the field of electrical material supply indicate considerable sensitiveness to local cost conditions at this time. Competition for orders seems to be active throughout the country, although the general volume of business is large enough to put a fairly heavy tax upon current manufacturing facilities. At the beginning of this week flexible armored conductor and rubber-covered wire softened somewhat, and brass was quoted on a lower basis than of late. The opinion was advanced Monday that the drop in flexible armored conductor represents but a temporary condition. For many weeks the production of this material has been more than adequate for current demands, judging from the lack of complaints regarding deliveries to jobbers. Sockets had not followed the brass reduction downward as the week began, but there has been a disposition of late among some manufacturers to pass along such cost reductions in their quotations on finished products, hoping thereby to stimulate more buying for stock on the part of distributors.

All these movements are regarded by some commercial engineers as of minor importance compared with the sustained high cost of labor in modern industry, this cost powerfully affecting the possibilities of profit all along the line from the raw-material producer to the ultimate consumer. "Overheads" are receiving much executive attention also; but the early trend of prices as a whole appears to depend more upon labor conditions than upon any other factor except in lines where automatic machinery and mass production of comparatively simple commodities control factory costs.

Decreased Building Operations Have Cut Down Porcelain Sales

PORCELAIN sales are considerably below those of six months ago, a condition which the majority of manufacturers attribute in part to the general falling off in building operations and the resultant hesitancy on the part of both jobbers and dealers to stock material in advance. For during the year little wiring of old houses has been done, and very little porcelain is being used in new construction of any kind because of the wider adoption of armored cable and rigid conduit.

In the wiring-device field also there has been a marked trend toward the use of rubber-composition products to avoid dangerous breakage. The strongest place in the porcelain market is the high-tension equipment field, where during the last seven months demand has exceeded supply. All manufacturers agree, too, that large sales are continuing to the South and Southwest for use by the telephone companies and in connection with the installation of farm-lighting plants, but that tubes, cleats and knobs are doled out to the jobbers of the Eastern, Middle Western and the Pacific Coast sections by single barrels only. More business is reported in the Northern territories.

Makers of special porcelain report that the increasing business being done by the heating-appliance and automotive spark-plug manufacturers is holding their orders up to a rate exceeding that of any year since 1919. In this field the greatest demand is for hand-turned and "quality" products, little interest being shown in short-lived grades. The makers of very low-priced heating appliances have come to understand that the porcelain of a heater, a small stove or a range must be perfect even if the heating element and standard are of poor quality.

Deliveries of porcelain are no longer than normal—in fact, they are very much more prompt, which, of course, is due to the fact that production has caught up with consumption. General prices have not changed materially in recent weeks, nor do manufacturers see anything in the outlook for the immediate future which would appear to justify a change. As regards the outlook for the next half year, manufacturers are inclined to believe that business will be fairly active during the fall and early winter. They base this belief on the assumption that building operations will be increased after the summer lull and that jobbers and dealers will show a greater tendency toward stocking goods.

Steady Motor Business Anticipated for Rest of Year

BARRING relatively small fluctuations in demand above and below the present level, the sale of electric motors this fall bids fair to continue in a highly satisfactory general volume. Manufacturing plants are booking orders considerably above last year's rate, and although current sales are possibly 10 or 15 per cent below the volume of late spring orders, the normal fall "pick-up" is expected to materialize by October and to bring the year to a close with a total well above 1922. Motor deliveries out of factory stocks are being made promptly on most standard lines, and raw material on hand is ample for the needs of many weeks ahead. Some manufacturers, in fact, are sharply checking raw-material stocks on hand against future commitments, and for the moment there is a slight lull in purchasing copper, steel and insulation in view of the moderate recession in demand and the adequacy of the existing supply, combined with the reasonable probability of obtaining raw-material deliveries in the next few months.

The production of special motors still absorbs a substantial proportion of manufacturing output. In some factories this has arisen of late to roughly one-third of the total motor output.

A representative engineer stated recently that to produce one motor of special design costs as much in manufacturing facilities as it does to produce two or even more standard units. The pressure is therefore heavy upon manufacturers to concentrate the production of standard motors in establishments where the principles of mass output can be fully utilized, and in some companies this policy is receiving more and more attention. The separation of different sizes and types of motors from the manufacturing standpoint is a marked feature of modern development, and different parts of the country are becoming known as centers of particular classes of motor design and production. The motor price situation is unmarked by any notable movement at the moment, although competition is especially acute among smaller manufacturers. Wages are high and have shown little tendency toward deflation of late. Much progress is being made in the direction of new motor designs, and the fall is likely to witness radical improvements in this class of equipment looking toward the simplification of control and increased reliability of service. The recent Electric Power Club agreement as to motor temperature ratings is being well received by purchasers.

A Flutter in Lighted Signboards

THE recent announcement that three entire floors of the Hotel Cadillac, occupying the entire frontage between Forty-third and Forty-fourth Streets on Broadway, New York City, had been rented for a term of years by a prominent manufacturer of electric signs and billboards in order to obtain permission to cover the front of the building with an electrically illuminated sign has naturally attracted a great deal of attention. The manufacturer is said to have paid $90,000 for the lease of the three entire floors of the hotel, including the ballroom floor. This makes a front equivalent to four stories which will be withdrawn from all hotel uses in order that the windows may be covered up with the sign.

Not long ago a similar transaction withdrew from ordinary business uses several floors of an office building on Columbus Circle, New York, at Fifty-ninth Street, where an illuminated billboard 40 ft. high by 80 ft. long will be displayed. A similar lease on Astor Place, New York, has withdrawn three stories of a loft building, a space measuring 40 ft. x 114 ft., which will be covered by an illuminated billboard. The inference would seem to be that the advertising "circulation" of a building in New York today in a prominent location is worth more than the space it provides for the ordinary purposes of business. In the case of the Columbus Circle sign, the rental of the office space would amount to $10,000 a year, but the rental of the sign space is said to be $50,000 a year.

Sign manufacturers and large billboard companies, however, are both emphatic in declaring that these instances do not indicate a trend either nationally or in New York itself. Unusual real-estate conditions have served to reduce the value of hotel and restaurant properties, and a few situations have been found where the owners prefer to close up a building and lease its exterior for a sign. There is no question, however, that the popularity of illuminated billboards is growing steadily.

Five years ago billboard manufacturers adopted a standard type of billboard carrying appropriate ornamentation and eliminating unsightly features of previous billboard construction. In tune with the widespread sentiment in favor of reducing the disfigurement of country scenery by the placing of billboards at spots of beauty, the Poster Advertising Association has been working to reduce the number of country signs by discouraging competitive bill board advertising along the highways, concentrating the billboard "showings" closer to the centers of population and the sources of supply of the goods advertised. This move is meeting with popular favor and, coupled with the distinct improvement in billboard art and design which followed the enlisting of the country's best artists in poster service work for the Liberty Loan drives, criticism and interference by art critics and civic clubs are less common.

The number of electrically lighted billboards compared with non-illuminated billboards throughout the country is increasing steadily. What is termed a "complete showing" in the Boroughs of Manhattan and the Bronx, New York City, consists of 300 boards, of which 126 are lighted. In Hartford it numbers forty boards, of which six are illuminated; in New Haven, fifty boards, of which ten are illuminated. Roughly, about 20 per cent of the billboards throughout the country are electrically lighted today. This is a direct result of the increasing popularity of the automobile and motion picture shows. Both these influences are bringing more and more people out onto the streets in the evening and greatly increasing the possible "circulation" of an advertising billboard, provided that it is illuminated so as to be readable at night.

Delinquent Electrical Accounts Showed Material Increase in July

ACCORDING to the July reports of the National Electrical Credit Association, Chicago, the number of delinquent accounts for the five sections reporting showed a material increase over the figure for June. For the central division there was a decrease of three accounts from July, 1922, with an increase of average amount to $126.23 from $120.55. The Pacific Coast section showed the largest increase, the number increasing by twenty-three delinquent accounts over July, 1922. The average amount jumped to $222.01 from $98.51. The complete report is as follows:

DELINQUENT ACCOUNTS IN JULY

Branch and Month	Number of Delinquent Accounts Reported	Total Amount	Average Amount
Central Division:			
June, 1922	701	$79,207.62	$112.99
June, 1923	721	95,133.51	131.95
July, 1922	727	87,643.24	120.55
July, 1923	724	91,394.71	126.23
New York:			
June, 1922	479	69,303.00	145.00
June, 1923	428	50,758.00	118.00
July, 1922	395	54,704.00	139.00
July, 1923	404	61,434.00	152.00
Philadelphia:			
June, 1922	207	22,401.38	108.22
June, 1923	227	24,580.53	108.28
July, 1922	261	23,083.53	88.44
July, 1923	238	20,651.30	86.77
New England:			
June, 1922	81	10,152.24	126.57
June, 1923	29	2,325.95	80.20
July, 1922	55	6,779.49	123.26
July, 1923	26	3,062.32	117.78
Pacific Coast:			
June, 1922	18	2,353.13	130.75
June, 1923	52	13,873.41	266.80
July, 1922	13	1,280.71	98.51
July, 1923	36	7,992.57	222.01

Business Active in the East, Buying Conservative but Strong

ATLANTIC COAST electrical interests report well-sustained activity from week to week. A large percentage of manufacturing facilities is fully occupied, and apparatus builders are receiving a good volume of new orders. Jobbers' stocks are in liquid condition, with little complaint as to deliveries or shortages. Conservative buying rules in view of price uncertainties. Here and there raw-material costs tend toward lower figures, and in the absence of a rush of orders for supplies overtaxing production considerable competition is apparent. Underlying credit conditions appear healthy, and the banks report dullness in current demands for accommodation. Brass fell off ½ cent per pound on many lines during the past week.

The sale of motors, meters and transformers continues in excellent volume,

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.0337	$0.0327	$0.0278
Cold finished shafting, per lb.	0.0428	0.0428	0.0415
Brass rods, per lb.	0.1741	0.1825	0.1413
Solder (half and half), per lb.	0.276	0.276	0.180
Cotton waste, per lb.	0.1231	0.1231	0.10
Washers, cast iron (½-in.), per 100 lb.	4.66	4.66	4.06
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.08	3.08	3.11
Machine oil, per gal.	0.349	0.349	0.36
Belting, leather, medium, off list	37%	37%	46½%
Machine bolts, up to 1-in. x 30-in., off list	44½%	44½%	59%

but appliance movement is quieter pending the usual autumnal increase in sales activities directed toward a more responsive public. Building contracts in New England totaled $5,761,000 for the week ended Aug. 21, against $7,585,000 for a year ago. This year's figure, however, exceeds all but two corresponding weeks for the past twenty years. Labor conditions in New England are quieter than for some time; general business is good, and the outlook is excellent.

Lighting and Power Sales Engage the Coast—Stocks Down

MORE attention is being given to the development of lighting business and industrial power at present on the Pacific Coast than to the following up of building operations. There is plenty of building under way and every available craftsman is employed, but the headlong rush of construction seems to have slackened somewhat. The higher steamer rates which have recently gone into effect have apparently not influenced Coast prices to any extent, beyond such carload commodities as rigid-iron conduits. Bare and weatherproof wires continue to decrease slowly in price; the rubber-coated wires are reported firmer.

A noticeable trend is seen to place toggle and tumbler switches on the same price basis as corresponding flush switches, and schedule material generally is showing great activity under the stimulus of the exceedingly low prices which prevail. All in all, general business in the Pacific States evidences a firmer and steadier tone this week, and the electrical industry is busily engaged in a very confident state of mind.

A Quiet Week in Chicago, but with Good Pole and Appliance Sales

CHICAGO electrical jobbers report a very quiet week of trade in that locality. Business seems to have reached a point where very little buying is going on, and wholesalers are maintaining small stocks, buying from day to day. Building activity is not up to the previous months this year, and this, together with the conservatism of the jobber in placing orders, no doubt accounts for the slump in business. Pole-line hardware, however, is somewhat active, and although in some instances poles are becoming more plentiful, the demand is pretty fair for this class of material. Prices remain firm.

Iron conduit is the only commodity which is considered likely to increase in price in the near future. High-tension equipment sales to the central-station companies have been good, considering the month as a whole. Summer sales of appliances are running along at a healthy rate, although the volume of sales is primarily dependent upon the effort expended in making the use of appliances more attractive to the public. Washing machines and vacuum cleaners are being delivered in good volumes, and the smaller-sized appliances are also holding up well. This applies particularly to grills, toasters, urns and percolators.

The Metal Market

THE metal market has been quiet this week with little buying. Foreign demand has shut down apparently on fear of a coal strike here. Copper has been selling below 14 cents and may go down after Labor Day. Lead is strong because the supply is not equal to the demand and the price is up to 6¾ cents. The zinc market is quiet with prices unchanged; production has been cut down and producers are not pressing the metal on the market. Tin is firmer due to London influences.

NEW YORK METAL MARKET PRICES

	Aug. 22, 1923 Cents per Pound	Aug. 29, 1923 Cents per Pound
Copper, electrolytic...	14.25	14.00
Lead, Am. S. & R price	6.50	6.75
Antimony	7.75	7.55
Nickel, ingot........	27.00 to 32.00	27.00 to 32.00
Zinc, spot	6.20	6.90
Tin, Straits..........	39.00	40.75
Aluminum, 98 to 99 per cent...........	26.00 to 27.00	25.00

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

General Electric Business Healthy

Following a meeting of directors of the General Electric Company at Boston last week, it was announced that incoming business for the first and second quarters of the current year totaled $80,000,000 and $84,000,000 respectively, and that while a slight recession has occurred since June 1, nothing in the nature of a slump is evident. Unfilled orders increased since Jan. 1 last from $76,000,000 to $96,000,000. Export business is gaining in Canada, Mexico, South America and Australia.

In a Boston News Bureau analysis based upon information obtained from the company's officials it was pointed out that the average selling price of the company's products reached a peak of 155 in 1920 on a base of 100 in 1914, compared with a general commodity price of 231 as computed by the United States Bureau of Labor Statistics. The average price of General Electric products in 1922 was 125 against a commodity price of 152, and at no time have incandescent lamps exceeded 104 since 1914.

Hart & Hegeman Company Acquires Entire Stock of H. T. Paiste

The Hart & Hegeman Manufacturing Company, Hartford, Conn., has acquired the entire capital stock of the H. T. Paiste Company, Philadelphia, and the two companies will now be operated as one. For ten years the Hart & Hegeman company has been associated with the Paiste company as selling agent. The latter organization has been in business more than thirty years, having been organized by H. T. Paiste, who has been president and manager during that period.

Consolidation was effected through the merger of the two companies, Mr. Paiste exchanging his interest in the Paiste company for an interest in the Hart & Hegeman organization. Mr. Paiste will become a director and officer of the last-named company and will continue as manager of the Philadelphia division.

The officers of the Hart & Hegeman Company will be: Shiras Morris, president and treasurer; Monroe Guett and H. T. Paiste, vice-presidents; S. P. Williams, secretary; Edward C. Swan, assistant treasurer, and H. L. Everest, sales manager.

American Brass Company Makes Price Reductions

Price reductions ranging from ½ cent to 1 cent per pound were announced last week by the American Brass Company. A reduction of ½ cent took place on the entire line of brass and copper finished material with the exception of copper in rolls, which was reduced 1 cent. Nickel-silver sheets, wire and rods dropped ½ cent with the exception of 16 per cent grade A sheets. These were cut ½ cent per pound.

Cowan Truck Company Increases Capacity by 20 per Cent

The Cowan Truck Company, Holyoke, Mass., has made extensive alterations and rearrangements in its plant by which it has increased its production capacity by 20 per cent, and improved efficiency has enabled it to reduce its costs and prices, with the result of largely increased sales. These for the first half of the present calendar year are said to have approached closely those for the first half of 1919, representing the peak of the post-war period.

Barber Company Increases Representation

Weir, Smith & Company, 35 Warren Street, New York City, and Smith & Norrish, 609 Chamber of Commerce Building, Pittsburgh, have been appointed agents for the Barber Electric Manufacturing Company, North Attleboro, Mass. H. C. Barber, president, states that an active and well-dis-

tributed demand is being felt by this company for knife switches, although the company's output of switch boxes is steadily increasing. Business has shown much improvement during the current year.

Bates Expanded Steel Truss Firm Doubles Office Space

Moving from 208 South La Salle Street, to 232 South Clark Street (the Illinois Merchants' Bank Building), the Bates Expanded Steel Truss Company, Chicago, has doubled its office space. At the June directors' meeting a reorganization was effected as follows: President, A. J. Bates; vice-president, Walter A. Bates, and secretary, Albert J. Bates, Jr. Additions have been made in its sales force to provide for more extensive traveling. Sales for the first six months of this year are more than three times those of last year.

Brandes Products Corporation Starts Production

The Brandes Products Corporation, 194 Mount Pleasant Avenue, Newark, N. J., has officially started production at its recently acquired new plant. The corporation has been incorporated for $250,000 to operate as the manufacturing division for C. Brandes, Inc., 237 Lafayette Street, New York City, maker of head sets.

The company occupies a two-story brick building of modern mill construction with a total floor space of about 46,000 sq.ft., which is being rapidly equipped with various types of punch presses ranging from 5 tons to 50 tons capacity. Complete hardening and nickel-plating plants will be installed.

H. Stephenson, plant manager, is in charge of production, with offices at the plant. J. S. Stamp is in charge of the office and accounting. D. H. Moss, director of plants, will maintain his office at 237 Lafayette Street. The Brandes Products Corporation will eventually employ about a thousand persons.

Fuller Engineering Is Now Sole Licensee of Quigley Fuel

An agreement has been consummated whereby the Fuller Engineering Company, Fullerton, Pa., will act as sole licensee in the United States and Canada for all new business of the Quigley Fuel Systems, Inc.

The engineering personnel of the Quigley Fuels Systems, Inc., has become associated with the Fuller Engineering Company, and that staff is now in a better position to render more complete engineering service, as by this arrangement designs can be presented from a wider selection of pulverized-fuel equipment. In the future all business of the Quigley Fuel Systems, Inc., will be handled through the main and branch offices of the Fuller Engineering Company.

New York Electrical Trade Board Arranges Collection Service

In accordance with the resolution adopted June 20 at the meeting of the board of governors of the Electrical Board of Trade of New York, the governors have just completed arrangements with the Credit Clearing House to undertake collections of slow and delinquent accounts for the board's members. This service, the governors state, will be a source of income to the board, while adding nothing to the ordinary charges made for such work by any credit concern.

Westinghouse Bookings Increase $16,000,000 in Two Months

With many of the large electrical manufacturers showing forward business on their books substantially reduced as a result of the slackening of buying, coupled with the high rate of operations maintained, the position of the Westinghouse Electric & Manufacturing Company forms a rather sharp contrast.

This company's unfilled orders have been on the increase, standing at $78,000,000 on July 31 against $61,900,000 on March 31, sales billed in the period approximating $50,00,000. The reason for the sale of additional stock in the spring, which added $15,860,000 fresh funds to working capital, is now plainly evident. Increased demand for electrical equipment was anticipated and preparations were made in advance. For the fiscal year ended March 31 last earnings on the 1,719,250 shares of combined common and participating preferred stock of $50 par value outstanding equaled $6.70 a share, with net sales of slightly more than $125,000,000. From present indications sales this year should aggregate more than $160,000,000.

Recent Ball Park Fire Did Not Damage Driver-Harris Plant

The Driver-Harris Company, Harrison, N. J., manufacturer of resistance wires, wishes to correct the report published in some daily newspapers that the fire which recently destroyed the Newark baseball club structure had damaged its plant. These wrong reports, the company feels, gives the impression that its production has been interfered with.

Consulting Engineering Organizations Affiliate

George B. Nichols, consulting engineer, 300 Madison Avenue, New York City, and the Terrell Croft Engineering Company, of which Terrell Croft is directing engineer, of 6600 Delmar Boulevard, University City, St. Louis, have effected an affiliation whereby the experience and resources of each organization will be available to the clients of the other. Mr. Nichols will act as the principal for projects east of Illinois, whereas the Croft organization will so act for projects west of that state. The combination will specialize in mechanical and electrical engineering for power and industrial plants, institutions and buildings.

Injunction Granted in Water Softener Suit

The Permutit Company, 440 Fourth Avenue, New York City, manufacturer of water-softening apparatus, recently brought suit in the federal court in New York City against the Paige & Jones Chemical Company, 248 Fulton Street, New York City, for infringement of the Permutit Company's patent covering zeolite water-softening apparatus, which had previously been sustained by the District Court at Buffalo and the Circuit Court of Appeals, New York.

At a hearing in July in the federal court Judge Learned Hand granted an injunction against the Paige & Jones Chemical Company restraining it from further manufacturing or selling of infringing apparatus. The first suit in this patent, which was against the Refinite Company of Omaha, Neb., was carried to the United States Supreme Court, which denied a writ of certiorari to review it.

The Interstate Electric Company, New Orleans, manufacturer of electrical supplies, lighting fixtures and automotive equipment, announces the appointment of H. A. Robertson as sales manager. For the past twelve years Mr. Robertson was associated with the Varney Electrical Supply Company of Indianapolis and Evansville, Ind., but he recently resigned to join the organization of the Interstate Electric Company.

The Anaconda Copper Company has announced that it will enlarge its new Akron (Ohio) zinc-oxide refining plant to something like double its present capacity. Ground will be broken within the next few days on this factory unit. The company last year purchased considerable land in North Akron and established the first unit of what ultimately is expected to be a million-dollar plant. The first unit consists of seven buildings, including a garage and office building, and is now operating twenty-four hours a day.

Edward H. Jewett, Penobscot Building, Detroit, and associates have perfected arrangements for the acquisition of a controlling interest in the De Forest Radio Telephone & Telegraph Company, Sedgwick Avenue, New York, for a consideration stated to be $1,000,000. Dr. Lee De Forest, heretofore head of the company, will be succeeded in this capacity by Mr. Jewett, but will continue in active association with the new organization in the development of radio instruments and equipment. Tentative plans are under advisement for general expansion.

Foreign Trade Notes

AN ELECTRIC RAILWAY TO BE BUILT IN POLAND.—A Polish-British company, according to *Commerce Reports*, has been organized to construct electric railways in Poland. The first line will be built between Warsaw, Grodzisk and Zyrardow. Electricity will be secured from the Pruszkow power plant.

AUTOMATIC TELEPHONES PROPOSED FOR IRISH FREE STATE.—The Irish Free State Post Office Department, *Commerce Reports* states, has engaged an automatic telephone engineer to make investigations relative to the installation of automatic telephones.

PROPOSED MUNICIPAL ELECTRIC PLANT FOR LA PLATA, ARGENTINA.—The installation of a municipal electric plant, according to *Commerce Reports*, is under consideration by the Department of Public Works of the municipality of La Plata, Argentina. The proposed plant will be built at the Great Dock, La Plata, and will cost with underground cables for 200 city blocks, approximately $1,300,000. The contract which the city now has with a private company expires in July, 1926.

PROPOSED ELECTRICAL DEVELOPMENTS IN MOROCCO.—Several electric power plants with a total capacity of from 15,000 kw. to 20,000 kw., according to *Commerce Reports*, are included in a proposed program for electrical developments in South Central Morocco (zone of the French protectorate). The plan includes a hydro-electric plant at Sidi-Machou, a steam-power plant at Casablanca and a series of developments in the upper basin of the Oumer-Rbia River. High-tension transmission lines will be erected to connect these stations with a number of phosphate works. The Compagnie des Chemins de Fer du Maroc has undertaken the construction of the plant at Casablanca, which is to be equipped with three 6,000-kw. turbo-alternators. It will be completed during the first quarter of 1924. Preliminary plans for the hydro-electric plant of the Oumer-Rbia River call for a 5,000-kw. unit.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Warsaw, Poland (No. 7,565), for electrical engines.

Purchase and agency is desired in Halifax, Nova Scotia (No. 7,566), for complete radio sets.

Purchase is desired in Mexico City, Mexico (No. 7,546), for the purchase of electric water heaters, etc.

An agency is desired in Chihuahua, Mexico (No. 7,574), for refrigeration equipment.

An agency is desired in Shanghai, China (No. 7,561), for X-ray show-window reflectors.

New Apparatus and Publications

VACUUM-TUBE SOCKETS.—The Walnart Electric Manufacturing Company, 1251 West Van Buren Street, Chicago, has placed on the market a line of vacuum-tube sockets.

COLOR LIGHT UNIT.—The Bright Light Reflector Company, 494 Gates Avenue, Brooklyn, N. Y., has developed a color light unit using glass color films.

CYLINDER BELLOWS.—T. Peiffer, 82 Liberty Street, Newark, N. J., has brought out a cylinder bellows for use in cleaning out electrical machinery.

INDUCTION MOTORS.—The Reliance Electric & Engineering Company, Ivanhoe Road, Cleveland, Ohio, has issued bulletin No. 5,018, which describes and illustrates its type AA "Reliance" induction motors for two-phase and three-phase, alternating-current circuits.

ELECTRIC WATER HEATER.—The Automatic Electric Heater Company, Warren, Pa., has developed a storage-type water heater in capacities of 20, 30 and 40 gal.

ELECTRIC HEATER.—The Fitzgerald Manufacturing Company, Torrington, Conn., has placed on the market a new model electric heater, under the name of "Star-Rite."

RHEOSTAT.—The National Electric Controller Company, 154 Whiting Street, Chicago, has developed a rheostat, known as type R3, designed for cabinet or panel mounting.

INDUCTION MOTORS.—The Allis-Chalmers Company, Milwaukee, is distributing bulletin No. 1087D covering its large polyphase induction motors.

THEFT-PROOF BULB.—A new theft-proof electric bulb, "Kulp," that fits into any standard socket, has been developed by Lester Kulp, 143 West Austin Avenue, Chicago.

ELECTRIC TRUCK.—A new electric fork-lift truck for use in warehouse, freight car, pier shed or factory yard has been added to the "Elwell-Parker lift and carry" series of the Elwell-Parker Electric Company, Cleveland.

ELECTROPLATING AND BUFFING APPARATUS.—Catalog No. 10 issued by A. P. Munning & Company, Matawan, N. J., covers the "Munning" electroplating and buffing apparatus and supplies for all industries.

STEEL POLES.—The Bates Expanded Steel Truss Company, 232 South Clark Street, Chicago, is distributing a booklet entitled "Pictured Evidence," which describes and illustrates the use of "Bates" steel poles for transmission systems, including foreign installations, special river crossings, etc.

RECORDER AND INDICATOR.—Bulletin No. 117 issued by the Uehling Instrument Company, Paterson, N. J., illustrates in diagrammatic form the principle of operation of the Uehling CO_2 recording and indicating equipment.

REFERENCE BOOK FOR LIGHTING INDUSTRY.—"Building Store Lighting Business" is the title of a book published by the Society for Electrical Development, Inc., 522 Fifth Avenue, New York City, which is one of a series of permanent reference books, all specially designed to assist the industry to "electrify" by promoting the idea of "do it electrically."

RAILWAY OPERATING DATA.—The first five leaflets in Volume 2 of its "Railway Operating Data Series" have been issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. These data are for the use of electric railway operators in the care and maintenance of car equipment.

USE OF ELECTRICAL HOUSEHOLD APPLIANCES.—"The Conlon Plan as Applied to Central Stations" is the title of a booklet published by the Conlon Corporation, Chicago, in which it advocates the use of electrical appliances in the home. It contains illustrations comparing the old method with the new. A booklet describing and illustrating the "Incomparable Conlon" washer is also being distributed by the company. The June number (Vol. 1, No. 1) of *The Conlon Medallion*, a house organ, has been issued by the company.

FLASHERS.—The Reynolds Electric Company, 2650 West Congress Street, Chicago, is distributing bulletin No. 40, covering the "Reco" flashers for electric signs and displays. They are also used for "stop and go" traffic signals, fire-alarm sirens, call systems, special timbers and other automatic contacting work.

INSULATOR UNITS.—Several insulator units for busbar and switch use have recently been added to the line of products of the Ohio Brass Company, Mansfield, Ohio.

AIR FILTERS.—"Dust Problems and Their Solution" is the title of the new "Midwest" air-filter catalog issued by the Midwest Air Filters, Inc., 100 East Forty-fifth Street, New York City, which contains a brief outline of useful information for architects, engineers and plant executives and all others interested in industrial processes.

New Incorporations

THE NORTHEASTERN OHIO POWER & LIGHT COMPANY, Ashtabula, Ohio, has been incorporated with a capital stock of $50,000 by Palmer Wardman, E. R. Gordon, F. L. Sanders and R. D. Wardman.

THE MUTUAL LIGHT COMPANY, Harrisonburg, Va., has been incorporated with a capital stock of $1,500 to erect and operate a transmission line from Harrisonburg to Pleasant Valley Road. The officers are: Samuel H. Callender, Rockingham, Va., president, and N. E. Bowman, secretary.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

PORTSMOUTH, N. H.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 4, for twenty-seven circuit breakers. (Schedule 1235.)

LAWRENCE, MASS.—Electric power equipment will be installed in the proposed bottling plant to be erected on Beacon Street by the Curran & Joyce Company, Common Street, to cost about $150,000. Ashton, Huntress & Alter, Essex Street, are architects.

TAUNTON, MASS.—The Municipal Lighting Department is considering plans for the construction of two substations on Court Street, to cost about $250,000. Jackson & Moreland, 387 Washington Street, Boston, are engineers.

NEW LONDON, CONN.—The Connecticut Power Company is planning to erect a building on Meridian Street, to cost about $200,000.

Middle Atlantic States

BALLSTON, SPA, N. Y.—The Commissioners of Saratoga County are considering a hydro-electric development and water-supply system for the Homestead Sanatorium, Saratoga County Tuberculosis Hospital, to cost about $50,000. The Utilities Engineering Company, Inc., 467 Broadway, Albany, is engineer.

BUFFALO, N. Y.—The American Lithographic Company, 111 Swan Street, plans to install electric equipment, including motors, etc., at its proposed new plant on Amherst Street, to cost $1,000,000.

COEYMANS, N. Y.—The Public Service Commission has granted the Atlantic Light & Power Company authority to transfer its property and franchises in Bethlehem to the Municipal Gas Company, Albany, to enable the latter company to extend its service there. For details see issue of Aug. 18.

NEW YORK, N. Y.—Electric power equipment will be installed in the proposed ten-story ice and refrigerating plant and industrial building to be erected at Washington and Little West Twelfth Streets by the Fox-Gelberg Holding Corporation, 1254 Fifty-first Street, Brooklyn.

TOMPKINSVILLE, N. Y.—Bids will be received by the Superintendent of Lighthouses until Oct. 9 for one third-order, four-panel flashing lens. (Proposal 15509.)

TOTTENVILLE, N. Y.—The Nassau Smelting & Refining Works, Ltd., 603 West Twenty-ninth Street, New York, contemplates the construction of a power house in connection with a new group of buildings, to cost about $200,000. Lockwood, Greene & Company, 101 Park Avenue, New York, are architects and engineers.

ALLENTOWN, PA.—The Loyalsock, Greenwood and Armstrong Power & Light companies, recently organized, plan to erect a transmission system in portions of Loyalsock, Greenwood and Armstrong Townships. The companies, it is understood, will be operated in conjunction with the Pennsylvania Power & Light Company. P. B. Sawyer and C. M. Walter are principal incorporators. Thomas J. Perkins, Allentown, is representative.

McCONNELLSBURG, PA.—The Todd Electric Light, Heat & Power Company and the Ayr Electric Light, Heat & Power Company have been organized to operate in this district. H. S. Daniels is treasurer of the first-named company and D. H. Patterson of the latter, both of McConnellsburg.

PHILADELPHIA, PA.—The Philadelphia & Reading Railroad Company plans to build an addition to its battery plant at Broad Street and Lehigh Avenue.

READING, PA.—The Metropolitan Edison Company has increased its capital stock from 90,000 to 300,000 shares, part of the proceeds to be used for extensions and improvements, including the construction of an electric generating plant in the vicinity of Middletown.

ROULETTE, PA. — The Roulette Glass Company, Corning, N. Y., recently formed, plans to build a power house in connection with its proposed local plant.

HAVRE DE GRACE, MD.—The Tiger Tire & Rubber Corporation, Equitable Building, Baltimore, recently formed, plans to build a power house in connection with its proposed local plant, to cost $150,000.

ELKINS, W. VA.—The Deep Run Coal Company, Cumberland, Md., plans to install mechanical and electric power equipment at its properties in the Elk Garden district near Elkins. About $300,000 will be expended on the project. Benjamin Robinson, Sr., Frostburg, Md., is engineer.

HUNTINGTON, W. VA.—The City Council contemplates the installation of a street-lighting system in the Westmoreland section.

GRAHAM, VA.—The Blue Stone Furniture Manufacturing Company, recently organized, contemplates the construction of a power house in connection with a new local plant.

HARRISONBURG, VA. — The Mutual Light Company, recently organized, contemplates the installation of a local system for light and power service. A transmission line and substation will be built.

WASHINGTON, D. C.—The construction of a conduit road, hydro-electric plant, filtration plant, reservoir and completion of conduits is under consideration by the United States Engineer Office, Old Land Office Building.

WASHINGTON, D. C.—The Longborough Development Company, 234 Southern Building, contemplates the construction of a power house in connection with a proposed industrial terminal in the West Washington section, to cost about $10,000,000. R. F. Beresford, Southern Building, is architect.

WASHINGTON, D. C.—Plans are under consideration by the Commissioners of District of Columbia for improvements to the street-lighting system, to cost about $1,400,000. John E. Wood, assistant engineer, is in charge.

North Central States

DETROIT, MICH.—Electric power equipment will be installed in the six-story addition to be built by the Detroit Lubricator Company, 5938 Trumbull Street, to cost about $325,000. Smith, Hinchman & Grylls, Marquette Building, are architects.

YALE, MICH.—The Detroit Edison Company is negotiating for the purchase of the local municipal electric system.

HAMILTON, OHIO.—The Columbia Gas & Electric Company, Charleston, W. Va., has acquired control of the properties of the Hamilton (Ohio) Service Company, and of the Ohio Gas & Electric Company, Middletown. It is understood that the service of the Columbia Gas & Electric Company will be extended to the town of Hamilton, Middletown, Franklin and nearby communities.

MANSFIELD, OHIO.—The Ohio Brass Company plans to construct a power house at its plant, to cost about $50,000.

LOUISVILLE, KY.—The Louisville Gas & Electric Company plans to increase the output of its power plant on Washington Street to 120,000 hp. The cost is estimated at $500,000.

LOUISVILLE, KY. — The Louisville Hydro-Electric Company has been granted a preliminary permit by the Federal Power Commission to construct a hydro-electric plant at the Ohio River Falls, to cost about $500,000.

COLUMBIA CITY, IND.—Work will soon commence on an addition to the municipal electric and water plant, to cost about $35,000. C. Brossman, Merchants' Bank Building, Indianapolis, is engineer.

FORT WAYNE, IND. — The Thieme Brothers Company plans to erect a power house in connection with extensions at its textile mill, to cost about $75,000.

INDIANAPOLIS, IND. — The Kramer Manufacturing Company, 602 South New Jersey Street, plans to construct a power plant in connection with a new factory, on South LaSalle Street, to cost about $250,000. All machinery at the main works will be motor-driven.

MEROM, IND.—The Knox & Sullivan County Light & Power Company is planning to install a local light and power system for commercial service.

RICHMOND, IND.—The Fibre Conduit Company, Orangeburg, N. Y., has awarded a general contract for the first unit of its proposed local plant, to cost about $400,000. The plans provide for a power house.

GREEN BAY, WIS. — The Wisconsin Public Service Corporation has purchased the Davies Falls water-power site on the Pike River, south of Amberg, where it proposes to build another hydro-electric plant.

GREEN BAY, WIS. — Plans are being prepared by A. E. Kringel, city engineer, for replacing the present steam equipment of the municipal waterworks with gas-engine and electric motor equipment. New pumps will be required. The cost is estimated at $75,000.

IRON RIVER, WIS.—Preparations are being made by the Iron River Water, Light & Telephone Company for rebuilding its dam.

MILWAUKEE, WIS. — The Milwaukee Electric Railway, Light & Power Company contemplates the erection of a transmission line from Fort Atkinson to the Elkhorn-Delavan line, to cost about $40,000. The company also plans to erect a transmission line from its Lakeside plant, Milwaukee, to connect with the plant of the Whitewater (Wis.) Electric Light & Power Company.

WAUSAUKEE, WIS. — The Wisconsin Public Service Corporation, Green Bay, contemplates erecting a transmission line from its Johnson Falls plant to Wausaukee if sufficient business can be obtained to guarantee the expenditure.

WHITEWATER, WIS. — The Milwaukee Electric Railway & Light Company is planning to erect a transmission line from its Lakeside plant, Milwaukee, to connect with the local plant of the Whitewater Electric Light & Power Company.

ST. PAUL, MINN.—Plans are being prepared for the construction of a power house at Macalester College, Grand and Macalester Avenues. W. M. Ingeman, Endicott Building, is architect.

RED WING, MINN.—The construction of a municipal electric plant is reported to be under consideration.

DES MOINES, IOWA.—Plans are being considered for the installation of an ornamental lighting system on Keosauqua Way from Seventh to Fifteenth Streets. A. E. McGlothlen is city clerk.

WASHINGTON, IOWA.—An election will be held Sept. 6 to vote on the proposal to issue $80,000 in bonds for improvements to the waterworks, consisting of a 200,000-gal. elevated tank, complete with pumping station, equipped with electric motor-driven pumps, switchboard, etc. Arthur L. Mullergren, Gates Building, Kansas City, Mo., is engineer.

BOLIVAR, MO.—The Council is considering submitting the proposal to issue $45,000 in bonds for a reserve power plant for the power-dam project planned for Sac River at Stockton.

REPUBLIC, MO.—A bond issue of $35,000 is being considered for the installation of an ornamental lighting system.

STOCKTON, MO.—The Stockton Light & Power Company is planning to build a power plant, dam and an 18-mile transmission line from Stockton to Fairplay, to cost about $60,000.

THAYER, MO.—Tentative plans are being considered by the City Council for the installation of deep-well electrical pumping machinery, to cost about $40,000.

WENTZVILLE, MO.—The East Missouri Power Company is planning to install a local system for general commercial service. A franchise is being arranged.

CHANCELLOR, S. D.—A company has been incorporated by A. J. Waltner, R. R. Grebiel and F. C. Gish to finance the erection of a transmission line to furnish electricity to farmers living in this vicinity. It is also proposed to build a line from Marion to Greeman and from there to Menno. The new company, it is understood, has made arrangements to secure energy from the Northern States Power Company, Sioux Falls, to operate the proposed system.

BEATRICE, NEB.—The Black Brothers Flour Mills Company has started work on the construction of a second hydro-electric plant southeast of Beatrice. The company was recently awarded a contract to supply electricity in Wymore.

EMPORIA, KAN.—Extensions are contemplated by the Kansas Electric Power Company to its local plant, including extensions to power plant, underground tank for storing fuel, the installation of switchboard, etc.

Southern States

BETHEL, N. C.—Work will soon commence on the installation of an ornamental street-lighting system on principal thoroughfares of the city.

MOORESVILLE, N. C.—Plans for extensions to the local works of the Cascade Mills, Inc., Lexington, include a 750-hp. power plant. Lockwood, Greene & Company, Charlotte, are engineers.

COLUMBIA, S. C.—The installation of two motor-driven pumps of 12,000,000 gal. capacity each in the municipal waterworks is under consideration.

GREENVILLE, S. C.—Plans are under consideration for the installation of electric pumping equipment in connection with proposed extensions to the municipal waterworks, to cost about $300,000, for which bonds have been voted.

MACON, GA.—The Central of Georgia Power Company is preparing plans for an addition to its hydro-electric plant, to cost about $4,000,000, including steel-tower transmission line.

DELRAY, FLA.—Bonds to the amount of $22,000 have been voted for extensions to the light and water plant, including the installation of a new engine, generator, etc.

ST. AUGUSTINE, FLA.—The Southern Utilities Company is planning to remove the plants of the St. Augustine Ice Company and the St. Augustine Steam Laundry Company from their present location to Riviera Street and to erect new buildings to house them. The ice plant will be 70 ft. x 80 ft., and electrical equipment will be installed. The building for the laundry will be 97 ft. x 75 ft. and will be operated by electricity. New equipment will be installed in the power plant, including a 1,500-kw. steam turbine, boiler, new condenser and switchboard.

STUART, FLA.—The Council is considering calling an election to vote on the proposal to issue bonds for the installation of electric lighting system, waterworks, sewers, etc.

BESSEMER, ALA. — The Harbison-Walker Refractories Company, Farmers' Bank Building, Pittsburgh, contemplates the construction of a power house in connection with its proposed local plant, to cost about $500,000.

DOTHAN, ALA. — Contract has been awarded by the City Council for the construction of a hydro-electric plant at Chalkers Bluff to serve the Brooks Callaway Company, Atlanta, Ga. The work will include a concrete dam, 25-mile transmission line and power station to house two units of 3,000 hp., with provision for two additionl units of same capacity. The total cost is estimated at $800,000. Ludlow Engineers, Inc., Winston-Salem, is engineer.

WATERLOO, ALA.—The H. F. Young Lumber & Land Company, Birmingham, contemplates the construction of a power house at its proposed local lumber plant, to cost about $100,000.

FORT SMITH, ARK.—The Model Window Glass Company contemplates rebuilding its power plant, recently damaged by fire, with loss of about $200,000.

PINE BLUFF, ARK.—Plans for the proposed local textile mill, to be built by a company now being organized, to cost about $900,000, include a power house. J. E. Boyce, Chamber of Commerce, is in charge.

GIBSLAND, LA.—The Council is asking bids for improvements to waterworks and electric lighting system, including one 100-hp. oil engine and 75-kw. generator, directly connected, switchboard, street-lighting regulators, 7½ kw., and thirty series hoods, compressor, motor, two centrifugal pumps with motors, 125 gal. per minute, etc., for air-lift system.

LITTLE WOODS, LA.—The City Commissioners are negotiating with the officials of the New Orleans Public Service Corporation relative to extending its service to Little Woods. Inquiries have also been made relative to the cost of establishing a municipal electric plant. The town already has electric service, but it is not at all satisfactory.

BLACKWELL, OKLA. — The Hazel-Atlas Glass Company, Wheeling, W. Va., plans to build an addition to its power house, to cost about $75,000.

DAVENPORT, OKLA.—The Davenport Clay Company, recently organized, contemplates the construction of a power house in connection with a new local plant. C. A. Noll, Wichita, Kan., is interested in the company.

OWASSO, OKLA.—Plans are being arranged for the installation of electrically operated pumping machinery at the proposed municipal waterworks, to cost about $75,000. The Holaway Engineering Company, Wright Building, Tulsa, is engineer

DALLAS, TEX.—The Texas Power & Light Company plans to construct a substation on Tuttle Street, to cost about $60,000.

MARLIN, TEX.—New interests have purchased the properties of the Central Texas Ice & Light Company, including the light,

power and ice-manufacturing plants at Marlin, Chilton, Rosebud, Riesel, Travis, Mart and Lott. The company will be reorganized and the plants extended and improved.

OAKDALE, TEX.—The Oakdale Ice & Light Company contemplates rebuilding its power plant and ice-manufacturing plant, recently damaged by fire, causing a loss of about $55,000.

Pacific and Mountain States

MOUNT VERNON, WASH. — Allen R. Moore, Mount Vernon, and associates have applied to the State Engineer for permission to build a hydro-electric plant on Swift Creek, a branch of the Baker River, to cost about $100,000. It is purposed to organize a company to operate the system.

SEATTLE, WASH. — The Stetson Post Lumber Company, 5501 Marginal Way, contemplates the construction of a power house in connection with a new local plant, to cost about $100,000.

BAKERSFIELD, CAL. — An ordinance has been approved for an ornamental lighting system in the business section, to consist of 14-ft. steel poles, mounted with single lamps of 400 cp. W. D. Clark is city engineer.

HELM, CAL.—Bids will be received by R. M. Bostwick, secretary Stinson Irrigation District, until Sept. 4 for improvements, including (1) 10-20 vertical-shaft motors, etc.; (2) 3-6 horizontal-shaft induction motors, etc.; (3) 3-6 deep-well turbine or propeller pumps, etc.; (8) 15-20 deep-well pumps and motors, etc.; cement, metal gates, construction of bridges, etc. Code & Hill, Hollingsworth Building, Los Angeles, Cal., are consulting engineers.

LOMPOC, CAL.—Steps are being taken for the installation of an ornamental lighting system on the principal streets.

LOS ANGELES, CAL.—The Los Angeles Gas & Electric Company has issued bonds for $4,000,000, part of the proceeds to be used for extensions and improvements.

ORANGE, CAL.—The Western Cordage Company contemplates the construction of a substation in connection with its proposed plant on West Palm Avenue, to cost about $125,000.

REDLANDS, CAL.—Plans are under consideration for the installation of an ornamental lighting system on Myrtle Avenue between Olive and Fern Avenues.

SACRAMENTO, CAL. — Bids are being received by the City Commission for a fire-alarm system, to cost about $25,000. A. Givan is city engineer.

SANTA ANA, CAL. — Plans are being considered for the installation of an ornamental lighting system on North Broadway and South Main Street.

SANTA ANA, CAL.—The Southern California Edison Company has acquired property adjoining its substation on South Main Street and will build an addition, to cost about $40,000.

STOCKTON, CAL.—Bids will be received by the College of Pacific, care of Davisis-Heller-Pearce Company, architects, Delta Building, Stockton, after Sept. 1, for construction of science building, dining hall and gymnasium, auditorium, boys' dormitory and girls' dormitory, power house and stadium, to cost about $600,000.

UKIAH, CAL. — The Eureka Electric Company has applied for a twenty-five-year franchise to erect a transmission line in Round Valley.

Canada

VANCOUVER, B. C.—The British Columbia Electric Railway Company is considering extending its high-transmission line to Nanaimo and Ladysmith.

NORTH YORK TOWNSHIP, ONT.—By-laws will be submitted to the ratepayers in Hydro areas 1 and 2 on Sept. 8 providing for Hydro installation. The cost of the installation in Area No. 1 is estimated at $70,000, and in Area No. 2 at $18,000.

DRUMMONDVILLE, QUE. — Contract for construction work in connection with the deveyopment of the power sites at Hennings Falls, near Drummondville, on the St. Francis River, has been awarded to the Foundation Company, Ltd., of Canada. The plans call for a development of 30,000 hp. The purchase of building materials will be in charge of the contractors, and the machinery and equipment will be purchased through the purchasing department of the Southern Canada Power Company, Ltd., Coristine Building, Montreal.

HULL, QUE.—The Ottawa & Hull Power Company, Ltd., is planning a new development at Calumet, about 50 miles up the river from Ottawa.

Electrical Patents

Announced by U. S. Patent Office

(Issued Aug. 7, 1923)

1,464,243. ANTI-THEFT DEVICE FOR ELECTRIC LAMP BULBS; T. A. Dickinson, Youngstown, Ohio. App. filed April 22, 1922.

1,464,245. CONTROLLER FOR ELECTRIC MOTORS; C. E. Fairburn, London, England. App. filed Sept. 22, 1920. For motors required to work on two or more circuits having different characteristics.

1,464,255. ELECTRICAL HEATING DEVICE; R. F. Zimmermann, Buenos Aires, Argentina. App. filed July 14, 1922. Resistance wire wound spirally on dry calcined non-fusible material.

1,464,274. CONNECTOR FOR RADIO EQUIPMENT; S. Storch, Brooklyn, N. Y. App. filed May 15, 1922. "For three-coil mountings."

1,464,280. ELECTRIC HEATER; L. P. Hynes, Albany, N. Y. App. filed Jan. 25, 1922. For railway and other vehicles.

1,464,304. FILAMENT CLAMPER; J. B. Whitmore and J. E. Ferguson, Bloomfield, N. J. App. filed Sept. 3, 1921. For securing the filaments to the leading-in wires of lamps.

1,464,312. ELECTRICAL RESISTANCE ELEMENT; F. A. Fahrenwald, Cleveland, Ohio. App. filed Sept. 30, 1921. Composed of iron alloy, chromium and a metal of the titanium group.

1,464,322. RADIO RECEIVING METHOD AND APPARATUS; F. A. Kolster, Washington, D. C. App. filed Nov. 28, 1920. Apparatus for transmitting undamped electroradiant energy waves.

1,464,346. VARIABLE ELECTRIC LAMP; J. Ardo and F. Melfo, Newhall, W. Va. App. filed Sept. 21, 1921. Dimming device built into lamp.

1,464,382. ELECTRIC LAMP; R. M. Eaton, Niagara Falls, N. Y. App. filed Jan. 26, 1922. Portable flashlights.

1,464,402. SOCKET COVER; M. Berman, Brooklyn, N. Y. App. filed June 16, 1921. For use either with ball or spherical lamp.

1,464,413. RENEWABLE PRIMARY DRY-CELL BATTERY; W. S. Doe, Kent, Ohio. App. filed May 2, 1921. For flashlights.

1,464,455. ATTACHMENT FOR TELEPHONES; A. B. Toppan, Watertown, Mass. App. filed Nov. 13, 1922. Sanitary attachment for mouthpiece.

1,464,468. ELECTRICAL CONNECTOR; H. A. Douglas, Bronson, Mich. App. filed March 13, 1919. For miniature light bulbs.

1,464,470. ELECTRIC CONTROLLING DEVICE; W. W. Drummond, Fort Collins, Col. App. filed Jan. 23, 1920. For typesetting and other machines using a controlling keyboard.

1,464,487. RHEOSTAT SOCKET; C. B. King, Detroit, Mich. App. filed April 13, 1922. Electron-tube socket and rheostat built in one unit.

(Issued Aug. 14, 1923)

1,464,496. ELECTRIC FURNACE; C. A. Cadwell, Cleveland, Ohio. App. filed April 29, 1920. Muffle or reheating furnace.

1,464,503. FREQUENCY CHANGER; C. Le G. Fortescue, Pittsburgh, Pa. App. filed Sept. 19, 1919. Auxiliary distributed winding on armature improves commutation.

1,464,506. ELECTROLYTIC PROCESS; J. S. Groff, Newport, R. I. App. filed Aug. 18, 1920. For coating metal vessels as protection against corrosion.

1,464,509. TROLLEY FROG; W. Schaake, Pittsburgh, and F. H. Miller, Wilkinsburg, Pa. App. filed July 30, 1920. Means for clamping renewable approach members to frogs.

1,464,514. BATTERY-TESTING INSTRUMENT; C. W. Terry, Detroit, Mich. App. filed Oct. 31, 1919. By voltmeter.

1,464,519. SIGNALING SYSTEM; H. J. Vennes, New York, N. Y. App. filed July 16, 1918. Multiplex carrier-current systems.

1,464,533. RADIO RECEIVING SYSTEM; Siegmund Loewe, Berlin, Germany. App. filed Aug. 26, 1921. Multistage amplifiers used with vacuum-tube detectors.

1,464,535. TROLLEY-CONDUCTOR HANGER; J. P. L. McGivern, Wilkinsburg, Pa. App. filed Feb. 26, 1921.

1,464,538. SWITCH; E. K. Read, Wilkinsburg, Pa. App. filed Feb. 15, 1919. Operating mechanisms for disconnecting switches.

1,464,543. ELECTRIC FURNACE; Marius Sauvageon, Paris, France. App. filed April 2, 1921. Resistance type.

1,464,552. VANITY BOX; Eleanor A. Warner, St. Paul, Minn. App. filed July 3, 1922. Electrically lighted.

1,464,563. REPEATER-CONTROL ARRANGEMENT; C. S. Demarest and O. H. Loynes Woodbridge, N. J. App. filed Feb. 26, 1921. Repeater apparatus at intermediate station automatically controlled from terminal station.

1,464,565. CALL SYSTEM FOR RADIOTELEPHONY; Lloyd Espenschied, Queens, N. Y. and Ralph Brown, East Orange, N. J. App. filed April 13, 1921. Remote control of mechanism by radio transmission.

1,464,573. FLASHLIGHT AND BATTERY THEREFOR; G. W. Heise, Elmhurst, and H. H. Thompson, Flushing, N. Y. App. filed July 15, 1922. Means for variation in number of cells in circuit.

1,464,602. LAMP SOCKET; Ciriaco Garcillan, New York, N. Y. App. filed June 5, 1920. Simple construction.

1,464,618. ELECTRIC HEATER FOR OIL WELLS AND THE LIKE; R. S. Pershing, Fort Worth, Tex. App. filed Sept. 11, 1920. Comprises series of interchangeable heater units.

1,464,620. SUPPORTING BAR FOR TERMINAL BOXES; F. A. Tefft, Toledo, Ohio. App. filed Nov. 28, 1921. For fastening to studding or joists.

1,464,625. ELECTROLYTE FOR ALUMINUM PRODUCTION AND METHOD OF PREPARING SAME; Aladar Pacz, Cleveland Heights Ohio. App. filed March 18 1920.

1,464,631. REEL FOR CONDUCTING CORDS; F. J. Spuehler, Toledo, Ohio. App. filed Sept. 28, 1921. For electric irons and other electrical appliances.

1,464,663. IMPULSE COUPLING; Adolph Rosner, Springfield, Mass. App. filed July 22, 1921. For use with magnetos.

1,464,689. ELECTROLYTIC CELL STRUCTURE; W. G. Allan, Toronto, Ontario, Canada App. filed Sept. 2, 1920. For production of hydrogen and oxygen from water.

1,464,703. HEATING ELEMENT; L. J. Fuller, Brooklyn, N. Y. App. filed Feb. 2, 1922 Type designed to be submerged in liquid.

1,464,714. ENGINE-STARTING APPARATUS; A. A. Kent, Ardmore, Pa. App. filed May 22, 1920. Starting motor.

1,464,719. TELEPHONE-EXCHANGE SYSTEM; A. E. Lundell, New York, N. Y. App. filed Sept. 21, 1918. Arrangement for controlling selectively operable switches.

1,464,726. TELEPHONE-EXCHANGE SYSTEM; Lipa Polinkowsky, Antwerp, Belgium App. filed April 30, 1920. Machine-switching mechanism.

1,464,782. ELECTRIC HEATING APPLIANCE OF THE IMMERSED-ELEMENT TYPE; Walter Stubbs, Mascot, New South Wales, Australia. App. filed Jan. 31, 1922. Heating element brought into direct contact with liquid.

1,464,806. SIGNALING APPARATUS; Colin J. Campbell, Newark, N. J. App. filed March 18, 1920. Rear direction signals for automobiles.

1,464,826. ELECTRIC INCANDESCENT LAMP; Anton Lederer, Vienna, Austria. App. filed May 16, 1914. Process of manufacture.

1,464,838. PRIMARY BATTERY AND PROCESS OF MAKING THE SAME; Henry Wilhelm, Brooklyn, N. Y. App. filed Dec. 31, 1918.

1,464,840. ELECTROLYTIC APPARATUS; W. G. Allan, Toronto, Ontario, Canada. App. filed Sept. 13, 1920. Electrolytic production of oxygen and hydrogen from water.

1,464,857. RHEOSTAT; H. N. Wade, Milwaukee, Wis. App. filed July 1, 1918. Fluid type.

1,464,862. METHOD AND APPARATUS RELATING TO THE PRODUCTION OF METALS; C. W. Balke, Highland Park, Ill. App. filed Feb. 10, 1919. Utilizes electric furnace.

1,464,894. SIGNALING DEVICE; J. W. Webb, Chicago, Ill. App. filed April 6, 1922. Rear direction signal for automobiles.

1,464,911. ELECTRIC MOTOR; G. H. Leland, Dayton, Ohio. App. filed March 10, 1920. Single-phase motor of repulsion starting and induction running type.

1,464,952. TYPEWRITER ATTACHMENT FOR TELEGRAPH SYSTEMS; Donald McNicol, New York, N. Y. App. filed Aug. 23, 1919.

1,465,007. ELECTRIC TOASTER; Ernest Sjolin, Chicago, Ill. App. filed March 9, 1922. Horizontal type with method of reversing toast.

1,465,034. PROCESS FOR THE ELECTROLYTIC DEPOSITION OF COPPER; F. L. Antisell, Perth Amboy, N. J. App. filed Nov. 3, 1921. From cupriferous electrolytes.

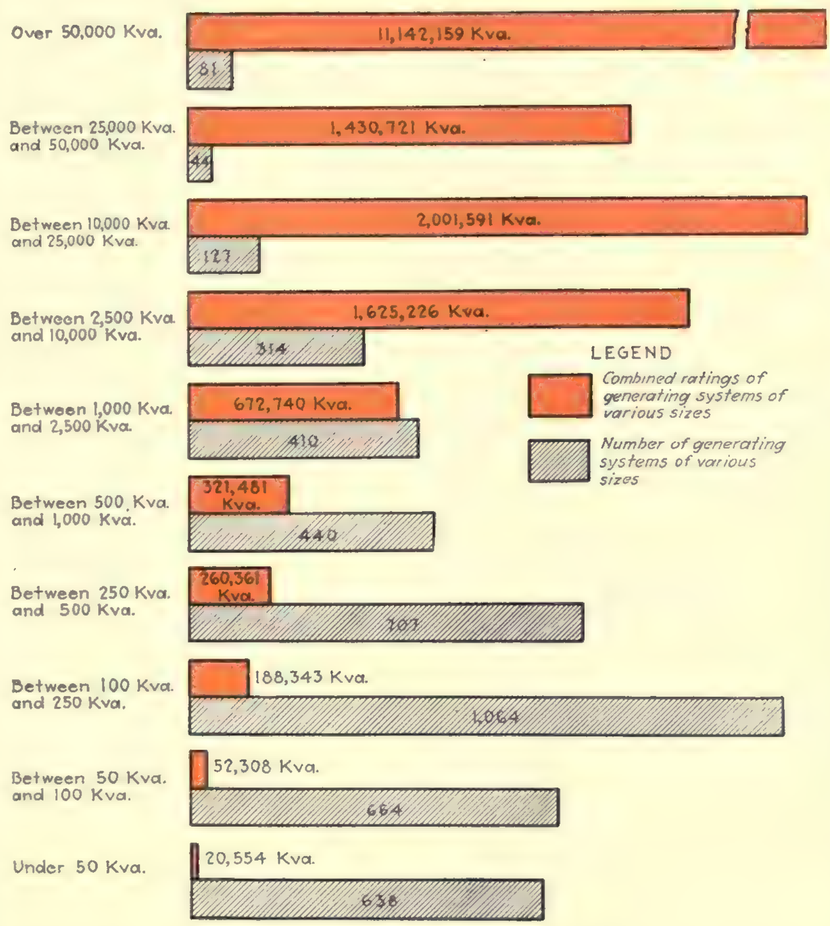
1,465,042. CARBON HOLDER FOR PICTURE PROJECTORS; A. S. Hruska, Detroit, Mich. App. filed April 16, 1921.

1,465,081. ELECTRIC MACHINE; Frank Holden, London, England. App. filed June 24, 1920. Electromagnetic mechanism for driving clockwork.

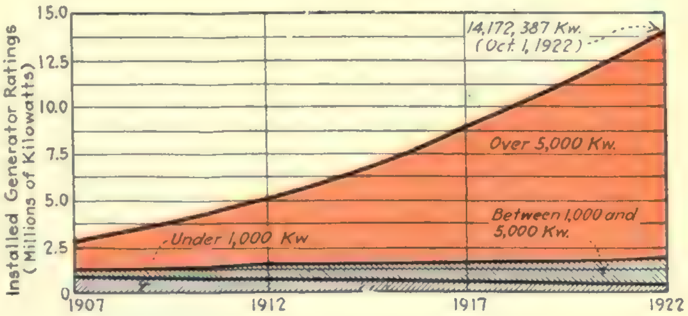
Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Less than 2 per Cent of the Total Number of Generating Companies Operate 63 per Cent of the Generator Rating of the Country



Growth in the Central-Station Industry Has Been Confined Almost Entirely to Systems of More than 5,000 Kw. Generator Rating

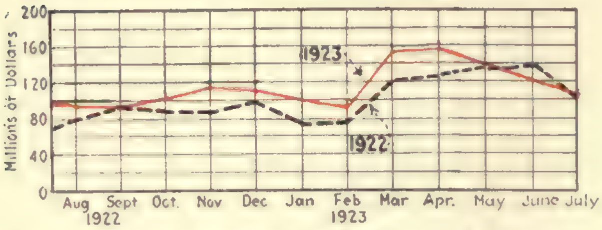


The Advent of Superpower Generating Systems

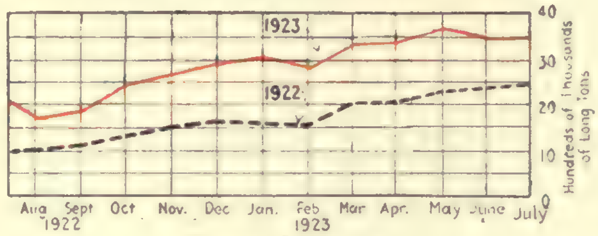
THE recent history of the electric light and power industry might truly be said to portray a period of concentration, of gathering together loose ends to form a cohesive force for public service. Superpower generating plants have come into being, transmission webs have enveloped the country eliminating large numbers of small inefficient generating plants, and large holding organizations have absorbed operating companies until it has been estimated that at the present time, 95 per cent of the generator rating of the central-station industry is indirectly controlled by such administrative corporations. Considering the local generating companies as distinct from the holding companies, the latest data indicate that less than 2 per cent of the total number of generating companies of the country operate 63 per cent of the total generator rating.

Growth in the central-station industry has been confined almost entirely to systems of more than 5,000 kw. rating. Back in 1907, only sixteen years ago, the total rating of systems with a generator rating under 5,000 kw. was 1,524,000 kw., or 30 per cent of the total generator rating of the country. Today the rating of such systems has increased only to 2,130,000 kw., while the percentage has decreased to only 15 per cent of the total. It is probable that in 1907 there was not a system with a total rating of more than 50,000 kva., whereas at the present time there are eighty-one such companies, representing a combined generator rating of 11,142,159 kva., or about 63 per cent of the total rating of the country. When it is also remembered that in 1922 there were eighty-six electric light and power companies with an annual output of more than one hundred million kilowatt-hours, the bigness of the companies operating in industrial and thickly populated centers is made apparent.

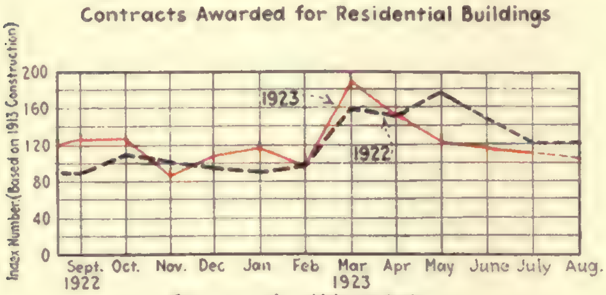
How the Primary Industries Are Trending



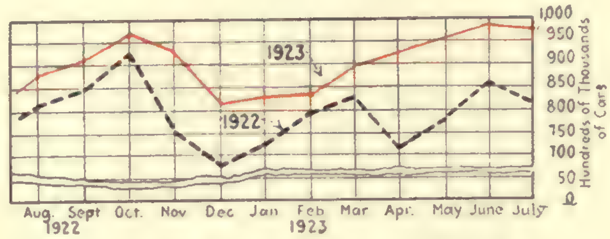
Contracts Awarded for Residential Buildings



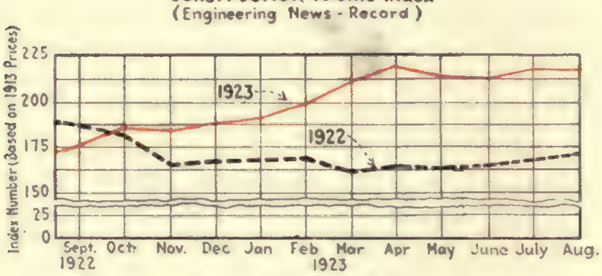
Pig-Iron Production



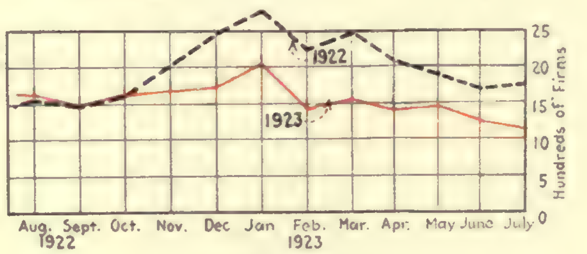
Construction Volume Index
(Engineering News-Record)



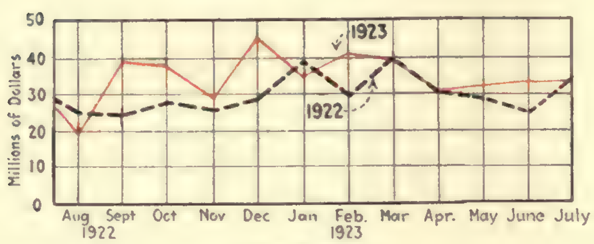
Total Average Weekly Freight-Car Loadings



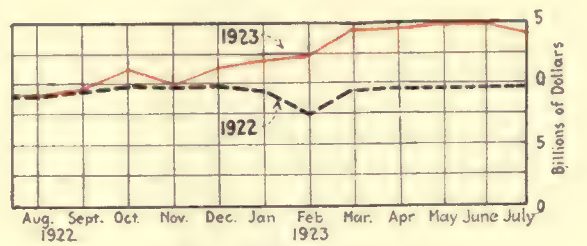
Construction Cost Index
(Engineering News-Record)



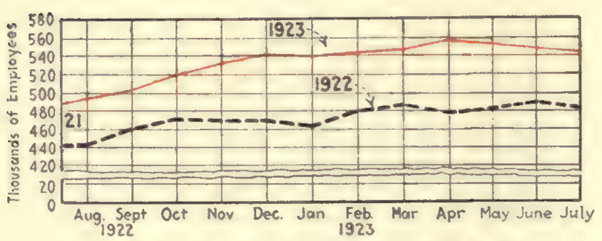
Business Failures



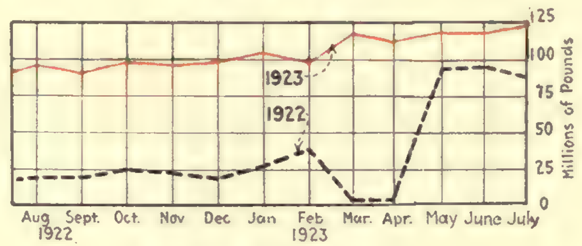
Fire Losses



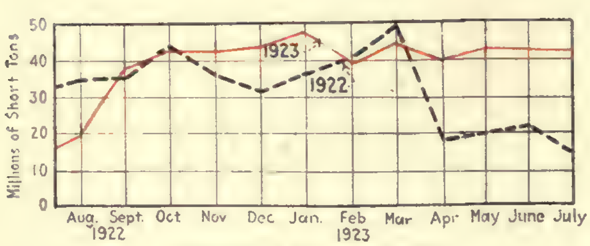
Bank Clearings
(Outside of New York City)



Employees in Factories of New York State



Copper Production



Bituminous Coal Production

Business Conditions Generally Sound

ECONOMISTS appear to agree that, considering the chaotic disturbances abroad, midsummer business in the United States has been remarkably well sustained. As the Irving Bank of New York reviews present conditions, "Railroad traffic is excellent, building construction continues on a vast scale, losses through failures are not large, domestic credit conditions are generally sound, liquid capital is in abundant supply, and retail trade continues at a very high level."

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

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To Labor Less and Accomplish More

WHAT is actually the purpose to which the development of the electrical industry is working? What is it that step by step electrical men are forever striving to do? In a word, the entire intent is to provide new mechanisms and new opportunities whereby humanity may be enabled to accomplish more and labor less.

Every advance of applied electricity in the arts of peace creates a new means of doing something more efficiently, more easily or in some way better than before, if, indeed, it does not enrich the world with a fresh method of satisfying some need or by contributing a new service entire. Every forward step in illumination, in communication, in power or in electric heating application—every new achievement in design or operation—throws open the path toward doing the work of the world at large more easily.

THIS combination of increased service and lessened effort can be capitalized through an immense range of electrical applications from the microscope lamp to the biggest searchlight, from the tiny fan-driving element to the huge steel-mill motor, and from the smallest heating element to the largest electric furnace. It is beyond computation how much time and human effort have been saved by electric communication alone in the past few decades. It is a mere truism to point to the utter dependence of twentieth-century affairs upon multiplied electrical service, but this ubiquitous agency of increased accomplishment and reduced labor speeds on to greater triumphs, actually simplifying the existence of the average man, woman and child in the very faces of those who cry out that civilization is becoming too complex for human mentality and physical organisms.

If the user of modern mechanisms and systems of service were forced to understand them intimately, if the housewife at the washing machine could get no results without comprehending generator and turbine design, relay practice and transmission laws, it would be true that science had created a Juggernaut car bent upon destroying its votaries. But from the layman's standpoint the simple switch controls the local application so effectively that no thought of the complexities of the service it commands is required to enjoy perfect performance. Comprehension by the user is to be desired if it is voluntary, but it is to the lasting credit of engineers that a grasp of electrical technique is no part of the price which must be paid for the privilege of laboring less and accomplishing more by the use of the resources of this wonderful industry.

IT IS not surprising, therefore, that in the public mind the cost of service is held secondary in importance to quality of service. If actually no more work could be done by the use of electrical as against older methods, there would still remain the advantage of being able to perform the same volume of work better, as well as the attractions of easy manipulation. But since electricity accelerates production without loss of other advantages in innumerable fields, its appeal is simply irresistible. Its guaranteed capacity, as a burden bearer for humanity, is sweeping away every obstacle to its advance, and the scope of its future usefulness well-nigh transcends the powers of a sober imagination.

Charles Stetson Cook

A pioneer in transmission who later was largely instrumental in assuring the domination of electric power in the industrial district of Pittsburgh.

JUST thirty-one years ago a young Pittsburgh electrical engineer startled the world by successfully installing for 28 miles between San Antonio Canyon and San Bernardino, Cal., the first long-distance electrical transmission system in the United States carrying 10,000 volts. Today that same engineer, enriched by the wonderful activity and experience of a quarter century, is working out the problems concerned with placing Pittsburgh above any other city in the world as a center of electrical power in industrial development. This engineer is Charles S. Cook, vice-president of the Duquesne Light Company, who figures in units of 60,000 kw. and more with far less concern than he did with his two 150-kw. generators and their forty-eight glass-jar transformers in the California canyon thirty years ago.

Mr. Cook was born on a farm at Amherst, Mass., the son of Horace W. and Mary N. Cook. He was educated at Worcester Polytechnic Institute and was graduated from this school in mechanical engineering in 1885 with the degree of bachelor of science. He went to Pittsburgh in 1887 and began work in the shop and testing room of the old Westinghouse Electric Company's plant in Garrison Alley. The following year he became installing engineer in charge of the erection of lighting and power plants, and in 1889 he became engineering superintendent of construction in the Chicago offices. In 1892 he laid out the first long-distance transmission system installed in the United States, making it 10,000 volts, when all of his engineering associates thought half that voltage was the commercial limit.

In 1893 Mr. Cook laid out for George Westinghouse the electric plant for the Columbia Exposition at Chicago. In 1895 he returned to Pittsburgh, taking charge for the Westinghouse Electric & Manufacturing Company of special sales engineering work in the Pittsburgh district. At that time the great steel mills were practically without electrical equipment, motors being confined to cranes. Duquesne had no electric power, Homestead had only 300 hp. and Edgar Thomson 100 hp. Now electricity practically dominates the operation of these monster mills. In January, 1899, Mr. Cook became manager of the Westinghouse Pittsburgh office, taking charge in April, 1904, at East Pittsburgh of that company's railway and lighting department and controlling all commercial operations relating to power machinery.

On March 1, 1917, he became general manager of the Duquesne Light Company, and on Dec. 1, 1922, was made vice-president. He is now at work upon many plans for the further expansion of the Pittsburgh district as a great electrical center.

Editorial Comment

Electrical World, September 8, 1923

Volume 82 Number 10

Blend of National Characteristics Will Help Research

THE Anglo-Saxon race as a whole has been prone to empiricism, while the Teutonic scientists have been decidedly inclined to *a priori* reasoning. Both races have prospered and suffered from this one-sidedness and a union of these opposite racial characteristics should lead to wonderful results. A new tendency—namely, a combination of these national characteristics—is shown in the thermal or "pyro-electric" theory of breakdown which was almost simultaneously presented by the prominent German physicist and engineer Dr. Karl Willy Wagner and by Dr. C. P. Steinmetz and J. L. R. Hayden of this country. The conditions and principles which led up to and influenced this investigation are applicable to many branches of physics or engineering. They may be thus stated: (a) An investigator finds some facts contradicting an accepted theory; (b) he establishes a new theory based upon rational physical foundations; (c) he and his co-workers verify the theoretical conclusions by a series of tests.

In the past, unfortunately, the procedure when engineering difficulties have arisen has frequently been as follows: (a) Certain facts are found not to be in accord with preconceived views; (b) tests are made which do not clear up the matter; (c) more tests are made; (d) still more tests are made; (e) a large committee of busy men is appointed, to serve without compensation; (f) the committee issues a long preliminary report on what ought to be done; (g) matters of more immediate importance permanently distract attention from the problem. It is to be hoped that the old procedure is fast on the ebb and that it will eventually give place to a combination of all the good qualities in research methods everywhere.

Crest Measurements Require Care

THE accurate measurement of the crest value of high alternating voltage is a matter of considerable complication, if not difficulty. With sufficient care, in a well-equipped laboratory, a high degree of precision is possible, as, for example, by the rectification of the charging current of an air condenser and its measurement with direct-current precision instruments. Next in order in decreasing complication, but also diminishing accuracy, are the corona voltmeter, apparently a very accurate instrument in its complete form; the sphere gap, and finally the ratio of transformation and the low-voltage instrument. The size and auxiliary equipment of the corona voltmeter has so far discouraged its general use, particularly in comparison with the much simpler sphere gap, although both are accepted A. I. E. E. standards. In careful hands the sphere gap will give a crest reading accurate to within 1 or 2 per cent.

But even the moderate complexity of the sphere-gap measurement, or perhaps the need of the careful hands, too often leads to reliance for an estimate of the crest voltage on the combination of a low-voltage measurement, a ratio of transformation and a guess at the crest factor of the alternating wave. The possibility of making the reading entirely in the low-voltage circuit and on the scale of a portable instrument is very tempting as compared with the time and care required by other methods. Ratio of transformation is relied on in many forms of station transformers, but in these the load is usually fixed and its influence on the voltage wave form small or at least known. In high-voltage testing, however, as is well known, the voltage wave may be badly distorted by the capacity of even ordinary equipment and connections on the high-tension side, particularly if the generator wave itself has any appreciable irregularity. It is an old story, but a more or less innocent-looking primary voltage wave in conjunction with the capacity of the high-voltage secondary connection sometimes leads to some very remarkable values of crest factor, which cannot be predicted even with complete knowledge as to the generator wave.

Begin Public Relations Work with Company Employees

GOOD public relations are held by some to be the greatest asset a utility has. They are admitted by all to be of real value. The topic has, however, been treated so copiously and so frequently that it threatens to become trite. The condition is somewhat analogous to that of the man who attends church each Sunday, admires and agrees with the sermon and then forgets his religion for the other days of the week because of the pressure of everyday work. It is continuous practice that really causes results.

The more one studies the question, the more apparent it is that many really efficacious ways of bettering public relations are being neglected by some utility executives who complacently regard the subject from the perspective of their positions and the flattering remarks of understanding friends in their community. The man who is successful in his public relations work is constantly in touch with its effect. And most important, while he uses newspaper advertising, illustrated booklets and motion pictures showing the company's facilities, and while he conducts customer-ownership campaigns, he does not believe that these are the only essential things or that the amount of money spent in this way is a direct measure of the progress attained.

One point cannot be emphasized too much or too often. Public relations must be studied and improved at the

source if real and permanent progress is desired. It is the employee of the company in his every-day work who most effectively makes or mars public sentiment. And yet how many general managers, filled with ideas on public relations, know even the name or personal appearance of the "girl at the window," the meter reader, the troubleman, the power salesman or the many others down the line who form the myriad points of contact with the public?

Direct thought must be given to all these individuals to help them develop good public relations through the way they conduct themselves in their everyday work. Specific ideas in words that interest and appeal to these employees, financial inducements and many other agencies may be utilized. A local and personal flavor must be given to the public relations activities, and every man in the utility must be an active worker before any executive can say that he has done everything possible to improve the standing of his company with its customers. Any executive can well devote as much time to knowing his employees and "selling" them his ideas on public relations as he devotes to chamber of commerce meetings and other public affairs, and with far greater return in the way of improved public relations. He can eliminate the little customer ills before they occur and prevent their developing complications that require major operations. In other words, company spirit and company courtesy are the proper and only sure weapons to develop the right kind of public relations.

Corona and Spark-Over Between Electrodes of Various Shapes

ONE of the signs of progress in high-voltage engineering is a slow but steady advance of the theory whereby dielectric stresses can be predicted from the design rather than measured on a device already built. The mathematical theory of electrostatic field distribution between two given electrodes is quite involved, and exact solutions have been obtained only in a few of the simplest cases. The problem is further complicated by the phenomenon of ionization of gas molecules by collisions with free ions near the surfaces of the electrodes. Because of this ionization a rather involved relationship exists between the curvature of the electrode, the thickness of the ionized layer of gas and the magnitude of the corona-forming voltage gradient at the surface of the electrode.

One of the cases amenable to mathematical treatment is that of the electrostatic field between two parallel cylinders of infinite length external to each other. This arrangement has been considered theoretically by F. W. Peek, Jr., Dr. Alexander Russell and Dr. A. E. Kennelly. With a small spacing between the cylinders a spark-over occurs almost simultaneously with the first corona, while with a larger spacing a stable corona is possible. The names "spark-over system" and "glow system" suggest themselves for these two ranges. By the introduction of an auxiliary hyperbolic angle Dr. Kennelly simplified the theory and the final formulas. It is possible that a still different aspect of the problem can be had by using an auxiliary circular angle.

In time a similar mathematical treatment should be extended to electrodes of other shapes, so that a designer of high-tension insulation may use rational formulas and a slide rule like his more fortunate confrères who figure out machinery and feeders. The mathematical theory of high-tension stresses is one of the phases of the problem of dielectrics, and the committee on insulation of the National Research Council should not lose sight of the necessity of promoting its advance side by side with the experimental study of materials.

Growth of High-Voltage Networks Introduces Control Problems

THE problem of regulation and control on single long-distance high-voltage lines has been solved to a very satisfactory degree by the use of the synchronous condenser and by specially designing the generators to care for no-load charging conditions. But there are several problems connected with interconnected high-voltage networks that are difficult of solution, and so far no generalized treatment has been developed. These problems are the more pertinent because several systems are now under construction that expect to encounter them as practical operating difficulties. Take, for example, a system with three steam generating stations 100 miles apart and connected by a 165,000-volt line. In addition, assume that a hydro-electric station 100 miles away is tapped to the line at the center and near one of the steam stations. These 165,000-volt lines supply a dozen or more large substations at various points. The question then arises: How can the voltage regulation at each substation and at the "T" point on the transmission system be controlled? Also: How can the load division between generating stations be controlled? In addition: What are the limits of stable operation of the system if certain short circuits occur?

Such questions are fundamental and require an answer if satisfactory commercial operation is to be had. But, with the present state of the art, it is not surprising that there are very few men, even among the specialists, who will venture to give to them even the basis of an answer without a very laborious and detailed study of all the operating conditions, combined with difficult mathematical analyses and computations involving the constants of the system.

And yet such a network as the one described is in itself far from being as complicated as many that are now in process of development. It is to be expected that the engineers in charge of these developments have worked out the answers for their respective systems, but none of them have indicated that they have been able to accomplish any great degree of simplification. At best solutions to such problems, based on present knowledge and practice, involve the use of a great deal of equipment and a very detailed set of instructions for the operating organization. The use of synchronous condensers, variable tap transformers, induction regulators, special devices in the generating stations and complicated relay schemes are necessary in the light of present knowledge and available equipment. But it must be admitted that these devices, while splendidly serving in certain fields, as a whole form an unsatisfactory solution to the problem encountered on the new type of system where an immense amount of energy is to be handled and reliability of service is paramount.

Complex solutions of extensive problems usually become less involved as experience and time indicate possibilities of simplification. But the situation in trans-

mission networks is such that there is real need for an approach from some angle so far not considered. Some genius has an opportunity to obtain a better solution to the general problems encountered on such systems.

Transatlantic Radio Telephony

IN THE early flush of enthusiasm over the discovery of wireless telegraphy, among the most important advantages claimed were the possibility of selective sending and receiving offered by frequency adjustment and the wide range of wave lengths permitting numerous simultaneous messages. In the many long steps ahead since those early days, wave-length adjustment as between sender and receiver has continued an important feature of all radio transmission, but most serious limitations have developed as to the range of available wave lengths and the number of individual wave lengths which may be used within that range without mutual interference. Among other reasons for this limitation is the impossibility of restricting the energy of both sender and receiver to a single wave length. Resonance curves always have some width and they spread out at the bottom. This means spilling over into other wave lengths in sending and picking up something undesirable in receiving. Every amateur knows how wide a range of tuning is necessary to eliminate an undesirable incoming message completely. Thus not one wave length but a whole band must be devoted to a particular sender or group of senders, and consequently the whole spectrum of radio wave length is divided by law into a limited number of bands assigned to different classes of service.

The situation is even worse in the case of radio telephony, in which a sustained "carrier" or sending frequency is "modulated" in intensity to conform to the voice tones. This means that all the frequencies in the voice are superimposed on the carrier frequency, and thus that the minimum width of the frequency band necessary for carrier-wave radio telephony is more than 6,000 cycles, embracing the two 3,000-cycle side bands, one on each side of the carrier frequency. The most striking case is that of transoceanic service, in which, on account of daylight attenuation, the frequency must be below 60,000 cycles, and, to avoid telegraphic interference, above 30,000 cycles. Thus in the ordinary carrier system only four transatlantic channels of operation are open with equal limitation on the number of messages. And this is not a question of closeness of resonance, but is a matter inherent in the system itself.

Recent experimental development in this field, as described in a paper by Arnold and Espenschied before the Swampscott convention of the American Institute of Electrical Engineers, has resulted in a substantial improvement of this limitation by the perfection of the so-called single-side-band eliminated carrier system. In this system a bridge or balanced type of modulator completely suppresses the carrier frequency in the complex modulated wave, leaving only the side-band resultants. One of these is suppressed by a band filter and only one side-band resultant is amplified and transmitted. At the receiving end the carrier frequency is put in again, permitting telephonic detection in the usual way. The elimination of one side band virtually doubles the number of available transmission channels, and the suppression of the carrier frequency conserves transmitted power, a matter of increasing importance in long-distance radio transmission. Other advantages described are simplification of the antenna, ease in receiving adjustment and reduction of static disturbance. Transatlantic radio telephony has advanced to a point where speech can be delivered with the clearness and uniformity met with in the ordinary wire circuit. It is a wonderful achievement. If two-way speech is not yet a possibility, it is safe to predict that it is not far off.

Quantity Production Methods in Transmission-Line Construction

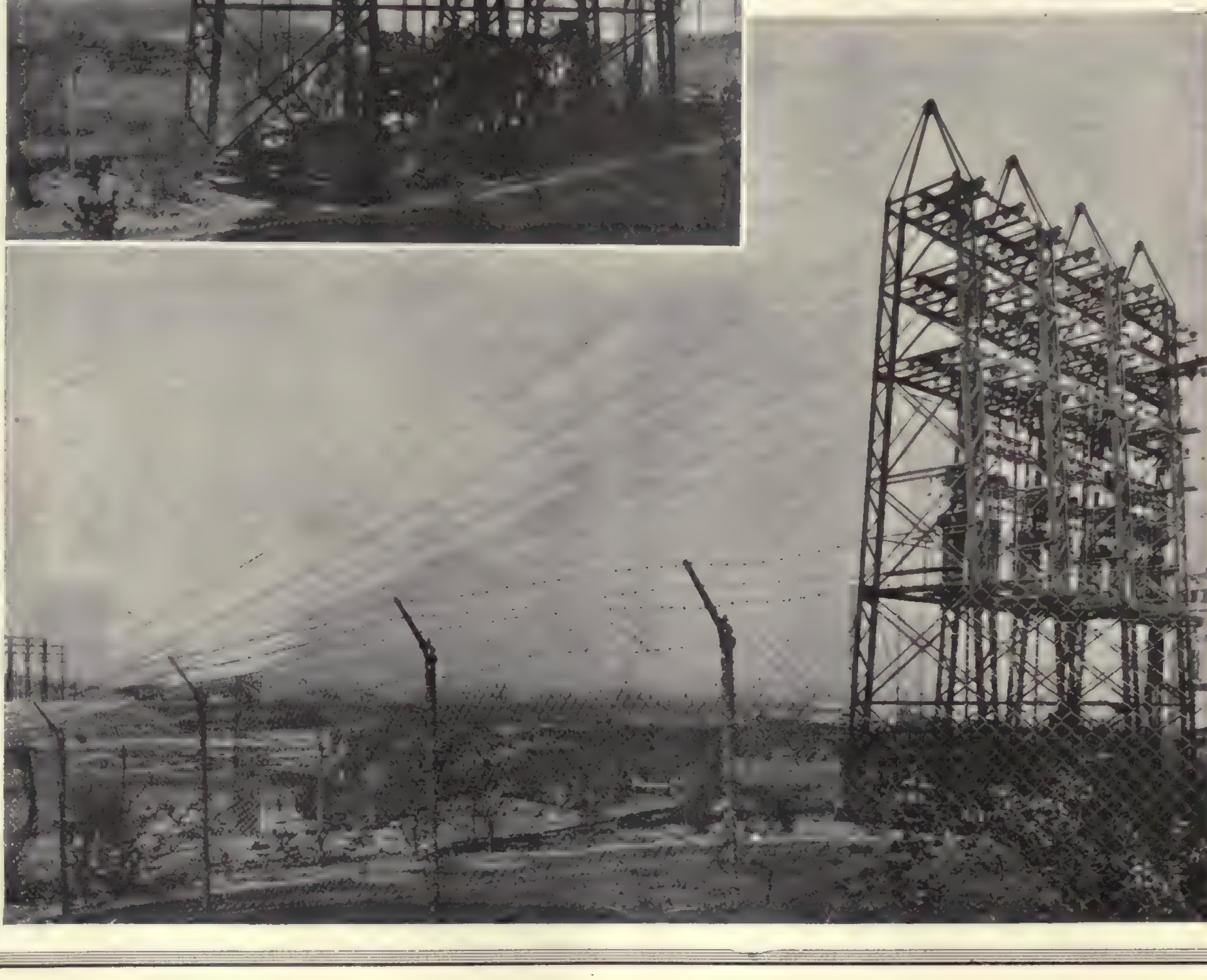
THE construction of a heavy steel-tower double-circuit transmission line with a length of a hundred miles or more is a job that compares in size with many types of structural construction jobs that have been considered big. The cost of such a line runs well above a million dollars, and, unlike the majority of jobs of this size, its construction problems are scattered over miles of territory in place of being concentrated in a few acres at most. There is thus more than ever opportunity to waste money unless the men in charge know how to lay out the work and keep the men working to the best advantage. The idea that factory production methods offer anything of use in this connection is scarcely entertained, and an investigation to determine if such methods are applicable has seldom been undertaken.

Elsewhere in this issue is a description of a line built by the Kansas Gas & Electric Company in which a definite application of quantity-production methods was made in the handling of the entire job. The building of the towers, which is the most difficult individual item in such work, was split into a number of operations —footings and stubs; assembly of towers, by two different gangs each handling a part of the tower; erection, also by two different gangs handling different parts of the tower, and placing the insulators. The material gangs distributed the parts so that each was always to be found in the same position, no matter where the tower was located, and the assembly gangs left the assembly parts always in the same position, so that as each succeeding gang took up its work it went through the same motions as before and each man on a gang performed the same task over and over again. The same was true of stringing the conductors, and an interesting fact was the use of dynamometers in place of targets for sagging conductors.

To help in keeping the work moving steadily the men were thoroughly drilled in their duties, and every method used was carefully worked out before the men were instructed, so that every man knew his duties and what was expected of him and few embarrassing shifts had to be made. The use of auto-trucks contributed materially to the machine-like precision with which operations moved. The description of the construction methods contains many valuable suggestions for those who handle such work, and not the least valuable is the method of handling the labor through permanent camps at advantageous points. Labor is always a problem because of the large turnover that is ordinarily a feature of camp jobs of any kind. The method followed on this job reduced the labor turnover to a fraction of what it usually is, because comfort for the men off duty was the primary object sought in camp arrangements.

Crossing the Miami River with Six 6,600-Volt Circuits

TO ACCOMMODATE the six circuits from the Millers Ford plant of the Dayton Power & Light Company crossing at 6,600 volts the Great Miami River into Dayton, two 18-ton towers were erected. Using a span length of 900 ft., the line was sagged to 14 ft. at a temperature of 40 deg. F. The main tower in the foreground is close to the plant and has an elevation of 50 ft. up to the top conductors, while the opposite tower stands 5 ft. higher. Conductors of No. 4/0 seven-stranded bare copper wire are dead-ended on a row of five pin-type insulators which are jig-cemented to caps and pins. These pins are bolted to the channel bases and half-inch boiler plate is fastened to the caps of the insulators, distributing the conductor stress transversely upon the five insulators. The circuits leave the station through 350,000-circ.mil cables rising in the tower legs and passing through choke coils to the river crossing conductors. There was installed on the platforms a three-phase electrolytic arrester for each circuit with the necessary reversing and disconnecting switches. The towers were designed for a maximum stress of 135,000 lb. with an assumed factor of safety of three, while the foundations have a safety factor of two.



Heavy Transmission-Line Construction

Kansas Company Establishes Permanent Camps to Lodge the Men Who Build Its Steel-Tower Lines—Factory Quantity-Production Methods Applied in Tower Erection

WHEN a heavy transmission line is under construction the question of how the workmen shall be cared for is a serious one. In some of the older and more settled parts of the country it is possible to gather a construction crew who will find their own board and lodging, thus removing that worry from the mind of the construction superintendent. When lines are built across country in the mountain and Far Western regions such arrangements are not possible. Similar lines are multiplying in the Middle West and East, and for the men to find their own board and lodging within reasonable distance of their work becomes more difficult, particularly where the lines are erected across agricultural territory and towns of any size are few and far between. The establishment of labor camps, therefore, often becomes necessary. Generally, in transmission-line work these camps have been of the movable variety, and the transmission-line worker knows the unpleasantness of moving day in such camps, when eating and sleeping seem for a day or two almost like lost arts. The camps present a problem also from a sanitary point of view because all arrangements of any kind are extremely temporary. Resentment against living conditions has been a big reason for the large labor turnover for which camp jobs of every kind have been noted.

When it became necessary to establish camps to handle the labor on the Midian-Neosha 132-kv. line of the Kansas Gas & Electric Company it was decided that, in place of a few movable camps, a somewhat larger number of permanent camps would be used. These camps were ten in number and all alike in arrangements, so that when it became necessary for a gang to change its sleeping place it merely meant going to the new camp at the end of the day in place of back to the old one. A man could immediately make himself comfortable and the dining room was ready for him at the accustomed hour. The buildings in this case were merely tents with wood floors or other protection against the weather, which is rather mild in this part of Kansas during the winter. Each camp was supplied with its dining room and a cook and his helpers. A commissary building was also provided in which a small stock of tobacco and the little knickknacks that are necessary were carried. Socks, gloves, and other like items of clothing were provided in small quantities so that men would not find it necessary to be continually running to town. In the same building space was provided where the men could gather during the evenings to read or amuse themselves in legitimate ways. Reading matter, including current magazines and daily papers, was provided. The camps were put under the supervision of a physician, and a regular inspection and report of camp conditions was made. Every effort to see that the men were comfortable and that the surroundings were healthful was put forth. As the work was carried out with gangs each organized to do certain portions of it, the number of men in any camp at one time was not large, and as each section of the line was completed and cleaned up the camps on that section were abandoned.

FIG. 1—TRUCK AND GIN POLE USED IN ERECTING TOWERS ON MIDIAN-NEOSHA TRANSMISSION LINE OF THE KANSAS GAS & ELECTRIC COMPANY

TOWER ASSEMBLY AND ERECTION

The usual method of tower erection has been the assembly of the towers on the ground and raising them by means of a gin pole which itself must be raised and guyed at each tower location. After a study of the situation it was decided to try a new method of handling the work, based on the factory theory of quantity production. The excavation and setting of stubs by templates was carried out in the usual way.

The tower assembly work was divided between two gangs, one of six men and the other of eight. The gang of eight men assembled the entire batter sections for the two sides of the tower, placing the connecting bracing which forms the other two sides on the assembled sides so that when the batter sections were raised all the material needed to complete this part of the tower would be in the air and ready to bolt to the opposite member. The other gang of six men assembled the top or mast section and the spiderweb bracing at

the bottom of the tower. All of this work was done from material that had been distributed and laid in certain specified positions on the ground so that there would be no searching for material and unnecessary running around. The assembled parts were also left in certain definite positions ready for raising and each man on an assembly crew had his exact work to do. All this work was so planned that no one stood around idle, and when assembly was complete all that was necessary for the erecting crews to do was to pick up the parts that were always to be found in the same position and put them in the air.

A crew of eight men erected the batter sections. This crew was supplied with a 2-ton White truck, fitted with a large engine and winch equipment. A pole was mounted on the rear of the truck. The truck was backed into position between the two batter sections laid out by the assembly crew, already-prepared tackle was hooked on, and the two batter sections were raised into place with the truck winch. Owing to the fact that the two sections were on opposite sides of the truck and the load on the pole was balanced, the only guy lines necessary were those to steady and control the

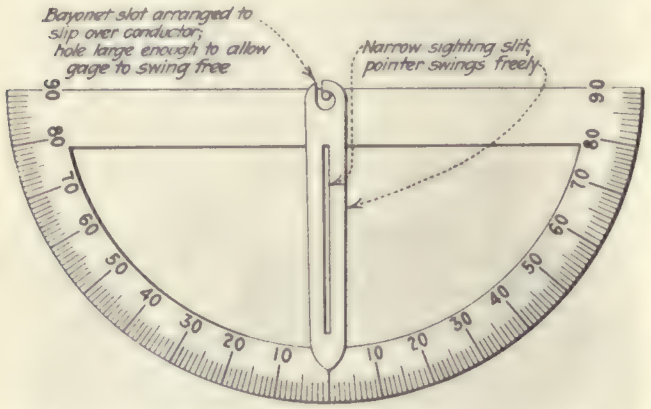


FIG. 2—WIND GAGE WAS USED TO OBTAIN CORRECTIONS FOR THE EFFECTS OF WIND VELOCITY ON TENSION IN STRINGING CONDUCTORS

This was used to find the swing of the conductor under wind pressure, and a table with the proper tensions for the various degrees of swing was referred to for the stringing tensions.

parts as they were raised into position. These consisted of a rope-back guy on each of the sections and a tie between the two sections.

Once the batter sections were in the air, one man started at the ground on each tower leg and rapidly bolted the bracing for the other two sides into place. Two men on the ground took care of the needs of the tower men, and the rest of the crew put all tools, ropes and other materials back on the truck ready to move to the next tower location. In this operation, as in the assembly, every man has his particular job to do, and the tools and equipment on the truck were always put in the same place so that there was no confusion in finding the things needed. A representative of the ELECTRICAL WORLD watched the erection of the batter-section of a tower by this method in which the elapsed time from the arrival of the truck at the location and its start to the next location was thirty minutes. Almost the only spoken words were those of direction to the truck driver as he backed his truck to position for tower erection and the requests of the men on the towers to the ground men to "take up" or "ease off" a guy. The truck was equipped with pneumatic tires and seemed able to traverse almost any kind of ground, even newly-plowed fields. In spite of the cross-country work during the winter none of the trucks had stuck. Although this country is flat, it is apparent that such trucks are capable of work over fairly rough territory.

The masts were put in position by "topping" gangs of six men each. These gangs, of which there were six, also erected the insulators. It was found that the complete assembly of the tower, including the mast and raising into position with the batter section, required too much rigging to prevent bending of the members and that separate erection was the cheapest. Here as in the rest of the tower work each man had his place and work to do. The average number of towers erected in a day by this method was about ten.

STRINGING AND SAGGING OF CONDUCTORS

All sagging of conductors was controlled with the dynamometer. The instrument used on this job had a maximum reading of 5,000 lb. A standard test instrument was kept in camp for test purposes and the instrument in use was checked daily before being allowed on the job. The instruments in use are carried in specially constructed cases to preserve them from injury. In addition to the use of the dynamometer, check sights on at least one span of normal length in each pull were taken by means of targets set up on the towers for the purpose. In this way the stringing crew made certain that sagging was correctly done.

Owing to manufacturing conditions for this size of conductor the lengths were short, half-mile reels having to be handled. The conductors were spliced in the manner recommended and approved by the manufacturer. One of the problems in handling aluminum conductor is to avoid damaging it and leaving weak spots that may cause future trouble. Dragging it across the ground, as is the usual method in stringing, does not help the situation. On this construction job two 2-ton White trucks were fitted up to carry three reels of conductor each. The conductor was "paid out" as the trucks traveled along one on each side of the line of towers. Where unpaved highways were crossed the conductors were buried in a trench across the road until they could be pulled to position.

At each tower the six conductors were hoisted by light tackle and placed in snatch blocks. These snatch blocks have a heavy wood frame with lignum-vitæ sheaves 12 in. in diameter and have been found to be the best for stringing any type of heavy transmission conductor because they do not chafe the conductors in case of a jam as metal blocks will. The large sheaves allow the conductor to adjust itself easily during and after pulling. In order to keep them in condition, they are dipped frequently in oil. On this job the old crankcase oil from the motor equipment on the job was utilized.

Motor trucks like the one used in tower erection were each equipped with a winch. When conditions were ready for pulling the conductors, "come-alongs" were attached to each end of a flexible steel rope carrying a snatch block at its center which served as an equalizer, when attached through tackle to the truck winch drum. Between the steel rope and one "come-along" was connected a dynamometer. With this arrangement two conductors could be sagged at once. The truck winches had ample power to develop the tension necessary, and as they are operated through worm gears the control was excellent. The construction crews

declared they could control the conductor tension within 5 lb. The foreman in charge was supplied with a table of tensions to be used under various temperature conditions and a small and accurate pocket thermometer of the clinical type to read temperatures.

Wind caused considerable trouble in the pulling of the conductors. With wind velocities of greater than 30 miles an hour conductors could not be pulled, and under that velocity it was felt that there should be some correction for the wind pressures. Accordingly a wind gage was devised. This consists merely of a large protractor with a loose-hung pointer having a long narrow slit along its center line. The device is hung on the conductor at the tower and by sighting through the pointer slit at the conductor in the center of the span the deflection due to the wind could be read. With this deflection and a table of corrections the foreman could select the proper tension to which the conductor should be pulled. The table of corrections merely showed the correct tension for the temperature prevailing when the conductor swing was any given number of degrees.

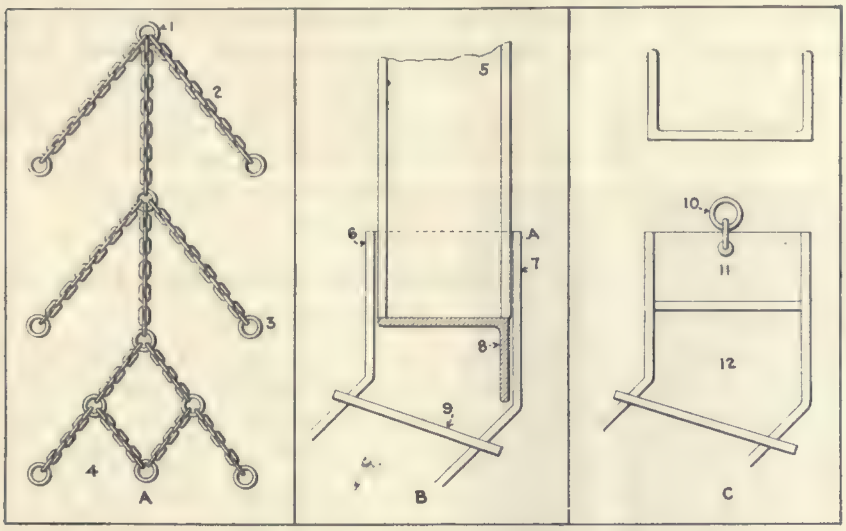


FIG. 3—SOME CONSTRUCTION KINKS USED

A is a chain anchorage used for snubbing tackle, and B shows the shoe used in the erection of the batter sections of the tower to prevent the tower legs slipping past the stubs.

(1) Chain to tackle; (2) unit of three 18-in. chains with big link at junction and similar links at end of each chain (big links large enough to take 1-in. pin used as stake); (3) four parallel pins 1 in. x 36 in. hexagonal steel with upset heads; (4) two chains made up with big connecting link; (5) tower angle leg as it lies on ground ready for erection; (6) shoe in use; (7) erection shoe; (8) tower stub; (9) rod to hold shoe in place around stub; (10) link for anchor stake if needed; (11) bottom for tower leg to rest on; (12) open space to fit over stub.

Between the time of sagging conductors and the tying in to the clamps several days was allowed to elapse so that the conductor would adjust itself. During the whole operation rope tackle was used only for snubbing the conductors when a new hold had to be taken to pull in more slack. This is an important point, since rope tackle, in spite of its extensive use, introduces an element of uncertainty that sometimes makes for serious accidents. The breakage of a rope at a critical point in the pulling of large conductors is generally attended with unpleasant consequences. In anchoring the snubbing tackle an interesting device was used. It consists merely of an arrangement of chains with links large enough to take a 1-in. hexagon rod welded in at intervals. These rods or pins are made of tool steel, are 36 in. long and have upset heads to prevent battering when they are driven into the earth. They make a temporary anchorage that can be rapidly placed in position since all that it is necessary to do is to lay the chains in position and drive the pins. There is sufficient "give" in the arrangement to equalize the strain between the pins in the group.

In tying in the conductor it is necessary to use a protective sleeve to prevent its being damaged by the clamp. On the Kansas job about 15 ft. of aluminum ribbon, 0.3 in. wide and 0.05 in. in thickness, was spiraled around the conductor. As the ribbon came in large reels, it would have been awkward to cut off and handle merely the lengths required each time, so small reels were made which would hold just the proper length of ribbon. Then in camp small compact spirals were formed which would fit into the pocket and which could be carried up the tower without inconvenience.

RAISING A BATTER SECTION USING SHOES AND STUBS EQUIPMENT DESCRIBED IN FIG. 3

In the erection of the towers two of the batter-section legs butted against the stubs on each side. To offset the stress and prevent bending of the stubs, 4-in. x 4-in. timbers cut to the right length were put between the stubs as braces. As the batter sections were raised on opposite sides the bracing took the stress

from both directions. The shoe shown in the accompanying illustration was used to hold the tower legs in line with the stubs as the sections were raised and also to hold the legs at the proper height to allow bolting to the stubs.

The test checks on the dynamometers were made on a rectangular frame of 4-in. x 4-in. timbers, with a cable anchorage on one of the short ends of the rectangle and a heavy rod with a machine bolt thread on the other. This was passed through a threaded metal plate. With the standard-test dynamometer and the working instrument swung between these centers and a crank with a threaded end to fit over the threaded rod the two instruments could be pulled to tension.

In place of the boatswain's chair frequently used for adjusting insulators and tying in conductors, small ladders similar to a fireman's scaling ladder were used. These merely hooked over the cross-arm so that the man could work from them at the level of the conductor fastening. Moreover, they could be placed out on a dead-end so that the fastenings could be reached.

As stated already, the effort in organizing the work was to build up the gangs so that each man had a definite thing to do and the work was evenly distributed among the men who composed any one gang. In a job of this size there is sufficient work of different kinds to permit this to be done successfully, and the work can proceed without the "whoop and holler" method that is a familiar part of so much line work. On the trucks carrying tools every item of equipment had a place, and it was the business of the men who had to use equipment to see that each item went back into its place.

When a crew started on a piece of work, such as tower erection, every man knew his place and the things he had to do. The assembly crews found the tower parts in the same place on every location and left the assembled parts in exactly the same position in each case, so that the erection gangs had no adjustments to make when they arrived at the location but could go ahead with the scheduled routine. The effort throughout the job was to carry out every operation on this principle.

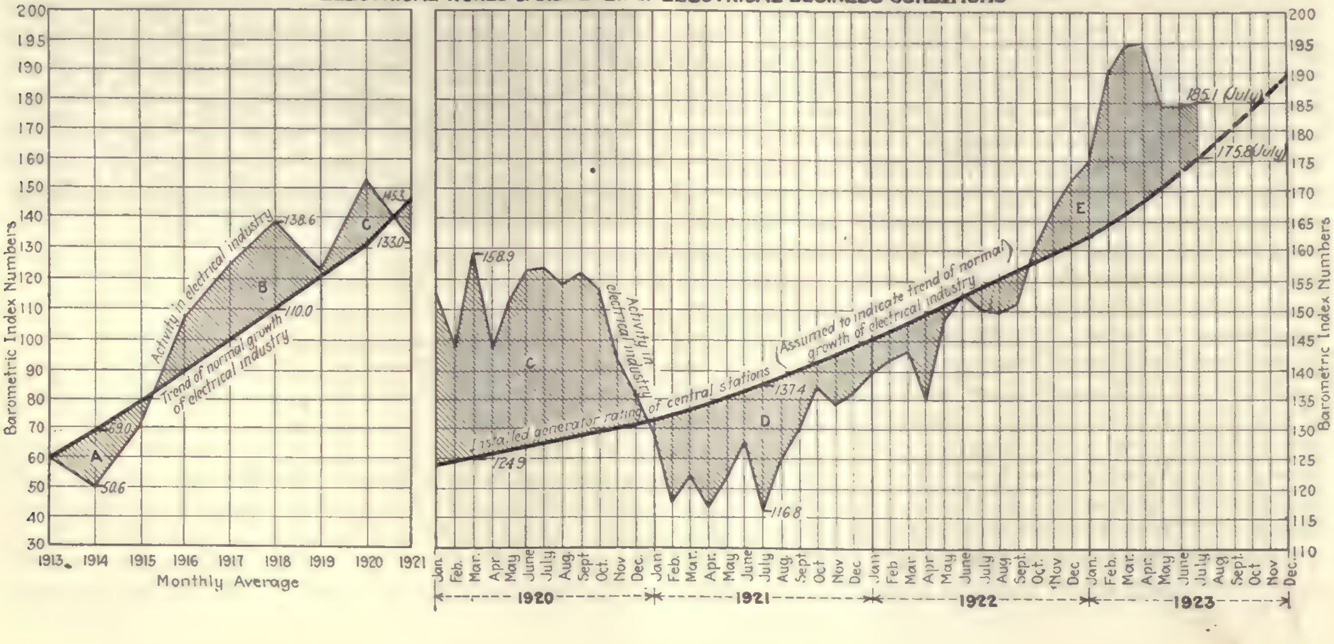
An interesting phase of the records was the progress chart. Listed vertically on the chart, on the wall of the construction office at Fredonia, were the items of right-of-way secured, holes dug, stubs distributed, stubs set, tower steel distributed, towers assembled, towers erected, insulators hung, wire distributed, wire strung, wire sagged, wire tied in and clean-up. Opposite each item was a space to represent each tower on the line. As each item of work was complete the space for that tower was filled in in red crayon. At the end of each week the red was covered with black crayon. The chart therefore showed graphically the progress of the work, the work immediately completed being indicated in red and that completed in the previous weeks showing as black. Space was also provided under each tower in which to show the date on which the final clean-up took place and the work so far as that structure was concerned was finished.

Midsummer Activity 9.3 per Cent Above Normal

INDEX figures upon which the "Electrical World Barometer of Business Conditions in the Electrical Industry" is based indicate that activity in a large proportion of the primary industries of the country was further curtailed during July. The iron and steel and the copper industries are notable exceptions to this general trend. Statistics of former years indicate that such a slowing up in the activity of the mills and factories of the nation is normal during the midsummer season and yet the industry as a whole is operating several points above the value that would be indicated by normal estimated growth.

The data upon which the "Electrical World Barometer" is based indicate an increase of seven-tenths of a point on the barometer scale as compared with June activity. During this interval the industry has grown 2.5 points, leaving a net decrease in activity of 2.2 points on the barometer scale as compared with June. The electrical industry as a whole was operating in July at 9.3 points or per cent above what would have been the point of seasonal demand if growth in the industry had been normal. In June it was operating at 11.5 and in May at 13.6 points or per cent above the point of normal demand.

ELECTRICAL WORLD BAROMETER OF ELECTRICAL BUSINESS CONDITIONS



Electric Furnace Demonstrates Flexibility in Steel Foundry

Successful Results Obtained During Good and Bad Operating Conditions — Location of Furnace, Selection of Auxiliaries, Acid Versus Basic Linings and Detailed Operating Results

By J. L. McK. YARDLEY
General Engineer Westinghouse Electric & Manufacturing Company

FEW installations have provided more opportunities for the electric arc furnace to prove its flexibility and adaptability under the changing commercial conditions that affect the operating requirements of a steel melting plant and foundry than has the 6-ton Ludlum-furnace installation at the Trafford foundry of the Westinghouse Electric & Manufacturing Company. This furnace, which was first placed in operation Feb. 27, 1920, was installed through the foresight of A. Slusser, foundry manager, who in addition to desiring to turn into ingots a large tonnage of nickel-steel scrap for rush-order costings which custom foundries were unable to deliver in time, anticipated considerable growth in the electric steel foundry business and wished his organization to become experienced in the making of electric steel under good and bad conditions and with a variety of materials.

FIG. 1—6-TON LUDLUM ELECTRIC FURNACE AT TRAFFORD CITY STEEL FOUNDRY OF WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

In the foreground is a bucket containing steel turnings, and to the left is a carload of light charging scrap, including 3-in. shells. Also to the left is a spout for charging hot metal. Back of the furnace is shown the low-tension interlaced bus coming down from the transformer on the floor above. The furnace is equipped with three 10-in. graphite electrodes with a 27-in. separation. The bottom lining consists at present of 9 in. of silica sand over 9 in. of brick. The 30-ton reverberatory coal-fired air furnace to the rear and left is for the purpose of making large iron castings, and affected the location of the Ludlum furnace.

At the outset it was realized that any single electric furnace installed in the Trafford works which was built, organized and operated as an iron foundry would be handicapped by local conditions more than would a steel foundry especially laid out for the purpose. It was concluded, however, that these conditions would not cause prohibitive operating costs, and might give better experience than would otherwise be obtainable.

Some of the conditions which existed are worth considering, both as an aid to interpreting the results obtained in this particular installation and as a guide to determining what conditions would produce the ideal situation in a specially designed electric steel foundry.

The furnace bottom as originally built had only 6 in. of magnesite over a 9-in. brick lining, and it had an actual capacity of more than 8 tons. Because of the necessary location of the furnace it is on the pouring-floor level, it is accessible to only one of the two cranes in the furnace bay, and the resulting necessary location of the furnace transformer causes unusually long secondary leads.

With small furnaces, from which the metal is shanked out directly in hand ladles, location of the furnaces on the pouring-floor level is unavoidable. But when the metal is handled by crane ladles there are many points in favor of setting the furnace on a raised platform of sufficient height to obviate the necessity for a deep ladle pit in front of the furnace and of sufficient area to make furnace operations as convenient as possible. This setting has a number of advantages:

1. It keeps the furnace crew away from the molders.

2. It permits mounting the tilting motors and machinery where there is less chance of injury by vagrant hot metal or water. (The Trafford furnace was shut down for several days at one time owing to the flooding of the pit.)

3. It cuts time in all operations of the ladle at the furnace and also makes for easier slag disposal.

As disadvantages this setting requires that:

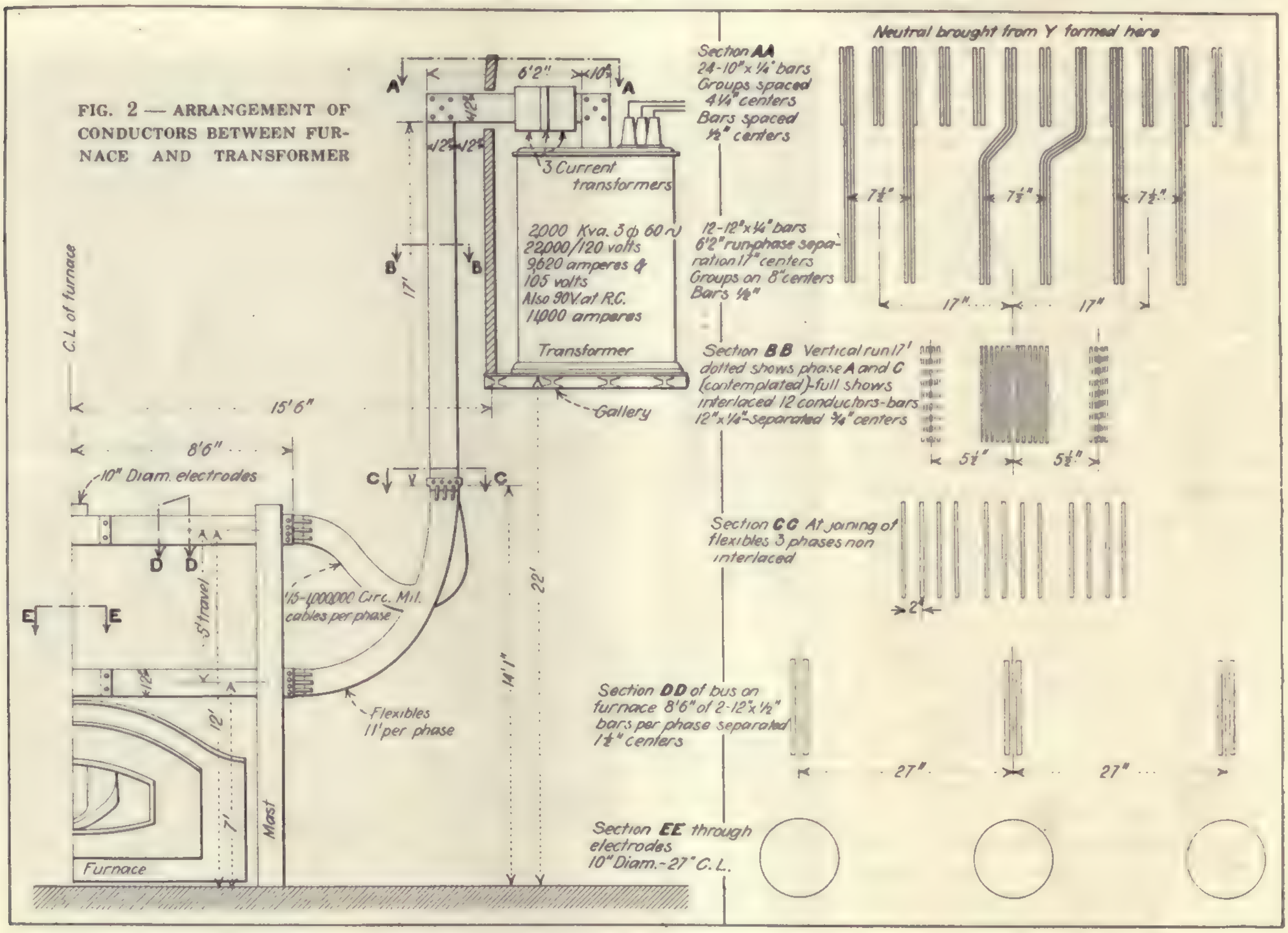
1. A more expensive structure be provided. The whole building must be higher to allow the cranes to pass over the furnace.

2. All materials must be carried up to the platform. The space under the furnace is not wasted, however, as it can very conveniently be used for the storage of furnace materials.

Accessibility and adequacy of material-handling equipment are essential in order that operations shall not be hampered. Where the hot and cold metal are both handled by crane it is important for quick operation that more than one crane be available for work at the furnace at times of pouring and charging. This is particularly important where castings are poured directly from the crane ladle and where a crane is also required in charging the cold metal, either because of the size of scrap used or owing to the fact that top charging from preheated bucket is employed.

In one custom foundry, where the crane ladle filled with hot metal from the furnace is quickly deposited upon a car for transfer into the pouring-floor bay, where it is dumped by crane into a number of hand ladles, the furnace crane picks up the bucket containing the new charge of 5 tons of steel scrap, which has been preheating with oil, and takes it to the furnace, where it is lowered through the opened top and emptied. The whole operation of pouring and recharging the furnace consumes not more than fifteen minutes. Power is delivered to the furnace for from one hour and thirty-five minutes to two hours per heat. The maximum five-minute power demand is limited to 1,500 kw. Five heats are poured during the ten-hour operating day. The average power consumption is 460 kw.-hr. per ton of steel melted. From twenty to seventy heats are obtained per roof. Under the conditions existing at the Trafford works, where the furnace and pouring floor are fortunately in the same bay, really speedy operation at the time of pouring and recharging the furnace with the grades of scrap employed can be accomplished only by transferring the hot-metal ladle from the furnace crane to the pouring-floor crane and allowing the former to turn at once to the work of charging the heavy scrap. The present average time of one hour and fifteen minutes would, of course, be reduced materially if light scrap such as is easily shoveled by hand were used entirely, if a charging machine were provided, or if the frequency of patching the furnace bottom could be changed from once after every heat to every two or three heats or every day.

FIG. 2 — ARRANGEMENT OF CONDUCTORS BETWEEN FURNACE AND TRANSFORMER



Relative Location of Electrical Equipment and Furnace

Second only to the location of the furnace with respect to shop operations is the relative position of the electrical equipment and the furnace. At Trafford space was not available on the pouring-floor level for

the transformers and other equipment with the exception of the furnace-control panel, owing to the fact that power is supplied at 22,000 volts. For this reason it was necessary to place lightning arresters, incoming line circuit breaker and tap changing switch, metering panel, automatic regulator and the 2,000-kva., three-phase furnace transformer on a gallery 22 ft. above the pouring-floor level. This introduced problems in delivering power to the furnace which demanded special attention in the general consideration of a suitable layout.

MANUFACTURER'S REQUIREMENTS

The furnace manufacturer required that the furnace transformer be connected in star on the secondary side so that the neutral could be carried to the furnace shell. Voltages of 120 and 105 at full capacity and 90 at reduced capacity were specified. As indicated by Fig. 1, it was necessary, therefore, to make provision to carry a current reaching 11,000 amp. at full transformer rating a distance of approximately 43 ft. per phase from the transformer terminals to the furnace electrodes. The schedule* under which power is purchased required that this be done in such a manner that the high-tension power factor would be at least 90 per cent, otherwise a penalty would be incurred. It actually developed that fulfilling this requirement was less difficult than doing the job economically, that is, without appreciable efficiency loss due to futile use of an excessive amount of copper. It was appreciated that "mutual induction" and "self-induction" and "skin effect" combine to unbalance alternating current in parallel conductors and cause it to flow chiefly in the outer layers of the individual conductor, thus making it difficult at 50 and 60 cycles to design the heavy current-carrying buses and connectors. Thorough analysis† of these effects in the proposed electrical layout was therefore deemed essential before its structure could be finally determined and the material ordered. The structure selected, which is shown in Fig. 2, is designed to cause very small unbalancing effect and to operate at 96, 93 or 91 per cent power factor, at full rated transformer load, depending upon which voltage is being supplied to the furnace.

*In accordance with Schedule F (see *Forging and Heat Treating*, March, 1921, and *Blast Furnace and Steel Plant*, June, 1921), power was purchased from the Duquesne Light Company on a fifteen-minute demand basis.

†This analysis is given in detail, together with conclusions in the article on "Heavy Alternating-Current Busbars and Connections for Electrolytic Synchronous Converters, Electric Furnace and General Industrial Service," by J. L. McK. Yardley, *Blast Furnace and Steel Plant*, September, 1923.

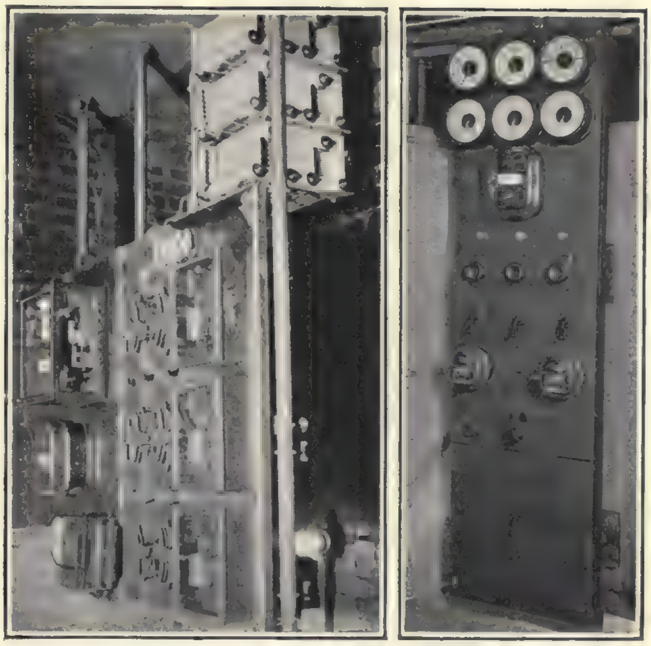


FIG. 3—AUTOMATIC REGULATORS, METERS AND FURNACE-CONTROL PANEL

The regulator panel supports the control element, the magnetically operated switches which control the electrode motors, the necessary switches and fuses with resistances and capacities mounted back of the panel. The control element consists of a pivoted lever floating in horizontal position with one core at each end extending into solenoids. The pull of one of these coils varies with the current which flows through the corresponding electrode, while the pull of the other coil varies with the voltage between the electrode and bath, or between two electrodes on a free-burning arc furnace. The pivoted arm has one set of contacts at each end. These contacts are so arranged that they control magnetic contactors, which in turn control the electrode motors. With power off the furnace this lever remains in horizontal position. On closing the main breaker, potential is immediately established between each electrode and the furnace charge. The voltage coil becomes energized and pulls its core up, thereby closing the contacts on this end of the lever, which in turn closes the contactors operating the electrode motor in direction to lower the electrode continuously and at full speed until it makes contact with the charge.

As the voltage coil is connected between the electrode and the furnace charge, its current will be shunted and it will become de-energized the minute the electrode makes contact with the charge, thus allowing the lever of the main control element to return to its horizontal position and open the motor circuit. As soon as the circuit has been completed by another electrode having made contact with the charge, the current coil becomes energized, thereby closing the contacts which cause the electrode motor to raise the electrode, thus drawing an arc to the bath. The motor continues to raise the electrode until the voltage between the electrode and the charge increases and its current decreases to such an extent that the pull of the voltage coil is equivalent to that of the current coil. The lever will then assume a horizontal position, opening the motor circuit. Any disturbance of the equilibrium between the pull of the coils due to variations in the arc will cause either contact to close, thus operating the electrode motor in a direction to compensate for the disturbance. A current-adjusting rheostat is connected across the current transformer. By changing its position, the value of the current per phase for a given current in the current coil of the element can be altered at will within the limits of the apparatus.

TABLE I—DATA ON STEEL CASTINGS PRODUCED ACCORDING TO FOUR DIFFERENT SPECIFICATIONS

	A	B	C	D
Description of Product	Soft Steel Castings	Good Commercial Grade of Castings	High-Grade Normalized Steel Castings	Large Annealed Steel Castings
Manufacture	Castings to be thoroughly annealed	. . . .	Castings allowed to become cold and then uniformly reheated to proper temperature to refine the grain (approximately 1,700 deg. F.) and then drawn from furnace and allowed to cool in the air at ordinary shop temperature, protected, however, from moisture and drafts.	Castings left in mold until entirely cooled to 700 deg. C. Castings annealed by being heated slowly and uniformly to proper temperature to refine grain and held at this temperature sufficiently long to insure complete penetration and allowed to cool uniformly and slowly.
Chemical Properties by Analysis of Test Ingot from Ladle, Per Cent	C, 0.20—0.35 Mn, 0.40—0.80 P not over 0.05 S not over 0.05 Silicon, 0.15—0.35	C, not over 0.30 P, not over 0.08	C, 0.20—0.35 Mn, not over 0.75 P, not over 0.06 S, not over 0.06	Mn, not over 0.75; P, not over 0.05; S, not over 0.05
Physical properties	No physical tests made. Surface inspection before and after machining. Castings true to pattern substantially or within commercial limits and all cores accurately placed. Castings free from injurious defects. Bearing surfaces solid and without porosity in positions where the resistance and value for the purpose intended would be seriously affected thereby. Gates and risers neatly and closely trimmed and castings free from sand, scale, etc.			½-in. diameter x 2-in. L, tension specimen, and ½-in. x 1-in. section-bend specimen are taken from test coupon, 1½-in. x 1½-in. x 5-in., after removal from casting. Tensile strength, 60,000 lb. per square inch minimum. Yield point (by drop of beam), 27,000 lb. per square inch. Elongation in 2-in., 22 per cent. Reduction of area, 30 per cent. Bend specimen, 120 deg. around 1-in. diameter pin.

T-3001

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.—TRAFFORD FOUNDRY

ELECTRIC FURNACE REPORT "Acid" operation. 4b.

SHIFT Day | DATE 5/23 1923 | GRADE Spec. D Steel Castings | HEAT No. 885

CHARGE	LBS.
Foundry Returns	4300
Light charging scrap	7950
Steel trimmings	3700
TOTAL	
METALIC ADDITIONS — PER CENT CARBON, PER CENT ALLOY	
CARBURITE	
80% FE. MN	150
50% " SI.	160
Aluminum	2
TOTAL METAL IN FURNACE AT TAP	16262
ELECTRODES	
ROOF	
FURNACE	
DOORS	

ANALYSIS	C EST	C	MN	SI	P	S	CR	NI	W	VA
SPECIFIED										
FINAL		.19	.59	.31	.034	.036				
FIGURED										
PRELIMINARY 1		.16	.09							
" 2										
" 3										

MELTER	TIME	METER READING K W H	HOURS FOR HEAT	K W HOURS TOTAL	PER TON MELTED	PER TON GOOD CAST	EXTRA
START CHARGING							
POWER ON	11 AM	788600					
SKIM							
TAP	2.30 PM	792350	3½ hrs.	3750	462		

SLAG MATERIALS	LBS.
LIME	
FLUORSPAR	
CARBON CORE	
FINE SILICON	
ORE	
REFRACTORIES	
MAGNESITE	
" CEMENT	
CLAY	100
SAND	400
NOZZLES 2"	1
STOPPERS	1
SLEEVES	6
TILES	

WEIGHT REPORT	LBS.
GATES AND RISERS	
REJECTED CASTINGS	
BUTTS	
SKULLS	
PIT SCRAP	
TOTAL SCRAP	
ACCEPTED CASTINGS	
TOTAL	
TOTAL IN FURNACE AT TAP	16262
DIFFERENCE	

CASTINGS REPORT: NO. OF PIECES	SIZE	TOTAL WEIGHT

FIG. 4—ELECTRIC FURNACE REPORT

When operating basic, the following results were obtained on three occasions: (1) Grade—Cast Iron: Charge, 18,036 lb. of cast-iron millings; slag, 100 lb. lime, 432 lb. carbon; length of heat, 4 hr. 15 min.; energy consumption, 625 kw.-hr. per ton melted. (2) Grades—Specimens A, B, C and D steel castings: Charge, 1,820 lb. trimmings, 1,710 lb. sheet, 7,210 lb. foundry returns, 2,430 lb. light charging scrap; metallic additions, 42 lb. carburite, 109 lb. ferromanganese, 108 lb. ferrosilicon, 3 lb. aluminum; slag, 804 lb. lime, 102 lb. fluospar, 72 lb. carbon, 55 lb. fine silicon, 150 lb. ore; length of heat, 3 hr. 50 min.; energy consumption, 700 kw.-hr. per ton melted. (3) Grade—5 per cent nickel steel ingots: Charge. 5,136 lb. 5 per cent nickel millings, 3,086 lb. blades, 2,238 lb. ingots, 100 lb. scrap, 280 lb. lime; metallic additions, 61 lb. ferromanganese, 96 lb. ferrosilicon, 3 lb. aluminum; slag material, 608 lb. lime, 152 lb. fluospar, 12 lb. carbon, 105 lb. fine silicon, 150 lb. ore; length of heat, 4 hr. 15 min.; energy consumption, 1,025 kw.-hr. per ton melted. The form in which these results are recorded is shown above.

Since the purpose of the electrical equipment is to serve faithfully the furnace and enable it to produce steel at the lowest possible power cost, reliability is the essence of the installation, and ruggedness and simplicity of construction and accuracy of control must be its chief characteristics. Switchboard details should not cause annoyance and delay. Controller handles should be substantial, easy to hold with sweaty hands, and where indication of controller position is necessary it should be made obvious from a considerable distance away from the switchboard. Attention should be given to the visibility of meters from operating positions of the furnace men. The rear of control panels must be protected from dirt, dust and mechanical injury amid the strenuous operations of the steel plant and yet must be readily accessible. The graphic wattmeter should be away from access by the furnace operators, preferably in the superintendent's office, as it is a most valuable check on operations. At Trafford the graphic wattmeter was placed on the metering panel in the transformer vault on the gallery, where an automatic furnace regulator was also installed. As this piece of apparatus is so vital in any successful electric arc-furnace installation, it deserves the greatest consideration of all.

Ever since electric arc furnaces have been in commercial use in melting steel, ferro-alloys and non-ferrous metals, there has been a demand for a suitable device to maintain steady electrical conditions in the furnace. The Westinghouse regulator which was selected for this installation may be adapted to any furnace having any number of movable electrodes. Its features are emphasized in Fig. 3.

The regulator can be adjusted to operate when the current varies 5 per cent from its normal value. The utilization of both arc voltage and arc current for controlling the electrode motors prevents the electrodes from getting into the steel under automatic regulation. The regulator is particularly rapid since an electrode speed of 2½ ft. to 3 ft. per minute is possible under automatic control. Current surges are brought back to normal with a promptness which results in a reduction in the demand load, especially when a short demand period is the basis upon which the power company figures its rates. The speed with which settled conditions are attained reduces the over-all time per charge and permits a greater production of metal per hour. The regulator operates at full speed until current is within about 10 per cent of normal, and from there on its speed diminishes to zero as the current reaches normal. This zoning effect is accomplished by means of auxiliary contacts on the main contactors which operate to short-circuit sections of the voltage and current coils of the regulator respectively. High speed, insuring close regulation, is thus obtained without overshooting or hunting.

In early installations it was the practice to control the position of electrodes manually, in order to obtain constant power input as nearly as possible. This manual regulation required the unceasing attention of

one or more men per furnace, depending upon the number of electrodes. An automatic regulator relieves the furnace crew from attention to the regulation of the furnace and allows them to give their entire attention to the metallurgical aspect of melting steel and producing hot metal. This results in a reduction in the number in the crew, particularly if several furnaces are charged and tapped in rotation.

Acid Versus Basic Linings

Whether the furnace lining should be acid or basic is a question which is so essentially tied up with the kind of product desired and with the economics of every installation that careful consideration must be given to it. It is usually considered cheaper to operate an acid electric furnace than a basic, taking account of power and electrode consumption, refractory costs and greater production. In practice, however, the advantage is largely offset by the high price of guaranteed melting stock.

The choice between acid and basic operation depends to a great extent upon whether quantity production or steel of definite and highest quality is desired. There is no question that better steel can be made by the basic process than by the acid process. It is impossible in the latter to make alloy steel with guaranteed results, because the alloys themselves oxidize very quickly. In adding alloys in the ladles it is difficult to obtain uniform results. In basic practice the alloys may be mixed in the furnace. In some respects the basic electric furnace is like the basic open-hearth furnace. It is superior, however, to the open-hearth because of the uncertainty of sulphur elimination in the latter. One difficulty in basic electric furnace practice is the tendency of slag with top pouring to get into the mold. The effect of this upon the steel can be largely overcome, however, by bottom pouring.

Considered from every viewpoint, the question of whether the lining shall be acid or basic is usually decided as follows:

Acid lining should be used when:

1. The sulphur in the scrap employed is, and is likely to continue to be, less than the sulphur required in any castings to be made.
2. The phosphorus in the scrap employed is, and is likely to be, less than the phosphorus required in any castings to be made.
3. When the range of manganese and silicon contents will not be too exacting.
4. When close limits are not set for physical tests.
5. When power consumption must be low and rate of operation is of prime importance.
6. When very small castings in quantity production are to be the sole output.

Basic operation is advantageous when reasons (1) to (4) are opposite to those given above, and when:

1. Alloy steels are ever to be made in the furnace.
2. A steady load is essential.
3. Refining of cast iron is being considered. In making engine cylinders, high-pressure valves, piston rings and parts requiring uniform wearing qualities, a practice now being adopted is to pass the molten iron from the cupola through the electric furnace for a refining period of from twenty to forty minutes, which gives a rapid desulphurization, elimination of occluded gases and an accurate pouring temperature.

It is interesting that during its more than two years of service the Ludlum-furnace installation at Trafford has been successfully operated for different lengths of time in (1) melting down nickel-steel scrap and refining to form ingots with basic lining; (2) melting down miscellaneous steel scrap and refining to form steel castings with basic lining; (3) melting down cast-iron borings and turnings to form iron castings with basic lining, and (4) melting down selected steel scrap to form steel castings with acid lining, (a) at approximately 115 volts, (b) at approximately 128 volts.

When this installation was first planned, only two operations were contemplated—(1) a temporary period and (2) a permanent operating period, during the first nineteen and one-half months of which a basic lining was used. During the latter period 131 heats of nickel steel, six heats of cast iron using cold scrap and one heat of cast iron using hot metal from the cupola were poured. During the period mentioned 492 heats were poured with an average energy consumption of approximately 725 kw.-hr. per ton.

Operating Results Obtained

Steel castings were produced according to four different specifications, as shown in the accompanying tabulation.

TABLE II—COST OF STEEL AT SPOUT FOR MONTH OF FEBRUARY, 1923

Miscellaneous alloys		$531.00
Scrap, etc.		10,642.00
Wages of chargers and helpers		928.00
Salaries of foremen		158.00
Material handlers		528.00
Wages of crane operators		233.00
Fluxes, etc.		72.00
Furnace repairs, including electrodes		2,372.00
Laboratory expenses		312.00
Maintenance of buildings		9.00
Maintenance of cranes		70.00
Depreciation—buildings		23.00
Depreciation—mechanism, transformers and furnaces		169.00
Insurance		6.00
Taxes		40.00
Power, heat and light		4,694.00
General expenses:		
Salaries of superintendents and clerks, furnishings, office expenses, dining rooms, police officers, telephone and telegraph, prorated charges from general books, etc.		302.00
Total defective castings	$372.00	
Miscellaneous small tools	54.00	
		426.00
(Remaining two-thirds against pouring floor)		
Portion of stores		10.00
Total		$21,525.00
Total output, exclusive of melting loss, lb		929,936
Average cost per pound of steel at spout		$0.0231
Loss, heads, gates, splashings, etc., lb.		324,726
Cost at 0.0125 cent per pound		$4,059.00
Net output, lb.		605,210
Cost per pound of steel in molds		$0.02886

Business depression forced the shutting down of the furnace on Oct. 14, 1921, for fourteen months. When conditions permitted starting again steps were taken to reduce operating costs. It was found possible to buy at reasonable price turnings and light charging scrap of a composition which would analyze before charging less than 0.04 per cent P and 0.04 per cent S. The furnace was accordingly lined (bottom 9 in., sand over 9 in. brick) for acid operation, it being considered that the greatest savings could probably be accomplished by increasing the number of heats per working day and reducing the kilowatt-hours consumed per ton of steel produced. The furnace was started on Dec. 20, 1922, with acid lining for the 631 heat to make steel castings according to specification (D), working upon charges consisting of (a) heavy charging scrap (foundry returns); (b) light charging scrap (plate shearings, small forging stock, 3-in. shells), and (c) heavy short shovel turnings.

The first sixty heats with the "acid" lining were melted with too low an applied furnace voltage. As a result the heats were of unequal and uncertain length. Owing to the condition of scrap and method of charging, high resistance due to non-conducting material under the electrodes caused great difficulty in getting current through the charge at the beginning of a heat. In time the three graphite electrodes of comparatively small diameter in a row would cut a narrow trough down through the metal, establish a longitudinal pool and finally heat and melt the entire mass of metal. Power consumption was practically as great as with "basic" operation and electrode consumption was higher, being around 17 lb. per ton. The electrode cost, at 18 cents per pound, was therefore $3.06 per ton.

The applied voltage was then increased to the maximum obtainable from the transformer and greater care was observed in charging. Markedly improved results were at once obtained. This is indicated by the accompanying furnace report (Fig. 4). Electrode consumption was reduced to 8 lb. or 9 lb. per ton. That is, on the average, one section 60 in. x 10 in. in diameter was added every fourth 8-ton heat. More than 200 heats have been poured under the improved conditions.

A power cost of ½ cent per pound, and an average cost per pound of steel at spout of 2.31 cents, or a net cost in the molds of 2.886 cents per pound, is not what could be called a low cost; but it is unquestionably low for the conditions and indicates a vigilance in management obviously directed toward overcoming the admitted shortcomings of the installation. The particular immediate impediment to reducing cost is lack of pouring-floor space. The furnace operation must be slowed down at present because the floor is unable to take its capacity. This situation will be relieved somewhat, and a lower melting cost should prevail, when the addition to the foundry now under construction, in which small green-sand castings are to be made, is in operation.

In conclusion, the results of operation have indicated that there are two serious defects in the furnace which should be and can be eliminated. One is that the roof does not last so well as the circular roof, and the other is that the electrode masts lack rigidity against side whip. The electrode plants are very satisfactory, but the door construction is very poor. For some unknown reason, the furnace was designed with doors on the chamber side of the furnace wall, so that the ledge is on the outside rather than on the inside of them. Notwithstanding these defects, the installation has been a commercial success. Under the circumstances, a good life of refractories has been obtained.

At last report, about June 1, 1923, the first acid lining was in good condition. A new roof lasts about one month—that is, fifty or sixty heats—before requiring patching. It usually stands patching about twice and lasts in the neighborhood of three months, or a total of approximately 150 heats.

Acknowledgment is gladly made to A. Slusser, J. R. Thompson, superintendent, and D. N. Witman for placing the foundry records at the writer's disposal.

Interconnection Progress in Ohio at 132,000 Volts

Plan Contemplates Connection of Ohio Public Service Company's Properties and Interchange with Neighboring Utilities

BY GEORGE E. SNIDER* AND E. E. SPRACKLEN†

THAT part of the ultimate interconnection of the Ohio Public Service Company's properties lying between Warren and Alliance, Ohio, was completed and placed in operation recently. Interconnection of this

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FIG. 1—STANDARD AND ANGLE TOWERS USED ON OHIO INTERCONNECTION

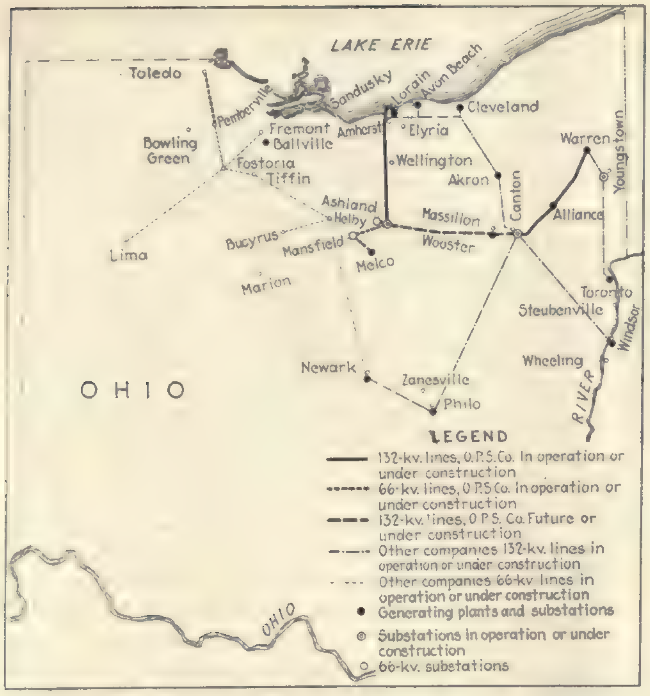


FIG. 2—INTERCONNECTIONS OF THE OHIO PUBLIC SERVICE COMPANY IN OPERATION OR UNDER CONSTRUCTION

section with the Ohio Power Company at Canton and the interconnection between Lorain and Mansfield are now under construction and will be completed soon.

Some idea of the work contemplated may be obtained from a study of Fig. 2, which shows only the proposed interconnections of properties owned and operated by the Ohio Public Service Company and the connections to be maintained with other large utilities of the state for interchange of power. Connection with utilities operating in neighboring states allows for an interchange of power well into Pennsylvania, Indiana and Michigan and will eventually form a large link in a vast superpower system, combining the natural resources of the Ohio River Valley with those of the Great Lakes, to supply the industries and communities throughout Ohio and western Pennsylvania.

Present development includes a double-circuit rigid-steel tower line from Warren through Alliance, Canton, Massillon and Ashland to Lorain, to be operated at 132 kv., 60 cycle, with substations at each point, and a similar line from Ashland to Mansfield for operation at 66 kv. Until the connection between Canton and Ashland is completed, the line between Lorain and Mansfield will be operated at 66 kv. but insulated for 132 kv. from Lorain to Ashland.

The type of towers used is shown in Fig. 1. Standard line towers (type A) are spaced about one-sixth of a mile apart, while strain towers (type B) are erected at all angles exceeding 5 deg. Both types of towers are galvanized and mounted on earth footings. The type A tower weighs 7,600 lb., including earth anchors, and the type B tower 15,000 lb. No strains or semi-strains are employed except at substations, where single-circuit horizontal-spacing dead-end towers are used to obtain proper position for entrance. No ground wires have been installed, although the construction of the towers allows for the installation of one if it is found necessary. The conductors, which have a cross-section of 336,400 circ.mill, have a normal spacing of 22 ft. 6 in. horizontally and 12 ft. vertically, with 2 ft. 6 in. offset of center conductor.

On straight suspension a standard ten-unit string of 10-in. disks is used, while at angles exceeding 5 deg. and at dead-ends a ten-unit string of extra-strength 11-in. disks replaces the usual method of installing double twelve-unit strings of the lighter 10-in. disk. At the conductor end of the string a standard galvanized horn is used to reduce the potential gradient.

All substations along the line are developed from a unit structure and are consequently essentially the same, differing only in the number of lines and the low-tension voltage required for that locality. A typical installation, now in operation at Alliance, is shown in Fig. 3. The steel work is composed of a minimum number of

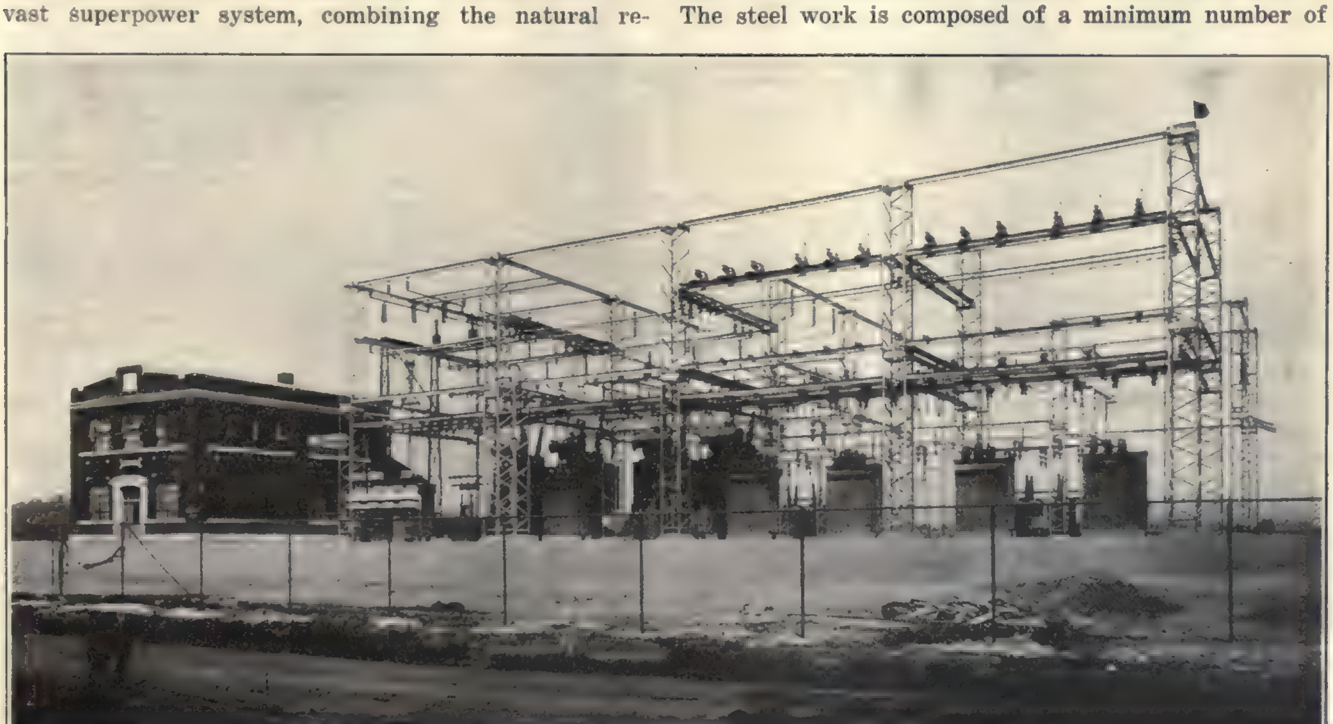


FIG. 3—SUBSTATIONS DEVELOPED FROM UNIT STRUCTURE

standard shapes and is galvanized throughout. All columns are of the same construction, are 30 in. square and extend in two sections of 20 ft. above foundations. This splicing at the 20-ft. elevation allows for the construction of columns 20 ft., 30 ft., 40 ft. or 50 ft. in height, reduces the length of members to permit galvanizing and purchase from any manufacturer, and reduces shipping damages and delay and cost of erection. Each column is erected on angles cast into a concrete foundation, instead of following the usual bolt-and-plate construction, and each leg is fabricated to permit the bolting of the supporting angles for all cross-members at the several heights determined for all voltages between 22,000 and 132,000. The cross-members are standard 8-in. I-beams and, owing to the method of fabrication, are interchangeable throughout the structure. By the use of standard shapes for all pieces the purchasing field has been broadened. By the use of a few interchangeable parts, with additional fabrication, instead of special fabrication for each part, erection has been greatly simplified and costs reduced.

Further to reduce costs of erection and reduce steel details all insulators, bus supports and disconnecting switches, except 132-kv. "disconnects" and air-break switches, are mounted on the cross-members with clamps. All beams are drilled for mounting the 132-kv. switches with 8-ft. 6-in. spacing between phases and 5 ft. to ground, and the 132-kv. bus supports and insulators are clamped to the beams at the same spacing. For lower voltages and lighter switches the clamping feature allows for easy changes, variable spacing and the use of the same steel employed in the high-voltage structure. Very rugged construction is obtained without the use of special clamps or any special work at any point in the construction.

Bus supports for all voltages consist of standard strings of 10-in. suspension-disk insulators held in the vertical position. Single-pole, single-throw inverted "disconnects" are used and mounted so that all blades are easily accessible for hook-stick operation; when closed the switch hook is not more than 17 ft. 6 in. above the ground. A grounding switch for each 132-kv. line has been adopted, using the blades of an air-break switch mounted on an operating shaft. It is operated by a standard mechanism and makes contact with an auxiliary clip on the line side of the first set of "disconnects" in each line bay. All air-break switches are hand-operated and break vertically.

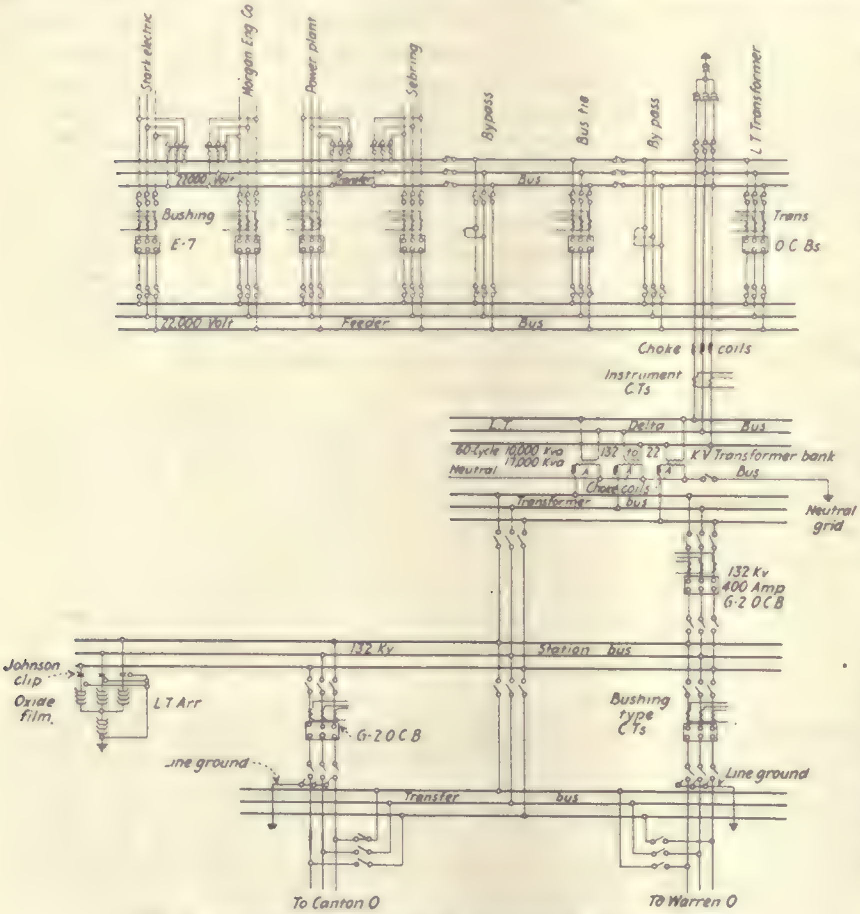


FIG. 4—SUBSTATION SWITCHING FACILITIES THAT AFFORD FLEXIBILITY OF OPERATION

By the use of galvanized angles for bus conductor it has been possible to relay on bus supports at each end of the bays with no intermediate supports, thus accomplishing a decided saving in insulators and steel work with the use of a suspended bus. The cross-section of the steel in these buses is such that they have current-carrying capacity approximately 75 per cent greater than No. 4/0 copper wire and can easily be reinforced for higher capacities. Connections between buses are made with No. 4/0 stranded copper and large tinned lugs are bolted to the angles. The lugs are made of ¾-in. standard copper tubing cut and formed to meet the conditions. Connections between buses and disconnecting switches are the same except that extra flexible No. 4/0 copper wire is used.

Any breaker may be removed from service and inspected without an interruption, using a spare breaker or manipulation of air-brake switches and oil circuit breakers. (See Fig. 4.) A spare or bus-tie breaker is maintained on the 22,000-volt side of the transformer bank which may be used to replace any feeder breaker or the transformer breaker. No spare breaker is used on the 132-kv. side, but by closing the line air-break switches the line is made continuous through the station and any of the three breakers may be used for transformer protection. Normal operation requires the use of all three breakers to clear trouble on either line and the transformer bank.

Transformers are connected 132 kv. star to 24,000-volt delta with a "disconnect" in the neutral ground on the high side to allow for operation according to the most favorable conditions. The design of these transformers is such that they have a rating of 10,000 kva. self-cooled, and by the application of water through the cooling coils the rating is increased to 16,800 kva.

Lightning arresters are installed on the main station or transformer buses. Oil circuit breakers of the highest rupturing capacity and most modern design and the switching schemes employed provide ample means for protection and restoration of service.

Equipment Failures in England

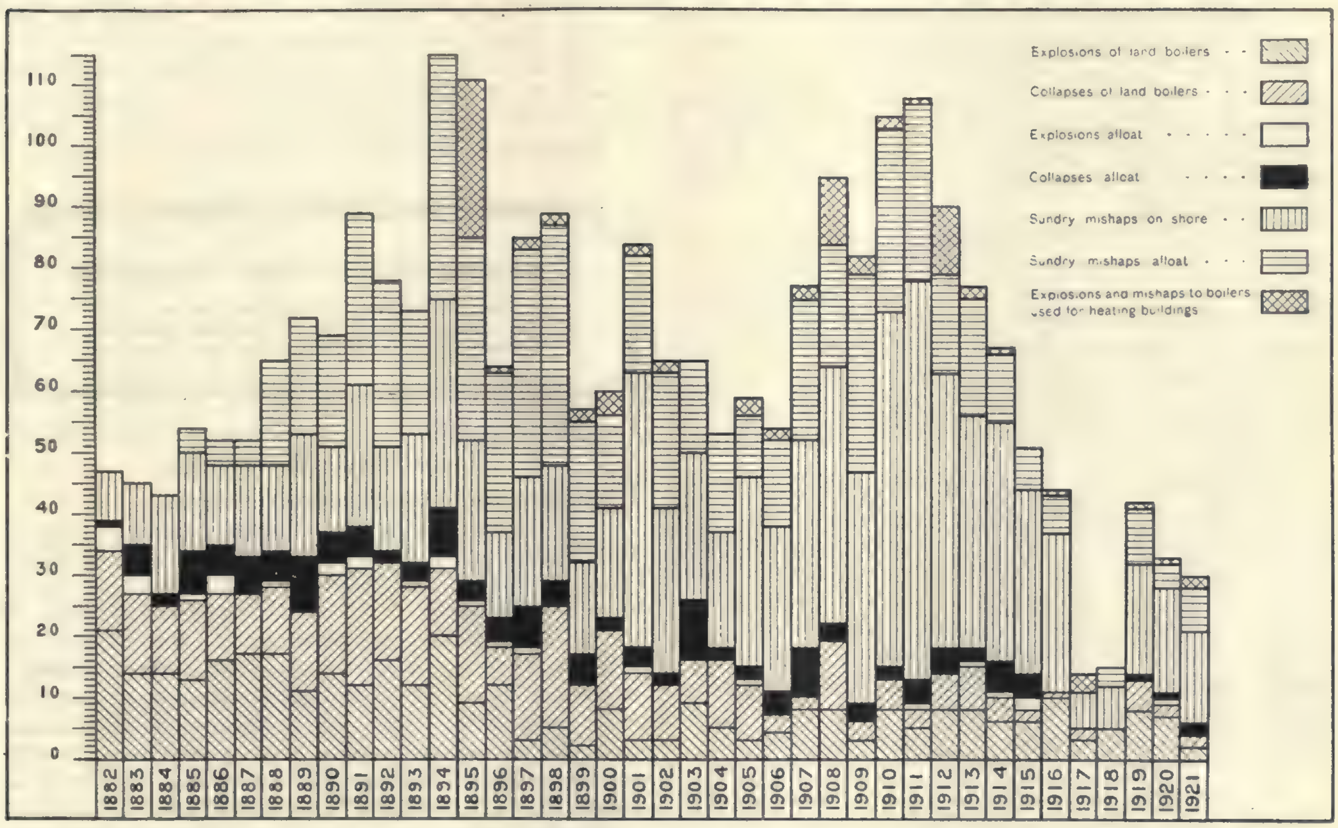
FOR MANY years the British Engine, Boiler & Electrical Company, Ltd., has published a technical report of equipment failures that have come within the company's experience. A brief digest of parts of the 1922 report, just issued, should prove interesting to American readers.

Turbine Failures

1. Rateau type, 5,000 kw., operating at 3,000 r.p.m. After five months' operation a crack occurred in the hub which originated in the keyway.
2. Impulse type, 5,000 kw., operating at 3,000 r.p.m. Complete wreck resulted from a crack in the first wheel due to metal fatigue, after twenty-six hours' operation.
3. Rateau type, 6,000 kw., operating at 3,000 r.p.m. After seven months' operation a piece came out of first-stage wheel owing to vibratory stresses set up by partial steam admission.
4. Impulse type, 3,000 kw., operating at 3,000 r.p.m. After nine months' operation machine failed when vacuum was lost under load because changing to atmosphere caused unequal expansions due to increased heat and guide blades made contact with revolving parts.
5. Curtis-Rateau type, 3,000 kw. After one month's operation manganese-bronze paddlewheel casting on low-pressure water seal failed and caused damage.
6. Reaction, geared type, 700 hp., 5,000 r.p.m. After operating since 1915, machine failed owing to rubbing caused by bearing failure.
7. Two units, 5,000 kw. each, 3,000 r.p.m. Failed quickly owing to trouble caused by Mitchell thrust bearings, causing running of the white metal pads; causes indefinite.

Turbine-Driven-Generator Failures

1. Rated at 8,000 kva., 7,500 volts, 50 cycles, 3,000 r.p.m. Short circuit on line resulted in burning of machine through arcing between adjacent turns of one phase.
2. Two units, 15,000 kva. each, 6,500 volts, 25 cycles, 1,500 r.p.m. One burned after three months' operation. Vibration of stator-core bolts caused breakdown of ½-in. micarta tubes; insulation failed and arcing resulted. The other unit failed in a similar manner after one week of operation.
3. Rated at 5,000 kva., 6,600 volts, 30 cycles, 1,800 r.p.m. Burned after one year's operation. Failure of insulation of stator winding caused by dirt and moisture allowed arcing to occur.
4. Rated at 23,500 kva., 6,600 volts, 50 cycles, 1,500 r.p.m. Rotor became grounded after operation for eight months; windings very dirty.
5. Rated at 6,000 kva., 6,600 volts, 50 cycles, 3,000 r.p.m. After eleven months' operation rotor insulation became low. Dirt and moisture caused trouble.
6. Rated at 12,500 kva., 3,000 r.p.m. After three months' operation rotor became grounded because of mechanical collapse of end turn of the windings.
7. Rated at 8,000 kva., 2,500 volts, 1,500 r.p.m. After six months' operation stator ground occurred as result of failure of insulation because of mechanical abrasion caused by movement of stator bars in the slots.
8. Rated at 5,000 kva., 11,000 volts, 1,500 r.p.m., 25 cycles. Stator grounded in eight months because of movement of core stampings causing cutting of coil insulation.
9. Rated at 1,000 kva., 3,000 r.p.m. Failed completely in six months owing to bursting of cylindrical manganese-aluminum brass end rings. Stress due to centrifugal force less than four tons, and examination showed coarse grain structure, oxide occlusions and shrinkage cavities.
10. Rated at 15,000 kva., 11,000 volts, 2,000 r.p.m., 33.3 cycles. Owing to closure of main switch to bus while machine was at rest arcing occurred between nickel-chrome end rings and slot wedges.
11. Rated at 7,500 kva., 11,000 volts, 3,000 r.p.m., 50 cycles. Operator closed main switch to bus with machine stationary and no excitation. Rotor came up to speed as induction motor, but heavy currents caused the phosphor-bronze slot wedges to buckle.



FROM ENGLISH "BOARD OF TRADE ANNUAL" RECORDS OF EXPLOSIONS ON BOILERS IN MANY TYPES OF WORK ARE GIVEN

OTHER ELECTRICAL MACHINERY

Seventeen failures of other electrical machinery are listed and described. The machines considered were motors, generators, motor-generators and rotary converters. An analysis of the failures on a proportional basis is given in the following table:

	Per Cent
Armatures and rotors	38.3
Field coils and stator windings	18.1
Commutator, brush rigging and slip rings	12.1
Miscellaneous	11.4
Starters	20.1

Heavy Loss to Industry Is Caused by Fatigue of Metals

FATIGUE of metals has caused an estimated loss of millions of dollars annually to American industry, according to a report to the Engineering Foundation and the National Research Council by Prof. H. F. Moore, who has been conducting an investigation at the materials-testing laboratory in the University of Illinois. Losses are caused not by spectacular disasters but by large numbers of minor accidents.

Dealing with economies possible of accomplishment as a result of the investigation, which has been in progress more than three years, Professor Moore says that losses might be cut 50 per cent. The report adds:

"In estimating the damage done by such failures probably the largest item of cost is the loss of service caused by idleness of machines during replacement of broken parts. A detailed study of the above causes of failure would in itself be a considerable investigation, but it does not seem unreasonable to estimate the total loss per year due to the above causes as several millions of dollars. It would seem that a careful study of the phenomena of fatigue failure might reduce this loss at least 50 per cent.

"This study would not only cover a study of the properties of ferrous metals, but would also include a study of the stresses set up in parts with irregular shapes. The loss by actual fatigue failure is, however, only one phase of the problem. Another phase, probably of equal financial importance, deals with the possibility of using in stress-carrying machine parts metals which are not now used because their fatigue-resistance properties are not known."

Two illustrations are given by the report as follows:

"It would be very desirable in many cases to use non-corrosive, non-ferrous metals for making steam-turbine blades. At the present time the fatigue-resisting properties of non-ferrous metals are almost entirely unknown, and, as a turbine blade is subjected to prolonged fatigue stress, the non-ferrous turbine blade has a rather limited use. A study of the fatigue-resisting properties of non-ferrous metals might enable a great saving in the cost of operating steam turbines to be made.

"The use of steel castings to replace expensive steel forgings is becoming more and more common. One of the great drawbacks to the use of steel castings is a lack of knowledge as to their fatigue-resisting qualities. It is a well-known fact that a steel casting with the same chemical composition as a steel forging may have quite different strength properties. A study of the fatigue strength of steel castings offers a promising field for the further extension of the use of steel castings and for the reduction of cost of complicated steel parts.

"During the past year the investigation of fatigue of metals has been in full progress. The main lines of work covered are: (1) The investigation of fatigue of wrought ferrous metals under cycles of stress repeated but not reversed; (2) study of the effect of heat treatment on fatigue strength of steel; (3) obtaining of further evidence for the existence of a definite endurance limit for wrought ferrous metals, and (4) the beginning of work on non-ferrous metals.

"Under (1) a fairly extensive series of experiments has been made, a tentative formula developed for various ranges of stress and a second series of experiments begun. These experiments have involved the design and construction of a new type of fatigue-testing machine. Under (2) heat treatment surveys of several steels have been carried out, including fatigue tests. Under (3) additional long-time test data have been accumulated, including one test of steel carried to one billion repetitions. There has been observed a distinct increase of endurance limit in steels subjected to millions of repetitions of stress below the original endurance limit. Under (4) fatigue tests on monel metal are now in progress.

"During the year the investigation has been financed almost entirely by the contributions of the General Electric Company. Contributions from the Allis-Chalmers Company, the Western Electric Company and the Copper and Brass Research Association have just become available, and a study of fatigue failure of non-ferrous metals will be a major feature of the investigation in the immediate future."

Reports of the progress of this investigation have been given in Bulletins 124 and 136 of the Engineering Experiment Station of the University of Illinois and in Publications 4 and 6 of the Engineering Foundation.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Familiarizing Lighting Customers with the Kind of Supply Available to Them

To the Editors of the ELECTRICAL WORLD:

W. O. Batchelder of our Chicago office has recently made a suggestion to me which I think is well worthy of being passed on to you. The suggestion was based upon a letter by J. H. Meehan, appearing on page 78 of the issue of the ELECTRICAL WORLD for July 14 last.

It is a fact that a large amount of correspondence is frequently necessitated and delays are encountered because prospective buyers of electrically equipped household utilities are not able to give information as to the current supply available. Mr. Batchelder suggests that electric light companies have prominently printed on their bills a statement indicating the nature of the electric supply—alternating-current or direct-current, single-phase, two-phase or three-phase, the frequency and the voltage available. If such a legend were prominently printed on all bills, it would seem that the customers of the central-station company would, because of the constant repetition of the information, soon become familiar with the characteristics of their current supply.

FRED M. KIMBALL,
Manager Small-Motor Department.

General Electric Company,
West Lynn, Mass.

A Protest Against the Seven-Day Working Week

To the Editors of the ELECTRICAL WORLD:

I have read your editorial in the Aug. 4 issue wherein you voice a plea for the college-bred engineer. About three years ago I was graduated from one of the large universities and then entered the power-house game. I was fully aware of what was before me in the way of long hours, steady work, ceaseless routine, dirt and prejudice against college men. However, a lot of poor

neophytes still under the watchful care of their beloved professors are not so well informed; hence this letter.

In all justice, the N. E. L. A. committee should tell the bad as well as the good side. The hardest part of the work is the remorseless seven-days-a-week, three-hundred-and-sixty-days-a-year grind. The strain of this will not be so apparent the first year, but after that it becomes, well, monotonous to say the least. One becomes stale, has little time for recreation and will gradually get out of touch with young people (assuming that the graduate is young, as are most). This is a bad thing. Friends ask, "Where is so and so?" and the reply comes: "Oh, he is in a power house and has no time for us any more."

My company has treated me very well, but oftentimes I ask myself whether I would not be just as well off in some other industry. So I ask you to state both sides and to urge the N. E. L. A. to start a movement for a six-day instead of a seven-day week, thereby doing a great thing for the industry. A YOUNG ENGINEER.

The Catalina Island Cable

To the Editors of the ELECTRICAL WORLD:

I have recently had my attention called to an erroneous statement appearing in the ELECTRICAL WORLD for Aug. 11, page 305, relative to the new Catalina Island cable. As yet no attempt has been made to apply carrier-current telephony to this system. There are two one-pair cables in operation, each of which is now capable of but one speech channel. In addition to the telephone circuit each cable is composited to provide a duplex telegraph channel. G. C. SOUTHWORTH.

American Telephone & Telegraph Company,
New York, N. Y.

Doubts Advisability of Explanatory Articles on Theft of Electricity

To the Editors of the ELECTRICAL WORLD:

In your Aug. 18 issue I find the article on "Preventing Theft of Electrical Service," by Ralph Pittman, on pages 342-344, very interesting. There is doubtless a question in the minds of some as to the advisability of publishing an article of this kind. Certainly we would not expect to find the newspapers publishing recipes for the distillation of illicit liquor, yet probably there might be some who would be greatly pleased by the appearance of such an article. Similarly there are doubtless some who are displeased and some who are well pleased with the publication of Mr. Pittman's article. It undoubtedly is of great merit and he has handled his subject ably, showing that he has had experience in dealing with electrical thefts.

In Case 8 he describes one condition for which the central station itself is usually to blame, and his description is very clear, but it is unfortunate that the figure which illustrates this condition (Fig. 6, page 343) is improperly labeled. According to Mr. Pittman's description in Case 8, Fig. 6 shows connections which he cautions against. It would seem that Fig. 6 should be labeled "*Improper* Connection for System with Grounded Neutral."

It is pleasing to note that the cases described by Mr. Pittman are altogether those which are illustrated by old forms of open service. To the uninitiated it should be said that such forms as illustrated do not represent present-day meter practice, and I think the recommendations in each case made by Mr. Pittman are covered by the use of present-day service and meter appliances.

It is to be hoped that the ELECTRICAL WORLD reaches a class of subscribers of such high order that no misuse will be made of information such as is set forth by Mr. Pittman. R. C. FRYER,

Union Gas & Electric Company, Superintendent Meters.
Cincinnati, Ohio.

[Mr. Fryer has very well covered the several policy angles introduced by the publication of the article by Mr. Pittman. Each case of possible theft is also accompanied by a remedy. The error is ours in Fig. 6, and its discussion should be based on "improper" ground connection.—EDITORS.]

Danger of Hasty Generalizations from Line-Material Tests

To the Editors of the ELECTRICAL WORLD:

Too little is published along the lines of the article on "Tests of Line Materials," describing work done by H. P. Seelye of the Detroit Edison Company, published in the ELECTRICAL WORLD for Aug. 25, page 379.

A word of warning should, however, be given readers as to drawing hasty conclusions from tests of this nature. The author of the paper has been conservative throughout, but the general reader will often attempt to prove too much from limited data.

A test of this kind on articles of wood, such as insulator pins, is affected by a large number of variables each of which may have a very wide range. Because of the number of variables it is not always possible, in making the test, to follow very closely the exact conditions of use of the article, if some variables can be eliminated by testing under other conditions.

To illustrate this point, I may refer to a test made by the Public Service Electric Company on 540 locust insulator pins a number of years ago to determine pin strength. In order to eliminate the effect of variations in the material of the cross-arms or the distortion of the pinhole, after repeated tests, cast-iron blocks with holes of slightly different diameters were used to hold the pin so that pins with slight differences in shank diameter might all have a snug fit.

Three lots of approximately 180 pins each were tested with the load applied at the following angles to a line tangent to the annual rings: 0 deg., 45 deg. and 90 deg. The resulting average breaking moments were respectively 5,291, 5,138 and 5,090 inch-pounds.

As regards annual rings, the pins varied from three to eighteen rings per inch, averaging eight. We were somewhat surprised to find that with 540 specimens tested there was little if any difference shown between pins from stock of slow and those from stock of fast growth. It was noticed that many of the imperfections which were visible, such as knots, sapwood, wormholes, etc., appeared to have virtually no effect on the initial strength of the pins. Such defects are, however, objectionable in service owing to the shorter life of the defective pins.

The test convinced us of one thing, namely, that to be able to justify any definite conclusions from tests of pins it would be necessary to use a very large number of specimens. H. S. VASSAR,

Laboratory Engineer.

Public Service Electric Company,
Newark, N. J.

Central Station and Industrial Practice

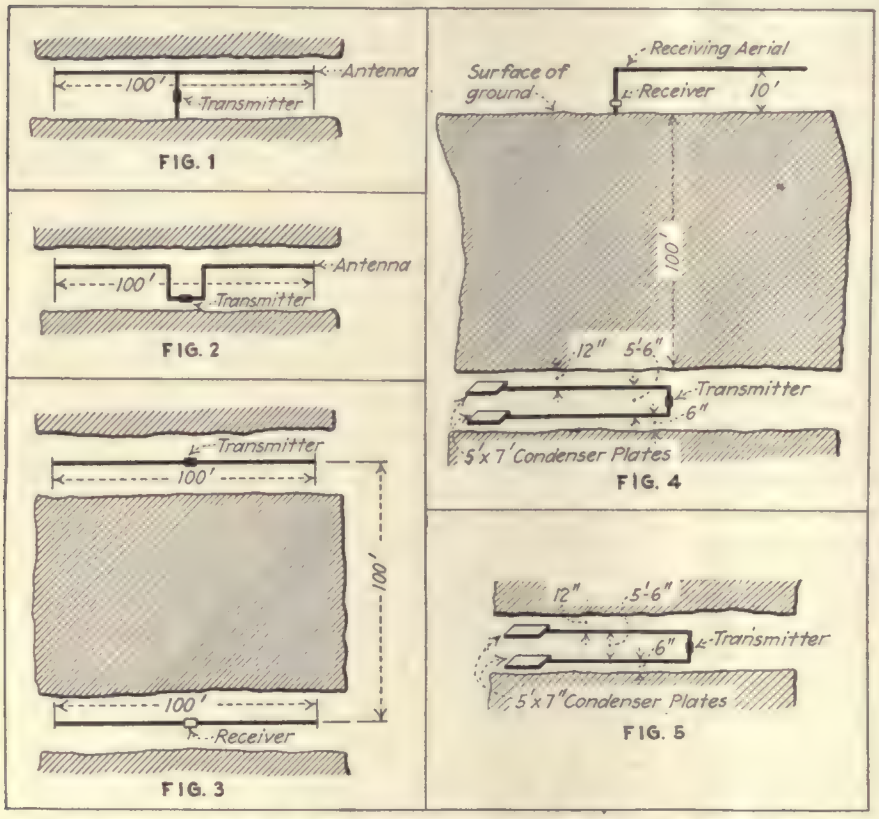
Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Underground Signaling with Radio

EXPERIMENTS with radio communications in a coal mine have been made recently by the Bureau of Mines in its experimental mine at Bruceton, Pa., under the supervision of C. L. Colburn, C. M. Bouton and H. B. Freeman. Although the methods employed in the preliminary experiments proved to be unsuitable for underground communication, they did show that electromagnetic waves may be made to travel through solid strata. The absorption or loss of intensity with distance is very great for the short wave lengths used in these experiments, (200 m. to 360 m.). Longer wave lengths are known to suffer less absorption and may possibly be found effective under certain conditions.

The experiments conducted consisted in receiving signals from without the mines and in both sending and receiving messages underground through the strata. It was found that with a receiving instrument set at a point 100 ft. underground signals from a broadcasting station 18 miles distant could be heard distinctly. The receiving of these signals was aided by some electric light wire extending from outside the mine to within 50 ft. of the instrument. The presence of these wires did assist materially in receiving, for when the set was carried to another point in the mine removed from wire and tracks the signals were much fainter. The fact that signals were detected, however, even though faintly, is sufficient evidence of transmission through the ground to encourage further experimenting.

In sending waves underground it was found that signals could be heard distinctly through 50 ft. of coal strata, but that the audibility fell off rapidly as this distance was increased. In all experiments the vertical antenna was found to give the best results. The horizontal antenna gave practically no reception, while a loop of a single turn was used with fair results. All of these experiments were tried with a wave length of 200 m. to 300 m. with the exception of the broadcasting station, which was 360 m. The strata of the experimental mines lies almost horizontal, and the direction of strata may have some influence on the transmission of radio waves, but the present experiment gives no conclusive evidence on this point.



EXPERIMENTS SHOW THAT ELECTROMAGNETIC WAVES MAY BE MADE TO TRAVEL THROUGH THE EARTH

Signals from the vertical oscillator shown in Fig. 1 were weak at a distance of 320 ft. increasing in intensity until they were very strong at 50 ft. In these tests open entries led from the transmitting to receiving station, but one or more right-angle turns always intervened. With no vertical component in the receiving antenna no signals could be received.

When a horizontal oscillator with a vertical section was employed such as is shown in Fig. 2, the signals were good at a point 100 ft. directly down the entry from the sending instrument. In this case the receiving antenna extended horizontally from the instrument in opposite directions and in a direction perpendicular to the transmitter. At a distance of 100 ft. laterally from the sending apparatus with coal walls intervening, the signals were very faint. This arrangement is shown in Fig. 3.

In another experiment utilizing a vertical oscillator with 5 ft. x 7 ft. condenser plates, Fig. 4, signals could be heard at a distance of 50 ft. in a direction approximately at right angles to direction of transmitter.

When the receiving antenna was located 750 ft. from the transmitter, outside of the mine, signals could be faintly heard. The receiving instrument was then taken to a point directly above the sending instrument, Fig. 5, where signals could be heard.

Wet Straw Aids Blasting Machine Foundation

By H. A. Fee

President Citizens' Light & Power Company, Adrian, Mich.

WHILE blasting out 30 cu.yd. of concrete foundation in the power house of this company without interfering with turbine operation, it was found that gunnysacks filled with straw and thoroughly wetted served most effectively in deadening the shocks of explosives. The foundation was being removed in order to provide room for a new 2,000-kw. turbo-generator. When the work first started we used wooden beams and tarpaulin—but these materials were not satisfactory as they tended to fly around too

freely, threatening to interfere with the turbines in operation alongside. When wet straw was used, the foundation—8 ft. in depth—was safely removed. An 8-ft. fence around the excavation helped to prevent small pieces of concrete getting out of bounds.

At one time we ran out of electric caps and were forced to use fuse caps, which were uncertain and slow. After a little experimenting we converted the fuse caps into "electrics," using two pieces of ordinary bell wire of desired length. These were bridged together with ½ in. of 1-amp. fuse wire soldered on. The two wires were separated with a small piece of tape pushed down so that the fuse made a short loop below the ends of the wires. They were taped together and pushed into the fuse cap so that the fuse wire touched the fulminate, and a little paper was packed in to keep the wires from coming out of the cap. The shots were then fired from the 110-volt station supply.

Layout of Secondary Networks

Methods of Ascertaining Load—Effect of Demand and Diversity Factors on Wire and Transformer Sizes—Calculating Consumers' Demand

FEATURES of construction and operation which have a definite bearing upon the design of secondary systems were outlined by C. A. Bacon of the engineering department of the Adirondack Power & Light Company at the last convention of the Empire State Gas and Electric Association at Utica, N. Y. The more important features of this paper are given below.

The first step in planning the reconstruction of a distribution system is to obtain some idea of the load to be provided for. This information is obtained by a field survey of the system, using a white print of an ordinary street map of suitable scale. Poles are located, and the number of services from each pole, with the connected load of each, is shown. Residence loads are estimated, while exact data are obtained on heavier loads, such as stores, churches, etc. These loads are expressed in equivalent 40-watt units (for example, a connected load of "20" would indicate 800 watts), and each residence outlet is assumed to have an average connected load of 40 watts.

TABLE I—DEMAND FACTORS USED IN CONSIDERING THE DEMAND OF EACH INDIVIDUAL RESIDENTIAL CUSTOMER

Connected Load 40-Watt No. of Units	Connected Load Kw.	Demand Load Per Cent	Demand Load Kw.
1 to 6	0.04 to 0.24	100	.....
7	0.28	90	0.252
8	0.32	88	0.282
9	0.36	86	0.310
10	0.40	83	0.332
12	0.48	73	0.350
15	0.60	67	0.402
18	0.72	59	0.425
20	0.80	57	0.455
25	1.00	53	0.530
30	1.20	50	0.600
35	1.40	48	0.670
40	1 60	46	0.735
45	1.80	43	0.770
50	2.00	40	0.800

The problem of wire sizes and transformer sizes necessarily brings up the question of demand and diversity factors, which ordinarily with accurate records of tests and data on distribution lines could be settled without an excessive amount of consideration. In some cases, however, no such records are available and values must be temporarily assumed.

In considering the demand of each individual residential customer, the Adirondack company uses the "sliding scale" of demand factors which is shown in Table I. The diversity factor was somewhat more of a question. This company is working at the present time upon an assumed factor of 2.5 (40 per cent), which is considered as an average for the residential districts. This factor will in all probability run high at a 5-kva. installation, be approximately correct at 7½ kva. and somewhat low at 15 kva. These transformer sizes cover the majority of the residential installations. Above 15 kva. the diversity factor will increase to 3 (33 per cent) and 3.50 (28.5 per cent). For determining transformer sizes and for checking purposes the table of transformer sizes as shown in Table II is used. Heavily loaded districts, such as business sections, are treated as individual problems, the demand loads being higher and the diversity less than in residential districts.

TABLE II—TRANSFORMER SIZES FOR VARIOUS NUMBERS OF CUSTOMERS

No. of Customers	Transformer Size, Kva.	No. of Customers	Transformer Size, Kva.
8	1½	150	15
15	3	250	25
25	5	375	37½
50	7½	500	50
70	10		

Using these values as a working basis, the company then proceeds with the determination of wire and transformer sizes. From inspection of the load map the logical and most advantageous transformer locations are determined, considering the load center, the most advantageous primary routing and the economical side of the question. Calculations are tabulated in a form similar to that shown in Table III. Loads are listed in the first column in groups, each group representing a pole. The fourth column gives the drop per 500 ft. of two No. 6 wires. This is obtained by use of a constant, K, which has been evolved to simplify the work. It converts kilowatts diversity to amperes diversity and multiplies this value of the impedance drop per 1,000 ft. of single No. 6 wire. The fifth column gives the distance from the transformer to the load multiplied by two, in feet. Column 6 is the product of column 4 by column 5 and shows the drop of two No. 6 wires at 115 volts. All calculations are made on this basis and are converted to the larger wire sizes by use of the percentage values shown in Table IV.

TABLE III—CALCULATIONS FOR DETERMINING WIRE SIZES FOR DISTRIBUTION SECONDARIES

(1) Connected Load 40-Watt Units	(2) Demand, Kw.	(3) Diversity	(4) Col. 4 × K	(5) Distance (Ft.) × 2	(6) Drop on Two No. 6 Wires, Volts
12–15–15–25–25	2.164	0.870	3.30	200	0.660
25–30–30	1.730	0.690	2.63	400	1.052
12–12–15–20–20	2.012	0.804	3.06	600	1.836
15–15–15–18–18	2.481	0.992	3.77	800	3.016

Drop on two No. 6 wires = 6.6 volts. Drop on three No. 6 wires = 3.3 volts. Drop on two No. 6 wires with No. 4 neutral = 3.3 × 671 = 2.22 volts.

Where the layout is so arranged that the secondary wire almost completely encircles a block it may be extended one or two pole spans, as may be necessary, to complete the secondary "ring." This method offers an advantage equivalent to

TABLE IV—CONVERSION FACTORS FOR TABLE III FOR OTHER SIZES OF WIRE

Wire Size	Conversion Factor	Wire Size	Conversion Factor
No. 6	1.000	No. 2/0	0.320
No. 4	0.671	No. 3/0	0 293
No. 2	0.468	No. 4/0	0.273
No. 1/0	0.356		

heavier copper and a smaller voltage drop.

In laying out a secondary system good judgment in estimating future load growth is an important factor. Allowance should be made for future building in the newer sections and for increased load due to an increased demand of the present customers. This provision applies, of course, only to the wire, the transformer size being selected for the present connected load.

The above has shown the method of calculation. The details, however, can be eliminated in many cases where there is a uniform type of load. Take, for example, a section of a city which is composed almost entirely of two-family houses, each flat having an average connected load of 18-watt to 40-watt units, or 720 watts. Calculations may be made on this load basis, indicating the number of pole spans each way from the transformer that it is possible to run with various sizes of wire, keeping within the maximum voltage drop. With these typical calculations, and by referring to the load map to check unusually heavy loads, it is possible to lay out the secondary wire using only a scale. Transformer sizes are selected to agree with Table II. In this way greater rapidity in layout work is obtained with no appreciable decrease in accuracy.

In presenting these methods of secondary distribution design it should be kept in mind that they are not intended as a criterion, but merely as an example of the methods temporarily employed by a company handicapped by a lack of reliable local data. It is intended to make extensive tests on the various distribution systems to check these values as soon as this can be arranged. The factors and methods now used will then be corrected to conform to local conditions, as indicated by the results obtained.

Protecting Men Against Danger in Central and Substations

BY P. W. EBERHARDT
Safety Supervisor, Substations Department, Duquesne Light Company, Pittsburgh, Pa.

FOR protecting workmen in the vicinity of electrical equipment the General Safety Committee of the Duquesne Light Company has issued to its operators and foremen in charge of construction the accompanying set of regulations. The rules apply particularly to workmen employed around a substation in construction work, who may be totally in ignorance as to the dangers that may be encountered. As will be seen, the foreman in charge is accountable for the enforcement of the regulations.

Emphasis is placed on the handling of parts of unusual size such as ladders and boards. Another source of danger is in working around live lines or equipment where sufficient clearance is not available. In this case provision should be made to have the lines or equipment taken out of service. When there is any reasonable doubt as to the safety of a workman all lines or equipment in the immediate vicinity should be taken out of service, making tests to determine that such equipment is actually dead before allowing the work to proceed.

Tests on an English 33,000-Volt Cable

ONE of the largest 33,000-volt cables now installed in the British Isles is one of the Clyde Valley system which is used as an interconnecting link between the Yoker and Clyde Mill power stations.

Regulations for the Performance of Construction Work in the Vicinity of Electrical Equipment

1. The foreman in charge of the work shall be responsible for enforcement of all rules and regulations for safeguarding the workmen. He shall insist upon necessary assistance from the operating department interested in order that proper measures may be taken to insure the safety of the men.

2. All ordinary working precautions shall be followed as usual, such as guarding against stumbling, slipping, falling articles, loose clothing, provision for eye protection, etc. Adequate light shall be insisted upon in all cases.

3. No construction work shall be started in connection with any station or line without the knowledge and permission of a responsible person in the operating department, at which time application shall be made for special instruction and for supervisor, as provided below. Particular instructions regarding danger points and working methods must be given by a competent person before work is started.

4. No member of a construction gang shall at any time attempt to operate any electrical apparatus except that a properly qualified person working with such a gang may be detailed to do such work by special instruction.

5. When work must be done in the vicinity of normally live parts or conductors two or more men must be present.

6. No construction work shall be done on or around live lines or equipment unless there is sufficient clearance to enable the men to work freely without taking extraordinary precautions to keep clear of such parts. This is understood to mean that sufficient space must be provided for the safe handling of tools and apparatus used in connection with the work. When such clearance is not available arrangement must be made to take the line or equipment out of service.

7. In any case where there is in the mind of the foreman any reasonable doubt as to the safety of the men, or at any time by special request, a supervisor shall be provided by the operating department, who shall be responsible for taking the lines or apparatus out of service, making tests to determine that such equipment is actually dead, and placing special protective devices applicable to the work in hand and the supervision of the men in their movements in and about the lines or equipment. The supervisor may at the discretion of the foreman be required to remain at the location during the progress of the work. After completion of the work said supervisor shall be responsible for removal of safeguards and protective devices, and restoring the equipment to normal condition.

8. Where clearances are ample for ordinary methods and tools and the work is performed in accordance with above provisions, special care must nevertheless be used in handling parts of unusual size. This applies particularly to handling of pieces of great length, such as ladders or boards. Sufficient help must be used in such cases so that the pieces can be handled easily and in such a manner that an unbalancing of the person handling the piece will not throw it into dangerous proximity to live parts. For such work the practice is recommended of having two men handle the piece.

9. When live parts are in the vicinity warning signs must be placed in addition to those permanently fixed thereon, whenever possible.

10. If workmen leave the vicinity of the work for long periods, check must be made on their return to determine that conditions are the same as when leaving and that it is safe to proceed with the work.

11. Upon completion of new construction work, and when tests are to be made upon the new equipment, arrangements shall be made to clear the line or lines feeding new apparatus and energize equipment from the source if possible. In all cases the premises shall be vacated by all except the person or persons required for the actual operation.

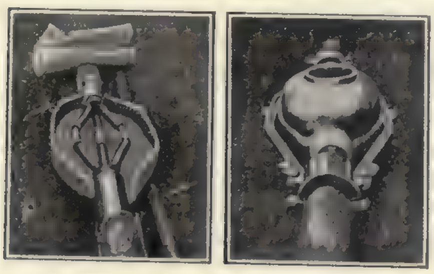
This three-core cable, shown in the accompanying illustration, was constructed by the Pirelli General Cable Works, Ltd., each core being of 25,-464 circ.mil cross-sectional area, with round conductors and paper-insulated. The three cores are laid up with impregnated paper fillings, covered by a further belt of impregnated paper, then lead-sheathed, compounded-jute-served, double-steel-tape-armored and compounded-jute-served over all. The cable is built for a working voltage of 33,000 with the neutral of the system grounded.

The cable was manufactured in lengths of 200 yd. to 220 yd., the total length of the line being 15½ miles with a weight of 38.5 tons per mile. The over-all diameter of the cable was 3.55 in.

The following tests were taken at the factory on each length during the lead-cased stage:

1. Insulation resistance measured with 400 volts direct current after twenty-four hours' immersion in water. The average result obtained was 250 megohms per st/ml.

2. Inductive capacity measured between one core and the other two and



A SECTION OF THE THREE-CORE, 33,000-VOLT CABLE READY FOR JOINING

ground with 400 volts direct current. The average result was 0.29 microfarad per st/ml.

3. Conductor resistance checked after twenty-four hours in water.

4. Each drum of cable was tested with 66,000 volts for one-quarter hour between cores and 40,000 volts for one-quarter hour between cores and lead.

5. Bending test was made on a percentage of the drums with a 3-yd. sample of cable bent three times in each direction to a radius equal to ten times the diameter of the cable. No sample so tested broke down at less than 120,-000 volts between cores or 80,000 volts between cores and lead.

6. A dielectric loss test was made at voltages up to 50 per cent above working voltage in all cases.

When the cable had reached the finished stage further tests, including tests for insulation resistance, inductive capacity, copper resistance, pressure and dielectric loss, were taken as a check. In addition to the above tests, samples of the cable were subjected to the following special pressure tests:

1. This sample was tested by applying and gradually raising the potential between two cores until the testing ends flashed over. The voltage at which this occurred was 192,000. A similar test was made between cores and sheath, which withstood a voltage of 120,000 without breaking down the cable.

2. It was then desired to find out what would happen to this cable if it were run at a considerably higher voltage for a long period of time. To this end a length was taken and subjected to a three-phase potential of 100,000 volts between cores for a period of six hours. At the end of this time, although the cable had not broken down, the test was stopped and the cable dissected so that the paper on the conductors and fillings could be examined. It was found, as expected, that in some places the paper was very slightly carbonized.

3. A further test by taking a sample of the cable and subjecting it to a three-phase pressure of 60,000 volts between cores was then decided on. This voltage was maintained for twenty-four hours continuously. At the end of this time the cable was again opened, and it was found that absolutely no carbonizing of paper, either in the insulation of the cores or in the fillings, had taken place.

This data was submitted through the courtesy of the General Electric Company, Ltd., Kingsway, England.

Extracts from an Operating Code*

Charging and Maintaining Lightning Arresters

INSTRUCTIONS for charging, cleaning and inspecting electrolytic lightning arresters are given below. Frequent charging of arresters is necessary as the films on the surface of the trays are gradually dissolved by the electrolyte. Owing to the symmetrical connection of the line tanks between phases, no currents flow in the ground tanks when the charging switch is closed. To charge the ground tank it must be interchanged by means of a transfer switch with one of the line tanks.

Charging

1. Charge lightning arresters regularly every day at the time specified by the load dispatcher for each station.

2. To charge the arrester bridge the horn gap for a period of five seconds, repeating this operation two or three times at intervals of five seconds. Make sure that each gap bridge makes positive contact when closed and opens cleanly when released. Proper opening of the gap is particularly essential as overheating and probable explosion of the arrester will result from leaving it connected to the line.

3. Make and break the contact between the horns and bridging device quickly so that arcing will be reduced to a minimum.

4. To charge the ground tank of the arrester reverse the transfer device and repeat the operation of charging as previously described.

5. While charging arresters observe the arc which is formed between the horns, because the size and character of the arc are indications of the condition of the arrester. A heavy reddish arc indicates incomplete forming of the film, while a small spark indicates an open circuit in the arrester, due possibly to an insufficient quantity of electrolyte between the plates. When the arrester is in good condition a bluish crackling arc, which does not rise on the horns, will be formed when the gap is bridged.

6. Measure the charging current once per month, unless local conditions make more frequent checking desirable.

7. If the arrester is in good condition the charging current will vary from 0.30 amp. to 0.60 amp. A smaller current indicates an open circuit, a larger one a deteriorated film.

Cleaning and Inspection

1. Exercise extreme care when working around lightning arresters.

2. See that the ground connection to the supporting framework is not disturbed. This rule is particularly important both for the operation of the arrester in discharging excess voltages and for the personal safety of those working near the arrester.

3. Clean the tanks, supporting ironwork, horn gaps and contacts once every three or four weeks.

4. At this time make a thorough inspection of the arrester for adjustment of the horn gap, loose connections and poor contact surfaces, making such adjustments as necessary.

Instructions for Operating Circulating Pumps

IN ORDER to function, a centrifugal pump must be filled with water and when starting must constantly be primed. For this purpose a steam siphon is generally installed in the housing of the pump, which, by ejecting air, creates a vacuum lifting water to the pump. The discharge valve must be closed to establish this vacuum. The pump being started after priming, water will continue to flow to the condenser when the discharge is opened. When the condenser is full the water discharged through the tail pipe creates a siphon effect which aids the pump in maintaining the circulation of water through the condenser. Instructions for starting and shutting down circulating pumps follow.

Starting

1. Inspect the condenser for open doors and see that the vent on the tail pipe is open.

2. See that the condenser wash-out valve in the water box is closed.

*Abstracted from the operating code of the Philadelphia Electric Company.

3. See that the discharge valve is closed.
4. Admit water to the seals of the pump.
5. Prime the pump. (a) Use air ejector by opening the steam valve first and the air valve last to raise vacuum on the pump to lift the water. (b) Open the valve on the priming line between the tail pipe and the pump casing. This can be used only when another pump is in operation.
6. After the pump is filled with water, start the pump slowly.
7. See that the oil system is operating in bearings, coolers, etc., and that water is on the coolers.
8. Run the pump at a speed that will maintain 8 lb. to 10 lb. pressure on the pump.
9. Open the discharge valve a few turns until water appears or suction occurs at the vent on the tail pipe.
10. Close the tail pipe vent and open the discharge valve wide and bring the pump up to normal speed.
11. Shut down the air ejector, closing the air valve first and then the steam valve.

Shutting Down

1. Close the discharge valve.
2. Stop the pump.
3. Shut off the water from the seals.
4. Shut off the water from the oil cooler.

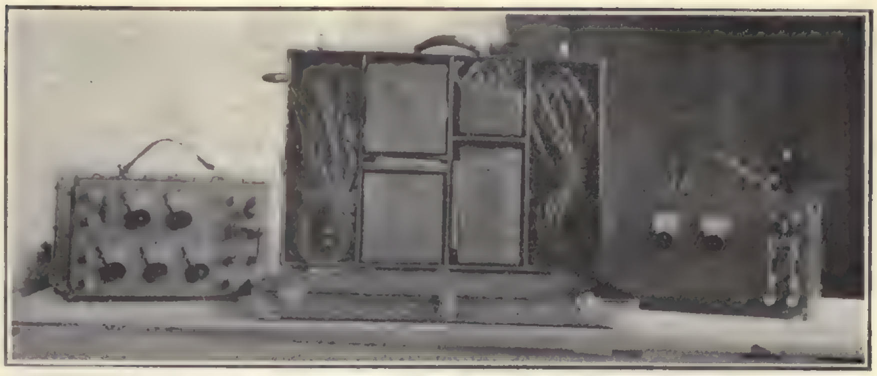


FIG. 2—THE WIRING DIAGRAM OF THE RELAY TESTING LOAD BANK

Portable Relay Testing Set

BY A. F. PALMER
Relay Inspector Puget Sound Power & Light Company, Seattle, Wash.

FOR convenience and facility in testing relays the Puget Sound Power & Light Company built a portable testing box which can handle a current capacity up to 67 amp. This apparatus has now been in use for more than two years and is so compact and rugged that the speed of testing has been increased considerably. The equipment consists of two load banks, both being of the same dimensions, 7 in. x 9 in. x 16 in.

The frame was constructed of No. 18 gage galvanized iron which was bent in small angle forms 3/4 in. x 3/4 in., then riveted together and soldered. Ward Leonard resistance units were placed in these frames in an upright position to lessen the chance of breakage, the units being held in place by small channel irons made of the same material as the frame. The bottom supports were riveted to the frame, while the top supports were fastened with screws in order that the resistances may be readily changed if broken or burned out.

The panel for the switches was made of 3/4-in. transite board painted a flat black on the outside. This provides a panel which is not affected by heat from the resistances. Current-selecting switches are a three-contact multiple type designed to give a quick adjustment of current. Referring to Fig. 1, the bank at the left has a capacity of 22 amp. and will give any current value from 0.15 amp. to the capacity of the bank in 0.15-amp. steps. This is the one most used. The connections for this bank are shown in detail in Fig. 2. The bank at the right is of 45 amp. capacity and is to be used in parallel with the 22-amp. bank when a greater current value is needed. Three of the current steps on this bank are rated at 10 amp. and three at 5 amp. The type of resistance used in these banks gives a current value that is practically constant, not being affected by temperature changes. There is less than 1 amp. variation with both banks combined.

The instrument-carrying case is of fiber reinforced with three-ply veneering. The two outside compartments are for test cords and tools. The other compartments are for the following instruments: Alternating-current ammeter, single-phase power-factor meter, cycle counter and a portable auxiliary direct-current relay. The single-phase power-factor meter is used in selecting potential leads that are 30 deg. toward the lead direction with reference to current applied in reverse-power relays. This is to take care more perfectly of phase distortions produced by short circuits.

The cycle counter is used in place of a stop watch and indicates definitely the number of cycles which elapse between the time the relay receives current and the time the contacts are closed. The portable auxiliary relay is used in connection with the cycle counter in determining many combinations of time value, such as the time for contacts of the oil circuit breaker to open after the relay has received current or the time required for the current breaker to operate after relay has closed contacts. These time-lag values are very important on large systems.

In A and B of Fig. 1 are shown the connections used for testing the ordinary circuit-closing and circuit-opening type of relays.

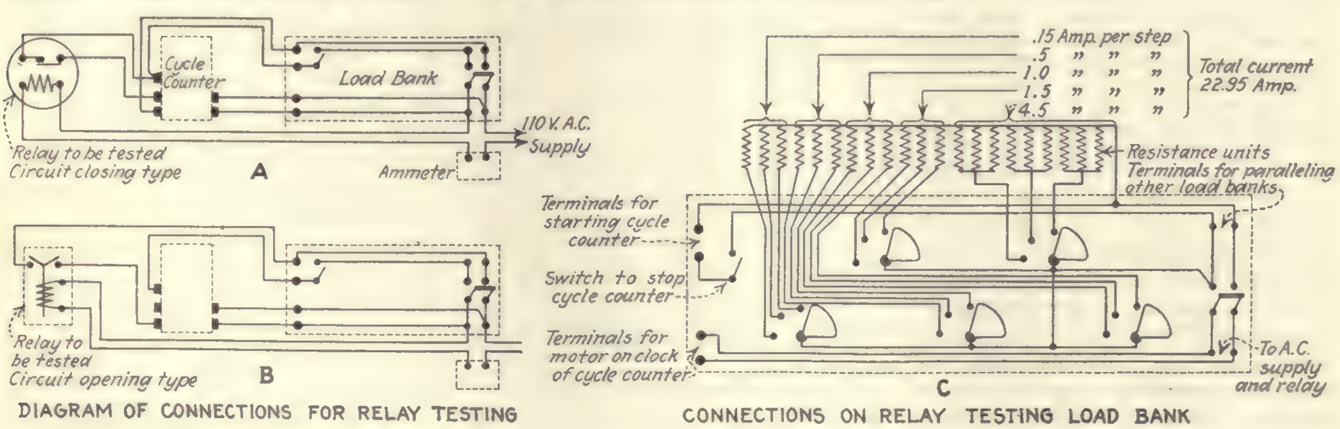


FIG. 1—THIS THREE-BOX RELAY-TESTING APPARATUS PROVIDES CAPACITY FOR CHECKING 67 AMP. OF LOAD

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

The Utility's Part in Business Building

Constructive Central Station Policy Results in Bringing New Industry to State—How the Company Benefits

THAT whatever builds up the surrounding territory also builds the utility and increases its prospective business assets is the belief of the Texas Power & Light Company. Accordingly, it has adopted the policy of energetically getting back of the promotion of any business projects that seem logical in the development of Texas. The way in which this policy is carried out is strikingly illustrated by the work of John W. Carpenter, vice-president and general manager of the company in the development of textile mills in Texas during the past year.

The theory that such mills could logically be located in Texas was based on the fact that the state produces one-third of the cotton crop of the United States. Incidentally, about one-tenth of this crop is grown within reach of the 1,000 miles of transmission lines and the plants of the Texas Power & Light Company. Cotton is therefore an asset to Texas that overshadows every other line of industrial or agricultural activity. The cotton gin has been an important source of energy sales and so thoroughly are the cotton ginners sold on the use of electric power that almost every gin within the reach of distribution lines is motor-driven. The one branch of the industry lacking was the manufacture of cotton into fabrics.

It had been tacitly assumed that there were reasons why the raw cotton should be shipped to distant points for the manufacture of fabrics. It was observed that in the southeastern section of the United States successful efforts toward the establishment of such mills in the heart of cotton growing territory were being made so that this section was becoming prominent in the manufacture of cotton fabrics.

To determine whether such manufacture is practical in Texas, Mr. Carpenter proceeded to inform himself on the textile manufacturing situation, first taking up a study of the trade periodicals and then establishing contact with the largest manufacturers. This was done by correspondence and by personal visits to Eastern mills, where conferences were had with the foremost authorities in the field. Becoming satisfied that the project was feasible, the next step was to convince both cotton textile manufacturers and the people of Texas that their state was the logical location for a textile manufacturing center.

To reach the people of Texas two things have been done. The first was to send copies of textile trade papers to selected lists of men in position to help the development of the manufacturing business. This was done to familiarize these men with the textile manufacturing business. In these magazines the Texas Power & Light Company had displayed its faith by advertising Texas as the logical location for cotton mills. Of course the merits of the company as a source of power supply were not forgotten. The second step was to bring prominent cotton mill men to Texas for visits of investigation to the various sections where textile manufacture might be advantageous. In this move two excursions have so far been arranged. One was early in February and the second the latter part of May of this year.

> ***Texas Builders***
>
> Texas' 5,000,000 souls are working with the artisan of builders' tools to build within its borders great industrial institutions, and just at this time a great deal of work and money is being put into the cotton manufacturing industry.
>
> Every man—carpenter, bricklayer, engineer, farmer, business man and industrial head—must join hands in the fight Texas is making to elevate the Lone Star State into the ranks of leadership in the cotton manufacturing industry. It means more building, more business, more and happier people and larger bank receipts.
>
> Texas grows one-third of the cotton of the United States, yet there are only a score mills in the state. Texas must develop its natural resources. Cotton manufacturing is its greatest opportunity.
>
> TEXAS POWER & LIGHT COMPANY.

ADVERTISEMENT SHOWING INDUSTRIAL ADVANTAGES OF TERRITORY

The parties were made up of textile men from the eastern part of the United States and business men of Texas interested in the development of the state. Meetings were arranged in numerous towns in the cotton-raising sections of the state through local commercial and other clubs and the proposition sold in this way to both the textile manufacturers and the Texas people.

Already a cotton mill for Dallas has materialized and is under construction. Another result has been the appropriation of $1,000,000 for the establishment of a new technical school in Texas, where the development of men for the textile industry will be undertaken.

What the Work Suggests

The results gained thus far indicate what such a policy means to a utility in added business and prestige in the community. In this case the Texas Power & Light Company has been a leader in a movement that was not confined to the territory served by the company, but was carried out to the benefit of other interests as well. Several of the railroads supplied excursion trains to carry the inspection parties into their territory. Men prominent in the textile world have been brought into the state and after investigation have passed favorably on the establishment of a textile industry in Texas. Mr. Carpenter, as the general manager of the Texas Power & Light Company, has traveled with these parties and was the leading speaker before the various civic bodies in the state. The movement has received many columns of publicity in the papers of the state. In all the publicity and in the minds of those who have

listened to the addresses the name of the company has been indelibly connected with the movement as an institution that has been willing to go out of its way to help the development of the state and take its chances of reward in the development that comes in the future, for, needless to say, the immediate returns in the form of power business are not expected to pay the time and expense put into the work.

"Electrified Ohio" a Feature Film

NO MATTER how familiar one may be with the central-station industry, the motion picture "Electrified Ohio," just completed for the Ohio Power Company by Pathescope, will be a revelation as to the possibilities of screening the operation of a large power system. At a private showing of this film in New York the audience, made up largely of central-station and holding-company executives, was held silent with interest as it watched the unfolding of this practical romance of the industry.

To those not connected with a utility company this film visualizes many undreamed-of uses for power. It shows vividly the steps in the generation and transmission of electrical energy. Beginning with scenes in the coal mine adjacent to the company's Windsor plant on the Ohio River, the film shows the progress of the coal out of the mine, through the tipple, over belt conveyors and into the boiler room, with some remarkable views taken inside the plant itself. From the outdoor switches the picture conveys its audience by means of an animated map over the transmission lines through Steubenville, East Liverpool, up to Canton and so on through the company's territory to the northwest corner of the state. Applications of power in different cities are strikingly illustrated. Unusual and spectacular operations of industrial machinery driven electrically are effectively illustrated in the manufacture of high-tension insulators, roller bearings, glass bottles, golf clubs, steel rails and a number of other products. The growth of the Ohio Power Company in customers and connected load is also shown by animated charts.

While this picture was being made a great deal of interest was aroused throughout the state. Newspapers recorded the progress of the work and the film has already received a considerable amount of publicity, as may be judged from the newspaper clippings shown here.

The picture itself is exceptional. It portrays truthfully the activities that go on behind the scenes in the operation of a large interconnected power system, and at the same time the atmosphere of propaganda has been kept at a minimum. Little attempt has been made to use employees in the capacity of actors. The whole story is carried by the physical operation of the company's equipment and the utilization of energy by industrial plants. The Ohio Power Company is to be congratulated on producing this picture.


CANTON, OHIO, WEDNESDAY, MAY 16, 1923

MOTION PICTURE PARTY ARRIVES TO FILM CANTON INDUSTRIES

Will "Shoot" Scenes Of Nationally Known Local Manufacturing Plants For Ohio Power Co. Educational Series—To Be Here Several Days.

This morning there arrived in Canton the Pathescope filming party which is making the big educational motion picture for the Ohio Power Company. They have been for the past week "shooting" the tremendous Power Station at Windsor on the banks of the Ohio river below Steubenville from which Canton's electric power comes.

Scenes were made way back in the interior of the company's own coal mine of the miners and of the ingenious machines run by electricity, which are used for cutting the coal out, of the loading of the mine cars and the tipple. The big chambers of the mine were made brighter than day by the flood of light from the great carbon arcs such as they use in the movie studios. They struggled up the steep hills back of the plant with their camera and tripod to get a panorama or "long shot" of the mine mouth and the enormous structural iron bridge which supports the miles of rubber conveyor belting as it carries the coal directly from the tipple to the top of the plant from whence it flows to the massive battery of boilers.

Filmed Pottery Works.

The filming party spent several days in East Liverpool, Ohio, the pottery center of the world, and while there they took scenes of the application of electric power to the crockery industry. The grinding of clay and the moulding and shaping of the pieces before they are fired, are all done by electric power.

But the most spectacular picture of all was made in the plant of B Thomas and Sons where the big porcelain insulators for high tension transmission lines are made. Each insulator must be carefully tested before it can be sent out, so in a great vaulted windowless chamber, surrounded by transformers, coils and all sorts of testing apparatus they hung a series of some of the largest insulators made. Then they turned on the power. As more and more power was turned on the insulators began to snap and crackle and finally at 350,000 volts, with a bang and a crash flashes of lightning filled the room.

The filming party will remain in Canton for some few days, making scenes in such nationally known plants as Timken, Hoover and United Alloy Steel. Canton, being famous as the home of diversified industry, gives them a peculiarly favorable opportunity to show to what widely different uses electric power is put. In this one city they can get scenes of the greatest variety of industries, perhaps more than in any other community in the United States.

Shows Electricity's Uses

The film when completed will be a permanent record of the achievements of Ohio's manufacturers and will visualize for all of us the importance of electricity in our daily lives.

Canton will be among the first cities to see the finished picture before the company sends it through Ohio and the rest of the country.


NEWARK ADVOCATE

USES OF ELECTRIC POWER TO BE SHOWN IN MOTION PICTURE

Ohio Power Company To Produce Film Showing System In Canton District And Its Application In The Large Industries.

Beginning this month a motion picture film will be made under the auspices of the Ohio Power Company to show to the people the wide diversification of industry in Ohio and the tremendous development and variety of the application of electric power.

As industry progresses and new methods for speeding up production are discovered, we become more and more dependent upon electric power. It is almost axiomatic to say that the industrial strength of a community is measured by the efficiency of its public utility service. By its aid one man can do as much today as two men years ago. All this will be shown vividly in the film and in addition we will be taken into some of the largest industrial plants in Ohio and shown how electric power is used in the manufacture of widely different things.

We will follow the growth of this great Ohio Power Company in which thousands of us are stockholders and partners, from its comparatively small beginning years ago to its present great size as it has kept pace with our constantly increasing imperative demands for more and more power.

To serve us millions and millions of dollars have been invested in the somewhat mysterious equipment which is needed to make electricity. Thousands of workmen are employed to keep the system in repair, to build the always necessary additions to make it possible for us to push a button any time of the day or night to light our lamps or run our vacuum cleaner or use our electric cranes.

Electricity can not be stored in a warehouse; you can not make it today and use it tomorrow—it must be made and used the same minute. This means that the Company must always have a great reserve of equipment ready for what they call the "peak load"; this peak may only come once a day or once a month, but when it comes, it must be met. The Company must be ready, must have the equipment to take care of it.

We will be shown the monster power house located right at the mouth of the company's own mine where they are assured of a constant supply of coal, where they can generate power in the most economical and efficient manner. We can see that electricity is just another form of energy—another form of coal. It is easier and more economical to use the great transmission lines to bring this power to us than it is to bring the coal in cars on the railroads. By burning the coal at the mine the Company releases for other uses thousands or rather hundreds of thousand of coal cars.

A well known motion picture company specializing in Educational Films will enter the various factories that have been selected as offering representative scenes of Ohio's industries. The trained eye of the director will select those scenes illustrating the spectacular and interesting uses of power. The whole will be welded together into a fascinating record of the industrial achievements of the State.

The Company wants to show us that it is a great big human organization, operated by our friends and neighbors, working and striving to serve us in every way—showing its high faith in the magnificent prospect of Ohio's future by investing millions in additional plants and equipment. The Company deserves the support of all its stockholders and customers, and of all well wishers of the community in this great educational campaign to show us by motion pictures how dependent we are in our daily lives for our comforts and necessities upon electricity and how nobly they are striving to meet our every need.

NEWSPAPERS SHOWED UNUSUAL INTEREST IN THE FILMING OF "ELECTRIFIED OHIO"

To Attract New and Please Old Customers

TO KEEP established customers contented and pleased with central-station service as well as to attract new patrons is the aim of the accompanying advertisement used in a house-wiring campaign now being

SHOW SIMPLICITY OF USING ELECTRICAL CONVENIENCES

run by the Haverhill (Mass.) Electric Company. By emphasizing the advantages of electricity in the home pictorially along with the easy terms by which service can be secured the company effectively appeals to local residents.

"Tell the Public"

WITH the above caption as its slogan the Alabama Power Company is now publishing a series of advertisements in the newspapers of Alabama, setting forth as clearly and concisely as possible facts relating to the operation of the company and showing how they affect the individual citizens of the state.

The advertisement says:

"With full realization of its threefold responsibility: First, to the people of Alabama; second, to its employees; third, to its stock and bond holders; it is the policy of the Alabama Power Company to create a closer relationship between its organization and the public which it serves; to promote and foster a better understanding of its activities and their effects upon the economic and industrial life of Alabama; and to develop a more pronounced spirit of co-operation in the upbuilding of our state."

Demand for Utility's Stock Greater than Supply

THE Union Electric Light & Power Company of St. Louis has sold, through its securities department and employees, 7 per cent preferred stock to the extent of $9,000,000, which composes the total amount of preferred stock that has been authorized for sale up to the present time. This stock has been sold during a period of about six years and was purchased by approximately ten thousand customers and friends of the company. Many preferred stock holders have formed the habit of buying additional shares of preferred stock as they accumulate sufficient funds to do so. At the present time applications which cannot

Union Electric Light and Power Company

7% Preferred Stock

Approximately 10,000 home partners in the St. Louis District have purchased all of the 7% Preferred Stock Shares we offered for sale.

We have no additional shares for sale, at this time nor will we have until such time as we have need for more money with which to extend the facilities of our company.

Many of our customers buy additional shares as their savings permit and

We Now Hold Orders for $150,000.00

of

Union Electric 7% Preferred Stock

that we cannot fill.

If any of our home partners have need for the money they have invested in these shares we will gladly pay them

—Par $100.00 Per Share Cash—

for such shares, with which we will fill the orders we are holding.

Securities Department

Union Electric Light and Power Company

12th and Locust Streets

EVIDENCE OF THE DEMAND FOR UTILITY'S STOCK AS AN INVESTMENT

be filled are on file for the company's 7 per cent preferred stock to the extent of $150,000. To try to obtain small blocks of stock for such customers the company ran the accompanying advertisement in recent issues of the St. Louis papers.

Boston Edison Issues Book of Home Comforts

TO GIVE the non-electrical home occupant an idea in simple language of the principal points to bear in mind in planning for wiring, the Edison Electric Illuminating Company of Boston has recently issued an attractive ten-page booklet which is far removed from the usual "Rules and Regulations on Electric Wiring"—so dry and technical to the public—which central station companies put in the hands of new customers, contractor-dealers and architects. The booklet was prepared by L. D. Gibbs, superintendent of the company's advertising department, in connection with a newspaper symposium on better homes. It is a republished article on "Complete Electric Comfort in Your Home," which was well received during the Boston *Herald's* campaign for better housing. The original article covers wiring outlets and appropriate symbols, but in the booklet only a friendly statement of the things to consider in planning wiring service is included.

What Other Companies Are Doing

Oil City, Pa.—The wiring campaign which has been carried on by the Citizens' Light & Power Company has resulted in the closing of an average of forty-eight contracts per month. At the outset of the campaign the company agreed to assume the responsibility for obtaining the contracts and for financing the activity, and the business resulting has been satisfactory both to the contractors and to the central station. The electrical contractors in the territory served by the utility gave their whole-hearted co-operation, and events have proved that they are handling the contracts at a reasonable profit and at the same time have been wiring homes that would not otherwise have been secured.

Pawtucket, R. I.—In a recent customer and employee ownership campaign, the Blackstone Valley Gas & Electric Company sold 3,482 shares of stock to 694 purchasers, of whom 489 were customers taking 2,835 shares. Although the sale included both cash and time-payment plans, 271 purchasers bought outright 1,688 shares, and the number of customers who paid cash totaled 244 against 245 on the partial-payment plan, showing local recognition of the value of this public utility security as a means of investing accumulated savings.

Philadelphia, Pa.—The electrical interests of this city are preparing for an electrical home exhibition to be held, probably, in October. It is planned to have two houses for the exhibition, a new house and an old one renovated. The Philadelphia Electric Company has subscribed $5,000 for the enterprise, the jobbers have contributed $2,500, the Electric Club $750, and the fixture interests $2,000. The contractors are expected to contribute about $2,000. The new exhibit house will be in the Lincoln Drive section of the city, and the other will probably be in the northeastern part.

Denver, Col.—In connection with the Denver Gas & Electric Light Company, the industrial development committee of the Civic and Commercial Association of Denver has begun a study which has for its object the devising of the best methods to utilize electric power for the development of manufacturing in the city. At a recent meeting discussion centered around the readiness-to-serve rule of the power company. It was stated that this rule was not entirely understood by the majority of manufacturers. V. L. Board, representative of the Denver Gas & Electric Light Company, stated that the company was ready to co-operate with the manufacturers in every way for the industrial development of the city. The decision reached was to hold a meeting with a special representative of the Doherty interests who will visit Denver in the near future. This representative is endeavoring to increase the commercial and industrial use of power.

California.—The East Bay headquarters for the Pacific Gas & Electric Company in Oakland was officially dedicated recently. At that time the late John A. Britton placed a copper box of relics behind the cornerstone of the building and put in the first trowelful of mortar that was to hold the cornerstone. Following this ceremony dedication ceremonies were held in the assembly hall of the building. The cost of this eight-story building was about $350,000. The main offices, where customers are cared for, are on the first floor. A display room for appliances is maintained in the basement. Offices of various departments are on the floors between the first and seventh. The load dispatcher's department is on the seventh floor. All the service lines in the northern part of the state are controlled here from the load dispatcher's board. Special telephone wires give the dispatcher ready communication with all generating plants.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Hydro-Electric Development and Steam Equipment

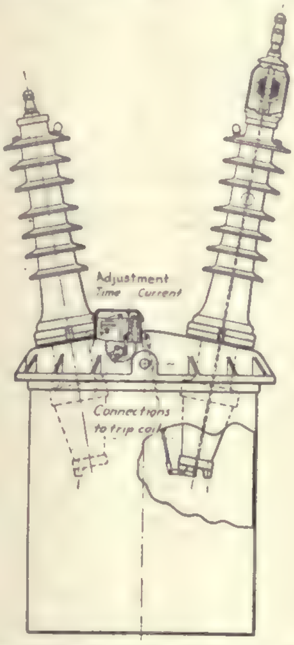
Interpretation of Surface-Condenser Readings.—B. C. SPRAGUE.—The large number of variable factors affecting the heat transfer in surface condensers makes the determination of the condition of the tube surfaces from condenser readings very difficult. In this article the author gives an idea of the readings obtainable and their significance. Among these readings should be the weight of steam condensed per unit of time, the inlet circulating-water temperature, the amount of air leakage, the volume of gases removed by the air pump or ejectors, the volume and velocity of the circulating water and the amount of deposited solids on the tube surfaces.—*Power*, July 10, 1923.

The Portobello Power Station in Scotland.—This new Edinburgh power station, on the Firth of Forth, has a present capacity of 30,000 kw. with possible extensions for 100,000 kw. Besides a general description of the boiler room, turbine room, switch house, coal-conveying arrangements, etc., there is an interesting account of three water tunnels for supplying the condensing water. Shafts for the tunnels were sunk at the station, from the bottom of which the three tunnels were carried one-third of a mile out to meet other shafts sunk in the sea bed. This tunneling was done after the manner of the London tube railways, lined with cast-iron segments and smoothed off with concrete. On each of the three sea shafts is a beacon and a winch.—*Electrical Times (England)*, July 12, 1923.

Tests of Five Models of Draft Tubes for Turbines.—A series of tests are recorded that were made with a turbine and tubes geometrically similar to full-sized ones. It was shown that the new symmetrical types were superior to older forms. The draft tubes of the turbine must be designed to take care of a complex condition of flow. Each installation requires special treatment and study.—*Engineering News-Record*, Aug. 2, 1923.

Transmission, Substations and Distribution

Substation of the Chemins de Fer du Midi.—H. RAEMY.—This outdoor-type substation is one of the fourteen which have been installed lately for the electrification of the Dax-Toulouse branch, operated with 1,500-volt direct current. The station contains three 750-kw., three-phase transformers of the self-cooled oil-conservator type, which reduce the incoming 60,000 volts to 1,150 volts. Three six-phase rotaries rectify the current to the overhead voltage of 1,500. The 60,000-volt oil switches, with a tested rupturing capacity of 300,000 kva., are composed of single-pole units, each in a round tank, holding 800 liters of oil. They are remotely controlled with a closing and a tripping magnet. Closing one three-phase switch set requires 7 kw. direct current for four-tenths of a second. Of particular interest is the overload tripping mechanism shown in the accompanying illustration. To avoid the use of a current transformer, the tripping magnet is placed in the top of one of the high-voltage leads, and its winding lies directly in the 60,000-volt circuit. By means of insulating rods and levers the motion of the magnet armature is transmitted down into the oil tank and out of it again to the regulating device which gives an independent current and time adjustment. Any change of the setting may be made safely while the switch is alive. Auxiliary contacts with interposed resistance avoid a current rush in closing the switch. Oscillographic investigations have shown that in closing the switch with the remote-control magnet the protective resistance of the first contact remains in series with the line for, on the average, five cycles on a 50-cycle system. All iron parts of the switch are zinc-coated by the Schoop process to avoid rusting. To prevent a dangerous glow discharge between the top metal cap and the upper part of the porcelain bushing, a zinc coat is sprayed over this junction, extending over the entire upper surface of the uppermost porcelain petticoat.—*Revue Générale de l'Electricité*, July 14, 1923.



SECTION THROUGH 60,000-VOLT OIL SWITCH, SHOWING ADJUSTABLE TRIPPING MECHANISM

Spacing and Wire Stresses of Catenary Supporting Structures.—P. A. MCGEE.—The subject is considered with particular reference to wind-load effects. The effect of temperature, wind and ice is shown in typical curves for single catenary systems having 150-ft. and 300-ft. spans respectively. A complete analysis is made of typical catenary construction.—*Electric Journal*, July, 1923.

Generation, Control, Switching and Protection

Grounding Reactors.—A symposium of four papers on the various types of grounding reactors now in use. The first paper, by Y. Watanabe, considers the resonance in a circuit that includes a condenser and an iron-core inductance, with particular reference to the Petersen coil. This paper includes remarks on the mathematical methods explaining the resonance, a general equation and graphical method of explaining the jumping phenomena and experimental results of various tests conducted. In the second paper by the same author a method is proposed for grounding the neutral transmission system, using a condenser in conjunction with a grounding reactor. The advantage of this method lies in the fact that a reactor with a slightly saturated core may be safely employed so as to compensate exactly for the capacity current without causing any appreciable wave distortion, so that the quenching action is very effective. In the third paper S. Togo considers the design of resonance factors and discusses the equilibrium points in resonance elementary reactors and the protection against series resonance. In the fourth paper, by H. Yagi, problems of grounding resonant coils are considered.—*Journal of Institute of Electrical Engineers of Japan*, July, 1923.

Units, Measurements and Instruments

Efficiency Tests Made on 55,000-Hp. Hydro-Electric Units.—H. G. ACRES.—This paper, presented before the A. S. M. E. spring meeting at Montreal, shows that between 32,000 hp. and 63,000 hp. an efficiency of 90 per cent and over was obtained for the turbine, with a maximum efficiency of 93.5 per cent. A maximum over-all efficiency of 91 per cent was developed for the complete unit. The Gibson method of measuring the flow is described and the pressure-time diagrams are analyzed.—*Power*, July 24, 1923.

Rail-Joint Tests on the Detroit Municipal Railway.—The Municipal Department of Street Railways in Detroit has conducted an extended series of tests on seam-welded rail joints. Full particulars are given, with comments on a large number of cast-welded joints removed during track rehabilitation. Summarizing, the tests indicate that the cast-welding process,

besides being more inconvenient to apply, is less reliable for rail joints than the seam-welding process. Moreover, the method of construction with seam-welded joints used in Detroit is effective both mechanically and electrically. The tests show that further study of the metallurgy of electrically welded rail joints is desirable.—*Electric Railway Journal*, July 21, 1923.

Illumination

Lighting of Theaters and Auditoriums.—A. L. POWELL.—The author considers the location, size and type of the unit, intensity of illumination and the proper decorative effect of this kind of illumination. The following parts of theaters and auditoriums are considered individually: Entrance, foyer, lounge, theater auditorium, motion-picture auditorium, concert hall, assembly room, lodge room and building exterior. The relation between light and music is also discussed.—*Bulletin L.D.* 145 *of the Edison Lamp Works.*

Esthetic and Utilitarian Value of Luminaires.—E. G. PERROT.—In the designing of luminaires the illuminating engineer should have a knowledge of the architectural styles and periods, so that the method of lighting will be in harmony with the style of the room or building. While there are certain problems, such as the lighting of offices or factories, in which the object of the light provided is purely utilitarian, and where the illuminating engineer has much good work to do in providing efficient and serviceable conditions of illumination, there are higher fields for his activity in connection with the lighting of buildings of distinction, where esthetic and architectural considerations must prevail.—*Transactions of I. E. S.*, July, 1923.

Motors and Control

Explosion-Proof Electric Motors.—E. J. GLEIM.—The explosibility of methane air and gasoline air mixtures as related to the design of explosion-proof electric motors is considered. A description of how the tests were conducted, effectiveness of different gauze combinations, cooling surface required to prevent an explosion, etc., are discussed. A general tabulation of the results and a discussion of the test results are also given.—*Serial No.* 2,422, *Bureau of Mines.*

Protection That Safety Switches Can Provide.—D. H. BRAYMER.—The elements of protection that insure safety in the manipulation of inclosed, externally operated switches at machines, their inspection, repair and maintenance, and the resulting economies from the standpoint of elimination of preventable accidents and interruptions of power service, are discussed. The requirements for protection from the standpoint of both user and manufacturer, giving the features of design and construction which are essential in order to insure the protection desired, are also considered.—*Industrial Engineer*, August, 1923.

Heat Appliances and Material Handling

Arc-Welded Cast-Iron Enameled Ware.—O. H. ESCHHOLZ.—The most frequent defects encountered in thin ⅛-in. to $\frac{3}{16}$-in. cast-iron structures for enameled ware are small holes and weakening cracks. These may be repaired in most cases by employing the metallic electrode arc-welding process with either cast-iron or steel electrodes. The procedure for repairing is described.—*Journal of American Welding Society*, July, 1923.

Electric Welding Car.—C. L. BAXTER.—An electric welding car has been added to the standard welding equipment of the New Brunswick Power Company at St. John, N. B. The reason for mounting the equipment in a motor car is to provide a portable unit which would be suitable for track or shop use.—*Electric Railway Journal*, July 21, 1923.

Traction

Collecting 5,400 *Amp. at* 58 *M.P.H.*—In recent tests conducted at Erie, Pa., a new form of overhead trolley suspension was tried. With a pantograph collector large amounts of current are drawn without difficulty. The new type is a modification of the usual catenary construction of the so-called laced suspension type of construction.—*Electric Railway Journal*, July 28, 1923.

Electric Railway Construction and Operation in Cuba.—L. GEENENS.—The reasons for building the Hershey-Cuban Electric Railway and the construction methods employed are recounted. Some of the electrical difficulties caused by the moist, warm tropical climate and how they were overcome are discussed.—*Electric Railway Journal*, July 28, 1923.

Electrophysics, Electrochemistry and Batteries

Measurement of Permeability of Iron.—H. NUKIYAMA and Y. SHOJI.—Complex permeability is defined as the ratio of the effective value of the harmonics of alternating magnetic induction and magnetic force. The authors determine the complex permeability by measuring the impedance of the magnetizing coil arranged in the same manner as Epstein's apparatus when there is no iron core and when there is an iron core of the sample to be tested. The actual result obtained by this method in the audio-frequency range with sheet iron for telephone and amplifier use is compared with the static hysteresis loop obtained by the ordinary magnetometer method.—*Journal of Institute of Electrical Engineers of Japan*, June, 1923.

Specification for Dry Cells.—Specifications officially adopted by the Federal Specifications Board for the use of the departments and independent establishments of the government in the purchase of dry cells are given. These include definitions, types and sizes of cells, specifications of carton, zinc can, sealing compound, terminals and cell connections. Required voltage, various tests to show results obtained and performance characteristics are also included.—*Circular No.* 139, *Bureau of Standards.*

Comparison of Planté Type Secondary Batteries.—SAKAE MAKIO.—Comparison is made of the Planté type of secondary batteries that are principally used for communication work. Tests were made on batteries made in Japan, America, England and Germany. The experiments conducted reveal that, in spite of the fact that the comparison was carried out on the basis of equality of nominal capacities, their true capacities are not the same. A series of tables arranged in sequence gives the true capacities at various discharge rates of ten different batteries.—*Report of Electrotechnical Laboratory, Tokyo, Japan*, May, 1923.

Telegraphy, Telephony, Radio and Signals

Vacuum Tubes as Power Oscillators.—D. C. PRINCE.—An exact method is developed whereby the performance of a vacuum tube as an oscillation generator can be determined, together with the required voltages which must be impressed upon the different members to obtain such results. A method is developed whereby the effect of varying factors, such as space charge, voltage and so on, can be more readily determined than by the first method. Based on the conditions required for the tube, the design of a single tuned circuit is developed. The operation of vacuum tubes in doubly periodic circuits is described and the criterion for double periodicity is derived. Methods of controlling oscillations in this type of circuits are suggested. In the October issue the influence of the receiving circuit on the efficiency and output of the vacuum-tube power amplifier will be discussed, the methods outlined above being applied to circuits in which the plate voltages are not sinusoidal, and it will be shown that efficiencies and output may be considerably increased by circuit arrangements which give special wave form. A brief comparison will also be given showing the correspondence between theory and observation affecting emission, space charge and amplification constant.—*Proceedings of Institute of Radio Engineers*, June and August, 1923.

Tests of Radio Receiving Sets.—The results of tests of radio receiving sets by the Bureau of Standards are given in a series of Letter Circulars, of which the first (No. 90) deals with tests of electron tube sets. This circular gives the results of tests of crystal detector sets.—*Letter Circular No.* 93, *Bureau of Standards.*

Transatlantic Radio Telephony.—H. D. ARNOLD and LLOYD ESPENSCHIED.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. summer convention, July 7, 1923, on page 21.—*Journal of A. I. E. E.*, August, 1923.

New Books

Reviews of the Latest Contributions to Technical, Industrial and Commercial Literature of Particular Interest to Members of the Electrical Industry

Elements of Radio Communication

By Ellery W. Stone. New York: D. Van Nostrand Company. Second edition. 318 pages, illustrated.

Few elementary books on radio have value even to the non-technical reader for whom they are written. In the process of simplification much is lost. They are usually filled with pages of obsolete apparatus and circuit diagrams which serve no useful purpose. Happily this book does not fall in the foregoing class. The author has, in this the second edition, presented fundamental principles in language easily understood by the beginner. At the same time he has introduced new material and suggestive ideas that will prove stimulating even to the more advanced student. The book contains much information which is not usually found in other elementary texts. H. M. TURNER.

L'Eclairage

By E. Darmois, professor at Nancy. Paris: Gauthier-Villars et Cie. 276 pages, illustrated.

This work is one of a series of volumes devoted to technical, economic and financial subjects affecting industry, and according to an elaboration of the title gives "modern solutions of the problems of industrial lighting." As stated in a preface by Prof. André Blondel, the author has written on the one hand for the purpose of fostering the spirit of research in the field of lighting and on the other hand to make known to the general public and in particular to those engaged in industry the rational and efficient use of light sources and luminous flux.

In France illuminating engineering, as we know it, is not such an active branch of the profession as it is in this country or Great Britain, and so knowledge of progress in this field is not so readily accessible. The author has included many quite recent developments, such as the work of the 1921 meeting of the International Committee on Illumination, the Fabry and Buisson universal photometer, the neon tube, factory and school lighting and codes.

The academic instincts of the author are evident in the mathematical treatment in the chapter on definitions and units. However, the development is logical, starting with luminous flux as the basic quantity, and is not difficult to follow if one is somewhat familiar with the infinitesimal calculus and notation. The chapter on photometry is a very good condensed statement, including a brief discussion of the Ulbright sphere and of the measurement of sources differing in color.

The second part of the book, devoted to light sources, is more or less conventional, but includes a chapter on the radiation from a standard radiator (black body) and possibilities in the way of more efficient sources. It seems rather unfortunate that in discussing the incandescent lamp the author has retained the use of the term "half-watt," which is a misnomer and has become obsolete in this country.

The third part of the book is on the physiology of light and the hygiene of lighting, while the fourth part takes up lighting installations, including good discussions of methods and calculations as well as descriptions and illustrations of specific cases. It is interesting to compare the table of illumination values, all given in lux, with those which are now being recommended in this country. The maximum value in the table is 200 lux (19.4 foot-candles) for the illumination of black goods in show windows. At the 1922 convention of the Illuminating Engineering Society values for show-window lighting as high as 100 foot-candles were discussed. For class-room lighting in schools the table gives 30 lux (2.9 foot-candles), as against 3.5 to 6 foot-candles recommended in the old Code of School Lighting of the Illuminating Engineering Society and 5 to 10 foot-candles to be recommended in the revised code.

On the whole, the book covers the subject of illumination very well, combines theoretical and practical knowledge in a useful way, and should fill a gap in French technical literature. For the benefit of American readers it should be said that the author's style is very straightforward and readable, and any one with only a smattering of knowledge of the French language should be able to understand the diction without difficulty. F. E. CADY.

The Electric Furnace for Iron and Steel

By Alfred Stansfield. New York: McGraw-Hill Book Company, Inc. 440 pages, illustrated. First edition.

Professor Stansfield in this book has attempted to give a reasonably complete account of the electric smelting of iron ores to make pig iron and the making of steel from metallic charges in electric furnaces. The first part of the book contains historical matter, outlines the fundamental principles of the metallurgy of iron and steel and gives a very brief description of the electrical supply system for electric furnaces. This part is followed by a description of the electric smelting of iron ores for pig iron, the reduction of iron ores in the state of powder for subsequent smelting in electric furnaces and the production of ferro-alloys in electric furnaces. The last part of the book deals with the production of iron and steel from metallic materials and the various types of electric furnaces in use for this purpose and includes a chapter on the production of steel from iron ore and on electric welding.

The book is replete with statistics on the production of iron and steel in electric furnaces in the different nations of the world, and it emphasizes strongly the metallurgical aspects of the industry. The chapter on electric supplies for furnaces is very brief and general in character and could have been improved by being more specific and quantitative in treatment. The book is particularly valuable for its splendid description of all types of electric furnaces now available and for economic and metallurgical data showing the performances of these furnaces in different localities. The illustrations and charts aid materially in giving an understanding of the contents. The book should prove very valuable to those directly connected with the business and interesting to all engineers who desire to get a general understanding and knowledge of development in electric furnace application and construction.

Power Plant Machinery

Vol. I. By W. H. James and M. W. Dole. 271 pages, illustrated. New York: John Wiley & Sons, Inc.

The steam engine from the kinematic standpoint is the chief topic treated in this elementary textbook, which has been revised by the authors. As planned it is the first volume of a series for treating of the machines used in power plants. It covers the kinematics and details of valves and valve gear on the ordinary types of steam engines and also deals with governors and turbine valve mechanisms. The indicator card and its interpretation serve to introduce some heat engineering theory into the text. Problems are inserted for applying the principles incorporated in the text. Much detailed material on valve mechanisms will be found in the book which should make it valuable to operating engineers and teachers.

Books Received

Handbuch der Elektrischen Raumheizung. By Wilhelm Heepke. Halle: Carl Marhold Verlagsbuchhandlung. 264 pages, illustrated.

Données Numériques d'Électricité, Magnétisme et Électrochimie. Paris: Gauthier-Villars et Cie. Extract from Volume IV, years 1913-1916. From page 627 to page 1016. Preface by Dr. F. B. Jewett.

Patents Throughout the World. By William Wallace White and Wallace White. New York: Trade Mark Law Publishing Company. 244 pages, with tables and maps.

Der Glimmschutz. By Dr. Georg I. Meyer. Leipzig and Berlin: B. G. Teubner. 61 pages, illustrated.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Americans Thought Safe

Cablegrams Allay Anxiety Concerning Many Manufacturing Representatives in Japan

ANXIETY concerning the safety of American electrical men in Japan in view of the terrible catastrophe in that country can now be in large degree allayed.

The General Electric Company has received a cablegram from that country saying that all its representatives are safe, although some were injured. With their families the General Electric men, who escaped in a boat from the scene of destruction, are now on their way back to the United States. The company had about fifteen Americans stationed in Yokohama and a smaller number in Tokio.

The Westinghouse company has received a cable from Shanghai saying that its Japanese representatives are safe. The company had about six men in Japan, four at Tokio and two being engineers engaged in installation work.

The Western Electric Company has been unable to get any direct word from its employees except a cablegram from Kobe relating to its comptroller, E. S. G. Elliott, and his family, who are safe. A newspaper dispatch published on Thursday said that W. T. Blume of the General Electric Company had been killed. Mr. Blume, however, was a Western Electric Company man. The Western Electric Company operated a factory in Tokio employing 1,200 operators with a staff of four Americans. One newspaper dispatch reported that this factory was destroyed and 600 people killed. A later dispatch states, however, that the district in which it was situated was practically undamaged. P. K. Condict, vice-president of the International Western Electric Company, was expected to arrive in Tokio on the day of the earthquake, and considerable anxiety is felt as to his safety.

John I. Beggs Tells Plans of Milwaukee Company

Announcement last week of a ten-million-dollar bond issue by the Milwaukee Electric Railway & Light Company means that the capacity of the huge Lakeside power plant at Cudahy is to be doubled, that additions and extensions are to be made to local and interurban electric railway lines and to the electric light and power distributing system of the company, which furnishes service to nearly all of the utilities in the southeastern section of the state, comprising an area of more than 4,000 square miles with a total population in excess of 850,000 people, and that other expenditures in the company's program are to be provided for, according to John I. Beggs, president of the company. In addition, $3,600,000 worth of 7 per cent five-year notes, due in November, are to be retired. The new issue will bear 6 per cent interest.

Colorado River Hearing

Federal Board Notifies J. B. Girand and State Governors to Be Represented Sept. 24

A HEARING which may be expected to bring out fully the conflicting views regarding power and irrigation rights along the Colorado River and which probably will have an important bearing on the pending compact among the states interested will be held Sept. 24 before the Federal Power Commission in Washington.

J. B. Girand, who holds a preliminary permit for development of a hydro-electric project on Diamond Creek, Ariz., recently wrote the commission asking that action be taken on his application for a license, which has been pending since March, 1922, or that he be permitted to present arguments in behalf of the application. A few days later the Governor of Arizona wrote the commission requesting a conference between that body and a committee of Arizona citizens on the Girand application and the Colorado River problem in general. In view of these requests, the commission has notified Mr. Girand to appear before the commission on Sept. 24, and the Governor of Arizona has been notified that a committee of citizens or officials from his state will be received on the same date. In order that all interests may be represented, the commission has also invited the Governors of Colorado, Wyoming, Utah, New Mexico, Nevada and California to send representatives to this hearing.

The Arizona state permit held by Mr. Girand will expire Dec. 31 by default if work is not started under its terms, and it is generally believed that, owing to a change in state administration, he would experience considerable difficulty in securing a renewal; but he cannot proceed under the state permit without a license from the Federal Power Commission, which has withheld action on his application for a year and a half awaiting the hoped-for compact among the states.

Pennsylvania Power Board

At First Meeting of New Body Governor Pinchot Outlines Principles of Procedure

THE first meeting of the board provided for in the water-power legislation passed by the Pennsylvania State Legislature at its last session, in accordance with Governor Pinchot's recommendations, was held on Aug. 28, at which time the board was organized for the purpose of determining the latent resources of the state. The board consists of the Governor, who is chairman; the Attorney-General, the State Secretary of Agriculture, the State Secretary of Labor and Industry, the State Geologist, Deputy Attorney-General Philip P. Wells, Chairman W. D. B. Ainey of the Public Service Commission and Dr. R. H. Fernwald, director of mechanical engineering at the University of Pennsylvania, who will act as power expert. The survey will be conducted by Morris L. Cook, who was Director of Public Works in Philadelphia under Mayor Blankenburg. He organized the power section of the Emergency Fleet Corporation during the war and frequently represented the government in power matters. He was a member of the advisory transit board of engineers in Philadelphia appointed by Mayor Moore, and recently at the request of Governor Pinchot he conducted a survey of public utility regulation in Pennsylvania.

Concern for Farmer

The meeting was opened by the Governor, who told the members that he wanted them to determine the best methods for utilizing hydro-electric power and the power it is hoped to obtain from coal ordinarily wasted at the mines. He called attention to the probable effect on the coal industry and declared that the development of giant power stations at the mines would stabilize employment. The by-products which are now wasted in burning raw coal would be recovered. He asserted that his plan will give the consumer energy at a much lower rate, which in turn will increase the distribution of power to the farms, factories and homes, and this in turn will increase the demand for coal. In the investigations to be conducted, the Governor said, the first concern would be for the small consumer and the farmer. Technically no system of electrical development could be sound without being built on estimates of the industrial power load; just so, no system could

be socially sound without considering the requirements of the two hundred thousand or more farmers and perhaps the same number of urban or semi-urban homes in the state.

The work will begin as soon as possible, and the survey of the Susquehanna River and its power possibilities will be one of the first steps to be taken.

Kansas Gas & Electric's New 60,000-Kva. Plant

Construction is being pushed on the Kansas Gas & Electric Company's new 60,000-kva. steam plant at Service City, on the Neosho River, about 12 miles southeast of Parsons. This plant is being built along the most modern lines and will feed a 132,000-volt steel-tower transmission line already completed from Service City to Midian, Kan., just east of El Dorado, a distance of 112 miles. The power house and transmission line together will cost $7,000,000.

The demand for electrical energy is pressing, according to officials of the Kansas Gas & Electric Company, which, with headquarters at Wichita, serves more than forty places in central and southeastern Kansas with light and power, and it is hoped that work on the new plant will be completed in November. R. J. Bassett, superintendent of the Phoenix Utility Company, is in charge of construction.

General Harbord Talks About World Radio Affairs

Just returned from a trip to Europe, where he attended a meeting of the consortium of American, British, French and German radio companies held in London, General James G. Harbord, president of the Radio Corporation of America, said that the chief object of the sessions was to complete plans for a projected radio communication service connecting both the United States and Europe directly with South America. Circuits will extend from the high power stations at St. Asise in France, Nauen in Germany and Carnavan in Wales direct to Buenos Aires, while others will bridge the gap between New York City and Buenos Aires through the intermediary of the Radio Corporation of America station on Long Island. Reception from France and the United States has already been established at Buenos Aires, and a high-power transmitting station is being erected there. It is expected that the new service will be ready for commercial use this fall.

When asked about the status of radio broadcasting across the seas, General Harbord had this to say: "During my visit in France I had the opportunity to manipulate a French broadcast receiver and listen in to a program broadcast from the Eiffel Tower. The complicated apparatus used for this reception was in striking contrast to the efficient receivers of simplified control that we have in this country at present."

Referring to the agreement between his company and the Chinese government, General Harbord said: "This undertaking calls for the erection of five powerful stations in China, the principal one at Shanghai. Shanghai will also operate a station of lesser power for communication with similar smaller stations at Pekin, Canton and Harbin, cities separated from one another by approximately 800 miles. These stations will be operated jointly by the Federal Telegraph Company of Delaware and the Chinese government, thus placing the project under Chinese-American administration. There are no exclusive or monopolistic features in this contract, and American business men will be quick to appreciate the commercial significance of the plan, inasmuch as there is today only one cable crossing the Pacific to China."

Work on the Chinese stations will begin this fall, and the inauguration of service is expected during the latter part of 1925, although the plan may reach maturity before that time. Test signals will span the Pacific from China well in advance of the official opening, however.

N. E. L. A. Men Report General Prosperity

Executive Committee Meetings at Headquarters Fully Attended—"National Service Survey" to Go Ahead—President's List of Committee Chairmen Ratified

BUDGETS for geographic division and national activities were discussed and approved at the meeting of the national executive committee of the National Electric Light Association held at headquarters in New York City on Friday, Aug. 31. Details of the program for the present administrative year were outlined, and the program was unanimously adopted at this meeting and at a meeting of the Public Relations National Section executive committee held on Aug. 30. One of the most important features of the program will be a "national service survey" such as was proposed at the June convention in New York. This survey will be conducted along lines to be determined by a committee which will work out several optional plans.

President Walter H. Johnson announced that he had appointed all committee chairmen and that all committees were actively at work. He requested and received approval of his appointments of committee chairmen as follows:

Charles A. Coffin Prize—Walter H. Johnson.
Class "C" Membership Applications—Walter Neumuller.
Constitution and Bylaws—W. C. Eglin.
Customer Ownership—Milan R. Bump.
Doherty and Billings Prize Awards—A. S. Loizeaux.
Electrical Resources of the Nation—M. S. Sloan.
Electrification of Steam Railroads—L. A. Ferguson.
Finance—Joseph B. McCall.
Insurance—Charles B. Scott.
Lamp—Frank W. Smith.
Public Policy—Martin J. Insull.
Rate Research—Alex Dow.
Water-Power Development—Franklin T. Griffith.
Accident Prevention—Charles B. Scott.
Company Employees' Organization—T. G. Spates.
Educational—Fred R. Jenkins.
Membership—Howard K. Mohr.
Rural Electric Service (formerly "Rural Lines")—G. C. Neff.
Wiring—R. S. Hale.
Chamber of Commerce of the United States of America—National councilor, John W. Lieb.
Contact Committee, Department of Commerce—George H. Harries.
National Industrial Conference Board—Sloan.
Eastern Seaboard Power Supply Survey Advisory Board, Department of the Interior.—(The two N. E. L. A. representatives are Charles L. Edgar and M. S. Sloan.

Attendance at the national executive committee meeting was exceptionally full, representatives being present from all but one geographic division. These representatives said without exception that conditions in the electrical industry are excellent; in fact, that the industry is enjoying a period of growth and prosperity unequaled in its history.

The meeting of the Public Relations National Section executive committee also was well attended. The program outlined calls for a continued activity on the part of all committees of the section and increased activities with respect to work with employees and co-operative work with other associations, institutions and industries.

N. E. L. A. Adopts New Policy on Sale of Publications

A new policy regarding the distribution and sale of the association's publications has been announced by the N. E. L. A. Free distribution will be limited to one copy of each paper to every member company in good standing, one copy to each geographic division, state association, company section and utility information committee; copies to the members of the committee under whose supervision the paper was prepared, single copies to associations and organizations exchanging like courtesies with the N. E. L. A., to the technical press, to selected libraries throughout the country, to universities, colleges and engineering institutions and to government offices. Additional copies will be sold to members at from 15 cents to 35 cents each and to non-members at from 25 cents to 55 cents each according to the number of pages in the publication, with special prices for orders for any paper in quantities of 25, 100, 500 and more. Advance subscriptions may be entered for all papers dealing with any general or specific subject, as, for instance, all technical papers, all commercial papers, all papers dealing with prime movers, accident prevention, insulators, meters, etc. The *Proceedings* of the 1923 convention will be supplied to members at $5 a copy and to non-members at $10. Complete price lists and further details of the plan will be sent by the association on request.

Del Monte Meeting Plans

Revised Program for A. I. E. E. Pacific Coast Convention to Be Held Next Month

CONSIDERABLE changes have been made in the program for the Pacific Coast convention of the American Institute of Electrical Engineers, to be held at Del Monte, Cal., Oct. 2-5, since it was printed in tentative form in the ELECTRICAL WORLD for July 28. As finally arranged it is as follows, Tuesday being given over to registration and recreation:

WEDNESDAY, OCT. 3

Morning.—Address, Past-president F. B. Jewett; address, "Researches Relating to High-Voltage Transmission," President H. J. Ryan; symposium by transmission engineers of the great West on the mechanical and electrical construction of modern power transmission lines, including insulators for high-voltage lines: "Mechanical-Electrical Construction of Modern Power Transmission Lines," C. B. Carlson and W. R. Battey, Southern California Edison Company; "110-Kv. Transmission Line for Oak Grove Development of Portland Railway, Light & Power Company," H. R. Wakeman and H. W. Lines, Portland Railway, Light & Power Company; "Insulation Design of Anchors and Tower Supports for 110,000-Volt, 4,427-Ft. Span Over Carquinez Strait," L. J. Corbett, Pacific Gas & Electric Company; "Transmission-Line Construction in Crossing Mountain Ranges," M. T. Crawford, Puget Sound Power & Light Company; "Group Operation of System Having Different Frequencies," E. R. Stauffacher and H. J. Briggs, Southern California Edison Company; "Special Features of the Design of Transmission Lines as Imposed by Electrical Conditions," W. Dreyer, Pacific Gas & Electric Company, San Francisco.

Afternoon.—Symposium by transmission engineers of the great West on waterwheel construction, operation and governing, etc.: "Experience with Bearings and Vibration Conditions of Large Hydro-Electric Units," John Harisberger, Puget Sound Power & Light Company; "A Study of Irregularity of Reaction in Francis Turbines," R. Wilkins, Pacific Gas & Electric Company; "Recent Hydro-Electric Developments of the Southern California Edison Company," H. L. Doolittle, Southern California Edison Company; "Upper Falls Development of the Washington Water Power Company," L. J. Pospisil, Washington Water Power Company," Spokane, Wash. Symposium on the practice of high-voltage switches, bushings, lightning arresters and busbars: "High-Voltage Switches, Bushings and Lightning-Arrester Experience of the Southern California Edison Company on its 60,000, 150,000 and 220,000-Volt Systems," H. Michener, Southern California Edison Company; "High-Voltage Circuit Breakers," A. W. Copley, Westinghouse Electric & Manufacturing Company; "Electromagnetic Forces on Bus Supports," L. N. Robinson, Stone & Webster, Seattle; "Test Results on the Performance of Suspension Insulators in Service," C. F. Benham, Great Western Power Company.

THURSDAY, OCT. 4

Morning. — "High-Voltage Insulation," J. L. R. Hayden and C. P. Steinmetz, General Electric Company, Schenectady; "Power Resources of United States" (illustrated), F. G. Baum, San Francisco; "Waterwheel Generators and Synchronous Condensers for Long Transmission Lines," M. W. Smith, Westinghouse Electric & Manufacturing Company; "Performance of Auto-Transformers with Tertiaries Under Short-Circuit Conditions," J. Mini, Jr., Pacific Gas & Electric Company; L. J. Moore, San Joaquin Light & Power Company, and R. Wilkins, Pacific Gas & Electric Company; "Transformers for High-Voltage Systems," A. W. Copley, Westinghouse Electric & Manufacturing Company.

FRIDAY, OCT. 5

Morning.—Symposium on radio communication as applied to power transmission networks: "Carrier-Current Telephony on the High-Voltage Transmission Lines of the Great Western Power Company," J. A. Koontz, Jr., Great Western Power Company; "Recent Developments in Carrier-Current Communication," L. F. Fuller, General Electric Company; "Some Experience with a 202-Mile Carrier-Current Telephone System," E. A. Crellin, Pacific Gas & Electric Company; "Symposium on Theory and Practice in High-Voltage Operation," R. J. C. Wood, Southern California Edison Company; "Economic Consideration of Power-Factor Control of Long High-Voltage Transmission Line," A. V. Joslin, Pacific Gas & Electric Company; "Methods of Voltage Control of Long Transmission Lines by the Use of Synchronous Condensers," J. A. Koontz, Jr., Great Western Power Company; "Applications of Long-Distance Telephony on the Pacific Coast," H. W. Hitchcock, Pacific Telephone & Telegraph Company; "Telephone Transmission Over Long Cables," H. S. Osborne, American Telephone & Telegraph Company.

Thursday and Friday afternoons will be devoted to sports and trips, and on Thursday evening the Edison medal will be bestowed on Dr. R. A. Millikan, following a banquet.

TRIP TO BIG CREEK

R. H. Ballard, vice-president and general manager of the Southern California Edison Company, has extended an invitation to the delegates to visit the Big Creek developments of the company. A two-day inspection trip is planned, starting Friday evening, Oct. 5, and those who make it will be able to observe the scope of the work and in particular the tunnel construction at the discharge end of the Florence Lake Tunnel, the operating plants below Huntington Lake and one end of the 220-kv. transmission line that is operating between the Big Creek plant and Los Angeles.

Work of the New England Public Service Bureau

To diversify further the composition of the committee in charge of the New England Bureau of Public Service Information and to increase the representation of utilities outside Massachusetts upon this board, eleven members have lately been added. They include five representatives of electric light and power companies, W. A. Buttrick, vice-president Twin State Gas & Electric Company; Samuel Ferguson, vice-president Hartford Electric Light Company; Fred D. Gordon, general manager Cumberland County Power & Light Company, Portland, Me.; Edward M. Graham, president Bangor (Me.) Railway & Electric Company, and D. W. Jardine, manager Burlington (Vt.) Light & Power Company.

During the coming winter a speakers' bureau will be established for the presentation of underlying principles and problems of the public utility industry as an industry to representative groups and to the general public, including chambers of commerce, rotary clubs, etc. Radio broadcasts will also be utilized in some of the larger New England cities. Newspaper acceptance and reuse of the bureau's material is running about 30 per cent ahead of a year ago.

Strength of American Public Utilities Company

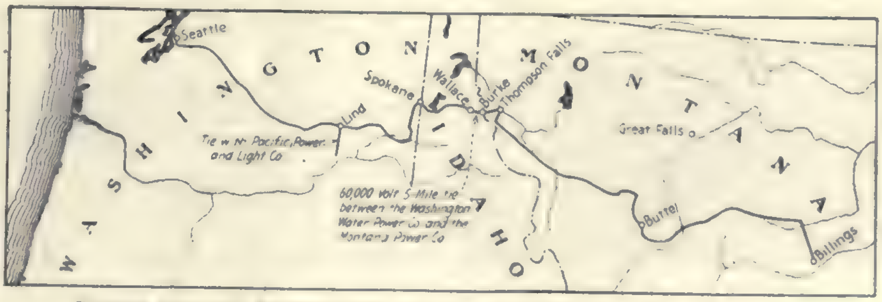
The annual report of the American Public Utilities Company of Grand Rapids, Mich., for the year ended June 30, 1923, shows an improvement in earnings, while reduction of funded indebtedness to \$436,000 and elimination of floating debt has strengthened its financial structure. Both the company's preferred issues are now on a dividend-paying basis.

For the year ended June 30, 1923, gross earnings, including those of the Wisconsin-Minnesota plants recently sold to the Northern States Power Company, were \$10,508,809, with a balance available for depreciation and dividends of \$720,418. With the liberation of the capital employed formerly in the Wisconsin-Minnesota plants and its application to the development of the electric properties in the more populous Indiana territory it is estimated that income available for stockholders based on past record of the Indiana properties and present demand for additional power for the year ending June 30, 1924, will be \$1,430,690, compared with \$720,418 for the fiscal year just closed.

Linking the Power Systems of Washington and Montana

The five-mile, 60,000-volt tie line now under construction between Wallace and Burke, Idaho, to connect the 60,000-volt system of the Washington Water Power Company with the 110,000-volt system of the Montana Power Company, will, as already stated in these columns, form an interconnected transmission system from Billings, Mont., on the east to Seattle on the west. This is a distance of more than 700 miles. The interconnection, together with a switching station at Wallace and a substation at Burke, will be completed this fall and power will be interchanged between the two systems through transformers at the Burke substation.

Following the completion of this tie and that of the Puget Sound Power & Light Company between Olympia and Tenino, Wash., there will remain only two small gaps of less than 25 miles in the interconnected transmission system of the West, extending for 2,000 miles, from Billings to Mexico.



CLOSING THE GAP BETWEEN WASHINGTON AND MONTANA POWER SYSTEMS

Fight on Adirondack Power

Towns and Land Owners Attack Plan for Regulatory District in Lake Region

PUBLICITY has recently been given to the controversy over the petition of the Hanna Paper Corporation and the Power Corporation of New York asking the New York State Water Control Commission to grant permission for the establishment of a Raquette River Regulating District. Opposition to the petition has been registered with the commission by the Adirondack Property Owners' Association, civic and commercial organizations and village authorities as well as individuals in the region that embraces Raquette, Tupper, Long, Forked and Saranac Lakes. These opponents assert that the Power Corporation is seeking a "blanket right to the Raquette Lake district," that there is no public necessity for the creation of the regulating district proposed, that the present flood damage is nominal and would not be lessened by storage, that the state would get nothing for the storage rights, that summer resorts and cottages in the most valuable districts of the Adirondacks would be destroyed if the scheme were carried out, and that the odor from the reservoir basins would become a nuisance and "affect most detrimentally" the United States Veterans' Tuberculosis Hospital now being built near Tupper Lake. If regulation of the river is necessary, opponents say, it can be brought about at less cost and without the use of state land by establishing reservoirs at sites below and outside the summer resort region.

The Power Corporation of New York, which was incorporated in 1922, issued last November a statement in which it said it was about to acquire rights to two sites on the Black River and five sites on the Raquette River, including one on the latter stream as yet undeveloped. The total horsepower upon completion of the proposed storage was estimated by the corporation at 100,000, 37,500 hp. already developed and producing income and 62,500 hp. on the Raquette undeveloped.

J. N. Carlisle of Watertown, N. Y., president of the Power Corporation of New York, is quoted as denying emphatically the contentions of the opponents of the Raquette development and saying that they are men who bought large properties after they knew the regulation district was proposed. Mr. Carlisle points out that the location of any particular reservoir must be settled by the state officers. He asserts that every village on the Raquette River would benefit from storage in the matter of adequate water supply, that it has been estimated the proposed hydro-electric development would do the work annually of a million tons of coal in small steam plants, and that Tupper Lake, which is now a "big swamp," would become a beautiful sheet of water. Any possible injury to the Veterans' Hospital he scouts as a "howling joke."

Cleveland Municipal Plant Needs $1,000,000

The report for 1922 of the Municipal Electric Light Plant of Cleveland seems to show that, regardless of earnings, a municipal plant will be hampered by high operating charges at a low rate of return. While the net earnings were $169,215, as against $27,000 in 1921, the plant remains in need of maintenance and extensive additions to meet the growth of business. The large increase in net earnings, which, however, represent less than 2 per cent net on the investment, is attributed to the fact that the Mayor cut down payrolls and other expenses when the output was reaching its maximum.

The valuation of the plant is given as $7,666,006, and it is rated at 35,000 kw. The total gross earnings for the year were $2,127,846. If tax allowance had been omitted, net earnings would have been $331,048. Toward the depreciation reserve there was added $303,749, increasing this fund to $1,173,604. Some plan may be worked out whereby this reserve can be used in order to get new equipment immediately.

The City Council last year granted a bond issue of $500,000, which went for much-needed new boilers and cables, but this was a small portion of the required new equipment. At the present time, according to Director E. L. Myers, at least $1,000,000 is necessary for improvements. Twice this amount would be better. Since 1917 the number of customers has jumped from 20,197 to 32,036, with a corresponding increase in energy output of 59,000,000 kw.-hr. Immediate action will be necessary in order to increase the plant capacity since the City Council has voted $500,000 for new "white ways," all of which must be lighted from the municipal plant.

Growth of Alabama Power

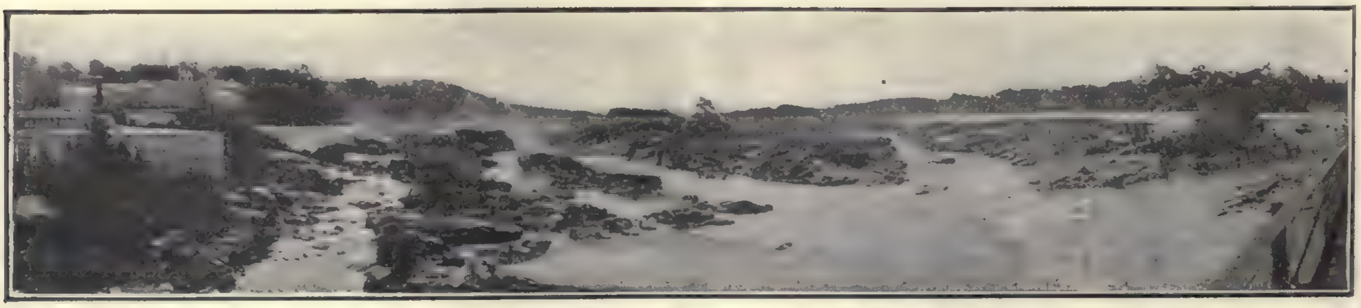
How the Company Contrives to Meet the Increasing Demand on Its Facilities

INDUSTRIAL development in Alabama has attained such an impetus, according to the figures of the commercial development department of the Alabama Power Company, that it is a hard task to fill the demands for energy. These figures, based on signed contracts and indications given by power users of future needs, reveal a state-wide power demand of 211,000 hp. this year as compared with only 150,000 hp. at the close of 1922. Careful estimates on future requirements reveal an expected need at the end of 1926 of 370,000 hp., making a total increase from 1922 to 1926 of 220,000 hp.

Thomas W. Martin, president of the Alabama Power Company, says that during May the power demand reached about 175,000 hp. Signed applications are now on file for 16,000 hp., while lighting and power requests from various consumers indicate a definite demand for a minimum of 20,000 additional horsepower. This rapid growth in the demand for power has been the moving force behind the comprehensive construction program of the Alabama Power Company, which includes the erection of a ten-million-dollar hydro-electric power dam at Cherokee Bluffs, on the Tallapoosa River, to generate 132,000 hp.

Tallassee Plant to Be Enlarged

Estimates of contractors show that the Cherokee Bluffs dam cannot with the utmost speed be completed before the end of 1925. In order to care for the demand which will accrue before that time the company will utilize the power house at the dam site acquired when the Montgomery electric properties were taken over and is now rebuilding the dam. The plant at Tallassee Mills will also be enlarged. Immediate power needs are being met by the installation at Mitchell Dam, where the third 24,000-hp. unit has gone into service simultaneously with the completion of the permanent high-tension transmission system. Mitchell Dam's 72,000 hp. brings the company's total hydro-electric output to 184,000 hp., and provision has been made for two additional 24,000-hp. units to be ultimately installed at the dam.



Lower Tallassee Dam, Acquired by Alabama Power Company from Tallassee Falls Manufacturing Company, Where Additional Generating Equipment Will Be Installed

I. C. C. Experts Report Against Staley Electric Line

Interstate Commerce Commission examiners have recommended that the application of William L. Staley for authority to construct an electric railway to be known as the Staley System of Electrified Railways in Arizona, New Mexico, Colorado and California be denied.

The application asked authority to construct a line which with branches would total 1,240 miles in the United States and 66 miles in Mexico. The whole territory to be traversed by the proposed line, the commission's examiners declared, appeared to be well served by existing railroads. The report made the further statement that the applicant had "grossly overestimated traffic possibilities."

Construction costs have been estimated by the Staley interests at about $76,000,000, with an additional $27,000,000 for power supply and about $30,000,000 for the purchase of equipment. The examiners declared, however, that no actual surveys had been made and that there was no method of ascertaining except by estimate what the actual construction costs would be.

Harriman Talks of Deerfield Power Development

"When completely developed the Deerfield River will be the most highly utilized stream for its drainage area in the Eastern States and one of the most complete examples of water-power conservation in the United States," said President Henry I. Harriman of the New England Power Company recently at Boston. "During the past eight or nine years," he continued, "the company has developed heads aggregating about 500 ft. on this stream and has built a large storage reservoir at Somerset, Vt., to equalize the flow. The new hydro-electric plants at Searsburg and Davis Bridge add 600 ft. to the total developed fall, and with these the storage capacity is being trebled. When these latter developments are completed, there will still be about 45,000 kw. undeveloped power below Davis Bridge. When this is developed the river will have a total developed capacity of about 135,000 kw. of primary regulated power. The new reservoir above Davis Bridge will have a capacity of 5,000,000,000 cu.ft., compared with 2,500,000,000 at Somerset. The flow of the river, formerly a 'flash' stream, will thus be made practically uniform."

Federal Departments at Odds as to New Coal Mines

Considerable interest has been aroused in Washington by the conflict between the attitudes of the Interstate Commerce Commission and the Interior Department toward opening new soft coal mines. As already reported, the Interstate Commerce Commission recently denied the Virginian Railway permission to build a branch line 1.19 miles in length in Wyoming County, W. Va., to reach a proposed coal mine, saying at one place in its decision: "There are at present more mines in the country than is consistent with the most efficient use of carriers' equipment, and their aggregate capacity exceeds greatly the country's demand."

While one government agency thus gives what appears to be a general declaration that too many coal mines are in existence in the country, the Department of the Interior has announced the sale at public auction of mineral rights to 1,840 acres of public land in Fayette County, Ala. The coal rights were purchased by Moss & McCormick of Birmingham, who paid a cash bonus of $85,000, with a pledge to spend $75,000 for improvements on the property within three years and to guarantee the government a royalty of 10 cents per ton per annum on a minimum production of 20,000 tons of coal, the stipulations meaning that the coal must be mined.

Landing the New Atlantic Cable

THE above photograph, by Alexander A. Brown, shows the shore end of the Commercial Cable Company's new European cable being floated in to land at Far Rockaway, N. Y., from the lighter in the distance. The buoys attached to the cable are being removed as they float in to shore.

Brief News Notes

Editor Condit to Give Radio Talk.—The second of the four radio talks to be given this month by editors of McGraw-Hill publications will take place on Wednesday, Sept. 12, when Kenneth H. Condit, editor of the *American Machinist*, will speak about "Automatic Machines and Their Effect on Men."

Bristow, Okla., Has New Substation.—The new substation of the Oklahoma Gas & Electric Company at Bristow was recently placed in service. New equipment costing approximately $75,000 has been installed. Ample capacity has been provided for the city's future growth. R. G. Justice is the local manager.

Feather River Development.—A permit has been granted by the California Department of Public Works to Guy Wilkinson of Oroville, Cal., to use 15,000 sec.-ft. from the Feather River in Butte County. The permittee intends to develop 47,659 hp. at a cost of $300,000.

Middle West Subsidiaries Consolidate.—Stockholders of the Central Illinois Public Service Company and the Middle West Power Company, both subsidiaries of the Middle West Utilities Company, have voted to consolidate. The consolidated company will own the 50,000-kva. power plant under construction in the Mississippi River at Grand Tower, Ill., and a 66,000-volt steel tower transmission line now being built to deliver energy from that station to the coal fields and communities of southern Illinois.

Kansas' New Power Plant Will Serve Both Topeka and Atchison.—It is announced that C. A. Leland, superintendent of the Atchison Railway, Light & Power Company, will have charge of the construction of the three-million-dollar power plant which, as already reported in these columns, the McKinley interests are to build at Tecumseh, on the Kaw River, a few miles from Topeka. This plant will serve Atchison as well as Topeka, and transmission lines are to be built to both cities, whose respective central-station companies have a joint interest in the building of the plant.

Iowa Electric Company at Odds with Maquoketa Authorities.—Legal action is being taken by the Iowa Electric Company of Cedar Rapids in an effort to prevent the city authorities of Maquoketa from installing a municipal lighting system. The company asserts that the city has constructed its lines so

that the property of the plaintiff is in danger of damage. It also alleges that the purpose of the city is to destroy the plaintiff's rights and property in Maquoketa, and it asks the court to enjoin the city from such action and that the contract between the city and the contractor be declared null and void.

Lightning Interrupts Service on British Columbia System.—Lightning of unusual severity recently caused a complete interruption of service on the system of the British Columbia Electric Railway Company in the early morning. The three cables carrying power from the Lake Buntzen plants were put out of commission and the machines in the Stave Lake plant were burned out, leaving only a small amount of power available. The 17,000-kw. steam standby plant in Vancouver was hurriedly pressed into service but was of insufficient capacity to carry the light and power load and street-car service had to be suspended.

Interstate Power Company Has New 33,000-Volt Transmission Line.—The Interstate Power Company is completing and will soon have in operation its new high-power transmission line from Postville to Ossian, Iowa. The former 13,200-volt line has been entirely rebuilt to give more direct connection with Galena, Ill., and Prairie du Sac, Wis. When completed it will operate at a voltage of 33,000, enabling the company to give better electric light and power service to Waukon, Decorah, Cresco, Lansing and other northeastern towns. Instead of copper wire steel cord inside of aluminum wire has been used.

Pennsylvania Power & Light Absorbs Three Properties.—A formal transfer of the franchises and assets of the Lycoming Edison Company of Williamsport, Pa., to the Pennsylvania Power & Light Company has been made. The Pennsylvania Power & Light Company is also absorbing the Jersey Shore (Pa.) Electric Company and the Lock Haven (Pa.) Light, Heat & Power Company. A new division has been established to be known as the Williamsport division, of which Lewis W. Heath of Grand Rapids, Mich., has been appointed manager. With the acquisition of the properties named the Pennsylvania Power & Light Company extended its operations from Lock Haven to the Delaware River, serving 150 communities.

Superior's Plants Still the Property of Central-Station Company.—The Wisconsin Railroad Commission at the instance of attorneys for the city of Superior has handed down a decision rescinding the order issued in March which transferred the title of the plants of the Superior Water, Light & Power Company to the city. This action was taken, it is understood, "to correct an error" made in issuing the March order, the error being that the transfer order was issued before the final valuation of the company's properties had been determined. Just what effect the most recent action of the commission will have on the proceedings to acquire the utilities is not yet entirely clear, but the decision definitely establishes that the plants are still the property of the company.

Blue Island Now Buys Utility Power.—As a result of an engineering investigation the City Council of Blue Island, a suburb of Chicago, has sold the municipally owned electric light and power distribution system to the Public Service Company of Northern Illinois. A thirty-year franchise has been granted besides an agreement whereby the Council may sell its street-lighting system to the company within a year. The reason for this change-over was the need of a new generating plant, which would have cost $293,000 with a yearly operating expense of $100,000, an outlay the Council shrank from incurring. The plant serves 12,000 domestic customers besides many industrial plants. The Blue Island generating plant of the Public Service Company of Northern Illinois, just south of the city limits, is conveniently situated to handle the increase in load.

Westinghouse Summer Conference for Engineering Teachers Well Attended.—Twenty-one teachers of engineering from twenty-one widely separated colleges and universities spent the month of July in the East Pittsburgh works of the Westinghouse Electric & Manufacturing Company renewing their contact with industry in the interest of better teaching. A similar program was conducted at the company's South Philadelphia plant. This is the thirteenth consecutive season that a group of engineering teachers has gathered at the Westinghouse company's plants and during these years more than four hundred engineering teachers, representing every engineering college in the United States and many of the leading institutions in foreign lands, have participated in the conferences.

General Tripp on "The Electrification of North America."—General Guy E. Tripp, chairman of the board, Westinghouse Electric & Manufacturing Company, contributes to the *World's Work* for September an illustrated article entitled "The Electrification of North America—What the Superpower Plan Means and How It Can Be Carried Out." In this article General Tripp explains the plan for continental electrical interconnection, dwells upon the great part that water power must play in such a project, alludes to the superpower systems already in operation on the Pacific Coast, in New England, the Southeastern States and the Northwest and those in process of formation, and tells of the detailed plans already drawn up by Frank G. Baum. Attempts, General Tripp says, may be made to bring about federal ownership of the nationwide power system when it becomes a fact. Opposing this idea as inefficient and unworkable, he favors constructive and stimulating but not restrictive government regulation. "The one essential," he concludes, "is to remember that the aim in view is the maximum prosperity of the nation and of every inhabitant of it."

Associations and Societies

Electrified Foundry at Iron and Steel Engineers' Exposition.—Special attention is called by the Association of Iron and Steel Electrical Engineers to the complete electrified foundry which will be in actual operation, producing finished castings, at the exposition to be held in the Broadway Auditorium at Buffalo, N. Y., in connection with the annual meeting of the association on Sept. 24-28. Starting with the electric furnace, every operation known in modern foundry practice will be exemplified, and as this is the first time that this feat has been attempted in America, it is expected to attract thousands of foundrymen. The names of the papers to be presented at the meeting, with their authors, were printed in the ELECTRICAL WORLD for Aug 25, page 402.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

Pennsylvania State Association of Electrical Contractors and Dealers—Wilkes-Barre, Sept 12-13. M. G. Sellers, 15-18 Sansom Street, Philadelphia.

Conference of Electrical Leagues—Association Island, Sept. 17-19. Society for Electrical Development, New York.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 17-19. O. A. Weller, 900 15th St., Denver.

Association of Edison Illuminating Companies—Dixville Notch, N. H., Sept. 17-21. P. S. Millar, 84th St. and East End Ave., New York.

Michigan Electric Light Association—Grand Rapids, Sept. 18-20. Herbert Silvester, Detroit Edison Co., Ann Arbor.

Illuminating Engineering Society—Lake George, N. Y., Sept. 24-28. S. G. Hibben, 29 West 39th St., New York.

Association of Iron and Steel Electrical Engineers—Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

International Association of Municipal Electricians—Reading, Pa., Sept. 25-28. C. R. George, Houston, Tex.

Great Lakes Division, N. E. L. A.—French Lick Springs, Sept. 26-29. R. V. Prather, 305 Illinois Mine Workers' Bldg., Springfield, Ill.

Indiana Electric Light Association—French Lick Springs, Sept. 26-29. T. Donahue, Northern Indiana Gas & Electric Co., Lafayette, Ind.

American Electrochemical Society—Dayton, Ohio, Sept. 27-29. Colin G. Fink, Columbia University, New York.

National Safety Council—Buffalo, Oct. 1-5.

American Institute of Electrical Engineers—Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

Empire State Gas and Electric Association—Lake Placid, N. Y., Oct. 8-9. C. H. B. Chapin, Grand Central Terminal, New York.

Association of Electragists International—Washington, Oct. 8-13. Farquson Johnson, 15 West 37th St., New York.

American Electric Railway Association—Atlantic City, N. J., Oct. 8-13. J. W. Welsh, 8 West 40th St., New York.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Oct. 19-20. Herbert Smith, Robson-Prichard Bldg., Huntington.

Electric Power Club—French Lick Springs, Ind., Nov. 19-22. S. N. Clarkson, 900 B. F. Keith Bldg., Cleveland.

Commission Rulings

Two Methods of Dealing with Accrued Depreciation.—In fixing a rate base for the Duluth Street Railway Company, which operates lines in Superior, Wis., the Wisconsin Railroad Commission found that the determination of accrued depreciation would be a heavy task and decided, instead of attempting it in order to arrive at the actual fair value of the property, to achieve the same object in another way. Explaining its course, the commission said: "There are two methods by which such consideration may be given. Under the first of these the company would be allowed to earn a return upon the property value after giving effect in such value itself to accrued depreciation. Where this is done the provision for depreciation would be made entirely by a charge to operating expenses. No interest credit could be required to be made to the reserve since the deduction of depreciation in the rate base in effect excludes from such rate base property built by the reinvestment of the reserve. A second method of giving consideration to accrued depreciation, although the effect of such depreciation is not measured by a deduction from the rate base, is to compute the rate of return upon the rate base before giving effect to accrued depreciation, which means that the utility is permitted to earn a return upon all property, including that built from reinvested reserves, and to provide for a credit of interest to the reserve based upon the reserve balance. This in effect constitutes a payment of interest to the reserve for the use of reserve capital exactly comparable to the payment of interest on a funded debt. Therefore, when a rate base is determined without giving effect to accrued depreciation in the base itself, no injustice is done to the consuming public as long as the company is required to utilize a proper part of the return which it is allowed to earn upon its total property as a credit to the depreciation or retirement reserve."

High Rates May Not Be Excessive in View of Supreme Court Ruling.—Dissent was registered by one member of the Pennsylvania Public Service Commission from the schedules ordered for the Luzerne County Gas & Electric Company on the ground that they provided an excessive return. This led another member of that body to file an individual report concurring with that of the majority. In this report he said: "The commission, in the disposition of the present complaint against excessive rates, is confronted with the alternative of either permitting and approving a rate schedule that will produce an amount sufficient to provide for a minimum allowance for operating expenses, depreciation and fair return, or disregarding the decisions of both the state and federal Supreme Courts, which have repeatedly held that rates shall not be confiscatory and that they are confiscatory when they will not yield a return which will at least approximate the legal rate of interest on the fair value of the used and useful property devoted to the public service over and above reasonable operating expenses and a proper allowance for depreciation. . . . Valuation was not an issue in the present proceeding and is conclusive on the commission, and while there is general agreement among the commissioners that the rates which must be charged for the services rendered to produce the required revenues to which the respondent is entitled are unusually high they cannot be termed excessive since there is no escaping the fact that they cannot, under the law of confiscation as declared by the courts, be made any less having due regard to the fair value of respondent's property as heretofore fixed by the commission and a minimum allowance for operating expenses and depreciation. For the reasons stated I prefer to go along with the majority report rather than to flout the decisions of state and federal courts."

Recent Court Decisions

Owner of Dam Given Time to Determine Height That Will Not Injure Plaintiff.—In Harp vs. Iowa Falls Electric Company the Supreme Court of Iowa modified a decree requiring abatement of a dam so as not to back water on plaintiff's premises by extending the time for the abatement and permitting the owner of the dam during that time to ascertain by experiment the height to which the dam can be maintained without causing the water to back up above plaintiff's lower property line. (194 N. W. 353.)*

What Constitutes Discrimination?—Confirming the dismissal of a complaint brought by the Cleveland & Eastern Traction Company against the Public Utilities Commission regarding rates filed by the Cleveland Electric Illuminating Company and approved by the commission which the Cleveland & Eastern company held to be in violation of a contract between it and the lighting company, the Supreme Court of Ohio held the commission's order to be in accord with the statutes and observed further: "A classification approved by the Public Utilities Commission which embraces in one class consumers guaranteeing a minimum demand of 500 kw. for combined electric railway and commercial uses, which has application to interurban companies procuring current from a power company at or beyond the limits of the city within which the power plant is located, and in another class electric railways guaranteeing a minimum demand of 20,000 kw. for electric railway purposes only, and which demand is constant and steady, such service being in said city and within a relatively short transmission distance, is a lawful and reasonable classification." (140 N. E. 139.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

To Predicate Damages on Discontinuance of Service Customer Must Tender Amount He Concedes to Be Due.—Reversing a verdict for the plaintiff in Nelson vs. Mobile Electric Company, a suit for damages because of the discontinuance of electric service owing to a disputed bill, the Supreme Court of Alabama declared that the rule that a company which ceases to furnish electricity because of a customer's failure to pay therefor, when his liability or the accuracy of the amount claimed is a matter of just dispute between the parties, acts at its peril is subject to the qualification that when the customer concedes a certain amount to be due he must pay or tender such amount. Failing to do so, he cannot complain that defendant's discontinuance of service was wrongful. It was not necessary, however, for the customer to allege the existence of a contract. (96 So. 713.)

Rules Governing Valuation.—In State ex rel. Capital City Water Company vs. Public Service Commission of Missouri, the Supreme Court of Missouri affirmed rates fixed by the commission for the water company, making these observations on the principles of valuation that the regulating body follows: "The Public Service Commission, in considering historical cost and cost to present owner of a public utility as a basis for fixing rates for the future, properly disregards so-called past losses or deficits arising from its net returns not being so great as it is claimed they should have been, the law not having prescribed any such return and such deficit not being a subject for capitalization. The commission, in arriving at depreciation, in determining reproduction cost new less depreciation, properly declines to be bound by either the 'sinking-fund method' or the 'straight-line method.' It properly disallows a hypothetical brokerage fee." Defining "going value" as the value distinct from good will which inheres in a plant where the business is established as distinguished from one which has yet to establish its business, the court said that good will should not be considered in valuation for rate making. It averred that what is a reasonable rate for a public utility in any given case is a question of fact, calling for the exercise of sound judgment and common sense of the commission, which is not bound by any hard and fast rule nor required to fix rates according to any general formula, nor according to any unvarying percentage of the value of the property in use. (252 S. W. 446.)

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

C. S. MacCalla Vice-President and General Manager of Pennsylvania-Ohio Company

C. S. MacCalla has been made vice-president and general manager of the Pennsylvania-Ohio Electric Company, the Youngstown Municipal Railway Company and other subsidiaries of the Pennsylvania-Ohio system, succeeding Garrett T. Seely, who recently resigned. Mr. MacCalla, who assumed the duties of his new office on Sept. 1, brings to his new field of activity a wide and varied experience in public utility operation. Immediately after his graduation from Lehigh University in 1896 he entered the installation department of the Philadelphia Bell Telephone Company and soon afterward spent a brief period with the Edison Electric Light Company of Philadelphia, now the Philadelphia Electric Company. Subsequently he became identified with the Edison Electric Illuminating Company of Brooklyn (the Brooklyn Edison Company), where he served successively as draftsman, construction boss and general construction foreman. In 1903, following two years' electric railway work in the foreign department of the General Electric Company, Mr. MacCalla went to the Pacific Coast, where he allied himself with the Washington Water Power Company, Spokane, serving for fifteen years as assistant to the general manager, assistant general manager, general manager and vice-president and general manager.

Returning to the East, Mr. MacCalla became vice-president and general manager of the Virginian Power Company, Charleston, W. Va., which position he recently resigned. During his residence in West Virginia he was appointed by the Governor to the State Board for Registration of Engineers and as a delegate to represent the state at a water-power conference in New York in February, 1922. Mr. MacCalla is an active member of the American Society of Civil Engineers and a fellow of the American Institute of Electrical Engineers.

C. S. Roadhouse, formerly superintendent of the municipal light plant at Walnut, Iowa, is now connected with the engineering department of the Nebraska Power Company, Omaha.

Graham Bright, formerly general engineer in charge of the coal and metal mining activities of the Westinghouse Electric & Manufacturing Company, has joined the firm of Howard N. Eavenson & Associates, mining engineers of Pittsburgh. Mr. Bright will give special attention to power-house systems, power-plant appraisals, transportation and transmission systems for coal and metal mines, and general industrial power applications. He became associated with the Westinghouse company in 1898, soon after being graduated from the University of Pittsburgh, and has been with the company almost continuously since.

H. C. Blackwell Heads Missouri Association

H. C. Blackwell, the new president of the Missouri Association of Public Utilities, has been vice-president and general manager of the Kansas City Power & Light Company since 1917.

H. C. BLACKWELL

After graduation from Purdue University in 1902, Mr. Blackwell was employed by the William B. Scaife & Sons Company, Pittsburgh, in the water-softening and purification department. In 1904 he served with the Wabash Railroad Company, but a year later joined the J. G. White Company of New York, where his work consisted in the construction of an interurban railway between Alton and East St. Louis, Ill. From 1906 to September, 1917, Mr. Blackwell filled various capacities with the People's Light Company at Davenport, Iowa, from engineer up to vice-president and general manager. He also served as gas engineer from 1914 to 1917 for the United Light & Railway Company. At this latter date he became associated with the Kansas City Power & Light Company in his present capacity.

C. F. Laible, formerly of the Chicago office of the Edison Storage Battery Supply Company, has been appointed district manager for New England, with headquarters in Boston. Mr. Laible succeeds George W. Holden, who recently left the service of the company.

John H. Albert, formerly associated with the operating department of the Brooklyn Edison Company, has severed his relations with the company.

E. F. Ryder has recently been made manager of the Oshkosh division of the Wisconsin Public Service Corporation's properties.

J. I. Mange, formerly vice-president of the Liberty (N. Y.) Light & Power Company, is now president of the company, succeeding Henry R. Taylor. C. A. Greenedge is vice-president.

Arthur E. Scott, for many years manager of the Atlantic Tank & Barrel Company of Louisville, has recently allied himself with the Interstate Public Service Company, Indianapolis, as director of relations.

E. M. Sweeley, president of the Public Utilities Commission of Idaho, has resigned. Mr. Sweeley, who was appointed to the commission in 1919, will be succeeded by Fred C. Graves of Filer.

Charles W. Brown, who has been associated with the Adirondack Power & Light Corporation for four years in various capacities, has severed his connection with the company to ally himself with the Service Appliance Company of Schenectady.

Leonard A. Doggett, who has been in charge of electrical engineering instruction of naval officers in the Post-Graduate School at Annapolis, Md., for the past ten years, has resigned to enter the department of electrical engineering at the Pennsylvania State College, State College, Pa.

Carl D. Luscomb, for several years assistant to C. A. Semrad, vice-president and general manager of the Western Light & Power Company, which was recently merged with the Denver Gas & Electric Light Company to form the Public Service Company of Colorado, has been appointed general superintendent of the division operated by the former company and will continue his headquarters at Boulder, Col.

Fred Fair, prominent geologist and irrigation engineer of Boulder, Col., has been appointed to the executive staff of the Lakeside Construction Company, which is now building the new twelve-million-dollar steam generating plant for the Public Service Company of Colorado at Valmont, close to Boulder.

Charles S. Banghart, general manager of the Augusta-Aiken Railway & Electric Company of Augusta, Ga., which is under the management of the J. G. White Management Corporation, New York, has resigned to accept the position of vice-president of the Staten Island Edison Company and the Richmond Light & Railroad Company, with offices at St. George, Staten Island, New York City. These companies are also under the management of the White corporation. F. Bayard Culley, assistant secretary and treasurer of the company at Augusta, has been selected to succeed Mr. Banghart.

Emerson Pugh, instructor in electrical engineering at Purdue University, has resigned to enter the development engineering division of the Western Electric Company at Chicago.

J. F. Orr, sales manager of the Idaho Power Company, has been appointed chairman of the range committee of the National Commercial Section of the National Electric Light Association.

Benjamin Robinson, chief electrician at the plant of the Bristol Brass Corporation of Bristol, Conn., has resigned recently. Mr. Robinson will devote his time to private research work.

Howard Corning of the Bangor (Me.) Railway & Electric Company has accepted the chairmanship of the rate committee of the New England Division of the National Electric Light Association.

H. L. Erlicher, formerly assistant to the general purchasing agent of the General Electric Company, has been named assistant general purchasing agent. Mr. Erlicher assumed his new duties Aug. 1.

P. J. Wilson of the Lowell (Mass.) Electric Light Corporation has accepted the chairmanship of the Power Bureau of the New England Division of the National Electric Light Association. The bureau is affiliated with the New England Association of Central Station Power Engineers.

W. B. Stover, who has been meter engineer for the Westinghouse Electric & Manufacturing Company with headquarters in Atlanta, has allied himself in the same capacity with the Southern Public Utilities Company, succeeding W. D. Alley, who recently became manager of the resales department of the Winston-Salem branch of the company. Mr. Stover assumed his new duties Sept. 1.

C. S. Walker, formerly president of the Varney Electrical Supply Company of Indianapolis and Evansville, Ind., has resigned his position to become secretary and treasurer of the Interstate Electric Company of New Orleans. Mr. Walker had been associated with the Varney Electrical Supply Company for more than twenty-five years.

John F. Cunningham, Jr., has been appointed assistant manager of the production department of the Schenectady works of the General Electric Company. Mr. Cunningham has been associated with the company since 1901, serving during that time in the armature department, the production department and more recently in the works manager's office in the capacity of special representative.

Magnus W. Alexander, managing director of the National Industrial Conference Board, New York, who has been studying industrial and economic conditions throughout the allied nations and Central Europe for the board, returned to this country on Friday, Aug. 31, on the *Resolute*. Mr. Alexander, who is a distinguished electrical engineer as well as an industrialist, being on the consulting staff of the General Electric Company, addressed meetings of industrialists in England, Germany and Austria. The results of his inquiries will be made known formally at the next meeting of the board on Sept. 20 at the Hotel Astor, New York City. Mr. Alexander has been peculiarly qualified to make this first-hand European survey at a crucial time by reason of his long leadership in the study of industrial problems. He has been identified with numerous industrial commissions and was named by President Harding on the advisory committee of the superpower commission to study electric development.

C. A. Morris, superintendent of the Northern Indiana Gas & Electric Company's power house at Michigan City, Ind., has been promoted and transferred to the East Chicago power house of the company. He formerly was employed at the East Chicago plant and a few years ago took the position of power superintendent with the South Shore Railroad. When the power house was taken over by the Northern company in October, 1921, he was retained as the superintendent. Donelly Leeds, present chief electrician at the power plant, has been promoted to succeed Mr. Morris.

A. N. Greene has resigned as publicity agent of the Century Electric Company, St. Louis, to become sales manager for the Watlow Electric Manufacturing Company, manufacturer of electric heating devices, also at St. Louis. K. G. Baker, who was graduated from Purdue University in electrical engineering with the class of 1923, will succeed Mr. Greene as publicity agent for the Century Electric Company.

Clinton Stark, formerly manager of supply sales of the Sprague Electric Company and more recently general manager of the Bonnell Electric Manufacturing Company, has joined the Westinghouse interests as special agent. He will be associated with John J. Gibson, vice-president of the Westinghouse Commercial Investment Company, with headquarters in New York.

Obituary

Oliver T. Harvell, a commercial engineer with the Georgia Railway & Power Company, Atlanta, for the past fourteen years, died recently at his home in Atlanta at the age of forty years. Mr. Harvell was well known in public utility circles in the South.

Gilbert F. Grider, superintendent of the Marshall (Ill.) light and water systems, died as the result of injuries recently received when an electric light pole upon which he was working broke and fell to the pavement. Mr. Grider was twenty-six years of age and had been employed at Marshall as light and water superintendent since May 1.

Delwyn Dessar, assistant engineer with the Duquesne Light Company, Pittsburgh, was killed in an automobile accident early last month. Mr. Dessar, who was a graduate of the University of Nevada, had been connected with the De La Vergne Machine Company, New York, the Nevada Valleys Power Company, and with the General Electric Company both in Schenectady and in New York. In 1922 he became identified with the Duquesne company.

Edward J. Hunt, managing owner of the Edward J. Hunt Manufacturing Company, Newark, N. J., died on Aug. 11. Mr. Hunt was a graduate in electrical engineering of Tufts College in 1892 and subsequently spent fourteen years in various departments of the General Electric Company. In 1913 he established the manufacturing business in Newark, where he built transformer oil drying and testing apparatus of his own design. Mr. Hunt was inventor of a number of electrical devices.

Hertha Ayrton, British engineer and the only woman member of the Institution of Electrical Engineers, died on Aug. 27 in Lancing, Sussex. Mrs Ayrton invented and constructed a line divider and assisted in the completion of a series of experiments on the electrical arc. She was nominated for a fellowship in the Royal Society in 1902, but the society's counsel gave an opinion that the organization had no power to elect a woman.

J. Alfred Landry, president of the Lake Charles (La.) Railway, Light & Waterworks Company since its organization thirty-two years ago, and one of the most prominent citizens and business men of the city, died on Thursday, Aug. 9. Mr. Landry, who was sixty-four years of age, had been in failing health for the last few years. He was an early and ardent advocate of public utility development in Lake Charles, and his activities in connection with the starting of the ice plant, the installation of electric lighting and the electrification of the street railway are an important part of the story of the growth of the city, to which he came first as an unknown country boy.

Frank G. Drum, formerly president of the Pacific Gas & Electric Company and one of the leading figures in the financial life of California, died suddenly as the result of a hemorrhage on Tuesday, Aug. 28, at his home in San Francisco. Mr. Drum was associated with the development of many of California's leading corporations. He was president of the Pacific Gas & Electric Company for a period of thirteen years, from 1907 to 1920, when he resigned in favor of Wigginton E. Creed, but continued as a member of the executive committee and the board of trustees. He served as executive manager of the Haggin and Tevis interests in California for thirty years. At the time of his death he was president of the Yosemite Valley Railroad Company, vice-president of the Mercantile Trust Company, of which his brother, John S. Drum, is president, and an officer and director in many other enterprises.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Great Additions to Wealth of Industry

Details from an Analysis of the Capital, Surplus and Inventories of Seven of the Largest Electrical Manufacturing Corporations of America

IN TERMS of cash, inventories and working capital industry has never been in a stronger position than it is today. This is true of all the principal industries of America, and also of the principal manufacturers of the electrical industry.

An extremely interesting analysis of 141 representative companies engaged in manufacturing in the United States has recently been compiled and published by the *Wall Street Journal*, embracing complete statistical reports from all these sources. It shows a combined working capital as of Dec. 31, 1922, of $4,441,778,556 as compared with $1,935,788,984 on Dec. 31, 1914, a gain of $2,505,989,572.

The inventories of these 141 companies on Dec. 31, 1922, totaled $2,620,925,133, compared with $2,654,094,870 on Dec. 31, 1921, $3,655,203,299 on Dec. 31, 1920, and $1,220,343,337 on Dec. 31, 1914. Cash and investment holdings Dec. 31, 1922, were $1,678,935,338, equal to nearly 40 per cent of working capital on the same date. Capital liabilities show an increase since Dec. 31, 1914, of $2,488,987,317, not including dividends in stock. These 141 corporations from Dec. 31, 1914, to Dec. 31, 1922, showed a combined surplus after all charges, including dividends, of $3,069,431,945.

Listed among these companies as selected to give a cross-section of American industry are these seven prominent electrical corporations:

Allis-Chalmers Manufacturing Co.,
American Telephone & Telegraph Co.,
Electric Storage Battery Company,
General Electric Company,
Otis Elevator Company,
Western Union Telegraph Company,
Westinghouse Electric & Mfg. Co.

The data presented on these seven companies have been lifted out and incorporated in the accompanying table, and the figures present a striking comparison. The combined

Comparison of Capital Income and Earnings

	Working Capital Dec. 31, 1922	Working Capital Dec. 31, 1914	Increase, Dollars	Increase, Per Cent	Cash and Investment Securities Not of Subsidiaries Dec. 31, 1922	Increase or Decrease in Capital Liabilities Less Dividends in Stocks 1914–1922	Earnings Available per Share Common for Common, Total 8 Years	Av. Earnings Available for Common per Year, per Cent	Added Value per Common Share, 8 Years
Allis-Chalmers	$23,838,021	$11,495,089	$12,342,932	108	$10,391,478	none	$58.55	$7.32	$43 26
American Tel. & Tel.	99,695,528	20,194,755	79,500,773	393	119,680,314	I $435,496,754	51 80	6 48	7 40
Electric Storage Battery	17,865,639	3,224,778	14,640,861	455	2,485,474	1,979,325	G 31.20	3.90	21.75
General Electric	179,680,280	72,035,317	107,644,963	149	85,341,538	73,812,769	96 40	12.05	50 20
Otis Elevator	13,321,565	4,661,705	8,659,860	186	6,978,322	— 290,044—	67 69	8.46	41.79
Western Union	18,033,877	10,218,080	7,815,797	76	23,441,462	12,286,518	86 33	10.79	33.36
Westinghouse Elec. & Mfg. Co.	A 90,286,743	F 28,230,469	62,056,274	220	A 7,909,333	46,409,113	H 69.50	H 8 68	27.45
Total	$442,721,653	$150,060,193	$292,661,460	...	$256,227,921	+ 569,979,479+ — 290,044— $569,699,435 net, +	$461.47		$225.21

Comparison of Inventories

	1922	1921	1920	1919	1918	1914
Allis-Chalmers	$10,009,030	$12,504,188	$19,659,335	$13,646,367	$17,436,478	$4,149;243
American Telephone & Telegraph	none	none	none	436,707	none	none
Electric Storage Battery	G 7,928,280	G 6,960,133	G 10,313,479	4,894,660	5,528,591	1,726,381
General Electric	75,334,562	64,848,189	118,109,174	83,978,463	88,305,681	29,292,763
Otis Elevator	3,680,738	2,572,181	3,033,787	5,287,519	4,574,656	3,175,889
Western Union	5,685,980	8,152,929	8,713,133	4,913,479	1,545,939	1,926,900
Westinghouse Electric & Mfg. Co.	A 68,971,104	B 55,027,059	C 80,724,389	D 63,018,123	E 59,550,262	F 13,307,795
Total	$171,609,694	$150,064,679	$240,553,187	$176,175,318	$176,941,607	$53,578,971

Earnings Retired for Surplus Each Year After All Cash Dividends

	1922	1921	1920	1919	1918	1917	1916	1915
Allis-Chalmers	$22,908	$29,827	$1,647,207	$1,819,540	$3,006,444	$2,392,115	$1,738,565	G $602,868
American Telephone & Telegraph	13,199,176	11,328,301	16,444,423	9,039,457	8,671,623	5,989,492	5,891,090	5,518,047
Electric Storage Battery	3,489,154	2,104,891	2,594,557	961,702	1,482,395	1,377,915	932,089	710,784
General Electric	12,157,391	8,243,290	11,476,066	15,532,502	7,939,360	17,768,102	10,467,882	3,607,992
Otis Elevator	1,037,103	762,112	2,490,277	1,216,191	303,913	90,688	28,012	27,094
Western Union	3,790,845	2,378,482	5,969,740	2,196,476	3,270,584	4,680,341	5,685,100	5,351,048
Westinghouse Elec. & Mfg. Co.	6,278,587	—47,506	6,632,642	9,221,442	9,822,224	9,794,832	14,049,980	6,859,929
Total	$39,975,164	$24,799,397	$47,254,912	$39,987,310	$34,496,543	$42,093,485	$38,792,719	$22,677,762

A. 1923, *B.* 1922, *C.* 1921.
D. 1920, *E.* 1919, *F.* 1915.
G. Based on aggregate shares of both classes as they receive dividends equally after 1 per cent on each class. This aggregate was increased from 199,793 to 799,173 shares during 1922. 1922, 1921 and 1920 figures are consolidated with those of Willard Storage Battery, all the stock owned.
H. Based on aggregate shares of both classes; common and preferred share alike after 7 per cent on common.
I. From general statements of American Telephone & Telegraph Company, which do not include those of associated companies except that part of earnings paid as dividends to parent company. Proceeds from increase in capital liabilities by sale were used chiefly in acquisition of minority stocks of associated companies.

working capital of these seven electrical companies on Dec. 31, 1922, was $442,721,653 as against $150,060,193 on Dec. 31, 1914, a gain of $292,661,460. Their inventories totaled $171,609,694 as compared with $150,064,679 at the end of 1921, $240,553,187 a year before and $53,578,971 on Dec. 31, 1914. Their cash and investment holdings on Dec. 31, 1922, were $256,227,921, which was equal to nearly 58 per cent of their working capital on the same date. They showed net increase in capital liabilities of $569,699,435, not including dividends in stocks, and a combined surplus for the eight years after all dividends were paid of $290,377,292.

The common stocks of some twenty-seven of the 141 companies were selling far below their value considering the combined surplus, after dividends were paid. Among these are noted:

	Market Sept. 1	Added Value in Eight Years
Allis-Chalmers	$43\frac{5}{8}$	$43.26
General Electric.....	179	50.20
Otis Elevator........	121	41.79

There were many instances, however, where corporations failed to retain all of this added value based on surplus after dividends, a great deal of the surplus being lost through inventory deflation or spent for new construction or acquisitions. Some retained most of their surplus in working capital as in the case of the General Electric Company among these electrical manufacturers.

The complete analysis of working capital in computing this statement showed that corporate purchasing power was never greater than at the beginning of this year. Covering the 141 companies, cash was equal to 60.5 per cent of inventories in 1919, 38.9 per cent in 1920, 50.4 per cent in 1921 and 64.1 per cent in 1922.

In the inventory totals there is an interesting record of the swing of the business cycle through which industry has been passing. It is also interesting to note that during this period central-station capitalization increased 91 per cent against the 195 per cent recorded here for these seven electrical manufacturing companies.

An Experience in Schooling Dealers

Describing an Educational Effort Which Has Produced Remarkable Results and Points an Opportunity to Other Electrical Manufacturers

BY GEORGE R. PURVIS
Assistant to President, Hurley Machine Company, Chicago

THE securing and developing of an efficient personnel among distributors and dealers is, of course, a serious problem with all manufacturers whose product is resold to the public. And this class of product bulks so large now in the electrical industry that I believe a recent experience of this company will be of general interest. It concerns an experiment in the systematic schooling of dealers and their salesmen and some remarkable results that have come out of it.

In the early days of our company, of course, a few of us were able to visit more or less frequently our principal customers. We were able to give general information concerning our line to our local distributors, and we felt that the real work of education could be best distributed to our customers and dealers through letters and data sent out from our home office and factory. As the business expanded, however, and our lines of distribution grew from a handful of dealers into hundreds and then thousands of jobbers, central stations, electrical contractor-dealers and department stores, we began to realize that a systematic educational program must be instituted and followed out if the salesmen on the firing line were to be properly equipped to fight our battle.

FAST SELLING NEEDED

Electric washing machines, ironing machines and vacuum cleaners, while recognized today as almost indispensable to the housewife, and of such common usage as to need but little description, are nevertheless specialties. As such they require salesmen with a trained knowledge that may only be gained through a special source of information.

Hit-or-miss statements regarding the use, cost of operation or comparative efficiency of electric home labor-saving devices destroy the confidence of the housewife and lessen her interest in these appliances. And unless her interest can be aroused there is but scant chance for imbuing her with a desire for them. Trained salesmanship, it was our opinion, would tend to equip salesmen with intimate knowledge of our product, acquaint them with details of its manufacture, familiarize them with the personnel of our organization and give them positive data which they could authoritatively pass on to their customer—the housewife.

We have always been firm believers here in the use of facts in selling. We have kept away from general statements and endeavored to implant in the customer a confidence in our goods and in our institution, and we have found it effective. But naturally the remote dealer, with his scant knowledge and with his uncertain contact with our end of the business, is usually not well equipped to tell this very vital story. After considerable study of the plan, therefore, we decided to make an attempt to bring in a certain number of our dealers or their best salesmen and in so far as possible give to them the history, the viewpoint and the experience of our company and a knowledge of its products. We were confident that enough could be accomplished to make better salesmen of them when they went back home.

We began this school in a very small way. A few salesmen came in to us from our dealers in Michigan, Indiana or Wisconsin towns. To them was given a careful and truthful history of the development of the washing-machine industry. We gave them intimate data of our own very humble beginning and then carried them along through the development of our business until they were brought to realize the tremendous sales possibilities that lay before them. They were taken into our factory from one department to another, and during these trips each process was explained with such care that they became thoroughly familiar with all parts of each product. Our schoolroom was the scene of play sales, play demonstrations, lessons in meter reading, and so on, and was then thrown open to discussions of various topics brought out through our factory trips and sales talks.

We sent them out into the city with the demonstrators and service men of the company. These trips carried them into the homes of users of our appliances, where they saw a washing or ironing done by one of our own experts. Or, in company with one of the service men, they discovered the shortest and quickest way to overcome the difficulty that

the housewife had encountered in the use of any appliance.

One of the most important points to us of this students' course was the information which we were able to gather and retain concerning our guests. We filed and indexed this information. It gave us a history of each man.

Of course, it must be realized that these students of ours were our guests and in every instance also our customers, and throughout the few days of training our thought was not only to teach these young men about our products, how to sell and how to make themselves liked, but also to make them like us. Therefore, we all were enthusiastic and intensely interested in each other's success and helpful to each other wherever possible, and in this atmosphere a strong human bond quickly developed.

Influence on Sales

When 250 of these students had visited us, each one our guest for a period rarely less than three days, we took stock of the work we had done. We were anxious to discover to what degree this training had benefited those men who had visited us. Here came the surprising fact. The *average* amount of sales personally made by these guests of ours over a two months' period following their visit, as compared with their sales for the two months prior to their visit, showed a surprisingly large increase.

Thus was laid the foundation for our later development—which we have called the "Hurley School of Salesmanship"—by which it is our plan to put into the electrical merchandising field not less than two thousand trained salesmen—men who will be thoroughly equipped to sell electrical home labor-saving devices to the housewife. We sent out an announcement of this plan to educate the salesmen of electrical dealers and central stations to all of our dealers, and their responses were immediate. The price is $37.50, but when the applicant is recommended by an official of this company he has the opportunity to enroll without cost. The course comprises eight lessons or books, sent out successively, and in each instance the prompt return of a questionnaire made up from the text of the lesson inclosed is required.

We have been literally overwhelmed with applications. Within the last four months more than twenty-five hundred men have asked to be enrolled in this course of training, and we are taking all of them as fast as we can meet the demands.

It has not been our thought to develop and make electrical experts of our students, but rather to place within their reach obviously simple, common-sense truths about the sale of electrical merchandise. It has been our one aim to develop in each student the capacity to analyze himself and to be able to solve properly his customer's problem. We believe that this offers a means whereby any manufacturer whose product must be resold at retail may build up a distributing organization more efficient than has ever been possible before. Undoubtedly, it will result in a tremendous benefit to the electrical market. It is an activity that, we believe, should be considered seriously by every appliance manufacturer.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

THE week has been generally characterized as dull by the electrical trade throughout the country—with a falling market. Brass and copper have dropped in New England and sockets have followed. A reduction in glassware became effective widely. A sweeping cut in wire, including rubber-covered and leaded conductors and cords, was reported from Chicago. Cautious buying and keen competition for orders are increasing on the Coast. However, it is almost universal opinion that business merely waits on the opening of the normal fall activity and that prospects are good.

There is undoubtedly a slowing down in building construction. Large power developments in the Pacific States have also slackened, but there is an expectation that railroad and industrial buying will be an important element in the market before long. Stocks are reported low and collections a bit tardy.

Better Volume But Disappointing Profit on Safety Switches

WITH sales of safety switches in July approximately 30 per cent greater than in January, the present business of the majority of manufacturers of these articles is considerably ahead of any six-month period in two years. Deliveries generally are somewhat retarded on account of the advances in connection with raw materials and shortages in the labor market. Prices have not changed recently, although the tendency of switches is toward a slight increase in the higher grades and considerable increases in the cheaper grades, as raw-material costs make up a greater proportion in the cheaper switches than they do in the higher-grade switches.

Manufacturers doubt very much if there will be any material decline in demand for safety switches, but at the same time do not expect any large increase in orders outside of the normal expansion due to safety education and legislation in that direction. Of the two fields, domestic and industrial, the domestic field is showing the bigger increase in orders. This field usually represents the lower-priced and simpler type of switch, such as may be required and suitable for residences, apartments and other places where severe conditions do not exist, in so far as continuous operation of the switch is concerned. Competitive pressure is usually much worse, however, because the same discrimination is not used in buying in this field that is used in the industrial field, because the general public does not understand installation conditions, and also probably because most of this material is bought on a bidding basis. It is the opinion of the manufacturers that a great many switches made for the domestic field are being sold at less than cost so far as the manufacturers are concerned, because there is a constant addition to the number of firms going into this field.

Elimination and standardization are becoming more and more necessary in this industry. The wide number of varieties, styles and duplications cut into quantity production and the customer does not get the benefits which would ensue if fewer styles and types were made, with lower costs on the part of the manufacturer. One important standardization affecting four leading manufacturers is announced on page 515.

Currency Status Now Working to Help American Exporters

IN SPITE of the fact that recent reports on exports of electrical material from this country have shown that business is falling off somewhat, the outlook in the foreign market generally is exceedingly promising in the opinion of a prominent New York export agent. This man maintains a specialized organization and represents about a dozen important manufacturers of electrical commodities, carrying on their sales in the foreign fields.

The basis of his optimism is the fact that throughout South America, in Australia, the Orient and generally about the world, American money has for three years or more appreciated.

This means depreciated local currency for the foreign merchants as applied to

imports from the United States. It has continued so long, however, that importers are becoming accustomed to it and adjusting themselves to the idea of buying from us on a rising market. Orders for American goods continue small in the main and spotty, but they are emanating from many odd corners where business is not expected, and from many other sections, where the American manufacturer naturally would look for orders, they are slow in materializing. All in all, however, this increasing activity indicates a better state of mind toward buying from this country, be the price what it may, because of American standards of quality and the ingenuity displayed in many of our products. It would seem to indicate that the manufacturer who will patiently develop these foreign contacts will be able to build up a very substantial export business that will continue as a distinct asset.

European business naturally waits upon the settlement of the French-German tangle, but in the opinion of many this works to the advantage of the American manufacturer rather than against his interests. Just so long as Europe remains unsettled and Germany in doubt as to her economic position, so long is there restraint upon German exporting activity, and the flood of German goods which will unquestionably follow a final adjustment of German debts is held back from our market. This gives more time to American manufacturers to establish themselves in foreign markets before the price competition of German goods begins to put pressure upon them.

Interesting Trends in Elevator Control Equipment—Sales 40 per Cent Better

UP TO July 1 manufacturers of elevator equipment have been enjoying a particularly gratifying volume of business, about 40 per cent better than the sales of 1922. The biggest single source of business has been the apartment house, the small hotel, the small office building and the department store. The biggest profit, however, comes from the large office buildings with installations of twenty to forty high-speed elevators.

The general business outlook in this field is considered very good. It is estimated that the country is underbuilt by several years on the type of building that requires elevators, and as conditions continue to settle down the market will be increasingly strong. No large immediate business is expected from the East as building is quiet. Buying on the Pacific Coast has been exceptionally heavy. Sales have been very active in Detroit, fair in Chicago, and in St. Louis not so good.

The interesting trend in the field of elevator equipment right now is the progress that is being made toward the development of high-speed and heavy-duty units with reduction in energy consumption. One of the leading manufacturers has developed a patented micro-drive control that automatically levels the floor of the elevator and is making possible important economies. This is actually a war product, for the micro-drive elevator was originally devised to make possible the laying of the North Sea mine field. The British government attempted to lay these mines, but was unsuccessful owing to inability to regulate the level of the mine accurately.

It was the possession of this machine—for it is not a device, but a complete machine—that made it possible for the American fleet to do the job. In its application to the passenger and freight elevator it brings distinct advantages, for to stop an elevator and then adjust it to within an inch of floor level consumes as much energy as to raise it to the next floor. On freight elevators this automatic control is so sensitive that as an industrial truck is driven onto the elevator the level of the floor is adjusted to the increased weight, taking all the shock off the truck.

In passenger service speed is steadily increasing in the large building installations. In the Woolworth Building elevators operate at 700 ft. per minute. The new Standard Oil Building will have service at 800 ft. a minute. Probably elevator speed will before long increase to 1,000 ft. a minute. It is all a matter of control. Apparently push-button control of elevators is soon to be carried much further than has been generally expected. This system is becoming standard in small apartments, homes, banks and so forth and is now being adapted for large industrial purposes. At the army base in Brooklyn ninety-six elevators are operated from a single switchboard by a car dispatcher. As an industrial truck or train approaches, this dispatcher signals the elevator which it is to board and controls the elevation of the load from his seat. It is estimated that this system of control is saving $96,000 a year in this one great warehouse.

In short, the elevator manufacturer's problem today is largely one of control, and he sells to a market that no longer has to be educated as to the need for elevators. The electric elevator has become standard throughout the country, and the selling process resolves itself into a matter of competition between systems, which is being maintained on a very high plane with a relatively small price pressure.

Business Quiet in the Northeast with Drop in Glass and Sockets

ELECTRICAL trade reports from the Northeast as August closed voiced general confidence in the outlook for fall business and in some lines recent orders indicate a desire to take advantage of present delivery conditions. Leading Boston jobbers announced a new schedule of prices last week on sockets in lots of 1,000, amounting to reductions of from 1 cent to 1.5 cents net according to type. Copper and brass prices reflect weakness. The only prospect of scarcity in stocks lies at present with rigid conduit, although deliveries of motor-control apparatus are lengthening as the demand for these products increases. On the whole, seasonal dullness marked last month in New England and New York, although in exceptional cases the volume of trade ran ahead of July's. New England textile mills and paper plants are resuming larger-scale operations. Retail trade is good, although electric appliance sales are expected to increase rapidly from now on. Electric ranges are moving better, and motor-operated refrigerating plant builders note increased interest in their products. Electric sign business is improving. A general reduction was made in a leading glassware line to meet competition, despite the fact that costs have not come down. Interest in electric industrial truck service is showing new life. Pre-holiday quiet prevailed over the week end.

Sweeping Revision Downward of Wire Prices in Chicago—Business Quiet

GENERAL business in the electrical trade in the Chicago district as a whole has not improved this week. In fact, it may be considered a little duller than last week. Pole-line hardware sales have not been so good as in the earlier part of the month. Stocks of poles are still short on many sizes and prices are firm.

The most important price change this week is a general revision in the prices of wire, effective Aug. 25. Rubber-covered code wire dropped approximately 5 to 10 per cent. Leaded conductors dropped approximately 7 to 10 per cent. Cotton lamp cord dropped approximately 10 per cent, while type P and reinforced cords dropped approximately 13 per cent. It is not the opinion of the trade that this condition will exist for a long period. No. 14 S.C.S.B. solid at $6.52 Chicago is a rather low price, and indications are that an upward revision of wire prices about the fifteenth of this month may be expected. Contrasting with the drop in code wire, flexible armored cable officially advanced to $42 Pittsburgh.

The steel trade announces that steel advanced 18 cents per 100 lb. While this advance is only on heavy beams and structural shapes, it may be an indication that there will be a general advance in steel, which would cause the price of conduit to advance with the price of merchant pipe.

Stocks Low in St. Louis, but Sales 40 per Cent More than Last Year

ELECTRICAL business in St. Louis has picked up considerably during the past month. Jobbers report that the volume of sales exceeded that of the corresponding month last year by about 40 per cent. There have been no important changes in prices with the exception of a slight reduction in the price of wire early in the month. Stocks are in fair condition. Jobbers say that

they are keeping stocks as low as is consistent with the present volume of business. Labor troubles have retarded the sales in some lines of contractors' supplies. Some slowing down is noted in the demand for ornamental lamps and fixtures. Revival of interest in radio is becoming quite apparent as is consistent with this time of year.

Collections indicate a slowing down compared with the recent months, wholesale dealers report backwardness on the part of retail dealers in the wheat section, and the coal-mining section is not so active as it has been during the same month in previous years. Following several months of marked activity, the commercial paper market during the last thirty days showed a very decided slump and the volume of bank credits in use has shown a considerable reduction.

Cleaner and Range Sales Increase in Southeast—Retail Business Good

ALL jobbers report a satisfactory business, considering the summer lull, with a slight pick-up to be noticed. The outlook for the fall is very good. General stocks are in fair condition and deliveries are reasonably satisfactory, except on copper wire—these ranging from stock shipments on certain sizes to three to four months on others. The movement of conduit is excellent, and jobbers are having no trouble meeting the demand, satisfactory stocks and regular deliveries being reported for this section.

Electrical contractors report a slight slowing up. Prospects are good, however, for the remainder of the year. The Southeastern manager for one of the largest vacuum-cleaner companies reports sales as double those of the same period of last year and the sales forces have been considerably augmented. The outlook for this line is better than for three years past. Dealers report a very satisfactory movement in batteries, particularly of the automobile type. Deliveries on this class of battery are lengthening.

The volume of sales of the popular-sized meters is reported quite satisfactory with the proportion of the 10-amp. size on the increase. Electric range sales by utilities have increased the sales of the 25, 50 and 75-amp. meters from 200 to 300 per cent. Retail business in general is very good for the season of the year, particularly the lighting-fixture line. Electric sign sales are going well, though business is mostly in the small-size store signs. Central-station expansion continues.

Increased Industrial Market on the Coast—Large Railroad Business in Sight

THE falling market for electrical commodities on the Pacific Coast has continued through this week and served to intensify the exceedingly keen competition that has prevailed throughout the year. Cautious buying is the rule. Major power construction has temporarily slackened in northern California, and power company purchases are now mainly for extensions and applications. Industrial business is good, however, and as the effect of the long-predicted decline of building becomes more apparent, it is possible that the industrial field will become the battleground for fall business. Building permits in San Francisco for August totaled $3,915,300, as compared with $6,214,082 for August, 1922. The last year's figures, however, include several very large buildings, and notwithstanding the apparent discrepancy, building is really holding up pretty well. There was, in fact, a 10 per cent increase in the number of jobs over August a year ago.

Retail business is fair. There is promise of a very large radio activity and the general expectation is that the season will be excellent. The neighborhood store seems to hold its own. Collections show a rather discouraging rate of improvement, but fruit and crop receipts circulating through all channels will generally help the situation. The Southern Pacific Railroad Company has announced an expenditure of $40,000,000 actual or impending for new equipment and in addition a projected expenditure of $50,000,000 for new trackage and yardage. It is possible therefore that railroad business may occupy the same dominant position in the markets of 1924 and 1925 that power business has occupied for the four or five years just passed.

The Metal Market

A GENERAL improvement in the metal market has been recorded this week, largely a reaction from a stiffening of prices in London due in part undoubtedly to the war scare, which naturally suggests heavy buying for munitions. Copper fell off and then recovered following the London rally and is much firmer at 13¾c. Lead is strong with a varied demand from manufacturers of paint, batteries, etc. Zinc has also improved largely on a demand from galvanizers, who are seeking sheet metals for Japan. The general feeling is confident.

NEW YORK METAL MARKET PRICES

	Aug. 29, 1923 Cents per Pound	Sept. 5, 1923 Cents per Pound
Copper, electrolytic. .	14.00	13.75
Lead, Am. S. & R.price	6 75	6 75
Antimony..........	7.55	7.60
Nickel, ingot.........	27 00 to 32 00	27.00 to 32 00
Zinc, spot........	6 90	6 55
Tin, Straits.........	40.75	43.00
Aluminum, 98 to 99 per cent.........	25 00	25.00

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Wetmore-Savage Sales Meeting Keyed to Hard-Working Fall Program

Thirty-five members and guests affiliated with the Wetmore-Savage Company, electrical supply jobbers, Boston, held a two-day semi-annual sales conference recently at the Exchange Club in that city under the chairmanship of Karl L. Norris, head of the appliance department at the main offices. The program included addresses by ten representatives of manufacturing organizations for which this company is a distributor. The general tone of the conference was favorable to excellent business this fall predicated on vigorous and sustained sales effort.

Walker Vehicle Opens a New Orleans Office

The Walker Vehicle Company, manufacturer of Walker electric trucks, with general offices and factory in Chicago, has opened a branch office and service station at 314 St. Joseph Street, New Orleans. Thomas H. Shields, formerly a dealer for the Walker Vehicle Company, has been appointed manager. The increasing importance of the southern part of the United States as regards transportation needs in cities is given as the reason for opening this branch as well as for the establishment previously of a branch office at Atlanta. Among recent installations of Walker electric trucks in the South is that of twenty-five Walkers recently put in the service of the American Railway Express Company in San Antonio, Tex.

W. N. Matthews Corporation Announces Changes in Territorial Representatives

The W. N. Matthews Corporation of St. Louis has recently announced certain changes in the territories covered by its various representatives. W. J. McIlvane, 30 Church Street, New York City, whose territory has consisted of the southern half of Connecticut, all the State of New York and the eastern half of New Jersey, will also look after the eastern half of Pennsylvania, the State of Delaware and the District of Columbia. H. G. Biglin, 41 Fairlie Street, Atlanta, and his organization will represent this company in Virginia, North and South Carolina, Georgia, Florida, Mississippi, Louisiana, the eastern half of Tennessee, and the southern half of Arkansas. These changes were brought about by the resignation of George C. Young, who has been a representative of this company for years with offices in Philadelphia.

W. M. Watters, 1319 Main Street, Kansas City, Mo., whose territory has consisted of the western half of Illinois south of Peoria and the States of Iowa, Missouri, Nebraska, Kansas and Oklahoma, will also have the northern half of Arkansas and the western half of Tennessee.

A New Chicago Distributor

B. J. Mockenhaupt & Company, 217 North Desplaines Street, Chicago, has recently been organized to conduct a sales and service busin.ss for electrical manufacturers, and has been appointed district sales representative for the Dayton Fan & Motor Company of Dayton, manufacturer of radio parts, fans and motors. Mr. Mockenhaupt was formerly vice-president of the Electrical Materials Company of Chicago, having had twenty years' experience in the electrical sales and jobbing business in this territory. This new organization is desirous of representing two or three other manufacturers of various electrical equipment.

Glassware Guild Makes a Survey

For the purpose of demonstrating the tremendous market for illuminating glassware that exists in the United States today, the Illuminating Glassware Guild of Cleveland has recently made a survey of conditions in homes and published statistics on the national market. Then, to crystallize the opportunity, it has made an intensive study of what this means in terms of the local market in Jasper, Ind., a community of 2,359 inhabitants. The figures are as shown in the table.

The Glassware Guild suggests, as a practical method of calculating the market for glassware in a town, that the number of wired homes in a community be multiplied by eleven. The result represents the possible sales of glass shades within the community for the next period of twelve months.

THE NATIONAL MARKET	
Wired homes in the United States	9,676,330
Total number of sockets	181,874,000
One half of these sockets need glass	90,937,000
Estimated number of homes to be wired by the end of 1923	1,231,000
Additional sockets to be shaded by glass	27,082,000
Total potential market for residential lighting glassware, end of 1923	118,196,000
THE LOCAL MARKET	
Population of Jasper, Ind.	2,359
Number of electrical dealers in Jasper	2
Number of homes	564
Number of wired homes	500
Number of sockets	11,000
Number of sockets requiring glass shades	5,500
Possible sales of residential lighting glassware per dealer, not counting homes wired in 1923	2,750

Nela Park Offers Undergraduate Lighting Course

The first annual courze in "the lighting business" was given at Nela Park, Cleveland, from Ang. 20 to Sept. 1, under the direction of the engineering department of the National Lamp Works. This course was designed to give university undergraduates an opportunity to look into this phase of the electrical industry before they became permanently tied up with any of the other branches. While at Cleveland the men, numbering about thirty of the junior class, were guests of the company, all their expenses being paid. Some of the subjects offered in this course were as follows: "Large lamp manufacture," "civilization and light," "demonstration of lighting fundamentals," "light and production," "general lighting for industrial operations," "light and living," light control" and "principles and applications." All these subjects were presented by engineers of the organization.

Johns Pratt, Square D, Trumbull and Westinghouse Standardize on Service Entrance Safety Switch

AN IMPORTANT contribution to standardization appears in the announcement that four prominent manufacturing companies in the safety-switch field, the Johns Pratt Company, the Square D Company, the Trumbull Electric Manufacturing Company and the Westinghouse Electric & Manufacturing Company, are going to manufacture a radically new service-entrance unit which combines all the functions necessary for complete service connection and distribution. This announcement was made by the Johns Pratt Company, Hartford, Conn., licensor of the device.

It is the belief of these manufacturers that the combination in a single compact safety switch of the features now provided only in several separate units offers opportunity for a distinct economy in manufacture as well as in installation practice. In addition they point out that this simple and standardized unit should also make for uniformity of practice, whether the installations are made by the central station, the contractor or the consumer.

It is the opinion of these manufacturers that the uniformity of their combined production on this single device will have a far-reaching influence on the promotion of the idea of standardization and provide a conspicuous example of what may be accomplished by the practical application of this economic principle.

Cleveland League Opens Another Electrical Home

The sixth electrical home to be established under the auspices of the Electrical League of Cleveland opened Aug. 19 and will be kept on exhibition for a period of one month. The home is at 2543 Euclid Heights Boulevard and is a nine-room brick structure with a two-car garage.

A special advertising campaign to sell the idea of more and better lighting equipment in homes is to be run in the daily papers during the exhibit. Under the league's lighting section committee a concerted drive is being made to improve store lighting in Cleveland. An illustrated folder dealing with this subject is being mailed to five thousand Cleveland merchants.

The Crocker-Wheeler Company, Ampere, N. J., manufacturer of electrical machinery, will soon build a one-story addition to its power house.

The Crown Rheostat & Supply Company, 35 South Desplaines Street, Chicago, is having plans prepared for a two-story building, 50 ft. x 72 ft., at 1908 Park Avenue, to cost $28,000.

The Reynolds Electric Company, 2650 West Congress Street, Chicago, manufacturer of electrical equipment, will build a one-story addition, 50 ft. x 75 ft.

The International General Electric Company, 120 Broadway, New York City, has taken a contract from the Paulista Railway, Brazil, for the electrification of 38 miles of line at a cost of $1,000,000, including equipment, completing the system from Tatu to Jundiahy, approximately 63 miles.

The Fibre Conduit Company, Orangeburg, N. Y., manufacturer of insulating conduits, etc., has awarded a general contract for the first unit of its new plant at Richmond, Ind., to cost $400,000 with machinery. S. R. Bradley is president of the company.

The Standard Underground Cable Company, Westinghouse Building, Pittsburgh, has awarded a general contract for a new two-story plant, 125 ft. x 300 ft., at Emeryville, Cal., to cost $200,000.

The Evergreen Electric Appliance Company, 411 Central Building, Seattle, Wash., which has acquired the Bestov Appliance Company, has established a factory and expects to be ready for operating in a few weeks. Frank MacKean is president.

The Western Electric Company has acquired a twenty-five-acre site at East Nashville, Tenn., where it plans to build a factory for the manufacture of electrical equipment.

The Crouse-Hinds Company, Syracuse, N. Y., manufacturer of electric wiring equipment, is preparing plans for a new one-and-two-story building at its Toronto works, estimated to cost $150,000.

The Rome Wire Company, Clyde Avenue, Buffalo, manufacturer of wire, cable, etc., has purchased a block of property in the vicinity of its works, totaling over four acres, and will use it for expansion. Plans for the first building have been arranged.

Portus Baxter, Jr., has joined the Western sales force of the National X-Ray Reflector Company, with headquarters at Los Angeles. Mr. Baxter will confine his efforts at present to the Southern territory, under the direction of F. S. Mills, Western district manager for the company.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Amsterdam, Netherlands (No. 7,576), for electrical appliances.

Purchase is desired in Turin, Italy (No. 7,582), of electrical equipment, etc.

Purchase and agency is desired in Rotterdam, Netherlands (No. 7,649), for electrical goods and small patented novelties.

Purchase is desired in Algiers, Algeria (No. 7,618), of ice-manufacturing machinery.

An agency is desired in Turin, Italy (No. 7,606), for ice-manufacturing and refrigerating plants.

An agency is desired in Antwerp, Belgium (No. 7,577), for industrial motors.

ELECTRIFICATION OF RAILROAD IN VENEZUELA PROPOSED.—The electrification of the Ferrocarril de La Guaira Railway, which connects the port of La Guaira with Caracas, Venezuela, *Commerce Reports* states, is under consideration.

AUTOMATIC TELEPHONES IN SOUTH AFRICA.—Automatic telephone exchanges, *Commerce Reports* states, will soon be installed at Port Elizabeth and Pietermaritzburg, South Africa. It is proposed to extend the automatic system throughout the country as existing plants require replacement.

New Apparatus and Publications

LIGHTING DATA.—The Edison Lamp Works of General Electric Company, Harrison, N. J., are distributing bulletins L.D. 118A, L.D. 145, L.D. 146, entitled "The Incandescent Lamp—Its History," "The Lighting of Theaters and Auditoriums" and "Stage Lighting" respectively.

MANUAL AUTOMATIC COMPENSATOR.—The Electric Controller & Manufacturing Company, 2700 East Seventy-ninth Street, Cleveland, has developed the new type "ZK" manual automatic compensator, which is an entirely new method of starting alternating-current motors.

LIGHTING FIXTURES.—The McPhilben Lighting Fixture Company, Queens, N. Y., has published a sixty-four-page catalog which describes and illustrates the various types of its "Queens" quality line of residential lighting fixtures.

VOLTAGE RELAYS.—Bulletin No. 47,635 issued by the General Electric Company, Schenectady, N. Y., covers its type PQ-25 and type PQ-26 under-voltage relays.

ADJUSTABLE-SPEED MOTOR. — The Reliance Electric & Engineering Company, Ivanhoe Road, Cleveland, is distributing bulletin No. 1,014, describing its type "AS" Reliance adjustable-speed motors of the armature-shifting design.

MULTIPLE - CONTACT AUXILIARY RELAYS.—Two types of auxiliary relays are manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., type "M" for intermittent duty on direct-current circuits and type "MC" for continuous duty on both alternating-current and direct-current circuits.

INTERNAL-COMBUSTION ENGINES.—The Worthington Pump & Machinery Corporation, 115 Broadway, New York City, is distributing a booklet containing a reprint of an address to the New Waterworks Association on the application of internal-combustion engines to waterworks service.

CLOTHES DRIER.—The Bock Laundry Machine Company, Toledo, Ohio, is distributing a folder describing the new "Bock" electric clothes drier.

ELECTRIC STOVE.—Two electric stoves, lamp-socket models, known as the "Ever-Hot," are being manufactured by the Toledo (Ohio) Cooker Company, the one-burner model has a detachable handle, while the two-burner plate handles are stationary.

WATER FILTERS.—The Graver Corporation, East Chicago, Ind., is distributing bulletin No. 501, describing its horizontal pressure-type water filters.

ELECTRIC CONDUCTION HEATERS.—Publication No. 3,062 issued by the Cutler-Hammer Manufacturing Company, Milwaukee, describes and illustrates its electric conduction heaters for general industrial and machine applications.

EXHAUSTERS VENTILATING FANS, BLOWERS, ETC.—The American Blower Company, Detroit, has issued a new general catalog covering its products, including exhausters, ventilating fans, air washers, blowers, engines, etc. The company is also distributing a folder entitled "Putting New Life Into Dead Steam," which calls attention to the use of its "Detroit" return systems in power and heating plants.

ELECTRIC TOASTER.—Landers, Frary & Clark, New Britain, Conn., are distributing a folder covering their "Universal" oven toaster.

ARC - CURRENT - WELDING TRANSFORMER.—The Waters Arc Welding Corporation, 619 Tenth Avenue, New York City, has brought out an arc-current-welding transformer.

TRANSFORMER INSTALLATIONS.—Bulletin No. 2,020 issued by the Pittsburgh Transformer Company, Pittsburgh, contains illustrations of installations of "Pittsburgh" transformers on lines of various public utilities, steel mills, coal mines and industrial plants throughout the United States.

New Incorporations

THE ST. CHARLES (KY.) ELECTRIC LIGHT & POWER COMPANY has been incorporated by W. L. Morse, H. E. Kinnett and others.

THE FORD HYDRO ELECTRIC COMPANY, Madison, Wis., has been organized with a capital stock of $25,000 to develop water rights, electric light and power plants and to generate and distribute electricity. The company is not a public utility. The incorporators are William Ryan, Arnold Peterson and Alfred T. Flint, all of Madison.

THE BETTENDORF (IOWA) LIGHT & POWER COMPANY has been incorporated by J. W. Bettendorf, E. J. Bettendorf, Henry Bellinghausen, J. H. Bendixen and W. J. Schneider. The company is capitalized at $100,000 and proposes to generate and distribute electricity in Bettendorf.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

SUNAPEE, N. H.—The Lake Sunapee Power Company will soon begin work on the construction a power plant to cost about $50,000. Charles T. Main, 200 Devonshire Street, Boston, is engineer.

BOSTON, MASS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 26 for changes in lighting and ventilating systems in the United States Post Office and Subtreasury, Boston. For details see Searchlight Section.

DEDHAM, MASS.—The Dedham & Hyde Park Gas & Electric Lighting Company has received permission to issue $48,455 in capital stock, the proceeds to be used for extensions.

LEOMINSTER, MASS. — Contract has been awarded by the Leominster Electric Light & Power Company for the construction of a new substation in North Leominster, to cost about $30,000.

ROCKY HILL, CONN. — The Belamose Corporation, 303 Fifth Avenue, New York, plans to build a power house at its proposed local artificial silk plant, to cost about $450,000.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 11, for fire-tube boiler and electric wire and cable, Navy Yard, Brooklyn.

BROOKLYN, N. Y.—Bids will be received by the Quartermaster Supply Office, G. I. depot, First Avenue and Fifty-eighth Street, until Sept. 12 for twenty-six single-phase, 110-volt, 10-amp. electric meters, and for thirty single-phase, 110-volt meters. (Circular 24-33.)

BROOKLYN, N. Y.—Electric equipment, conveying machinery, etc., will be installed in the new distributing plant to be erected on Third Avenue by the Borden Farm Products Company, 110 Hudson Street, New York City, to cost about $350,000.

CHURCHVILLE, N. Y. — Electrically operated pumping machinery will be installed at the municipal waterworks in connection with extensions, to cost $80,000. R. E. Gaskin, Cutler Building, Rochester, is engineer.

JAMESTOWN, N. Y.—Electrically operated pumping machinery will be installed at the municipal waterworks in connection with extensions, to cost about $280,000.

MEDINA, N. Y.—The Western New York Utilities, Inc., has been granted permission to serve electricity in Pavilion Township, under a franchise granted by the Town Board. The company was also authorized to erect and operate a transmission line across the Tonawanda Reservation, in Alabama Township.

RICHMOND, N. Y.—The Staten Island Edison Company, successor to the Richmond Light & Railroad Company, has issued $3,807,000 in bonds, part of the proceeds to be used for extensions and improvements.

WARREN, N. Y.—The Southern New York Power Corporation, Coopertown, has been granted permission to supply electricity in the town of Warren.

JERSEY CITY, N. J.—Electric power equipment will be installed in the proposed addition to the plant of the Continental Can Company, Fifteenth and Sixteenth Streets, to cost $500,000. Francisco & Jacobus, 511 Fifth Avenue, New York, are consulting engineers.

KEARNY, N. J.—The Western Electric Company, 195 Broadway, New York, is preparing plans for the construction of a power house at its new local works, to cost about $150,000.

TRENTON, N. J.—Electric power equipment will be installed in the proposed addition to the plant of the Hamilton Rubber Manufacturing Company, to cost about $80,000.

TRENTON, N. J.—Plans have been completed by the John A. Roebling's Sons Company for the erection of a power house at its wire works on Clinton Avenue.

ATWOOD, PA. — The Atwood Borough Electric Company and the Dayton Borough Electric Company, recently organized, plan to erect transmission lines. The companies are represented by McCahill, McCahill & Tabor, 908 West Penn Building, Pittsburgh.

BRISTOL, PA.—The Rohm & Haas Company contemplates building a power house at its chemical manufacturing plant.

CHESWICK, PA. — The Peerless Sand Company, Oliver Building, Pittsburgh, will install electric power equipment in connection with the rebuilding of its local plant, recently destroyed by fire with loss of about $90,000.

HUNTINGDON, PA.—The Penn Central Light & Power Company, Altoona, has acquired the properties of the Raystown Water Power Company, including a hydro-electric station on the Juniata River.

JOHNSTOWN, PA.—The Clarion River Power Company is perfecting plans for the construction of the first of a series of hydro-electric power plants at the Piney dam.

LYKENS, PA.—The American Briquet Company, Land Title Building, Philadelphia, plans to build a power house at its proposed fuel-briquet manufacturing plant, to cost about $350,000.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company plans extensions to its substation at Thirteenth and Mount Vernon Streets, to cost about $27,000.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company plans to build a mechanical and repair shop at Constitution and Monument Streets, to cost about $75,000.

HAGERSTOWN, MD. — The Potomac Transmission Company, Wingert Building, will have charge of the distribution of electricity generated at the plant of the Potomac Edison Company in Williamsport. The West Virginia Transmission Company will be incorporated to handle the distribution in West Virginia.

WILLIAMSON, W. VA. — The Thacker Coal & Coke Company, Cincinnati, is planning to install electric power and mechanical equipment at its local properties. An appropriation of $500,000 has been arranged.

CHARLOTTESVILLE, VA. — Contract has been awarded by the Virginia-Western

Power Company, Clifton Forge, to Francis R. Weller, contractor, Mills Building, for the construction of the proposed double-circuit, steel-tower, 110,000-volt transmission line between Charlottesville and Staunton.

NORFOLK, VA.—The Virginian Railway Company plans to build a 90,000-hp. power plant on the New River in connection with the electrification of its line from Roanoke, Va., to Mullins, W. Va., 213 miles. A number of substations will also be built.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Sept. 11 for three transformers. (Schedule 1265.)

WASHINGTON, D. C.—Bids will be received by the Quartermaster, United States Marine Corps, until Sept. 11 for switches, fuses, switch boxes, electric cable, wire strand, clamps, plugs and one regulator. (Schedule 112.)

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, until Sept. 20 for electric motor, electric hoists and other electrical and mechanical equipment. (Circular 1555.)

WASHINGTON, D. C.—Bids will be received by the Chief of Air Service, Munitions Building, until Sept. 10 for 250 single-pole, double-throw toggle switches; 250 single-pole, double-toggle switch guard plates, and 250 flush tumbler switches and plates, 3-amp. (Circular Q.R. 2416.)

North Central States

BEVERLY, MICH.—The Certain-Teed Products Corporation will install electric power equipment in connection with additions to its local plant, to cost about $250,000.

BIG RAPIDS, MICH.—Plans are under consideration by the Big Rapids Electric Company for the installation of new equipment at its hydro-electric plant. Burd & Giffels, Powers Theater Building, Grand Rapids, are engineers.

ITHACA, MICH.—The Council is considering the installation of deep-well pumping machinery at the waterworks plant. Burd & Giffels, Powers Theater Building, are engineers.

LANSING, MICH.—The State Highway Department contemplates the construction of a power house in connection with the proposed state-owned cement plant.

CINCINNATI, OHIO.—The construction of a telephone exchange at Harrison and Epworth Avenue, to cost about $250,000, is under consideration by the Cincinnati & Suburban Bell Telephone Company.

CLEVELAND, OHIO.—Bids will be received by the Commissioner of Purchases and Supplies, City Hall, until Sept. 14 for fiber conduit for the Division of Light and Power.

CLEVELAND, OHIO.—The Council is considering calling an election to submit the proposal to issue $3,000,000 in bonds for extensions to the municipal electric plant at East Forty-third Street or to build a new plant on the West Side near the Division Street pumping station.

CLEVELAND, OHIO.—Separate bids will be received by the Commissioner of Purchases and Supplies until Sept. 14 as follows: Material for and construction of an underground system for steam supply and return, and also for a conduit system for electric wires between the present tunnel and new administration building of the children's tuberculosis unit at Warrensville; also for installing 2,200-volt lead-covered cables from pole at tunnel to transformer vault in new administration building of children's tuberculosis unit, Warrensville.

DAYTON, OHIO.—The McCall Publishing Company, 236 West Thirty-seventh Street, New York, will build a power house at its new local publishing plant on Kinnison Avenue, to cost about $500,000. Lockwood, Greene & Company, 101 Park Avenue, New York, are engineers.

ELYRIA, OHIO.—A new company, known as the Columbia-Elyria Power Company, has been organized by the Elyria Iron & Steel Company and the Columbia Steel Company, to construct and operate a power plant to supply power to the two steel companies. H. B. Wicks is president of the power company.

TOLEDO, OHIO.—The De Vilbiss Manufacturing Company will build a power house at its spraying equipment manufacturing plant, to cost about $27,000.

BROWNSVILLE, KY.—The Natural Rock Asphalt Company, recently organized, contemplates the construction of a power house in connection with a new plant in Edmondson County, to cost about $175,000.

WOODBURN, KY.—The Kentucky Utilities Company has acquired the local electric plant and similar properties at Auburn and London. The systems will be consolidated and extended and additional equipment installed.

BLUFFTON, IND.—Plans are being considered for the installation of electrically operated pumping machinery in connection with extensions to the municipal waterworks. J. W. Moore, Indiana Pythian Building, is engineer.

INDIANAPOLIS, IND.—The Indiana Electric Corporation has issued $2,700,000 in bonds, part of the proceeds to be used for extensions, including the completion of its proposed generating plant on the Wabash River, with transmission system to the coal-fields section. The plant will have an initial output of 40,000 kw.

MUNCIE, IND.—Plans are being prepared by the board of trustees of the Indiana State Normal School for the construction of a power house, to cost about $60,000. Kibele & Garrard, Johnson Building, are architects.

WEST LAFAYETTE, IND.—Bids will soon be asked by the board of trustees, Purdue University, for the erection of an electrical equipment and instruction building, to cost about $100,000. Nicol, Scholer & Hoffman, 308 Main Street, Lafayette, are architects.

CHICAGO, ILL.—Electric power equipment will be installed in the new plant to be erected at Wood Street and Fifteenth Place by the Goss Printing Press Company, 1535 South Paulina Street, to cost about $260,000. R. G. Schmidt & Company, 7 West Washington Street, are architects.

DECATUR, ILL.—Electric power equipment will be installed in the proposed ice-manufacturing plant to be erected by the Polar Wave Ice & Fuel Company, 3626 Olive Street, St. Louis, to cost about $180,000.

CALVARY, WIS.—The installation of an electric lighting system has been authorized by the voters. Electricity to operate the proposed system will be furnished by the Badger Public Service, Plymouth.

COLBY, WIS.—The property of the Midland Public Service Company has been purchased by the Northern States Power Company, Chicago. A transmission line, it is understood, will be erected to connect the local plant with the transmission system of the Northern States company.

EUREKA, WIS.—The installation of an electric lighting system is under consideration.

FOND DU LAC, WIS.—Plans for improvements to the St. Agnes Hospital include the installation of additional generating units in the present power plant and the construction of a new power house of sufficient size to provide for future extensions to the hospital.

HONEY CREEK, WIS.—The plant and holdings of the Honey Creek Electric Light Company have been acquired by the Milwaukee Electric Railway Company. Extensions and improvements are contemplated to the system and connection made with its transmission line at Burlington.

LANCASTER, WIS.—The Council is considering the erection of a transmission line to Shreiner Park and to the city rock quarry, electricity to be furnished by the Interstate Light & Power Company. The installation of a lighting system in Shreiner Park is also under consideration by the Council.

MADISON, WIS.—Bids will be received by Mead & Seastone, Journal Building, Madison, until Sept. 15 for equipment, including power transformers, switchboards, supervisory controls and auxiliary equipment, for the new hydro-electric plant being erected at Chaldron Falls, Peshtigo River, near Ellis Junction, by the North East Power Company.

MARSHFIELD, WIS.—At a special election held recently the proposal to install a street-lighting system in the villages of Calvary and Mount Calvary was carried. Energy to operate the proposed system will be furnished by the Badger Public Service Company, Plymouth.

MENOMONIE, WIS.—Plans are being prepared by the Board of Normal Regents, Capitol, Madison, for an electric power plant, to cost about $74,000. J. C. White, care state power plant, Madison, is engineer.

MOUNT CALVARY, WIS.—At an election held recently the proposal to install an electric lighting system was carried. Energy will be supplied by the Badger Public Service Company, Plymouth.

NORWALK, WIS.—The voters have approved the proposal to sell the municipal electric plant to the Wisconsin-Minnesota Light & Power Company, which will erect a transmission line from Cashton to furnish service here.

PLATTEVILLE, WIS.—The Interstate Light & Power Company is planning to extend its light and power service to farmers along the Platteville Mound Road.

PORTAGE, WIS.—Plans have been approved by the City Council for a complete water purification plant with a daily capacity of 1,500,000 gal., to include a new pumping plant, equipped with electrically operated pumps. Pearse, Greeley & Hamilton, 39 West Adams Street, Chicago, are consulting engineers.

RACINE, WIS.—Preparations are being made by the Wisconsin Gas & Electric Company for the erection of a high-tension transmission line from the Lakeside plant of the Milwaukee Electric Railway & Light Company to a point on the Durand Road west of Racine, where it expects to erect a substation to supply electricity in Racine, Franksville, Union City, Burlington and other communities in the county.

RIPON, WIS.—Plans have been completed by the Wisconsin Power, Light & Heat Company to extend its transmission line from Markeson to Dalton, passing through Kingston and Manchester, a distance of about 13 miles. An extension will also be made to Omro (6 miles) to supply electricity to a large quarry.

WILTON, WIS.—The Middle Wisconsin Power Company, Madison, is planning to extend its transmission line from Wilton to Ontario.

ST. PAUL, MINN.—The Western Fruit Express Company will install electric power equipment in connection with its proposed local car repair shop, to cost about $150,000.

WALKER, MINN.—The construction of a power plant at the local State Sanatorium is under consideration.

WINONA, MINN.—Bids will be received by the State Board of Control, Capitol, St. Paul, until Sept. 11 for construction of school building, with power plant in the basement, at the local State Teachers' College, to cost about $550,000. C. H. Johnston, Capitol Bank Building, St. Paul, is architect.

FARMINGTON, MO.—Extensions to the municipal power plant are under consideration.

HANNIBAL, MO.—Electric power equipment will be installed in the proposed local plant to be erected by the Hamilton-Brown Shoe Company, St. Louis, to cost about $125,000.

MOUNTAIN GROVE, MO.—The proposal to issue $35,000 in bonds for an electric light plant will be submitted to the voters.

SPRINGFIELD, MO.—Electric power equipment will be installed in the new local plant and elevator to be erected by the Lipscomb Grain & Seed Company, 540 Wall Street, to cost about $165,000. The Southwest Engineering Company, Woodruff Building, is engineer.

KENESAW, NEB.—The proposal to issue $15,000 in bonds for the erection of a transmission line to connect with the system of the Central Power Company, Grand Island, will be submitted to the voters.

OMAHA, NEB.—The Metropolitan Utilities Company is planning to build an addition to its electric pumping plant at Twenty-eighth Avenue and Hunt Street.

HERNDON, KAN.—An election will be held Sept. 11 to vote on the proposal to issue $30,000 in bonds for the construction of a transmission line and electric light system. W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., are engineers.

LAWRENCE, KAN.—Plans have been prepared by the Bowersock Mill & Power Company for the installation of an electrical distribution system, to cost about $200,000. A. L. Mullegren, 555 Gates Building, Kansas City, Mo.

Southern States

CHARLOTTE, N. C.—Electric power equipment will be installed in the proposed new baking plant to be erected on West Trade Street by the American Bakeries Company, Atlanta, Ga.

ROUGEMONT, N. C.—A. Carver, it is reported, contemplates the purchase of water wheels, generator and auxiliary equipment for a local hydro-electric plant.

BREMEN, GA.—Lloyd Biggers contemplates the purchase of a waterwheel and other equipment for a local power plant.

SOUTH JACKSONVILLE, FLA.—The Lee Burg Fibre Pulp & Paper Company

Leesburg, plans to build a power house in connection with its proposed local pulp and paper mill, to cost about $500,000.

CHATTANOOGA, TENN. — The Dixie Consolidated Graphite Company, Birmingham, Ala., contemplates the construction of a power house in connection with its proposed local plant, to cost about $250,000.

WASHINGTON, LA.—Bids will be received by A. J. Muller, Mayor, until Sept. 18 for construction of an electric light plant as follows: Two 50-kw., three-phase, 60-cycle, 2,300-volt generators, directly connected to oil engines; switchboard, oil-storage tank, transformers, electric light and power distribution system; motor-driven, vertical-type service pump for water service, power house, etc. Plans at on file in the office of Sylvester Brother., Alexandria, engineers.

McALESTER, OKLA.—Bids will be received by the city of McAlester until Sept. 18 for waterworks improvements, including two 1,400-gal.-per-minute duplex power pumps, two 1,400-gal.-per-minute centrifugal pumps, filters, filter and pump building, concrete reservoir, pipe lines, etc. E. T. Archer & Company, New England Building, Kansas City, Mo., are engineers.

FORREST CITY, ARK. — Plans have been prepared for the installation of a municipal electric plant to cost about $35,000. Eates W. Mann, Memphis, Tenn., is architect.

FRISCO, TEX.—The Fris-Co-Lina Utilities Company, recently organized to acquire power plants at Frisco and Celina, contemplates the construction of a central generating plant with transmission lines for services throughout this district.

MART, TEX.—Plans are being considered for the installation of electrically operated pumping machinery in connection with extensions to the municipal waterworks, to cost about $175,000.

Pacific and Mountain States

McGOWAN, WASH.—H. S. McGowan is planning to build a hydro-electric plant near here. The plans call for a development of 29,000 hp. at a cost of about $2,000,000.

SEATTLE, WASH. — The Municipal Power Department has secured permission to erect a transmission line across Lake Union.

VANCOUVER, WASH. — The Columbia River Paper Mill Company plans to build a power house at its new local paper and saw mill. The total cost is estimated at $1,500,000.

MARYSVILLE, CAL.—Plans are being considered for the installation of electric pumping equipment in the municipal waterworks.

OROVILLE, CAL.—The State Department of Public Works has granted Guy Wilkinson, Oroville, permission to construct a 47,650-hp. plant on the Feather River, to cost about $500,000.

SACRAMENTO, CAL.—The Sacramento Pipe Works, Seventh and R Streets, contemplates the installation of an electric traveling crane in the proposed addition to its works, to cost about $50,000.

SAN FRANCISCO, CAL.—The American Laundry Company, 3338 Seventeenth Street, plans to build a power house at its proposed plant, to cost about $100,000. Shea & Shea, Chronicle Building, are architects.

SAN FRANCISCO, CAL.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 25 for 25,000 ft. of light and power wire for use at the Mare Island navy yard. (Schedule 1277.)

CHANDLER, ARIZ.—Plans are under consideration for the installation of a municipal electric distributing system for light and power service.

PHOENIX, ARIZ.—The Salt River Valley Water Users' Association is reported to have decided to proceed with the construction of the dam at Mormon Flat, to cost about $1,800,000, which will add 7,000 hp. to the capacity of the plant. The output of the Roosevelt plant will be increased by 20,000 hp.

PHOENIX, ARIZ.—Bids will soon be called by the Palo Verde River Irrigation and Power District for the construction of a 68,000-hp. hydro-electric plant, to be built in four units, and steel-tower transmission system, in connection with a large irrigation project. Holmquist & Becker, Phoenix, are consulting engineers.

YUMA, ARIZ.—The Gila Valley Power District, plans to erect a transmission line to Wellton and vicinity, with a number of new substations, to cost about $200,000. W. R. Elliott, Phoenix, is engineer.

Electrical Patents

Announced by U. S. Patent Office

(Issued Aug. 14, 1923)

1,465,087. SEGREGATED DRIVE FOR PAPER-MAKING MACHINES AND THE LIKE; W. L. Merrill, Schenectady, N. Y. App. filed July 12, 1922. Arrangements for establishing and automatically maintaining desired speed relation of separate driving motors.

1,465,108. UNIDIRECTIONAL RADIO RECEIVING SYSTEM; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Sept. 16, 1918. Secret radio signaling system.

1,465,173. METHOD OF ELECTRODEPOSITING COBALT AND CHROMIUM; H. C. Peffer and H. C. Pierce, Lafayette, Ind. App. filed Aug. 5, 1920.

1,465,210. SIGNAL FOR VEHICLES; W. J. Combs, Otterbein, Ind. App. filed July 21, 1922. Rear direction signal.

1,465,214. APPARATUS FOR THE FINELY GRADUATED REGULATION OF A CURRENT STRENGTH; R. Forster, Essen, Germany. App. filed Sept. 7, 1920. By closed series of resistances.

1,465,241. WELDING MACHINE; A. J. Townsend, Canton, Ohio. App. filed July 17, 1919. For spot welding.

(Issued Aug. 21, 1923)

1,465,250. TELEPHONE AND WIRELESS-TELEGRAPHY INSTALLATION; L. N. Brilluoin, Paris, France. App. filed April 25, 1918. Regulation for a given wave length by the proper selection and combination of capacities and resistances.

1,465,251. ELECTRIC MACHINE; A. B. Broluska and H. A. Broluska, Detroit, Mich. App. filed July 6, 1920. Direct current will flow without interruption or reversal through each conductor.

1,465,255. PIGTAIL CONNECTION; F. F. Dorsey, Rochester, N. Y. App. filed Oct. 19, 1921. Stranded wire coiled around end of pigtail and tamped into hole which receives pigtail.

1,465,264. ELECTRIC CONDENSER; F. G. Goldstone, Plumstead, London, England. App. filed Sept. 14, 1920. Condenser surface elements of shell or cup shape.

1,465,292. WINDOW-CLEANING APPARATUS; August Wessig, Chicago, Ill. App. filed Dec. 24, 1920. Self-contained air heating and circulating means requiring no supervision.

1,465,293. ELECTRIC LAMP; Eugen Alber, Basel, Switzerland. App. filed Dec. 10, 1919. Pocket type of glow lamp affording different degrees of brightness.

1,465,298. CORD-CIRCUIT REPEATER FOR USE BETWEEN FOUR-WIRE AND TWO-WIRE CIRCUITS; George Crisson, Hackensack, N. J., and A. F. Rose, West Brighton, N. Y. App. filed April 15, 1921. Balance provided in repeater without use of special networks.

1,465,299. LOW-FREQUENCY ALTERNATING-CURRENT SIGNALING SYSTEM; Lloyd Espenschied, Hollis, and John F. Toomey, New York, N. Y. App. filed Sept. 27, 1919. Simultaneous patch for telephonic and signaling currents, each path including selective apparatus.

1,465,301. AUTOMOBILE SIGNAL; Thomas Groves, St. Louis, Mo. App. filed Aug. 13, 1919. Two-section semaphore pivoted so either section may be rotated independently of other.

1,465,306. ELECTRICAL SWITCH; C. L. Hopkins, River Forest, Ill. App. filed Sept. 25, 1919. Improved construction in which circuit is simultaneously broken at two points.

1,465,308. SWITCH AND OVERHEAD SYSTEM; S. S. Matthes, Mansfield, Ohio. App. filed Aug. 2, 1922. Path of trolley wheel maintained at the point of crossing another conductor.

1,465,311. MEASURED-SERVICE TELEPHONE SYSTEM; W. W. Owen, Oak Park, Ill. App. filed June 14, 1919. Polarized relay used to collect or refund coin.

1,465,332. VACUUM-TUBE AMPLIFIER; H. D. Arnold, Maplewood, N. J. App. filed Sept. 3, 1915. Plurality of vacuum tubes supplied with space current from a single source.

1,465,340. APPARATUS FOR REDUCING SECONDARY RADIATION FROM ROENTGEN RAYS; A. W. Buck, St. Louis, Mo. App. filed Nov. 22, 1920. Consists of slotted diaphragm rotated between object under examination and photographic film.

1,465,344. CONDUCTOR SUPPORT; H. P. Chandler, Mansfield, Ohio. App. filed June 12, 1922. Clamping jaws for trolley wire.

1,465,352. ELECTRICAL TESTING SYSTEM; G. G. Dobson, Passaic, N. J. App. filed Sept. 27, 1920. Arrangement of balanced circuits by which measurements may be quickly and accurately made.

1,465,355. COMBINATION ELECTRIC HEATER; E. G. Eberhardt, Racine, Wis. App. filed July 22, 1922. May be used as a toaster, a hot plate and a convection type of heater.

1,465,357. RADIO COMMUNICATION; R. A. Heising, East Orange, N. J. App. filed Sept. 27, 1919. Increases the number of conversations that can be carried on simultaneously by radio.

1,465,358. SIGNALING; R. A. Heising, East Orange, N. J. App. filed Sept. 29, 1919. Interference due to waves of certain frequencies is eliminated.

1,465,360. TELEPHONE-EXCHANGE SYSTEM; G. A. E. Lundell, Chicago, Ill. App. filed Dec. 20, 1919. Slow-release relay whereby one register after the other may be rendered active in connection with the pulse circuit.

1,465,361. OPERATING MECHANISM FOR CROSS-BAR LINE SWITCHES; A. C. Magrath, Brooklyn, N. Y. App. filed Oct. 15, 1920. Unitary device sets trunk bars into operative positions and releases them after being so engaged.

1,465,368. SECRET SIGNALING SYSTEM; W. J. Shackelton, Scotch Plains, N. J. App. filed Sept. 4, 1919. Telegraph currents so small that they cannot be detected by ordinary instruments made audible by being continuously interrupted at audible frequency.

1,465,381. ELECTRODE AND ITS CONSTRUCTION; R. F. Trimble, Elizabeth, N. J. App. filed Nov. 4, 1918. Composed of two parallel U-shaped side wires, parallel cross wires extending from one U to the other and at right angles thereto.

1,465,393. TELEPHONE-EXCHANGE SYSTEM; C. L. Goodrum, New York, N. Y. App. filed Sept. 30, 1920. Two switching devices co-operate to transmit impulses for operating the switch, one being responsive to the connection of a calling substation while other is responsive only to movement of variably operable impulse sender.

1,465,394. CONTROL APPARATUS FOR EVACUATED VESSELS; W. G. Housekeeper, New York, N. Y. App. filed Nov. 6, 1920. Prevents the variations in pressure from producing fluctuations in the intensity of the electron discharge from the heated cathode.

1,465,395. TESTING CIRCUITS FOR CARRIER WAVE-SIGNALING SYSTEMS; J. S. Jammer, New York, N. Y. App. filed June 16, 1921. Test is made by disconnecting the common line with its conjugate transformer from both the transmitting circuit and receiving circuit and substituting an artificial line therefor.

1,465,410. ELECTRICAL CONNECTING DEVICE; R. B. Benjamin, Chicago, Ill. App. filed Sept. 23, 1918. Adapted to be inserted into a socket of the Edison type.

1,465,425. FIRE-ALARM APPARATUS; Vernon Durbin, Brookline, Mass. App. filed June 14, 1918. Construction and arrangement permit work of installation to be speedily and effectively accomplished.

1,465,478. ELECTRIC HEATING PLATE; Alfred Nielsen, Hovik, Norway. App. filed Sept. 6, 1922. Prevents spillage from the cooking vessel from reaching the heating wire.

1,465,489. SPRING TROLLEY EAR AND HANGER; James Scott, Cleveland, Ohio. App. filed Aug. 4, 1922. Durable resilient means of suspending a trolley wire where conditions require a relatively low suspension.

1,465,496. FIRE-ALARM SYSTEM; N. H. Suren, Needham, Mass. App. filed July 11, 1919. Immune from the transmission of false signals.

1,465,546. INDUCTANCE; H. P. Donle, Meriden, Conn. App. filed Feb. 11, 1921. A disk of insulating material having peripheral slots with a single length of wire woven back and forth through these slots.

1,465,547. ELECTRIC RESISTANCE ELEMENT; F. L. Driver, Jr., Newark, N. J. App. filed Dec. 6, 1921. Formation of "hot spots" largely eliminated and long life and high resistance to oxidation obtained by alloying 0.5 to 1.5 per cent of silicon with nickel-chromium and nickel-chromium-iron alloys.

1,465,596. DIRECTION AND STOP SIGNAL; W. D. Collins and G. W. H. Allen, Cazenovia, N. Y. App. filed March 29, 1919. Automatic as well as manual control.

1,465,615. ELECTROTHERAPEUTIC DEVICE; H. J. Nelson, Green Bay, Wis. App. filed Dec. 3, 1921. May be easily regulated without decreasing the electrical efficiency.

1,465,618. IGNITION COIL; August Toelle, Anderson, Ind. App. filed July 7, 1921. Unitary structure which may be connected to the regular engine ignition system.

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A "Charter of Liberties"

IT IS increasingly evident that the public of this country is to benefit greatly and quite generally from a wider interconnection of electric power plants and from the gradual extension of electric service. As interconnected systems grow, more and more communities and rural areas are supplied with power in an economical and convenient form. As these systems grow in size, it becomes more and more feasible to construct huge steam electric stations of greater economy, to develop larger hydro-electric plants and to build transmission lines to bring power from a distance to the systems.

One of the greatest influences in making developments of this sort possible, as all electrical men appreciate and as all responsible men in public position know, has been the federal water-power act. This act is more and more understood to provide the opportunity for the public and the utilities expert in power work to develop the latent water power of the country for the best interests of the people. The more experience there is in the development of power, the more it is apparent that it is a problem of mutual interest and benefit to the public and utility.

But the situation presents its mutual obligations as well as its mutual opportunities. This point was ably made last week at the Pennsylvania Electric Association convention by Deputy Attorney-General Philip P. Wells, a member of Governor Pinchot's Power Survey Board, speaking officially as to Pennsylvania's attitude in this undertaking. Part of his remarks are given in the news pages of this paper. Characterizing the federal water-power act as a "Charter of Liberties" under which power development could be made for the benefit of all, he called on utilities to make good their prophecies of a new era of general power supply. But at the same time he told of the obligations of the state to see that all power was developed with a full comprehension of its relation to general supply and that state lines as well as the limits of company territories must prove no barriers to the development of real systems of power. Already, said Mr. Wells, Pennsylvania "has secured the co-operation of some fifteen states" to defend the "Charter of Liberties" against the attack of New York State in the Supreme Court of the United States.

Pennsylvania's "Giant Power Survey" is to be undertaken as a duty of the state so that its citizens may be assured that any power development made under the federal water-power act, as well as any general development of steam stations in the coal fields, will be in their interest. It is a co-operative effort—with the state expressing full confidence in the electrical industry—to develop the state's resources to the people's benefit.

With such foresight on the part of the public there can be naught but encouragement to utilities to do all in their power to bring to a realization the opportunities offered by the "Charter of Liberties." Leaders of the industry who have prophesied the era of superpower development have not spoken without thought and knowledge of the possibilities. It will not come without great effort. But it will come if the brilliant achievements of the past era are any precedent.

Ralph Davenport Mershon

Whose independence of thought and personality have marked his many original contributions to the electrical industry in invention, in practical engineering and in association and other co-operative work.

MANY engineers use the results of development work of others and apply them in new combinations, with intelligent ingenuity and with great professional technique and skill. The real advance of engineering science, however, is produced by those engineers who think for themselves, who contribute a unique creative ability to the problems which confront them. In this latter class one of the most independent thinkers in the electrical engineering field is Ralph D. Mershon. While consistent in basing his work on sound technical training and adherence to fundamental principles, yet he approaches a problem with a vigorous determination to find his own solution whether it agrees with previously accepted practice or not. He is thought of perhaps most widely, at least among the younger generation of engineers, as the originator of the Mershon diagram, which is at once both a simple and a practical method of calculating transmission-line characteristics. His more important original contributions to the industry have been the six-phase rotary converter, the compound rotary converter and the compensating voltmeter. His original contributions, however, have not been limited alone to apparatus and devices, but are also evident in the larger engineering undertakings for which he has been responsible in various places scattered all over the world.

Not the least of his contributions in technical lines are actually but little known because they were made by him as lieutenant-colonel in the Engineers Corps during the late war, when he served as the executive officer in charge of most of the research work of the special problems committee of the Naval Consulting Board. In this position not only did he direct the work done under the auspices of the committee but he also made notable original contributions to this work, all of which were of material value to the country in the conduct of the war.

MR. MERSHON is a native of Ohio and a graduate of Ohio State University. While still a student he devised a method of determining wave shape by using the telephone as an auxiliary in the "contact" method, long before the oscillograph appeared. After a short experience of teaching at Ohio State he became associated with the Westinghouse Electric & Manufacturing Company in 1891, leaving in 1900 to take up independent practice as a consulting engineer. Mr. Mershon was the designer of a Westinghouse transformer for which a special award was made at the Chicago Exposition in 1893. He was in charge of various pieces of power transmission work for the Telluride (Col.) Power Transmission (where he made, in 1897, the first important measurements of corona loss), for the Colorado Electric Power Company, the Montreal & St. Lawrence Light & Power Company, the Shawinigan Water & Power Company, the Montreal Street Railway Company, the Niagara, Lockport & Ontario Power Company, the Mawashiro Hydro-Electric Power Company in Japan, the Laurentide Power Company, and the Victoria Falls Power Company in South Africa.

He is author of various articles on generators, transformers and transmission problems. He has been the recipient of both the Edison medal and the John Scott medal. He served the American Institute of Electrical Engineers in various official capacities, being president in 1912-1913. He was a member of the joint national committee Officers' Reserve Corps of Engineers and still retains his commission as lieutenant-colonel of engineers, O.R.C., U.S.A. He is a fellow of the American Institute of Electrical Engineers, a member of the American Society of Civil Engineers, American Society of Mechanical Engineers, Eletrochemical Society, Franklin Institute, Society of Canadian Civil Engineers, Institution of Electrical Engineers (British) and the Société Française des Électriciens, a fellow of the American Association for the Advancement of Science and a member and past-president of the Inventors' Guild. He is a member of the following clubs: University, Engineers', Sleepy Hollow Country and Railroad (all of New York), St. James (Montreal) and Shawinigan (Canada).

Editorial Comment

Electrical World, September 15, 1923

Volume 82 Number 11

Helpful Hints from Commissioner Guests

THE increasing presence of utility commissioners at national and regional conventions of the central-station industry marks the growth of a wholesome and an enjoyable relationship. Not so long ago the acceptance of a convention invitation by a commissioner was prone to be misunderstood by the public in some localities, and in some districts it was a rare experience to see a member of a regulatory body under a convention roof from one year's end to another. All this is changing rapidly, and to the triple benefit of electrical men and women, commissioners and public.

Those of us who live and move and have our being in the atmosphere of electrical development know how large a percentage of executive and subordinate time is spent at conventions upon trying to solve the problems of how better to serve the public; but those a little removed from the actual conduct of affairs often fail to realize the earnest effort which the industry is making to increase its usefulness. It is a fair assumption that a commissioner goes back to his office with a refreshed sense of confidence in the high aims of our industry after attending such conventions as those of the New England Division of the N. E. L. A. held last week at Swampscott and the Pennsylvania Electric Association at Bedford Springs. As such officials represent the public as a part of their functions, the people at large are real gainers from the commissioners' observations. On the other hand, the utilities are fortunate to receive the friendly suggestions of their guests from the state capitols, and great possibilities for good in public relations lurk within the testing of practical hints toward better service in all its aspects through open-minded management. The modern commissioner has an expert knowledge of public opinion, and the utility executive who turns this to account by thoughtful attention to the commissioner's utterances and follows this up by putting good suggestions to work derives a benefit that would be difficult indeed to appraise.

The Significance of Estimated Costs

COST estimating is a perennial task of the designing engineer responsible for successful hydro-electric development. Elsewhere in this issue are presented the details of the New England Power Company's anticipated investment at Davis Bridge, which form an interesting supplement to the description of this development published in this journal on June 16 last. About one-half the estimated initial outlay had been expended when the latter article was printed. The installation is proceeding so rapidly that it is believed the days of spring-flow losses on a large scale on the upper Deerfield River are ended, and within a few months another powerful factor in coal saving for New England will be at work.

The question naturally arises, why publish such an extended estimate before the job is completed? The answer lies in the high reputation of this company's engineers and their comprehensive experience in hydro-electric development in this particular territory for years, embracing the construction of some half-dozen stations with about 75,000 kw. combined rating. Careful cost accounting has gone hand in hand with skillful engineering and bold construction ability, resulting in well-conceived and conscientiously built installations which have aroused the admiration of visitors from many other sections. Again, these data are fresh from the field and from the designers' tables, and in this period of shifting costs it is useful to know what expert opinion counts upon in subdivided construction and equipment expenses for given projects. Close comparisons of either estimated or final costs with those on other jobs in other parts of the world are always to be made with a due sense of engineering perspective, but given this, few data are more stimulating or suggestive than the kind illustrated here.

Standardization of Service Connections

NOT many years ago customers' services consisted only of main service fuses, a main switch and a meter. Fuses and main switches were exposed and not necessarily a unit, meters were often separated from them, and the use of open wiring for connections was prevalent. Meter tests, when made, could be accomplished only after making changes in connections. Since that time radical changes in practice have been made by force of economic pressure, on account of regulations regarding fire and safety, and more recently because of the companies' pride in everything which represents their service. Exposed live parts have rapidly been eliminated, means have been developed to reduce installation and maintenance costs, protection against the theft of energy has been installed, facilities have been provided for meter tests, and load fuses have been made accessible to consumers without endangering meters. In fact, many companies have come to realize that the service equipment is such an important factor in their relations with consumers that the company itself should either install the service equipment or demand that types approved by it be installed. In spite of this progress, so many types of apparatus which have to be combined to make a service installation have been developed that there are almost as many varieties of installations as there are customers. The matter has been made worse in some localities by allowing contractors or consumers to pick their own service equipment.

Most companies today are willing and anxious to standardize service installations; but many of them are waiting for the appearance of something which will combine to their satisfaction the good features of all

existing equipment and have the additional advantage of being inexpensive to install and maintain. They will, therefore, hail as a valuable experiment the effort of four leading manufacturers, announced last week, to provide, through a system of interlicensing of patents, a standardized service unit, which is said to be an advance over previous practice in that it combines in one compact cabinet all the functions now performed by separate units for complete service connection and segregation of a limited number of circuits for distribution. Actual standardization, of course, can come only when all manufacturers can unite on a common manufacturing program. While many central-station engineers feel that there is so much still to be done that the time for standardization has not arrived, nevertheless progressive companies will be sure to give serious consideration to the proposed unit, now that a definite move toward standardization has been made.

There should be no fear that standardization will hamper advance. No one contends that no further progress can be made in any line because standardization is started. In the case at hand the service unit includes most of the features which seem desirable, judging, of course, without knowledge of the developments which the next few years will bring. Possibly these years will show an increase of residence loads so great that circuit breakers and not fuses will be needed on main circuits; possibly, too, radically new equipment of various sorts may modify demands upon service installation equipment. In any event this point should be clear—that only by trial and experiment will the weakness or strength of any proposed standard be brought to light.

The problem of adequacy, safety, convenience, appearance and cost of service installations is one of such magnitude that all central-station men, and contractors and manufacturers as well, can afford to give it earnest attention. If a standardization of equipment shall be found which affords a satisfactory solution, it will be only through the co-operation of all those whose interests are affected. The fact that all will benefit from such a solution should be an encouragement to co-operative study.

Emergency Service of Hydro Plants Not a Matter of Dollars

TOO frequently the addition of a hydro-electric plant to a system supplied from steam stations is accepted or rejected on the basis of installation and operating costs. Consideration should also be given to the fact that in many instances of practical experience these hydro stations give an added element of reliability to the service of the system which is very valuable.

Even in low-water stages, if there is any pond at all, the hydraulic station is waiting for the emergency call. Should a big steam turbine develop a minor trouble that requires shutdown for repair, or should some other equipment fail in the steam stations, the hydro-electric plant can be called upon. In other cases the system steam-reserve capacity can be reduced, and in still others the operation of the hydro-electric units as condensers is often equivalent to adding steam generating capacity to the system.

Thus in making analyses of system developments not only should the installation and operating costs of a hydro-electric plant be figured, but also the intangible elements mentioned should be evaluated and placed on the balance sheets.

Why Some Central Stations Have Trouble

THREE letters which tell their own story are printed in the "Central Station Business" department of this paper, page 549, this week. The only comment that is necessary is that a better exemplification of a "public-be-damned" policy would be hard to find.

It is not to be wondered that the company concerned, which operates in a New England city known for its industrial development, is in disfavor with its public. Surely any genuine seeker for information from a business house is entitled to courtesy, and it is probable that the manager who had the hardihood to sign such a letter would be the loudest in protest if some one should return the same sort of an uncivil answer to a courteous inquiry made by him. It is unfortunate that such men are to be found in the public utility business.

Why Should Railroads Not Be Reasonable in Agreements About Crossings?

CERTAIN steam railroads, particularly in the eastern part of the United States, which in the past have taken a rather uncalled-for attitude in the matter of overhead wire crossings, have received a setback by a recent decision of the Illinois Commerce Commission. The attitude of these roads has been one of demanding all sorts of stipulations in agreements, some of them almost prohibitive in character. In fact, the requirements in some cases are so stringent that it almost seems as if they are intended to be prohibitive. In the case in question, the Chicago & Alton Railroad Company asked the Illinois Commerce Commission to force the Spring Valley Utilities Company to sign agreements to maintain the crossing in compliance with the commission rules. The commission took the position that nothing in the law or the commission practices would require the companies to enter into such an agreement, and that whether such an agreement could be required was a case for determination in a competent court of law. The commission pointed out, in addition, that from the standpoint of safety no such agreement was necessary since the commission's rules must be complied with in any case.

There are two distinct cases involved in consideration of the crossing problem. One is that of a crossing over the railroad right-of-way at a point where there is no intersecting highway. This involves the provision of service by two utilities, the railroad and the power company, and the solution should be arrived at as with problems of other kinds—in the interests of all users of service. The situation is one involving the crossing of two rights-of-way, both devoted to public service; but in the past, unfortunately, the railroad companies have felt that they were in a position to ask whatever agreement seemed reasonable to them. The other case is that of a wire crossing at the same point as a highway crossing and within the limits of the highway on which the wire-using utility has a franchise. While this case, too, involves the same provision of service by two utilities, yet railroads have apparently been willing to admit that it is one in which the power companies have more standing.

In both cases it should be remembered that commission rules are established for the purpose of rendering all crossings safe, and that in case of defects in the rules the commission has full authority to establish safe practices. Involved in the problem is the question

of giving the public both railway and other utility service with the least possible restriction compatible with safety. Railway companies have no legal or moral right to load another utility with restrictive requirements that competent regulatory bodies have decided to be unnecessary. Nor have they popular approval in doing so. This applies particularly to two requirements insisted on rather frequently—that of a rental charge on an annual basis for each crossing and in some cases a stiff charge for the drawing of the agreements. There has been a small group of die-hard conservatives in the railway field who have sought to impose all sorts of severe requirements on wire crossings, and these men have not been at all satisfied with the requirements of the National Electrical Safety Code, which ought to be the final authority in all differences of opinion on this subject. It will pay some of these men to look on the question from the standpoint of public interest and to be a little less radical in their demands. The courts will finally decide the matter on the basis of the best interests of the whole public. But how much better it would be to decide without the help of the courts. There is enough engineering ability in the industry to reach a decision at a much less cost than will be incurred by legal action.

Multiple Arresters for Distribution Circuits

LIGHTNING neither strikes twice in the same place nor acts twice in the same manner. On this theory only can field reports of lightning-arrester behavior be reconciled. While specialists argue about what constitutes the best type and discuss discharge rate, gap design and mechanical construction, the men in the field use the arresters on the market and meet to compare notes. But the comparison brings no definite results, for a failure on a certain installation of one type of arrester can be offset—frequently, in fact, on the same property—by perfect behavior on another installation. System men call troubles which are not understandable "ghosts," and it is apparent that lightning must be a ghost.

But the evidence is overwhelming that arresters do protect equipment in the majority of cases, and this independently of the commercial type of arrester now used. While each engineer and each system may have his or its own particular preference as to the best type, all use arresters.

The particular value of an arrester is that it protects equipment against breakdowns and is the cheapest means for accomplishing this result, and it would seem logical, judging from a study of recent papers and field notes, to use multiple rather than single arrester installations on a system. Wherever apparatus involving a worth-while investment cost is exposed to lightning, an analysis should be made to determine the economic feasibility of an arrester installation. Although the arrester may not protect the equipment in certain extreme cases, yet it does give at least a six-to-one or eight-to-one chance of accomplishing that end.

Following out this line of reasoning, arresters should be placed at least on all the large transformers in the distribution system, and the existing practice in high-tension arrester installations should be carried to a greater extent down into the distribution system. It may even prove economical to use multiple instead of single installations on a given line or feeder independently of the transformers connected.

Local Electrical Leagues

TWO very interesting facts are beginning to stand out more and more clearly against the background of the discussion that for so long a time has been carried on upon the subject of central-station merchandising—first, appliances are not now being sold fast enough really to make headway with the important job of equipping the homes of America electrically; second, the trend of evolution does not seem to promise that the electrical contractor and dealer alone can adequately develop the market that lies waiting, but it does indicate an increasing participation by hardware, department and other non-electrical stores.

Central-station executives are going to find themselves impelled to give attention to the study of this problem. For it concerns them vitally.

By way of illustration, S. M. Kennedy, vice-president Southern California Edison Company, says in an interview published in this issue that probably more than forty thousand residence and commercial customers will be connected to that company's lines this year. Already this company has four hundred thousand household appliances on the circuits. Analysis has convinced the officials that this load produces an income averaging one cent a day per appliance. They want as many appliances as possible sold to the forty thousand new consumers gained this year, but some time ago the company withdrew from appliance merchandising, and Mr. Kennedy says that nobody today is aggressively going after this business.

At the same time R. S. Hale, chairman of the N. E. L. A. wiring committee, has discovered in a recent survey that with the increase in the electrical saturation of cities through the wiring of the houses the proportion of "curbstone" contractors is increasing. This indicates that this whole question of local trade relations is one of steadily increasing importance. For the electrical family of most communities is not well harmonized and organized as yet for carrying forward the tremendous task of equipping the American home electrically. And the situation is being complicated no little by the entry of the non-electrical store upon the scene. The department store and the contractor are both elements in the public relations of the modern central-station company no matter what the company's individual merchandising policy may be.

Next week the second annual conference of local electrical leagues will be held on Association Island at the invitation of the Society for Electrical Development. What will be accomplished, how soon, if at all, the associated local leagues will come to be a national factor in the electrical industry, no one can say. But they are growing apparently both in number and in strength, and they seem to offer the logical mechanism for the development of co-ordinated policies among the electrical men of any individual city.

The local electrical leagues are worth watching. Moreover, it is exceedingly important that central-station executives shall not only give them encouragement but personally take the initiative in guiding these leagues in their formative period, so that they may become an influence that will serve both in the expansion of the common market and the cultivation of better public relations from which the whole industry benefits.

Electrical men of every class frankly recognize the fact that the central-station manager must be the leader in this work of local organization.

Wrong Impressions Corrected by Pictures and Data

THE opinion is often expressed among the uninformed that electricity developed from water power should be cheaper than that from steam power. Every company has pictures and figures which can be used to correct this wrong impression if sufficient publicity is given to them. Construction pictures are particularly impressive if accompanied by a few pertinent data indicating the amount of labor, special equipment, time and supervision required for the work. Take, for example, road construction through rocky country for transportation of men, construction materials, etc., used on hydro-electric undertakings.

Besides pointing out the time required for preliminary surveys, attention can be called to the vast amount of rock that must be excavated, the expense of equipment and labor for doing it, the length of the roads, etc. The fact that such roads may cost from $40,000 to $60,000 per mile will astound a great many people.

Similar information on the cost of constructing dams and tunnels would be enlightening. Then, too, some of the more expensive pieces of equipment, such as waterwheel generators, transformers and circuit breakers, could be shown with cost figures and emphasis placed on the fact that they constitute only a small part of the total expense.

Status of Pulverized Fuel

Decreased Losses and Greater Flexibility in Operation Are Admitted Advantages from Its Utilization—Typical Installations and Trends in Development —Advantages and Disadvantages Outlined

By L. W. W. MORROW
Associate Editor ELECTRICAL WORLD

WHERE fuels from different sources are burned, where the constituents in the fuel vary, and where combustion conditions must be maintained at the highest efficiency under all operating conditions, pulverized-fuel installations have certain clearly marked advantages.

These advantages have resulted in the recent adoption of pulverized-fuel equipment by some of the most modern central-station organizations after they had made complete analyses of the merits of the equipment in comparison with other types of combustion apparatus. The fact that these decisions have been made, however, is not a good reason for the universal use of pulverized-fuel equipment, because the further fact that other equally progressive central-station companies have decided to use stokers in new plants shows that there are other conditions to be considered. Yet the statement may be made that, although the power-station art is ever changing and although a designer is very rash who predicts conditions even five years in advance, the trend at present is toward the use of pulverized-fuel.

A calm analysis of conditions shows a field of operation for both stoker and pulverized-fuel installations and in addition the possibility of a great amount of development in the engineering and mechanical features of each type of installation. Therefore, it is as yet unsafe to generalize, and each installation should be the subject of analysis before a decision is made.

ADVANTAGES OUTLINED

A study of the plants using or proposing to use pulverized fuel shows that one or more of the following advantages led to the decision:

1. Many plants are forced to use fuel from many different sources, and the pulverized-fuel equipment is best adapted for operation under these conditions because high combustion efficiency can be maintained. This is because the mechanical equipment needs no readjustments when different fuels are used, and, because of the type of combustion, the control of the fuel-feeding rate, air supply and combustion mixture can be made quickly and easily if the fuel quality varies at any time.

2. Where loads must be dropped or picked up very quickly and where boiler ratings vary widely throughout the day, pulverized coal is a splendid fuel to use because there is no time lag in control of the fuel in the furnace chamber. There is no bed of incandescent fuel to be handled and no slow-moving mechanism to change the fuel feeding. Rather, like gas, the pulverized fuel can be turned on or off almost instantly and fed in any desired amount. Included in this advantage is the fact that this type of combustion can be inherently controlled very readily and efficiently through the use of automatic devices which operate through pressure, draft and steam-flow changes.

3. High thermal efficiency is very important in power stations of today because of the high price of fuel and the necessity for conserving national resources. The pulverized-fuel equipment possesses inherent advantages over stokers in this respect because it can be burned with less excess air and consequently higher CO_2 and can eliminate some of the losses existing in other installations. Some of the losses eliminated are, for example, unburned fuel dropping through grates, banking losses and those occurring when boilers are put on or taken off the line, and those losses occurring when boiler steaming conditions are changed. Where the best stoker installations operate with an efficiency of about 76 per cent and 8 to 12 per cent CO_2, pulverized fuel installations realize efficiencies from 83 to 86 per cent with CO_2 from 12 to 15 per cent.

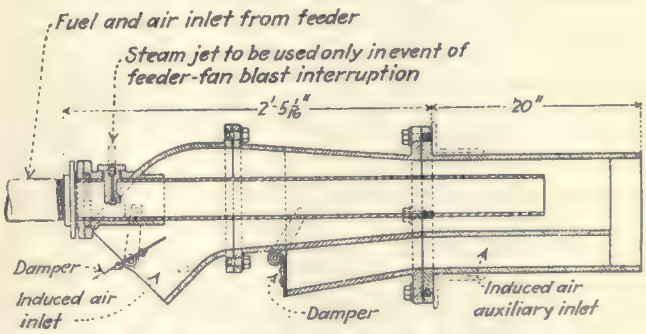

FIG. 1—SECTION OF LOPULCO VERTICAL BURNER

The fuel and primary air enter the burner from the feeder, and a portion of the secondary air is controlled by a damper. One stream of air entirely surrounds the air-cool mixture and stirs and aerates the coal thoroughly before it enters the furnace.

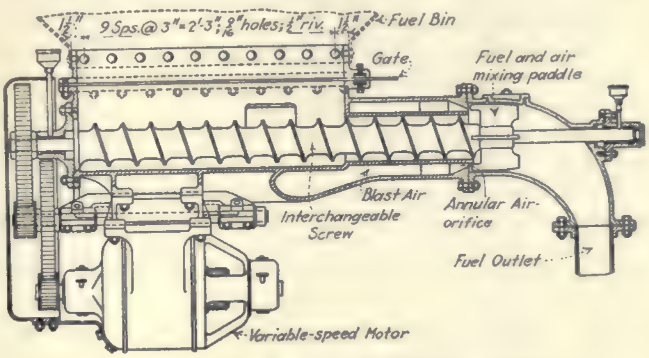

FIG. 2—SECTION OF PULVERIZED-FUEL FEEDER

The screw discharges the fuel into a blast of air which comes from an annular orifice under about 10 in. pressure of water. The revolving-screw shaft mixes the air and coal and passes the mixture on to the burner. About one pound of air per pound of fuel is used at the feeder and the screw is slow-speed, operating at about 4 r.p.m.

Several phases of the subject are open to controversy, however. For example:

1. For the same ratio of boiler rating to kva. rating, pulverized-fuel installations now cost from \$1 to \$5 more per kva. than stoker installations. It is argued that if credit be given the pulverized-fuel installation for the

savings associated with possible boiler operation at high ratings, the net cost will be equal to or less than stoker-plant costs. Of course, it may be said that stokers also can be forced to give high boiler ratings, but this is said to involve greater investment costs per kva. and larger space dimensions than are necessary when operation takes place at normal ratings. Bearing on the same subject several instances of installations can be cited to show that the total boiler-setting space requirements for pulverized fuel are not greater than with stokers. This is because the ash pits, grates and ash-handling facilities are eliminated and this space saving compensates in a great measure for the additional furnace combustion space and boiler-room fuel equipment space used with pulverized-fuel installations.

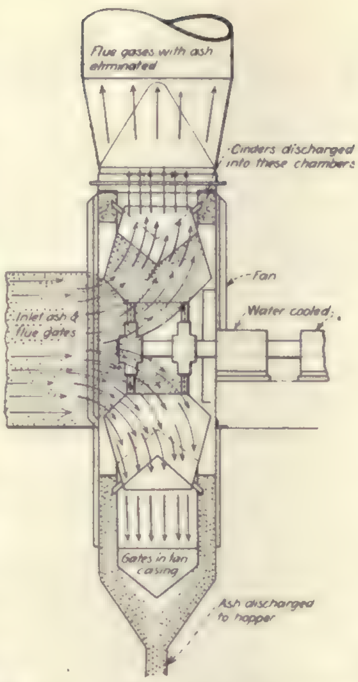

FIG. 3—A SECTION OF THE STURTEVANT CINDER VANE FAN

Centrifugal action separates the cinders and ash from the flue gases when they strike the blade surface. They are then caught in the cinder pocket and delivered by centrifugal action to the settling chambers at the side of the fan housing.

2. Many engineers argue that pulverized-fuel equipment is still in a state of flux and subject to a number of refinements and adjustments before satisfactory operation can be obtained. For example, instead of a 6-ton mill, a 20-ton mill is needed for the large station installations, and much development work is going on in an attempt to enlarge the sizes, but with few positive results. Whether to use concrete or steel fuel bins, air or conveyor systems for handling the fuel, simple or complicated burners, separately fired or stack gas-operated driers or no driers at all—these are subjects of controversy, although each question can be answered in specific cases by results from actual installations.

It is argued that the "shake-down" period for a new plant to achieve maximum efficiency in operation is longer and that improvements in the apparatus are occurring more rapidly with pulverized-fuel equipment than with stokers. In answer, however, the points are made that stoker installations are also in a state of flux, that stokers can be improved very much, and that most of the changes in boiler and furnace practice are occurring independently of the development of fuel equipment. It is asserted, besides, that, whereas a stoker breakdown because of the unit construction used, usually necessitates removing the boiler from the line for repair, a pulverized-fuel installation using fuel-storage bins affords a reserve fuel supply for the boilers in case the mill fails, and this is the part of the equipment that is more apt to fail. For the pulverizing mill and much of the mechanical equipment involved are independent of the boilers and can be repaired or stopped without interrupting boiler operation.

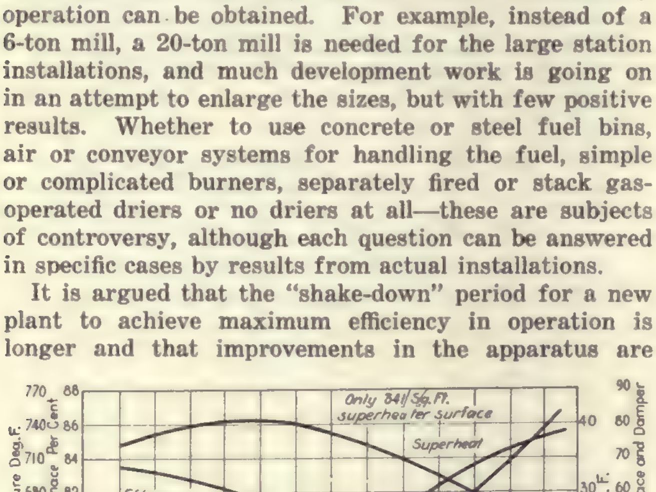

FIG. 4—TEST RESULTS ON BRUNOT'S ISLAND PLANT OF DUQUESNE LIGHT COMPANY

Coal used contained 13,200 B.t.u. as fired, 2.3 per cent moisture, 33 per cent volatile and 2.4 per cent sulphur.

3. The energy required to handle the fuel is greater for pulverized-fuel installations than for stokers. While the stoker energy is 8 kw.-hr. to 10 kw.-hr. per ton, the pulverized-fuel equipment uses from 18 kw.-hr. to 21 kw.-hr. per ton, of which from 15 kw.-hr. to 17 kw.-hr. is used in the pulverizing mill. There does not appear to be any possibility for reducing this energy consumption with any known type of mill; in fact, the larger the masses and the greater the speed of the mill, the greater is the unit energy consumption, because of friction-loss increase. If, however, a type of mill utilizing new principles not involving the movement of heavy masses were developed, the friction load could be eliminated and the consumption of energy reduced greatly. Attempts are now being made to develop mills of this character.

4. Furnace and boiler designs, equipment location and boiler-room arrangements for utilizing pulverized fuel are the subjects of argument and experiment. A study of the proposed installations bears out the statement that each group of plant designers has its own ideas as to the best design and that these ideas differ very much in fundamental points. However, there is no doubt that all of the proposed installations are workable, and it is argued that the same differences in opinions and practices will be found in stoker-fired stations and that the differences deal with the theory of combustion rather than with the pulverized-fuel equipment. The stack effect of the long flame length, the use of water screens, the greater or less furnace temperatures, the location and type of superheater, the use or non-use of driers and the arrangement of burners and combustion chambers are elements that result in differences of opinion and about which it is unsafe to generalize, because neither a theoretical nor an actual background is available to afford a perspective for conclusions.

Thus each of the new stations now under way differs materially from the others and will contribute data which in future installations should permit a realization more quickly of the inherent advantages of pulverized fuel. Even now the location and advantages of convection-type superheaters with pulverized-fuel installations are different from those in stoker-fired plants and new designs and practices are required to attain equally good results in the two cases. For example, in one proposed plant the superheater location is not going to be changed, but the amount of superheater surface will be about doubled as compared with the installation for stoker firing, and these designers argue that the great number of suspended particles in the flame reduce the possibility of radiant-heat absorption. In another plant radiant-type superheaters are to be used inasmuch as

the designers think they possess advantages for radiant-heat absorption in pulverized-fuel plants because of the longer flame length as compared with that available in stoker-fired plants. Other organizations are proposing the use of the ordinary types of superheaters in connection with radiant-type superheaters.

In the large power stations the equipment for pulverizing the fuel may or may not be installed in the boiler room proper. Incoming coal is handled as dictated by the usual practices in stoker-fired plants until after it goes through the crusher, at which time it passes to the coal-preparing plant by means of conveyors, hoists or elevators. The coal-preparing plant consists of the pulverizing mill or mills, exhausters, dust collectors, conveyors, coal bins and screens, or an air-system equipment, and in addition driers in those cases in which they are used.

If the superficial moisture in the coal is not greater than about 5 per cent, the fuel can be used without driers, but driers are great assets in keeping the coal from packing in the bins, clogging the conveyors and consuming greater power in handling. Whether driers should be separately fired or use the hot flue gases is a question for analysis, and they are of many types of construction. There is a general desire to eliminate driers, but if this is done, the raw fuel must be delivered without having absorbed moisture or becoming wet during transit and must be kept dry in storage. Fortunately, coal absorbs little moisture, so that it seems possible to develop storage arrangements which will eliminate the use of driers.

By conveyors of different kinds, whose relative merits form the subject of debate, the fuel goes to the pulvering mills, of which there are several types. The Raymond, Fuller and Aero mills are typical and differ chiefly in their mechanical design, in the use of rolls, balls or cones as crushing agencies, and in the use of screens or air for separating the fuel according to sizes. Although the pulverized fuel fires well when about 65 per cent passes through a 200-mesh screen, the finer it is pulverized (although it will burn more rapidly) the greater the tendency for the ash particles to pass out through the stack and the more the power required to operate the mill. The mills have difficulty in reducing all the coal to a uniform size. Taking the arrangement in a Raymond mill as typical, the coal passes into the base of the pulverizer for crushing and is then lifted by air currents to a separator for eliminating the larger particles of fuel. From the separator the material goes to the collector, where the coal is separated from the air and deposited on a screw conveyor. There may be a series of separators and a series of pulverizing rolls, depending upon the capacity of the plant, and the interior of the mill is kept below atmospheric pressure to eliminate leakage into the external atmosphere. The exhausted air returns to the base of the pulverizer from the exhauster and is used again and again.

From the pulverizer and collector the coal passes on a screw conveyor, through a helical pump or through a compressed-air conveying system to storage bins near the boiler or, as is the practice with one system, directly to the furnaces. Thus much leeway is afforded the plant designer in the selection of type of system and apparatus to be used, and successful installations may be cited using a wide range of systems and equipment.

If the direct feed with compressed air is not used, arrangements must be made to feed the fuel from the bins. To insure uniform and uninterrupted feeding

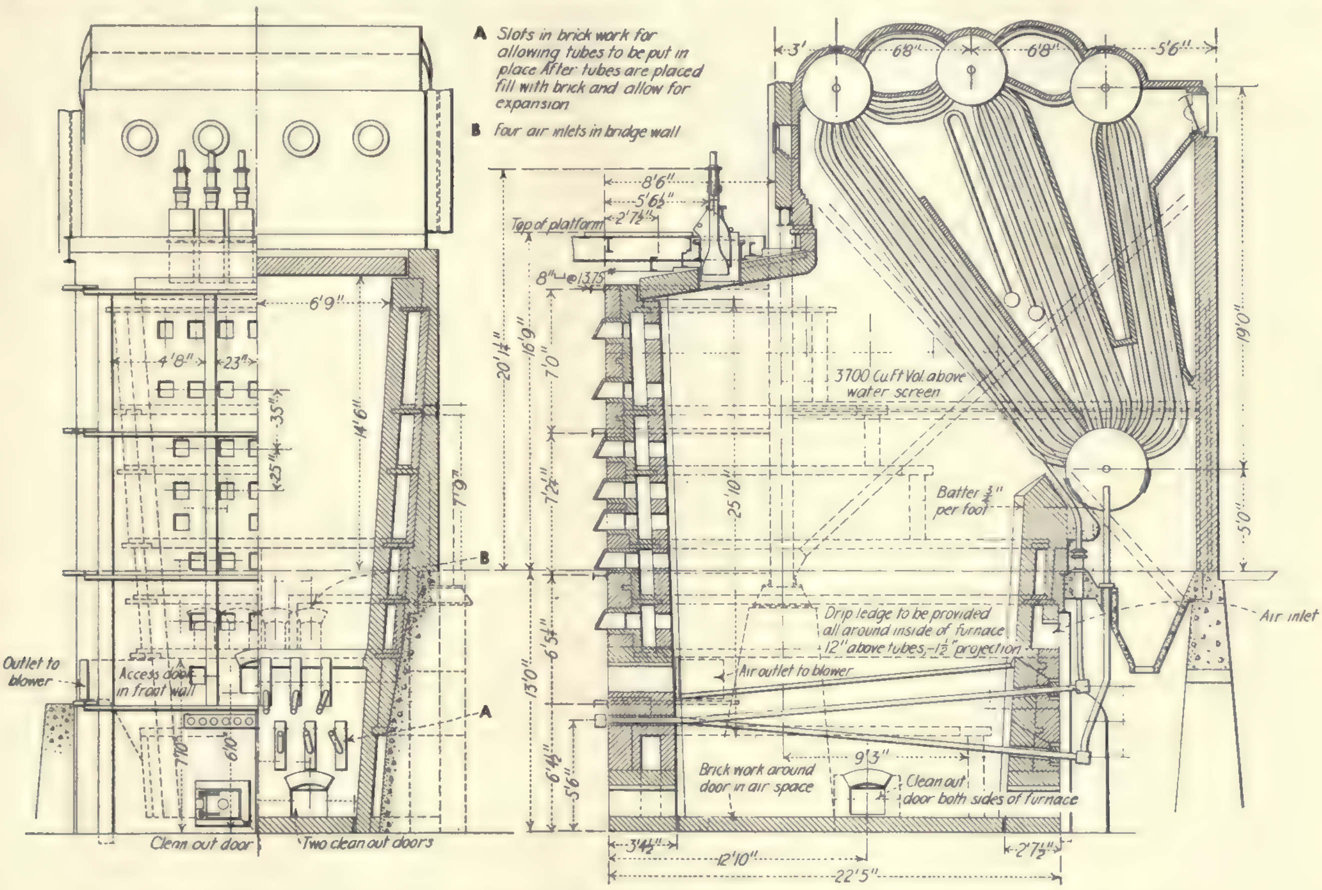

FIG. 5—CROSS-SECTION OF BOILER INSTALLATION AT BRUNOT'S ISLAND PLANT OF DUQUESNE LIGHT COMPANY

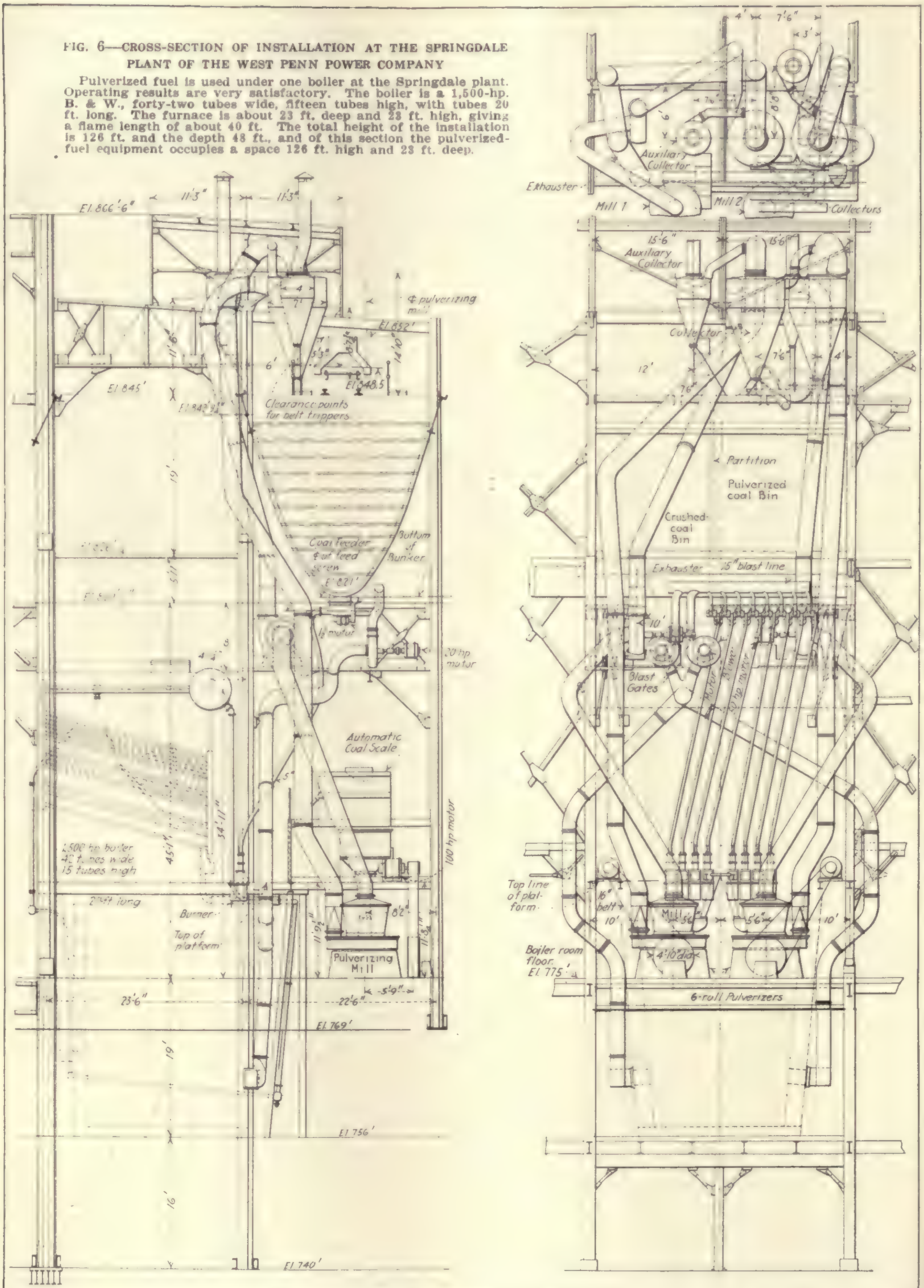

FIG. 6—CROSS-SECTION OF INSTALLATION AT THE SPRINGDALE PLANT OF THE WEST PENN POWER COMPANY

Pulverized fuel is used under one boiler at the Springdale plant. Operating results are very satisfactory. The boiler is a 1,500-hp. B. & W., forty-two tubes wide, fifteen tubes high, with tubes 20 ft. long. The furnace is about 23 ft. deep and 23 ft. high, giving a flame length of about 40 ft. The total height of the installation is 126 ft. and the depth 48 ft., and of this section the pulverized-fuel equipment occupies a space 126 ft. high and 23 ft. deep.

from bins to furnace is difficult because of variation in moisture content, temperature, fuel demand, fineness and aëration. Screw conveyors in combination with high-pressure and low-pressure air supplies are commonly used, although the direct feed using no conveyor, with the fuel suspended in the air, is frequently encountered.

The bins must have sides with slopes of 60 deg. or more in order to prevent the coal collecting and adhering to the walls. A difference of opinion exists as to the relative merits of steel and concrete bins, for the bin walls should be kept at a higher temperature than the inside atmosphere to prevent condensation and the coal should be kept dry and cool if reliable flowage is to be expected. The concrete bin is reported to have advantages over the steel bin in regard to condensation troubles.

Before the powdered coal is used in the furnace it is thoroughly aërated and mixed and is then supplied to the furnace through an adequate burner. Many types of mixers and burners have been devised using air, steam or the two in combination, and some are complicated devices with multiple nozzles and accessory mixing devices. The shape of the burner nozzle is subject to modification to permit the specific furnace to control the flame distribution and prevent its impingement on refractories or tubes.

The refractories used in the furnaces burning pulverized fuel are the same as those used in stoker-fired plants, but the furnace volume is usually greater and the design of the furnace differs materially. A general tendency is toward the use of hollow-walled and hollow-bottomed furnaces and the cooling of the walls by using air-preheating or water screens connected with the boiler system. The furnace volume and the location and number of the burners are the subjects for much difference of opinion and practice.

The use of water screens, usually in the form of boiler tubes in the bottom and sides of the furnace and connected to the boiler, not only helps to reduce the duty of the refractories but also absorbs heat, and they have their greatest advantage in preventing any slagging of the fuel. Several installations of this type of screen have proved their value and reliability.

Some question has arisen as to the effect of the finely divided ash which emerges from the stacks of pulverized-fuel installations. A certain portion of the ash goes out through the stacks, probably around 40 per cent, but this is in small crystals which are light and are carried great distances and scattered over a wide territory even by light winds. No evidence exists of recent trouble from the pulverized-fuel ash, but fans are being developed for handling it in the event that trouble occurs. Moreover, the Cottrell precipitation process presents possibilities for handling the situation. Most engineers of the larger stations would feel justified in using some ash-removal process, provided it could be operated economically to remove about 85 per cent of the ash.

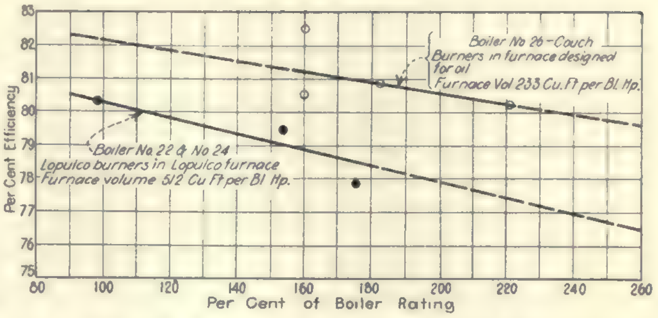

FIG. 7—RESULTS OF PULVERIZED-FUEL-BURNING TESTS AT PLANT OF NARRAGANSETT ELECTRIC LIGHTING COMPANY

Two 600-hp. boilers of the Narragansett Electric Lighting Company are supplied by one pulverized-fuel furnace. The height to the tubes is 25 ft., and the volume is 5,740 cu.ft., or 4.78 cu.ft. per boiler-horsepower. The furnace walls consist of an outer wall of red brick, an air space and a 9-in. lining of firebrick with rowlock setting. Four burners are installed in a vertical position with tips about 22 ft. above the furnace floor. The pulverized-fuel equipment consists of a Pomeroy mill, exhaust fan and a screw conveyor to feed the coal to the mill. The coal does not pass through driers and is fed by gravity directly from the exhauster to the burners with sufficient air introduced to insure combustion and hold it in suspension. The power required by the mill is said to be about 19 kw.-hr. per ton of fuel. Trouble occurred in obtaining arches to withstand the heat, and there was also a tendency to melt the brick lining. Three of the burners gave trouble through coke forming in their ends, and the pier around the front column was replaced twice. The mill proved inadequate for the installation and did not pulverize finely enough. Moreover, too much time was required weekly to clean the ash and slag from the furnace.

The first large central station to use pulverized fuel was the Lakeside station of the Milwaukee Electric Railway & Light Company. The Duquesne Light Company, the Puget Sound Power & Light Company, the Narragansett Electric Lighting Company, the West Penn Power Company, the Cleveland Electric Iluminat-

RESULTS OF BOILER TESTS AT LAKESIDE POWER STATION, WHERE POWDERED COAL IS USED THROUGHOUT

Tests were made by the Bureau of Mines in co-operation with the Combustion Engineering Corporation. The coal used had a gross B.t.u. of 11,500 to 12,800 per pound, containing 2 to 5 per cent moisture, 33 to 36 per cent volatile matter and 9 to 13 per cent ash, and was ground so that 89 per cent to 95 per cent passed through a 100-mesh screen. The ash had a softening point of 2,150 deg. to 2,450 deg. F.

			Per Cent Efficiency Based on Gross Calorific Value		Per Cent Efficiency Based on Net Calorific Value		Temperature Deg. F.			CO_2, Per Cent		Coal Size		
Test Number	Duration, Hours	Per Cent Rating Based on Heat Absorbed by Boiler and Superheater	Boiler and Superheater	Boiler, Superheater and Economizer	Boiler and Superheater	Boiler, Superheater and Economizer	Gases Leaving Boiler	Gases Leaving Economizer	Superheated Steam	Gases Leaving Boiler	Gases Leaving Economizer	Moisture, per Cent	Through Screen, 100 Mesh	Through Screen, 200 Mesh
1	42.33	137	83.3	86.4	86.6	89.8	436	170	547	15.8	10.4	2.2	89	68
2	23.97	216	82.6	87.1	86.1	90.8	470	195	592	14.6	11.9	3.6	91	69
3	19.92	210	82.5	87.1	85.9	90.7	484	204	598	14.7	12.0	3.9	91	69
4	24.37	144	85.3	89.1	89.0	93.0	432	205	529	16.0	13.2	5.6	92	71
5	24.17	236	79.7	84.4	83.1	88.0	500	254	590	14.1	10.8	5.7	91	67
6	28.25	139	83.4	87.6	86.8	91.1	456	229	554	15.1	11.4	3.7	92	68
7	25.57	178	84.0	88.4	87.3	91.9	469	240	561	14.7	11.2	3.5	93	66
8	24.00	176	85.1	89.5	88.5	93.1	470	239	558	15.0	11.4	3.5	92	63
9	24.28	205	83.9	88.4	87.2	91.9	493	256	572	15.1	9.9	2.8	94	73
10	24.62	204	83.4	87.3	86.6	90.7	490	256	565	14.7	10.5	3.5	90	58
11	24.08	243	81.6	86.4	85.0	90.0	535	286	592	14.0	10.2	3.7	95	69
12	23.92	241	82.3	87.0	85.6	90.5	528	263	595	14.3	11.3	4.1	93	69
13	24.25	248	80.9	85.5	84.2	89.0	538	272	601	14.2	9.8	3.6	93	70
14	24.50	130	84.5	88.3	87.9	91.8	440	218	521	17.1	14.7	3.2	93	65
15	17.63	136	84.7	88.8	88.0	92.3	444	221	538	16.4	14.0	3.6	92	65
16	24.15	251	83.8	88.8	87.4	92.6	530	256	612	14.8	11.2	5.5	91	68
17	23.45	238	82.3	87.6	85.7	91.2	528	268	605	14.1	9.9	4.9	92	65
18	24.67	257	82.1	86.9	85.4	90.4	526	269	594	14.9	10.9	3.4	93	70
19	27.38	256	82.8	87.6	86.1	91.0	519	262	588	15.0	11.6	3.1	93	64
20	26.67	251	79.5	84.5	82.6	87.8	545	306	594	13.9	11.8	2.2	92	67
21	23.93	175	86.9	91.3	90.3	94.8	468	260	563	15.6	13.8	2.2	93	72
22	24.42	167	86.2	90.4	89.5	93.9	463	264	564	15.7	13.7	2.5	92	70
23	24.83	233	81.8	86.2	85.0	89.6	526	298	595	13.7	11.4	2.8	92	57
24	25.00	224	81.2	85.9	84.4	89.3	512	294	588	13.1	10.9	2.8	91	69
25	24.03	170	85.4	89.3	88.8	92.9	464	254	562	15.7	13.9	3.5	92	66
26	25.55	166	86.0	89.9	89.4	93.4	459	252	566	15.4	13.6	3.4	92	70

Note—No time elapsed between tests which are bracketed together.

ing Company and the Detroit Edison Company have done a great amount of experimental work or carried on investigations which have convinced them that pulverized fuel should be used in extensions or for new stations. In many details the groups of actual experimenters differ about the best equipment and reach divergent conclusions, but all agree on the inherent general advantages of pulverized-fuel burning for high-load-factor stations and are optimistic about successfully solving details of installation and operation in the contemplated plants. Great credit should be given also to the manufacturers of pulverized-fuel equipment for their very courageous development of the systems for which their initiative and foresight is largely responsible.

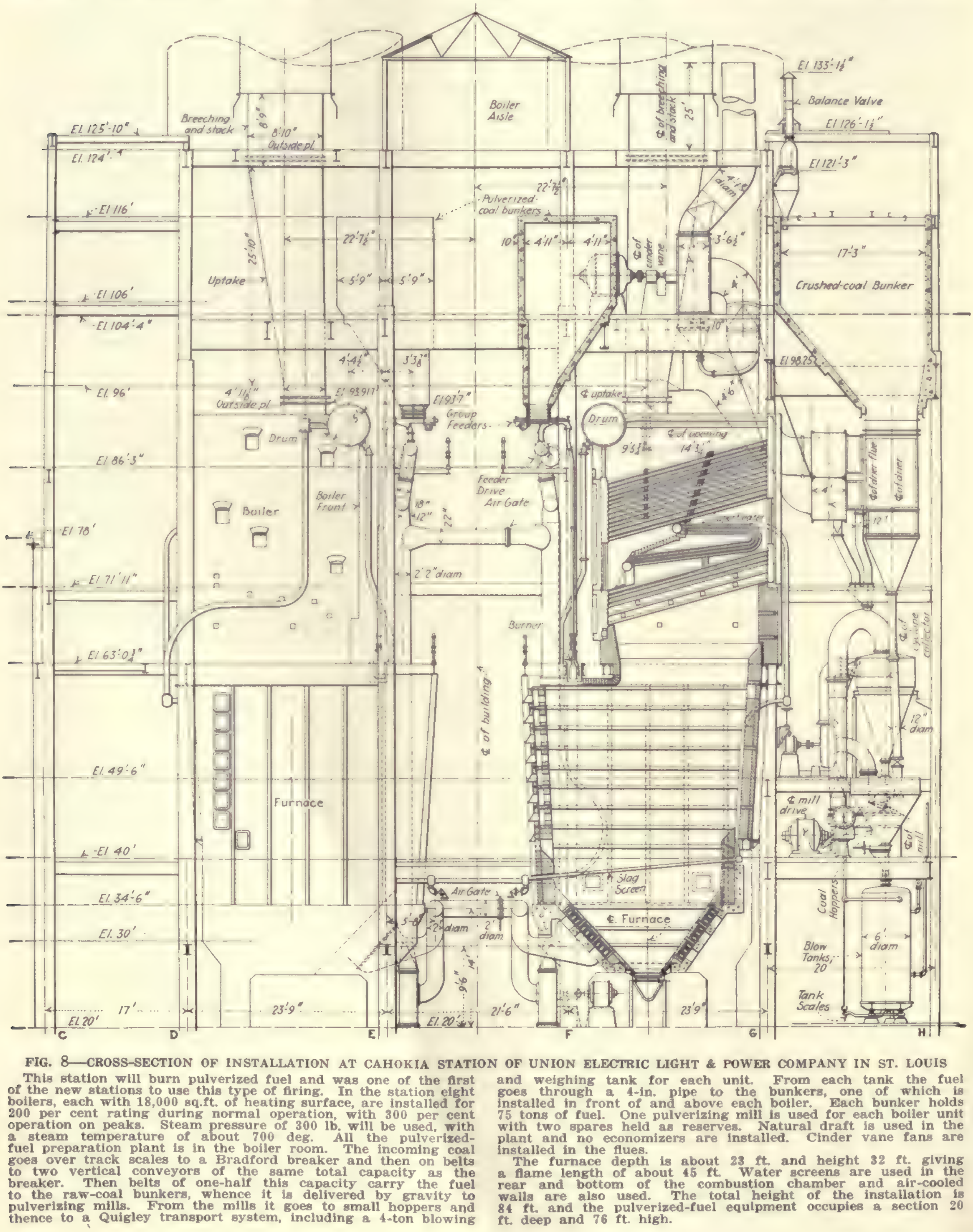

FIG. 8—CROSS-SECTION OF INSTALLATION AT CAHOKIA STATION OF UNION ELECTRIC LIGHT & POWER COMPANY IN ST. LOUIS

This station will burn pulverized fuel and was one of the first of the new stations to use this type of firing. In the station eight boilers, each with 18,000 sq.ft. of heating surface, are installed for 200 per cent rating during normal operation, with 300 per cent operation on peaks. Steam pressure of 300 lb. will be used, with a steam temperature of about 700 deg. All the pulverized-fuel preparation plant is in the boiler room. The incoming coal goes over track scales to a Bradford breaker and then on belts to two vertical conveyors of the same total capacity as the breaker. Then belts of one-half this capacity carry the fuel to the raw-coal bunkers, whence it is delivered by gravity to pulverizing mills. From the mills it goes to small hoppers and thence to a Quigley transport system, including a 4-ton blowing and weighing tank for each unit. From each tank the fuel goes through a 4-in. pipe to the bunkers, one of which is installed in front of and above each boiler. Each bunker holds 75 tons of fuel. One pulverizing mill is used for each boiler unit with two spares held as reserves. Natural draft is used in the plant and no economizers are installed. Cinder vane fans are installed in the flues.

The furnace depth is about 23 ft. and height 32 ft. giving a flame length of about 45 ft. Water screens are used in the rear and bottom of the combustion chamber and air-cooled walls are also used. The total height of the installation is 84 ft. and the pulverized-fuel equipment occupies a section 20 ft. deep and 76 ft. high.

Probably the earliest installation was that of the steam-heating station of the Puget Sound Power & Light Company, which installed horizontal burners under ten boilers with a total heating surface of 41,000 sq.ft. On the largest boiler the combustion volume is 2.7 cu.ft. per boiler-hp., and average operating conditions at normal rating give efficiency of 79 per cent with 10.5 per cent CO_2 and a flue-gas temperature of 535 deg. F. Fuller mills and indirectly fired driers are used in the station. The total maintenance and operating cost for 1921 was 71 cents per ton of fuel, not including overhead, depreciation, etc. The station experiences indicate that concrete bunkers are better than steel because the coal can be kept in storage twice as long without heating. Moreover, definite furnace temperature limitations were found necessary if slagging was to be prevented. Dirty coal gave trouble until washed and much experimentation was done on burners.

With the furnaces used, 2,400 deg. is the average operating temperature at the bridge wall. Higher temperatures injure the lining, fuse the ashes and cause bad slagging. The burners have a flattened nozzle, which spreads the fuel in a horizontal fan shape, and one burner gives best operation on a 400-hp. boiler.

The Lakeside station of the Milwaukee Electric Railway & Light Company has a reported efficiency of boiler economizer and superheater of 88 per cent under steaming conditions of 265 lb. and 170 deg. superheat at 150 per cent rating. The boilers have 13,057 sq.ft. of heating surface with a combustion space of 9.057 cu.ft. The gases enter the economizer at 436 deg. and leave at 240 deg. The CO_2 leaving the economizer averages 12 to 14 per cent. Experience shows that if the coal is raised to about 180 deg. during the thirty minutes required for it to pass through the drier, sufficient moisture will have been eliminated to secure satisfactory operation. A fineness of 65 per cent through 200 mesh has been found satisfactory for burning the fuel at highest efficiency. The Lopulco system of feeders, burners and furnaces is used in the plant. The screw conveyors, mill discharge and return piping, pulverized-fuel bins and supply lines have been covered with insulation to prevent the condensation of warm vapor rising from the coal. About 18 in. of air pressure is used in the primary air header and the feeder pipes are being equipped with steam nozzles to aid in mixing and feeding the fuel. The furnace uses hollow walls and bottoms, and air is drawn through ducts therein by the fans supplying the feeders. Test results are shown in the accompanying table. A complete description is given in the ELECTRICAL WORLD, page 721, April 15, 1922.

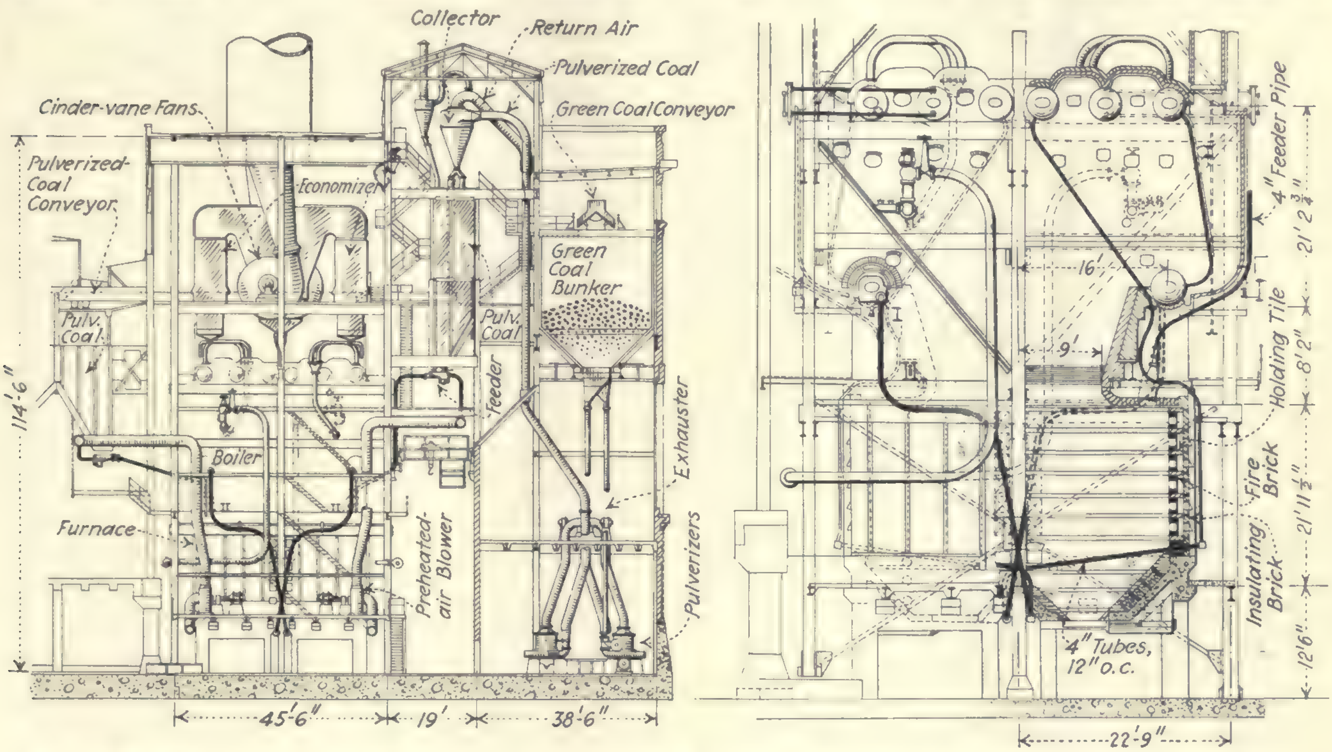

FIG. 9—CROSS-SECTION OF INSTALLATION AT THE LAKE SHORE PLANT OF THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

Four twin boiler units are being equipped for pulverized-fuel operation. Each unit consists of two class P-13 Stirling boilers fifty-five tubes wide, having a heating surface of 30,600 sq.ft. and operating at 250 lb. gage with 250 deg. superheat. B. & W. superheaters and twin Foster economizers are used.

The furnace depth is about 20 ft., the height 21 ft. and the flame length about 60 ft. The total installation of boiler unit and pulverized-fuel equipment occupies a section 114 ft. high and 104 ft. deep, of which the fuel-preparing plant is 114 ft. high and 57 ft. deep. The common combustion chamber for the two boiler sections is 32 ft. wide at the base, contracting to 18 ft. at the throat, and about 52 ft. is the height from bottom to top of boiler.

Crushers reduce the coal to about ¾-in. size, and it then goes to a Green coal bunker in the boiler room, from which it drops to the pulverizing mill in the basement. From the mill the fuel goes to the top of the boiler room, where fans and separators are installed, and thence by screw conveyors to the two bins which supply each boiler unit. The boilers are fired from each side of the common combustion chamber. The arrangement for this plant is particularly good as regards the location of the equipment.

Features of other stations are pointed out in Figs. 5, 6, 7, 8 and 9.

In addition to these stations, several others in process of construction will use pulverized fuel, but their design plans are not yet completed.

CONCLUSIONS

There may be a present tendency to overdo the installation of pulverized-fuel equipment, when the limitations of available data and available apparatus are taken into consideration; but another year should see a sufficient number of new and large installations in service

to afford more reliable data and correct answers to some of the present questions and also to give positive evidence as to the adequacy of the existing equipment for very large stations operating at high ratings. In the contemplated plants those in charge state that only some details of the mechanical features are questioned and that no great difficulty is to be expected in improving them when the plants start operation. Thus each new installation is a specific case and must be so treated by the engineers, and it would be incorrect to generalize at present from the existing experiences of any one company. But many very successful plants are in operation which show that pulverized-fuel burning is displaying its inherent possibilities for efficient utilization under boilers, and the introduction of this new type of fuel has stimulated interest in and the development of all types and kinds of combustion equipment. Pulverized-fuel burning is here to stay and adds a new tool for producing electrical energy efficiently and economically.

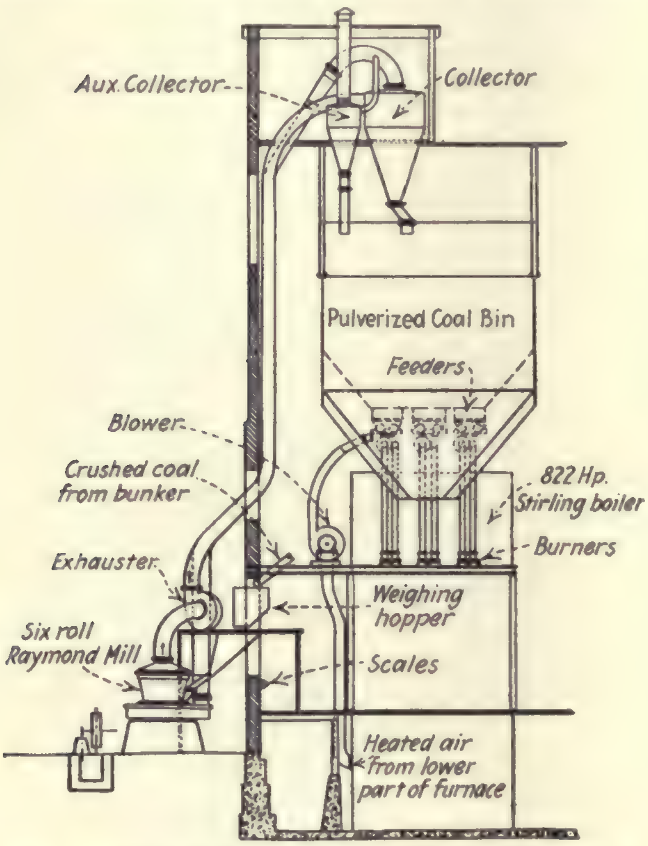

FIG. 10—ARRANGEMENT OF PULVERIZED-FUEL EQUIPMENT AT BRUNOT'S ISLAND PLANT

This experimental installation consists of a Class M-30 Stirling having 8,230 sq.ft. of heating surface, with a furnace 14 ft. 6 in. wide at the top and converging to 10 ft. in width at the bottom. Air-cooled side walls are used and secondary air is admitted through the front wall. Lopulco screw feeders take the coal from bins to the fan-tail burners, which are supplied with air from the side-wall air ducts by a motor-driven fan. Individual motors serve each of the three pairs of burners.

The furnace volume is 3,700 cu.ft., the height of the combustion chamber is about 36 ft. and the depth 15 ft., giving a flame length of about 45 ft. Water screens are used in the bottom of the chamber. The total height of the boiler installation is about 46 ft. and the depth 31 ft.

The pulverizer is a six-roll Raymond mill and delivers the coal by means of an exhauster to the overhead collector system. Driers are not used and the coal has a superficial moisture content of about 4 per cent with 2 per cent sulphur.

The experience with the installation has been very satisfactory, and curves ((Fig. 4) give test data on the plant. About 21 kw.-hr. per ton of coal pulverized is used by the installation. The experience with this installation has led to the adoption of pulverized fuel for the Colfax station.

Detailed Estimate of the Cost of Davis Bridge Development

Engineering Studies of Initial Installation of 32,000 Kva. Indicate Probable Over-All Expenditure of Nearly $9,000,000

ONE of the largest hydro-electric plants in the East is the Davis Bridge (Vt.) installation of the New England Power Company, situated on the upper Deerfield River a short distance above the Massachusetts-Vermont boundary. When completed, this station will exceed in capacity the combined Deerfield River plants at present in operation and will turn the flow of this stream into a virtually uniform volume. A comprehensive description of this project was published in the ELECTRICAL WORLD for June 16, 1923, page 1410. In connection with a recent petition to the Massachusetts Department of Public Utilities for authorization of a security issue, the company filed with the board one of the most detailed estimates of cost thus far presented to the commission in relation to a hydro-electric outlay, and this estimate is given here. To June 30, 1923, the company had expended about $4,350,000 of the estimated total of $8,816,903, and it is expected that the installation will be in operation in time to conserve the spring flow of 1924.

For an illustrated description of the Davis Bridge development the reader is referred to the article already mentioned, but, in order to enable the estimate to be more clearly visualized, the following résumé of the more important physical features of the development is presented:

The capacity of the present Deerfield River plants is 43,000 kw., that of the Davis Bridge development being 45,000 kw. The present yearly output of the Deerfield plants in operation is 144,000,000 kw.-hr., and the Davis Bridge development will effect a net increase of 136,000,000 kw.-hr. per year. The development includes the construction of a new reservoir of about 3.5 square miles area, having a capacity of 5,000,000,000 cu.ft. The mean operating head will be about 350 ft. and the reservoir will be about 10 miles long. The development involves the relocation of about 10 miles of the Hoosac Tunnel & Wilmington Railroad.

The dam will be 216 ft. high from the bottom of the cut-off trench, or 200 ft. above the original river bed. The maximum width up and down stream is 1,200 ft., this being the length along the top of the crest. The dam will contain 1,900,000 cu.yd. of earthfill.

A bypass tunnel handles the river flow during construction. This tunnel extends through the hill side on the east side of the river and is 22.5 ft. in diameter and about 1,500 ft. long. It is lined throughout with concrete of a minimum thickness of 2 ft. through the earth section at the upper end and a minimum thickness of 18 in. through the concrete section for the remainder of the tunnel. The tunnel is designed to carry a flood flow of 20,000 cu.ft. per second.

A circular type of spillway structure 160 ft. in diameter is provided, discharging into a vertical shaft 180 ft. deep and 22.5 ft. in diameter. The lower end of this shaft connects with the bypass tunnel, and the excavation for this spillway required the removal of 30,000 cu.ft. of ledge.

The flow of water through the power tunnel will be

controlled by an intake tower erected about 300 ft. upstream from the dam. This tower will be 125 ft. high and about 20 ft. in diameter, equipped with two valves in the base to control the flow of water. The power tunnel is to be 13,000 ft. long and 14 ft. in diameter, running in rock throughout. It will be lined with a minimum thickness of 6 in. of concrete. Near the tunnel outlet will be a plate steel surge tank 34 ft. in diameter and 184 ft. high. Plate steel penstocks 9 ft. in diameter will extend from the surge tank about 600 ft. down to the power house.

PLANT BUILDING SUFFICIENT FOR THREE UNITS

The power-plant building, 60 ft. x 110 ft. in plan, has a substructure of concrete built on ledge and a superstructure of brick and steel construction. The building is erected for three generating units, two of which are being installed at present. These units are of 19,500 hp. each, and each has a 16,000-kva. generator. Each wheel is controlled by a butterfly valve at the inlet in addition to a butterfly valve at the top of the penstock. The power-plant building incloses a low-tension bus structure, low-tension switches, switchboard, machine shop and office aside from the main generating floor. Erection is being handled by a 60-ton electrically operated crane also arranged to handle future repair work on the units and an installation of 110,000-volt transformers. It is planned to equip the generators for automatic synchronizing in view of the success of the automatic hydro-electric generating plant of the company lately completed at Searsburg, Vt. The 110,000-volt bus structure, with necessary switches, transformers and other equipment, is upstream from the power plant and about 100 ft. distant. The 60,000-volt bus and switches are similarly located downstream from the power plant.

ESTIMATE OF COST, DAVIS BRIDGE DEVELOPMENT

A—Local General	
Administration:	
Field superintendence—salaries and expenses	$45,000.00
Field office—salaries and expenses	40,700 00
Worcester office personnel in the field	15,200.00
Consulting engineers—services and expenses	2,000.00
Legal and right-of-way	15,300.00
Field engineering:	
Dam and appurtenances—salaries	49,500.00
Long tunnel and power house—salaries	35,240.00
Railroad relocation—salaries	24,780.00
Travel, hotel, automobiles and miscellaneous expenses	9,080.00
Camp buildings and equipment:	
Building	37,000 00
Equipment	18,650.00
Plumbing, sewer and water lines	11,350.00
Camp operation	4,000.00
Taxes, boiler and fire insurance	12,515.00
Liability insurance, premiums and hospital expense	16,000 00
Watching, lighting and guarding	8,500.00
Total, local general	$344,915.00
B—Construction Plant	
First cost	$40,000.00
Salvage value	* 25,000.00
Rentals	.....
Installation	6,000.00
Removal and storage	3,000.00
Maintenance and operation	20,000.00
Small tools	6,000.00
Total. construction plant	$50,000.00
Preliminary	
Investigations:	
Surveys	$46,376.94
Test pits	4,932.19
Borings	20,765.98
Lower power-house investigation	10,000.00
Clearing:	
Dam site, borrows and power house	5,808.70
Reservoir basin	35,000.00
Lumber operations	.....
Construction roads and bridges	13,000.00
Construction railroads and sidings:	
At dam	42,000.00
At power house	7,000.00
Highway changes	112,000.00
Relocation of Hoosac Tunnel & Wilmington Railroad:	
Acquisition of property—damage consideration	285,000.00
Switchback (1922)	41,500.00
Relocation of railroad—	
Local general	29,000.00
Plant	59,000.00
Preliminary	5,500.00
Grading	142,000 00
Trackage	104,000 00
Culverts, bridges and trestles	49,416 19
Freight and passenger depots, etc.	20,000 00
Removal of old line	*5,000.00
Transmission and telephone line changes:	
At dam and power house	6,625.00
Heath telephone line	10,375 00
Cemetery removal	4,500 00
Total, preliminary	$1,048,800.00
D—Dam	
Core-trench excavation	$67,500 00
Earthfill	1,254,000.00
Temporary diversion crib	$3,000.00
Miscellaneous	50,500.00
Total, dam	$1,375,000.00
E—Diversion Tunnel	
Construction of tunnel—contract	$404,250.00
Extra work on tunnel—outside contract	45,750.00
Total, diversion tunnel	$450,000.00
F—Spillway	
Earth excavation, rock excavation, and rockfill	$152,060.00
Concrete	127,260.00
Flashboards, control and spillway bridge	12,900.00
Tunnel closure and miscellaneous	36,980.00
Total, spillway	$329,200 00
FF—Penstock Excavation Cancellation	
Due to change in plans, necessitating cancellation of contract	$19,950.00
G—Gate House	
Earth excavation, rock excavation and backfill	$120,300.00
H—Pressure Tunnel	
Driving, trimming, concreting tunnel	$1,287,850.00
Special steel tunnel lining	18,304.00
Miscellaneous	3,846.00
Total, pressure tunnel	$1,310,000.00
J—Surge Tank and Tunnel Outlet	
Rock excavation	$21,000.00
Concrete	9,400.00
Steel tank	54,400.00
Steel-tunnel connection	6,600.00
Steel-tank connection	6,000.00
Steel breeching	15,500.00
Gates and flanges	27,000.00
Relief valves	3,000.00
Housing	25,000.00
Miscellaneous	13,100.00
Total, surge tank	$181,000.00
K—Penstocks	
Earth and rock excavation—concrete anchors, sills and reinforcing steel	$45,900.00
Backfill and steel railroad bridge	9,000.00
Penstock steel	55,600 00
Specials—Elbows, reducers, nozzles, manholes, flares, piping and miscellaneous	16,500.00
Total, penstocks	$127,000.00
L—Power House and Equipment	
Substructure—Excavation, foundations, concrete and reinforcing steel	$77,620 00
Auxiliary equipment in substructure—	
Air compressor, sump pump, miscellaneous, steel, etc	15,380.00
Superstructure—	
Brick building	86,000.00
Structural steel	24,000.00
Elevator, miscellaneous steel, etc	5,000.00
Machine-shop equipment	9,000.00
Crane	12,000.00
Inlet gates and accessories	24,000.00
Hydraulic equipment—	
Two 19,500-hp. hydraulic turbines and governors, with venturi, control panels, etc., unloaded and erected	$100,000 00
Electrical equipment (power house)—	
Two 16,000-kva., 360-r.p.m., 6,600-volt generators with exciters, together with motor-generator set (135-hp., 1,200-r.p.m., 2,300-volt motor and 90-kw., 1,200-r.p.m., 250-volt shunt-wound generator); main and auxiliary bus structures and equipment, with necessary power conduit and wiring; station-lighting apparatus, oil and water piping, telephones and equipment, operators' equipment and miscellaneous	270,660 00
Substations, outdoor—	
110,000-volt equipment—transformers, oil switches, arresters, etc., steel bus structures, high-tension wiring, etc.; 66,000-volt equipment—bus structures, oil switches, etc., control wiring, conduits, etc.	317,900 00
Siding to power house	12,810.00
Road to power house	7,190.00
Testing and starting	6,400.00
Grading and cleaning up	4,040.00
Total, power house and equipment	$972,000 00
M—Tailrace	
Excavation	$18,900 00
Riprap	3,100 00
Total, tailrace	$22,000 00
N—Transmission Lines and Contractors' Transformer	
Equipment at dam and power-house sites	$85,000.00
O—Operators' Quarters	
Six cottages, bachelor quarters, garage, storehouse, water supply, plumbing and sewer and grading	$45,360 00
Lands, flowage properties, right-of-way roads, farms, etc.—Necessary lands for additional flowage area on account of erection of so-called high dam, from elevation 1,385 to 1,400 around the entire basin, aggregating 400 acres, including the right to flood the paper and pulp mill properties at Mountain Mills, Vt.; land to be used for borrow pits; tunnel right-of-way for a distance of 12,500 ft. along the pressure-tunnel line; also the necessary acquisition of properties situated in the basin area to be flooded, together with lands acquired to close highways in and about the basin	$583,700 00
Surety bond premiums, commissions, etc., on account of guaranteeing fulfillment of various contracts, etc	66,900.00
Interest during construction, being interest on moneys expended for construction from the commencement of the work until the development is placed in operation	681,300.00
Contractors' expense (10 per cent) and engineering expense, 5 per cent	1,004,478 00
Estimated total cost of Davis Bridge development	$8,816,903.00

*Credited

Installation of Aerial Cables

Methods of Placing Cable in Position—Construction Equipment Used—Special Installation for Corners, Dead-Ends and Crossings—Protection of Cable and Provision for Future Extensions

By F. A. WESTBROOK
Formerly Field Engineer Habirshaw Electric Cable Company

THE methods of placing high-tension insulated aerial power cables on poles and holding them securely are naturally very much on the minds of engineers who are considering the use of this means of transmission and distribution. Although the practice is not a new one, it has, except in the case of a very few central-station companies, been employed for power work only here and there under special conditions. Now, however, more and more cases are arising where it is good engineering to use this type of construction, so that the methods employed by those companies which have already had experience in this direction furnish something definite to go by.

The Westchester Lighting Company is one of those which have installed a good deal of aerial cable in the past, and it is now doing a great deal more work of this kind. In this case it is interesting to note that one of the principal reasons for replacing open-wire circuits with cables, in addition to shade-tree and similar difficulties, is the greater freedom of cables from interruptions of service due to lightning storms. This has been demonstrated by experience.

The earlier cables used by the Westchester Lighting Company were of the varnished-cambric, steel-tape-armored type, but now this company is using paper-insulated, lead-sheathed cables, partly because of their superior electrical qualities and lower cost, but mainly because they can be taken down and installed in underground conduit in case such procedure should become advisable in the future.

Standard Installation Used

The aerial cables now placed are mostly three-conductor, 350,000-circ.mil, insulated for 13,200-volt transmission and protected with a lead-antimony sheath $\frac{1}{8}$ in. thick.

The messenger cable, consisting of 22,500 lb. galvanized-steel strand, is attached to poles by means of three-bolt clamps with studs passing through the center holes. When there are two cables, one on each side of the pole, a clamp is attached to each end of the through bolts. The poles are spaced about 100 ft. apart.

Blackburn galvanized-wire rings are used because they provide three points of support, which is desirable on account of the weight of the cables. The rings are spaced on 14-in. centers, but as they are 4 in. wide there is actually only a space of 10 in. from one end of a ring to the next. The grip of the rings, when properly placed on the messenger, is so tight that only an insignificant amount of slipping occurs while the cable is being pulled into place. Fig. 1 shows the two types of boatswain's chairs used for placing the rings. The end of the cable was prepared for pulling by sweating on a pulling eye placed over the conductors and wiping it to the lead sheath so as to prevent the entrance of moisture.

The cable was shipped on reels containing about 600

FIG. 1—TWO TYPES OF BOATSWAIN'S CHAIRS FOR PLACING CABLE RINGS

The steel support opens so that the runners can be placed over the messenger. The pulling rope is operated by means of a winch on a motor truck.

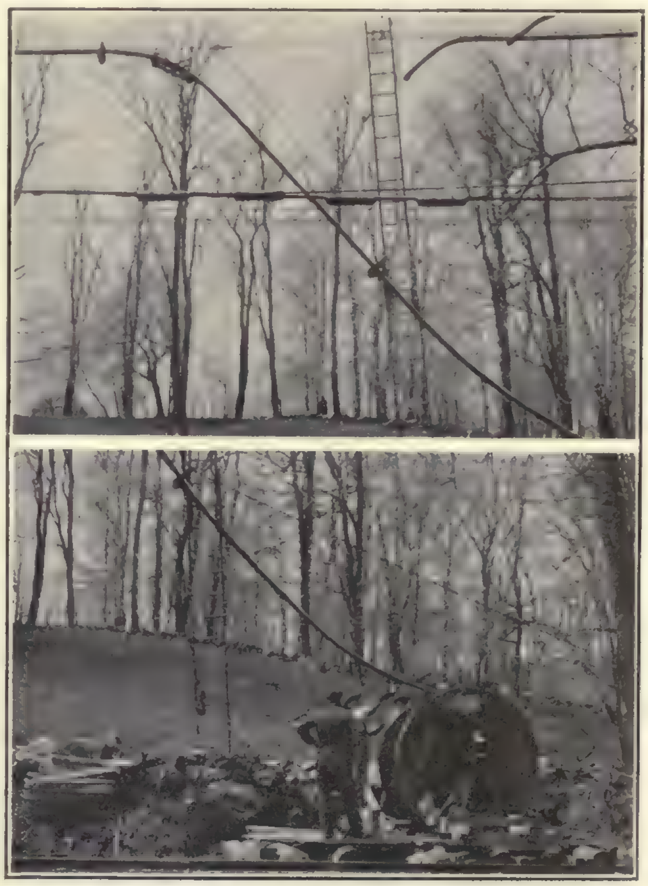

FIG. 2—CABLE IN PROCESS OF BEING PULLED

This shows how the cable is guided into the rings. The sheath is kept just as carefully greased as if it were going into conduit. Note the heavy rubber ducts which have been placed around the trolley feeders, carried on separate poles, to prevent injury to workmen and cables. A 4-ton cable reel trailer is now generally used in place of the temporary platform and jacks. This has been found much easier to use and affords a cheaper and faster method for handling the cable reels during the installation period.

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Typical Installations of Aerial Cables

Fig. 3—Cables are supported at each pole temporarily by means of rollers clamped to the messenger.

Fig. 4—Two parallel cables in place. The two upper cross-arms will be removed and the lower arm left for local distribution.

Fig. 5—Aërial cable installation on residential street where open wiring would be impracticable.

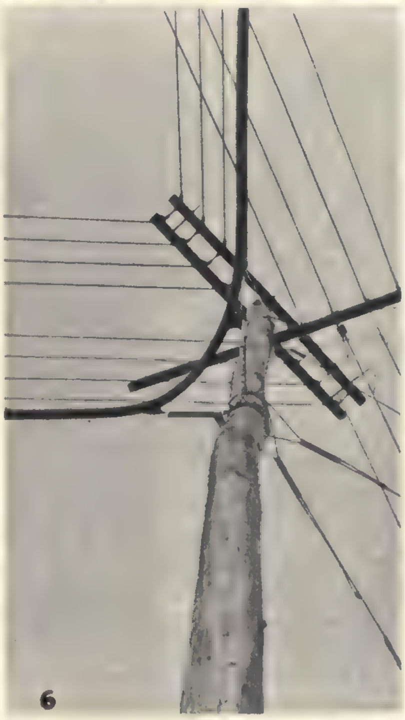
Fig. 6—At a right-angled turn the rings are reinforced by wrappings of marline and the messenger by an extra piece of steel strand passing around the pole.

Fig. 7—An important feature of guying on right-angle turns is to get the guys close to the messenger so that the pull of the cable will be taken by the guys instead of by the pole.

Fig. 8—Dead-end guying where aërial cable joins the underground system.

Fig. 9—Passing under a low railroad bridge, the cable is boarded.

Fig. 10—Open wires entering aërial cable at 13,200 volts. Note line guys used to compensate for the greater weight of the cable. Compression-chamber arresters adjacent to the cable terminal pole have given good service.



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10

ft., which was a convenient length to pull without putting a dangerous strain on the poles. The pulling rope, previously threaded through the rings and attached to the cable, is operated by means of a winch on a motor truck just exactly as in the case of installing underground cable.

PULLING THE CABLES

The details of the arrangements for setting up the reels and guiding the cable into the rings are shown in Fig. 2. An interesting detail for taking up the downward pull on the rings at the poles and to guide the cable smoothly over and around changes in angle is shown in Fig. 3. When preliminary precautions are well carried out there is no visible vibration of poles or messengers as the cable travels through the rings. It is altogether improbable that the steel-tape-armored type of cable could be installed with such ease, even if it could be pulled through rings at all.

Another very important feature of aerial cable construction is the matter of guying the line and attaching the messenger to the pole at dead-ends and turns. How this is done at a right-angle turn at a street corner is seen in Figs. 6 and 7, and at the dead-end in Fig. 8.

Sometimes in passing under a railway bridge, as in Fig. 9, it is necessary to bring the cable so low down that it is within reach of passers-by and subject to possible injury. In these cases, in order to protect both the cable and the public, it is boxed in with boards.

Fig. 10 shows how the open wires of a 13,200-volt circuit are brought into an aerial cable in a case where the latter is simply run from the substation for a few miles, through a road lined with trees impossible to trim, out to a point beyond which conditions are favorable for open-wire construction.

A gang of eighteen men, including splicers, linemen and helpers with their own truck and special equipment, has been trained particularly for work of this nature, which has resulted in a great improvement in efficiency in respect to both quantity and quality.

Water Powers of Czechoslovakia

FIVE new water-power stations have recently been completed or are nearing completion in Bohemia, according to reports issued by the Czechoslovak Ministry of Public Works and summarized by United States Consul Winans. The construction of these central hydro-electric plants was begun last year in connection with the government's plans for the electrification of this section of the republic. The power stations reported ready for operation are on the Jizera River, at Spalov, with a flow of 12 cu.m. per second and a yearly output of 11,000,000 kw.-hr., and on the Moldan River, near Latostice, with a flow of 9.48 cu.m. per second and an output of 6,900,000 kw.-hr. The other stations, in course of construction, are on the Zelivka River, near Humpolic, with an estimated output of 6,000,000 kw.-hr.; on the Cerna River, at Kaplice, with an estimated output of 5,600,000 kw.-hr., and on the Mze River, at Blahoust, with an estimated output of 1,700,000 kw.-hr. In addition to these projects, plans are being prepared for better utilization of the water powers of the Vydra, Kremelna and Sazava Rivers, and the government is considering schemes for the electrification of Russinia, which will include the construction of a dam on the River Uz.

Pertinent Facts About Mica*

Product Finds Its Principal Use in the Electrical Industry—Specifications, Classifications and Average Prices

BY OLIVER BOWLES
Mineral Technologist, United States Bureau of Mines

ABILITY to withstand heat and high electrical resistance have led to a wide application of sheet mica in the electrical industries. Mica has become so essential that some of the larger electrical companies own and operate their own mica mines, which, however, supply only a part of their requirements. One of the most important uses of electrical mica is for insulation between commutator segments, and its adaptability for such a purpose depends chiefly on its dielectric strength —that is, its ability to resist disruptive discharge due to difference in potential between the segments on either side of it. Only high-grade mica, free from iron impurities, pinholes or cracks, can be used for this purpose. A soft variety of mica is preferable, in order that the copper and mica may wear down evenly, and in this respect it is claimed that Canadian amber mica is superior to all others.

Practically all marketable mica is of the muscovite or phlogopite type. Biotite and chlorite are sold in pulverized form, but the amount thus used is so small that no further mention of it need be made. Mica falls generally into three classes—sheet mica, including punch; splittings, and scrap. Sheet mica is used chiefly for electrical purposes and for glazing; splittings are made into built-up mica, and scrap is ground to a powder.

SPECIFICATIONS OF MICA FOR ELECTRICAL USES

Mica to be classed as sheet must yield a rectangle of at least 1½ in. x 2 in., must split evenly and freely, be free from cracks, rulings or plications, and reasonably free from inclusions of foreign matter, though stains of a non-conducting character are permissible for some uses.

Thin films are used in vast numbers in condensers for magnetos and wireless apparatus. A high quality of mica is demanded for condenser use. It must be clear ruby, colorless or greenish, must split easily into smooth plates one-thousandth of an inch thick, and must be free from cracks, holes, stains, spots, wrinkles, rulings, air bubbles or knots in any form. Large sizes are not usually required, 1½-in. x 2-in. or 2-in. x 3-in. being those ordinarily used. For wireless outfits each film must be capable of withstanding 20,000 volts, while for magneto condensers a much lower electrical resistance is permissible.

As sheets in greatly diversified shapes, or as washers and tubes, mica is used extensively as an insulator in electric machines and in various fittings or appliances, in fuse boxes, insulators, electric heaters, flatirons and telephones. The highest grades of mica are required for condensers and spark plugs, but for uses where low-voltage currents are employed less perfect mica containing a limited amount of impurities may be employed.

Mica splittings consist of thin flakes split from the smaller sheets or from waste fragments. They are usually not less than 1 sq.in. in area, of irregular shape

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TABLE I—PERCENTAGES OF GROUND MICA USED IN VARIOUS APPLICATIONS

Patent roofing	60
Wall paper	21
Automobile tires	8
Fancy paints, concrete facing, Christmas tree "snow"	3
Molded electric insulation	3
Annealing, filling in rubber other than tires, printing, lithography and sizing cotton	3
Lubrication	2

and not more than one one-thousandth of an inch in thickness. They are used for the manufacture of built-up mica, consisting of the thin plates stuck together with shellac. Built-up mica is used chiefly for commutator segments and in various forms in generators, motors and transformers.

The invention of built-up mica marks one of the most important developments in the industry. Many hundred tons of splittings are used every year in making products that are quite satisfactory for many electrical purposes, thus filling a demand which it would be impossible for the world to supply with sheet mica at the present rate of production. The chief industries using sheet mica and splittings are manufacturers of electrical equipment, stoves, phonographs, lamp shades and chimneys. Ground mica is used by manufacturers of composition roofing, rubber products, wall paper and lubricants.

CONSUMPTION OF MICA BY COUNTRIES

There is little recovery of mica once used, and consquently consumption on an average is practically equivalent to production. No recent figures are available concerning consumption of mica by countries, but prior to 1914 the world consumption of sheet mica was estimated to be about 3,500 short tons per annum. The percentage consumed by each country was approximately as follows: United States, 49; Germany, 23; Great Britain, 11; India, 11; France, 3; Italy, 1½, and all other countries 1½. During recent years United States production has varied from 275 tons to 1,200 tons per year. Of sheet mica, not including punch, the United States produced in 1921 only about 20 per cent of its requirements, and consequently large quantities are imported.

The United States classification for mica is as follows: The lowest grade of sheet mica is designated as "punch." The uncut sheet must be of sufficient size to yield a circle 1½ in. in diameter if stained and 1¼ in. if clear. The next-size circle should provide a disk nearly 2 in. in diameter. The sizes of rectangular sheets vary from 1½ in. x 2 in. to 8 in. x 10 in. and larger, the exact sizes being those shown in the accompanying table giving the average prices of mica per pound paid at mine. When properly trimmed the uncut mica sheet is approximately one and one-half to two times as large as the maximum standard rectangle that may be cut from it. Each class includes the size designated and all larger sizes until the next class is reached. Thus, a sheet that would cut to a rectangle 3½ in. x 5½ in. or 3½ in. x 6 in. would be classed as 3 in. x 5 in.

TABLE II—AVERAGE PRICES PER POUND PAID AT MINES IN SOUTH FOR ROUGH-TRIMMED SHEET MICA OF GOOD QUALITY, SPLIT AND SORTED TO CUT TO SIZES INDICATED

Sizes (In Inches)	1915	1916	1917	1918	1919	1920	1921	1922*
Punch	$0.04	$0.05	$0.055	$0.07	$0.08	$0.10	$0.06	....
1½ x 2	0.20	0.30	0.40	0.55	0.55	0.51	0.35	$0.20
2 x 2	0.40	0.55	0.70	0.90	0.95	0.84	0.55	0.45
2 x 3	0.70	0.90	1.10	1.30	1.35	1.25	1.00	0.80
3 x 3	1.00	1.35	1.55	1.75	1.85	2.04	1.40	1.30
3 x 4	1.25	1.70	1.85	2.05	2.15	2.37	2.00	1.70
3 x 5	1.50	1.95	2.15	2.45	2.55	2.95	2.50	2.25
4 x 6	2.10	2.85	3.10	3.45	3.50	3.85	3.00	3.00
6 x 6	2.80	3.50	3.80	3.90	....	4.00	3.50	4.50
6 x 8	3.50	5.00	4.70	6.00	....	5.00	5.00	4.50
8 x 10	5.20	7.50	7.50	8.00	....	7.00	....	....

*Domestic mica, No. 1 quality, quoted in October, 1922, f.o.b. North Carolina

Requirements of mica for electrical purposes relate to dielectric strength, heat resistance and flexibility. All good mica is sufficiently resistant to heat for ordinary electrical equipment, and this quality is therefore rarely specified. Specifications for dielectric strength vary for different uses and with different consumers for similar uses. Navy Department specifications call for a dielectric strength not less than 25,000 volts for each 1/64 in. in thickness. Mica has such a high dielectric strength that failures most commonly occur in defective spots. It is very important therefore in selecting material where high dielectric strength is required that the mica shall have a careful visual examination so that all defective sheets may be rejected. A still better method is to pass over the surface a high-tension terminal of a vibrator-type ignition coil.

The pound is the unit on which the price of all mica is based, except finished condenser, diaphragm and radio sheets, which are sold by the thousand. The value is computed on the basis of quality and size of sheets, but prices vary considerably, as they are usually determined by individual bargaining rather than by fixed quotations. The abundance or shortage of any particular size has an important influence on the price paid.

As regards stability of prices, it may be noted that the sheet-mica industry is governed largely by activity in the electrical field. The price ordinarily paid for clear sheet mica is indicated in one of the accompanying tables, compiled by the United States Geological Survey. Grinding mica during the past year was quoted at $23 per ton delivered at a New Hampshire mill. The prices listed represent average conditions, but prices vary greatly for individual sales. The highest-priced foreign micas are those from India, South Africa, Brazil and Canada.

Mica is handled either by dealers who simply buy and sell or by manufacturers who work it up into finished forms that are sold to electrical companies or other consumers. Practically no mica passes directly from the producer to the consumer, though, as noted above, some of the larger electrical companies operate their own mines. The marketing of mica is so complex that the office of the intermediary concerns seems to be a necessity.

It is very important that every producer should know the dielectric strength of his product, the nature and detrimental effects of impurities or other defects, the sizes that are most in demand and standard classification by quality. Lack of knowledge and consequent lack of proper preparation of mine-run mica has tended to discourage development of domestic deposits, for, through poor classification and trimming, together with insufficient information on values, the producer is commonly forced to accept prices so low that active enterprise is discouraged.

A better standardized classification by quality would tend to protect the producer against degradation of his product, an element that greatly discourages domestic production. This practice may be due in part to poor preparation of the material offered for sale, but it is commonly due to looseness in classification, a loophole that works to the disadvantage of the producer.

Cost of Money to Utilities

Analysis of the Relationship Between Capitalization and Dividends and Influence of Different Classes of Securities—Who Pays the Cost of Money and How that Cost May Be Reduced

By C. T. CHENERY

CERTAIN costs of producing and distributing electrical energy are subjected to the closest analysis, and the most painstaking and minute investigations are made to clip a fraction of a mill from them. The cost of fuel belongs in this class. The reduction of almost each single B.t.u. from the previous number required to generate a kilowatt of energy has been the subject of a separate triumph.

On the other hand, the cost of money is at least as important as the cost of fuel. It takes, on the average, 40 kw.-hr. of steam-generated energy to produce one dollar of revenue, and 15 cents would be a high estimate of the amount expended for fuel out of each dollar of gross thus received by an electric utility; but 30 cents would be a low estimate of the amount expended, in the form of bond and note interest, preferred and common stock dividends for the rent of money. Yet, with the exception of the various features of the customer-ownership movement, discussion of this most important cost is conspicuous by its absence.

The reason perhaps is not difficult to discover. The utility business has drawn its officers and managers largely from the ranks of the engineering profession. The improvement of mechanical processes, the elimination of waste in the conversion of other forms of energy into electrical energy, the development of new fields of usefulness—these are the problems that absorb us. They are tangible things and offer a definite resistance to be overcome and a definite financial reward for doing so.

The cost of money, however, has been grouped among certain intangible costs and considered as a problem more or less set apart for solution by the directors and bankers of the company. Yet this cost of money is just as susceptible of being varied as is the cost of fuel, and the saving possible to be effected amounts to many times the savings that are indicated by other lines of research.

WHO PAYS COST OF MONEY?

Under commission regulation it is not of major importance to the revenue of a utility company (except in so far as its ability to obtain new business is affected) whether a pound and a half or four pounds of coal is used under its boilers to generate a kilowatt of energy, for unless the plant is demonstrably inefficient or badly managed, the cost of this fuel is a proper item of operating expense and as such, under the cost-plus method of rate regulation, is passed on to the public. Under this plan there is neither incentive nor reward for economical operation nor is there a penalty for uneconomical operation. The amount of the return allowed to a company is dependent almost entirely on the value of its property and has little to do with the quality of its management.

In addition to actual or estimated operating expenses, however, the rate is made up of an allowance for the depreciation of the property and a return which is expressed as a percentage of the value of the property, or rate base. This rate of return is supposed to cover the cost to the utility of the money which it has invested in the public service.

Thus the utility is in theory reimbursed at cost for all other expenses than the cost to it of money, and this expense is covered by a lump-sum allowance and theoretically is the source of profit or loss.

If the company is able to obtain its money at less than the 7 or 8 per cent allowed as a rate of return by the commission, such saving is profit to the company. If, however, the money costs the utility more than the rate allowed it, such difference represents a loss to the company.

INFLUENCES ON COST

The importance of this cost being apparent, it remains to be seen to what extent it can be varied. Consider first the matter of capitalization, and to be specific examine the "X" company which is capitalized as follows:

First mortgage 6 per cent bonds	$5,000,000
Preferred stock*	....
Common stock, 50,000 shares	5,000,000
Total capitalization	$10,000,000

*Five leading electric light and power companies have no preferred-stock issue.

The value of the company's property for rate-making purposes is $10,000,000. The company is permitted by the regulatory bodies to earn a return of 7½ per cent on the rate base in addition to (1) its operating expenses and (2) an allowance for depreciation.

The earnings available for common stock are as follows:

Net earnings, 7½ per cent on $10,000,000	$750,000
Deduct bond interest, 6 per cent on $5,000,000	300,000
Available for common stock	$450,000
Earnings per share of common stock (50,000 shares)	9 per cent

The capitalization above outlined is an excellent one from the viewpoint of strength, as the fixed charges of the company are very low and the capitalization is itself quite flexible in that it permits new securities of any desired class to be issued. It is not, however, the most advantageous capitalization from the standpoint of earnings on the common stock of the company.

It is almost an axiom, and can be verified by an inspection of almost any public utility quotation sheet, that the cost to utility companies of money obtained from various classes of security issues is least in the case of mortgage bonds. Then come collateral trust bonds, debenture bonds and preferred stock in the order named, and finally common stock, which is the most expensive of all.

It is also apparent that the fewer the shares of common stock which are issued, the fewer parts there will be into which to divide the final net earnings of the company and the higher will be the earnings for each share of common stock. As the common stockholder is the owner of the company, subject always to the priorities and preferences of ranking security holders, any action which increases the return to the common stockholder has the same effect as decreasing costs.

RESTRICTIONS ON SECURITIES

Let us examine the capitalization of the company, then, to see how we may vary its stocks and bonds to increase the earnings of the common stock holder.

As bonds represent the cheapest money securable, the first step is to determine the maximum amount of bonds issuable under the restrictions imposed by sound finance. The assumptions are made that further bonds may be issued at a cost to the company of 6 per cent and that 7½ per cent preferred stock may be sold at par.

The restrictions on the further issuance of bonds are two:

1. That the amount of the bond issue shall not exceed 75 per cent of the value of the property, or rate base.

2. That net earnings, exclusive of depreciation, shall amount to twice bond interest.

Restriction No. 1 limits the bond issue to 75 per cent of $10,000,000, which is $7,500,000.

Restriction No. 2, however, requires that net earnings, which are $750,000, shall be double the annual bond interest, thus limiting bond interest to $375,000. As the bonds bear interest at the rate of 6 per cent, the amount that may be issued under this restriction is $6,250,000.

The amount of the bond issue is therefore fixed at $6,250,000.

The restrictions governing the issue of preferred stock are:

3. There shall be an equity for each share of preferred stock of at least $150.

4. The preferred stock dividend shall be earned twice over.

In tabular form:

The value of the property is	$10,000,000
The bond issue is	6,250,000
The equity remaining for preferred stock is	$3,750,000
And the preferred stock issuable under Restriction No. 3 is	$2,500,000

Under Restriction No. 4 the preferred stock dividend must be earned twice.

The net earnings of the company are	$750,000
The bond interest is 6 per cent of $6,250,000	375,000
Earnings available for preferred and common stock	$375,000

The preferred-stock dividend of 7½ per cent must be earned twice. The amount of this dividend then cannot exceed one-half of $375,000, or $187,500. This limits the preferred stock issue to $2,500,000.

LOW COST RATIOS

The suggested capitalization then is as follows:

First mortgage 6 per cent bonds	$6,250,000
7½ per cent preferred stock	2,500,000
Common stock	1,250,000
Total	$10,000,000

The earnings for the common stock would be as follows:

Net earnings of company, exclusive of depreciation		$750,000
Bond interest, 6 per cent on $6,250,000	$375,000	
Preferred stock dividend, 7½ per cent on $2,500,000	187,500	
		562,500
Available for common stock (12,500 shares)		$197,500
Earnings per share		$15.80

Thus with the same net earnings it has been shown to be possible to increase the common stock dividends from the then earnings of 9 per cent to 15.8 per cent by merely changing the make-up of the company's capitalization.

It may be urged that the percentage of common stock herein set forth is too low for safety, and with that conclusion the writer has no quarrel. He has merely set it up as being the minimum permissible under the condition outlined.

Consider, however, the conservative capitalization of:

First mortgage bonds	$6,250,000
7½ per cent preferred stock	1,875,000
Common stock	1,875,000
Total	$10,000,000

Then the earnings available for common stock are as follows:

Net earnings of company		$750,000
Deduct bond interest, 6 per cent on $6,250,000	$375,000	
Preferred stock dividend, 7½ per cent on $1,875,000	140,625	
		515,625
Available for common stock (18,750 shares)		$235,375
Earnings per share		$12.56

Even on this basis the earnings on the common stock can be increased by more than a third, or from 9 per cent to 12.56 per cent.

A composite balanced sheet of fifteen important electric light and power companies shows the following:

Combined plant account	$1,169,436,270
Funded debt outstanding	$574,376,000
Preferred stock	122,276,000
Common stock	401,496,000
Capitalization	$1,098,148,000

or reduced to percentages: Funded debt, 52.3; preferred stock, 11.1; common stock, 36.6.

The result of operations of these fifteen companies for the year 1922 was as follows:

		Per Cent of Gross
Gross earnings	$232,713,619	...
Net earnings	100,635,806	43.2
Depreciation	19,653,619	8.5
Available for fixed charges	$80,982,187	...
Fixed charges	35,189,664	15.1
Available for dividends and surplus	$45,792,523	19.7
Preferred stock dividends	8,988,357	...
Available for common stock	$36,804,166	...
Common stock outstanding	$401,495,950	
Earnings per share of common stock	9.16 per cent	

Let there now be substituted for the present capitalization of these companies a new capitalization made up of funded debt, 60 per cent; preferred stock, 20 per cent, and common stock, 20 per cent, and use the same cost of money which the companies are now paying. At present the companies have a funded debt of $574,376,000, which costs them $35,189,664 yearly, equivalent to 6.126 per cent, and preferred stock, $122,276,000, which costs them $8,988,357 yearly, equivalent to 7.351 per cent. The suggested new capitalization then is

Funded debt, 60 per cent of $1,098,000	$658,889,000
Preferred stock, 20 per cent of $1,098,148,000	219,629,500
Common stock, 20 per cent of $1,098,148,000	219,629,500
Total	$1,098,148,000

The earnings for the common stock under the suggested capitalization would be as follows:

Net income available after depreciation	$80,982,187
Deduct funded debt interest, 6.126 per cent on $658,889,000	40,363,540
Available for dividends and surplus	$40,618,647
Deduct preferred stock dividends, 7.351 per cent on $219,629,500	16,144,965
Available for common stock	$24,473,682
Shares outstanding	2,196,295
Earnings per share	11.14 per cent

Again it appears to be possible to make a large increase in the return to the common stockholder by substituting a different capitalization. In the present case for the combined companies it seems to be practicable to raise the earnings of the common stockholders from 9.16 per cent to 11.14 per cent, an increase of 23.4 per cent. The new capitalization, while not so strong as the one it displaces, would certainly meet the tests which bankers normally apply.

This calculation is based on the assumption that the books of public utility companies correctly reflect the present fair value of their properties and that a valuation, for rate-making or security-issuing purposes, would establish values in harmony therewith. This assumption in times past might well have been considered unwarranted; however, the trend of recent Supreme Court decisions in valuation matters and the favorable outcome of the valuation of the steam railroads by the Interstate Commerce Commission would appear to justify it.

No Universal Formula for Determining Capitalization

The whole subject of capitalization and cost of money is one of the utmost importance to the utility companies and one which should return handsome rewards for work done. It will never be possible to reduce capitalization to a formula, for the problems involved call for individual solution; but it should be possible to point out certain definite limits and indicate some of the more obvious mistakes which have been made in the past.

That there is need for such work is evidenced by the commonly accepted belief that there are not ten holding or operating companies in the field with a sufficiently flexible financial structure and sufficient credit facilities to permit of the full expansion of their business as opportunities present themselves. Yet such flexibility is a fundamental requirement if better service is to be rendered.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Comparison of Plain-Break and Explosion-Chamber Breakers

To the Editors of the ELECTRICAL WORLD:

I have noted with interest the reprint of the paper presented before the South African Institute of Electrical Engineers in your issue of July 28. This article discussed the action of plain-break and explosion-chamber types of oil circuit breakers. Without entering into a theoretical discussion of the action which takes place in the breaker, it may be interesting and illuminating to show a few oscillograms and plots of observations

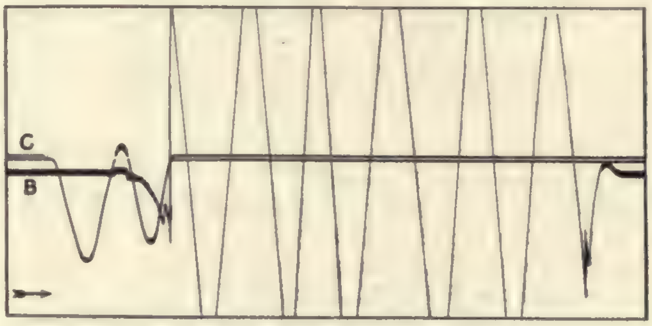
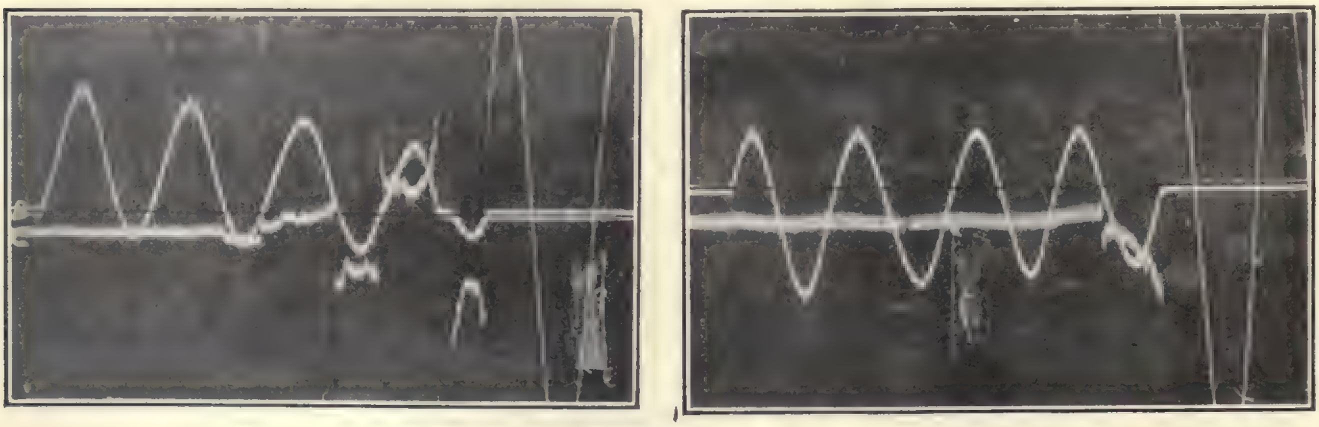


FIG. 1—EXPLOSION-CHAMBER BREAKER INTERRUPTING 10,000 AMP.

from actual tests made upon the two types of breakers with the large testing generator of the General Electric Company at its Schenectady plant.

Each series of tests was made in the same breaker structure, with the same operating mechanism, operating at as near the same no-load speed, current, voltage and circuit conditions as it was possible to obtain. The only difference was that in one case a plain break and in the companion case an explosion chamber was used. In short, the conditions under which the comparative tests were made were as nearly identical as it was possible to make them.

Comparison of the arc-rupturing abilities of a plain-break breaker and an explosion-chamber breaker interrupting approximately 5,000 amp. under the same conditions are afforded by Figs. 2 and 3. The arc



FIGS. 2 AND 3—PERFORMANCE OF PLAIN-BREAK AND EXPLOSION-CHAMBER BREAKERS INTERRUPTING 5,000 AMP. UNDER SIMILAR CONDITIONS

duration, namely, six half cycles for the plain break and two half cycles for the explosion chamber, indicate in a way the efficiencies of the two breakers. The current interrupted in the case of the plain-break breaker was all it could safely stand as determined by oil throw and bulging of the tank. Performance of the same explosion-chamber breakers, interrupting approximately 10,000 amp. under identical conditions with the 5,000-amp. test, is shown in Fig. 1. This duty was accomplished with signs of less distress than was manifest with 5,000 amp. and plain-break contacts. The superiority of the explosion-chamber construction is clearly shown by the tests to which allusion has just been made.

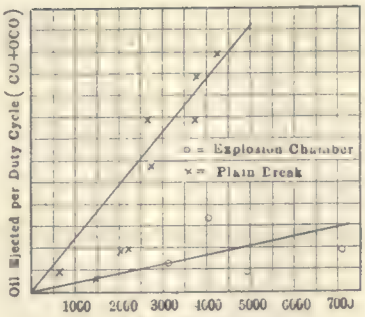


FIG. 4—OIL EJECTED PER DUTY CYCLE PER R.M.S. CURRENT IN ARC

The speed characteristics of the plain-break and explosion-chamber breakers are illustrated by Fig. 5. These breakers are the same as those whose curves are shown in Fig. 1 and had the same no-load speed. The superiority of the explosion chamber is indicated by its increased speed acceleration with the increases of current interrupted.

The arc lengths in the plain-break and explosion-chamber breakers are indicated in Fig. 6. The plain-break breaker test was limited to the current value indicated because the arc frequently held to the end of the stroke at that value, while with the explosion chamber there was no such limitation and the circuit was always satisfactorily interrupted up to the limit of our generating capacity at the test voltage.

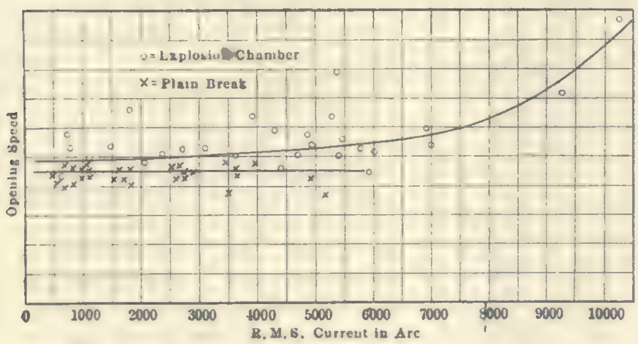


FIG. 5—SPEED CHARACTERISTICS OF PLAIN AND EXPLOSION-CHAMBER BREAKERS

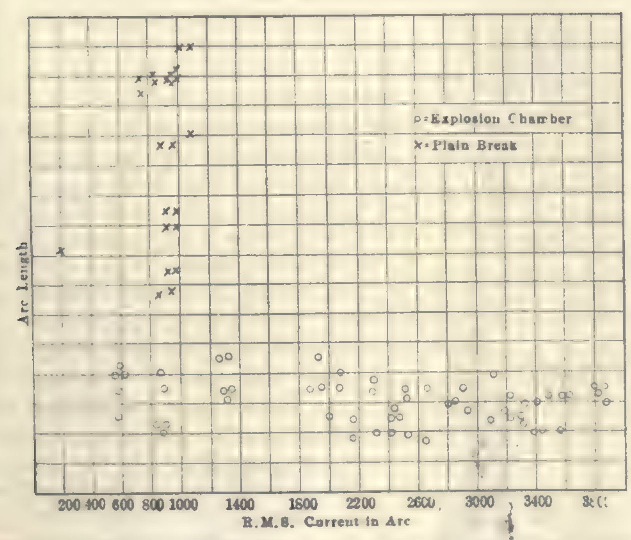


FIG. 6—ARC LENGTHS MAINTAINED IN TWO TYPES OF BREAKERS

The quantity of oil ejected from one of the old-style breakers, which were not especially built to prevent oil throw, is an indication of the efficiency of the breaker's internal construction. Such a comparison is shown in Fig. 4. Here also the marked superiority of the explosion chamber over the plain-break construction is shown because the oil throw is an indication of the quantity of gas generated and, therefore, of the stress to which the oil tank is subjected.

In general, the conclusions arrived at by Mr. Price, as a result of his work in Africa, were demonstrated some time ago as facts by exhaustive tests made at Schenectady. Observations from the several thousand short circuits made have been plotted, and the deductions drawn are from the most severe results observed. This is important, as the severity of an *individual* interruption in a series of tests made under identical conditions may vary from no arc at the contact points to a severe explosion. It is only by making many tests that the most severe conditions obtainable can be observed, and it is this severe condition which must determine the absolutely safe interrupting capacity rating of a breaker.

J. D. HILLIARD,
General Electric Company, Switchboard Department.
Schenectady, N. Y.

Seeking Information on the Carrying Capacity of Conduit Circuits in Mines

To the Editors of the ELECTRICAL WORLD:

There are considerable available data on the heating of lead-covered cables, and the temperature of a wire in air can be figured with a reasonable degree of closeness. I have been unable, however, to find data on rubber-covered, double-braided conductors in conduit. For many installations a knowledge of the exact temperature limitations is very valuable, and yet I have been unable to find any reliable information on the subject.

Knowing the ambient temperature, I should like to be able to figure the temperature of the conductor and insulation, using the heat generated per unit length of wire as a basis. Naturally the conductors do not fill the conduit and therefore will lie on the bottom, which condition may be taken care of by mathematical means or by the introduction of experimental constants. The greatest question seems to me to be, What is the action of the body of air within the pipe? How much convection of heat exists?

I have been unable to conduct any tests personally, but the matter seems to be one for experimental determination. Figuring the body of air within the pipe as motionless gives results which are found entirely too high.

As a problem assume three No. 1/0 B. & S. gage rubber-covered, double-braided copper conductors, each carrying 200 amp. This means that when the temperature of the copper is constant 11.81 watts must be dissipated for each foot of length. With the conduit surrounded by air at 65 deg. F., what is the temperature of the copper?

B. K. SHANER.
Frackville, Pa.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

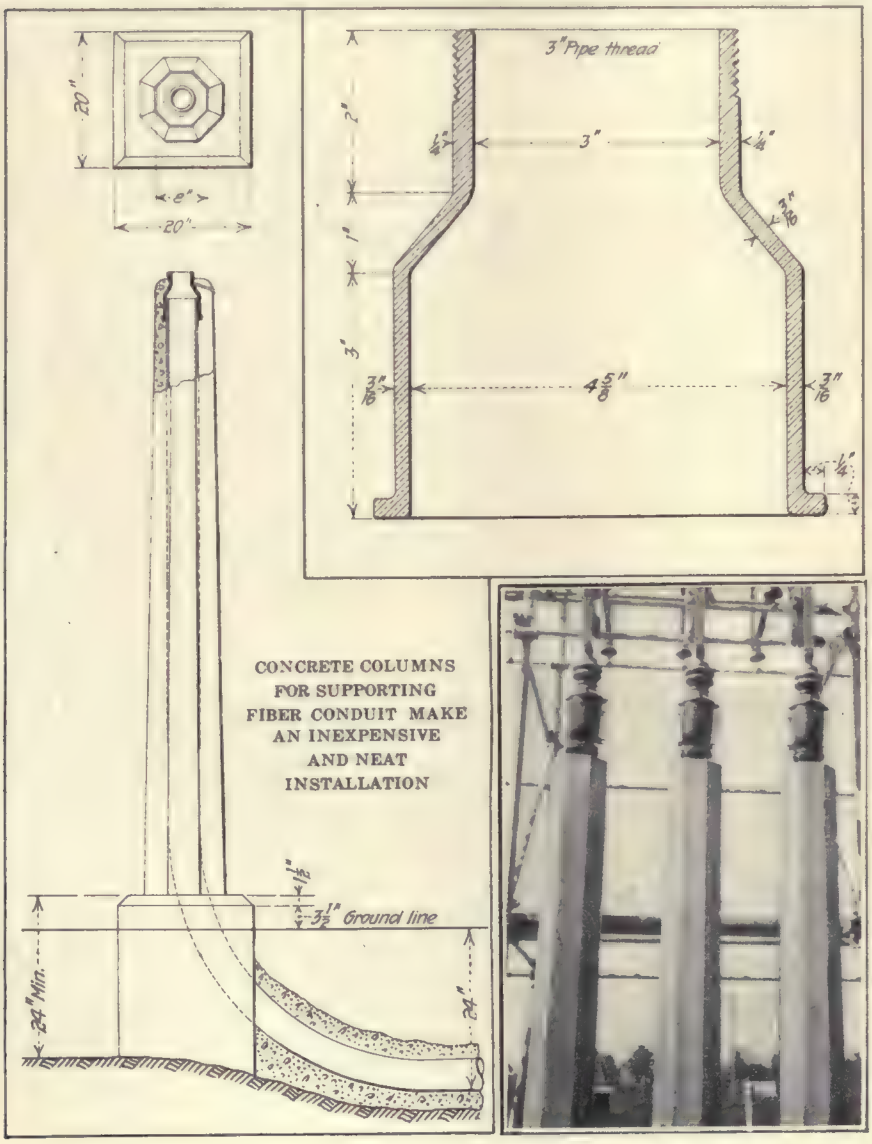
Supporting Fiber Conduit and Potheads with Concrete Columns

By C. E. Schnell

Designing Electrical Engineer San Joaquin Light & Power Corporation, Fresno, Cal.

Concrete columns were found to be the cheapest and most satisfactory support for the fiber conduit and cable potheads at the new California Avenue substation of the San Joaquin Light & Power Corporation at Fresno, Cal. Lead-covered 18,000-volt cables were used to carry the incoming and outgoing 12,000-volt circuits from the substation building to the outdoor bus and switching rack.

Iron conduit could not be used because some of the cable was 600,000 circ.mill single conductor, and accordingly fiber conduit was used for this as well as the three-conductor cable. The fiber conduit was cast in concrete columns as shown. A pothead flange was placed at the top of each column at the time of pouring the concrete. These were made of brass for the single-conductor cables and of cast iron for the three-conductor cables. On the top of each flange a standard 3-in. pipe thread was cut, and a ¼-in. pipe was threaded into the side and projected out through the concrete to ventilate the duct. Collapsible forms were used in pouring the thirty columns required. Actual installation of cables and potheads has shown this method of supporting fiber duct to be very satisfactory both as to cost and appearance.



CONCRETE COLUMNS FOR SUPPORTING FIBER CONDUIT MAKE AN INEXPENSIVE AND NEAT INSTALLATION

Accidental Grounds Located with Telephone Receiver

By T. W. Snell

General Superintendent Coast Valleys Gas & Electric Company, Salinas, Cal.

For locating accidental grounds on its secondary distribution system the Coast Valleys Gas & Electric Company uses an ordinary telephone receiver and telephone induction coil. Where local or state rules require the grounding of distribution transformer secondary neutrals, trouble is often experienced with accidental grounds which occur on the outside, or "hot legs" to ground. If the ground at the transformer is not in good shape, these accidental grounds frequently prove of lower resistance than the permanent ground, with the result that the wire leading down the transformer pole and the ground pipe or rod are raised to nearly 110 volts above ground potential.

If the induction coil is held at right angles and near to a wire carrying alternating current, a distinct humming is heard in the telephone receiver. The procedure is to disconnect the transformer ground, and while a man is opening and closing this connection at regular intervals a lineman climbs the pole and listens on each outside wire. The leg which is carrying the ground current can be easily determined by the intermittent buzzing in the telephone receiver. By following this wire and listening in every few poles the service which is grounded can be quickly located. By opening and closing the ground connection at the transformer pole at regular intervals the ground current can be easily distinguished from whatever load current the line may be carrying by the intermittent buzzing just alluded to.

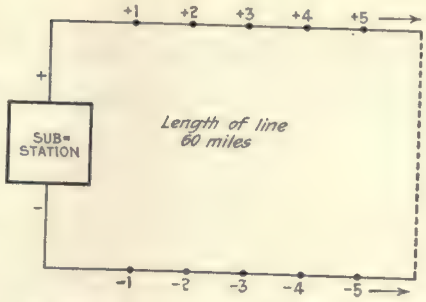
"Shooting" Trouble on Lighting Circuits

ON LONG series circuits a great amount of delay in finding trouble spots, such as grounds, often occurs. The Detroit Edison Company has worked out a scheme that applies to such series circuits. One of the company's lighting circuits is 60 miles around. This circuit uses 100-cp. lamps, and it would normally require eight hours to ten hours to patrol the circuit in order to locate a ground.

The method used is to number each lamp around the loop, as shown in the illustration, and record on a card these numbers and also the normal voltage drop, with an allowance for line loss, opposite each number. As an example, if there are 250 lamps:

+ 1 = 70 volts,	— 1 = 70 volts,
+ 2 = 139 volts,	— 2 = 139 volts,
+ 3 = 208 volts, etc.	— 3 = 208 volts, etc.

For normal operation the total voltage might add to say 4,356 in either direction. If a ground occurs, the transformer is set in the normal position at the substation, and if the measured voltage from side to ground is, for example, 2,320 volts, the card record would show this to be lamp number + 42. If the same measurements are made on the — side and reading is 2,042, for example, the card shows this to indicate lamp — 43. The trouble should be at lamp 42 or 43, and experience with the system has shown that the ground on the circuit is usually to be found within a distance of three lamps.



LOCATING GROUND ON STREET LIGHTING BY TAKING VOLTAGE READINGS

Extracts from an Operating Code*

Repairing and Inspecting Storage Batteries

THE principal causes of low voltages and specific gravity in individual cells are sulphation and short-circuiting. Sulphation is indicated by very low voltage (1.95 volts on floating battery, 1.3 volts or lower on discharge), very low specific gravity (0.030 or more lower than the normal value) and marked change in color of both plates (usually to a very light brown on the positive plate and to a very light gray on the negative plate). A short circuit is accompanied by similar low voltage, but not by marked lowering of the specific gravity unless it is long continued. The color of the plates in a short-circuited cell tends to become the same on both positive and negative plates. Sulphation is usually caused by excessive discharge, by leaving the battery too long in a discharged condition or by insufficient charging.

Treatment for Cells Whose Voltage or Specific Gravity Are Seriously Low

1. When the plates of a cell become sulphated cut the cell out of service; substitute water for the electrolyte.

2. Charge the cell until there is no further increases in specific gravity.

3. If the sulphation is so deep as not to have been all removed by this operation, again substitute water for the electrolyte.

4. Charge the cell until there is no further increase in specific gravity.

5. Repeat this operation as often as may be necessary to remove the sulphation.

6. Bring up the specific gravity to the normal value by adding acid.

7. If the plates of a cell become short-circuited owing to bulging of the active material or foreign material between the plates, scrape the plates well with a stick. Remove the deposited material from the bottom of the jar.

8. If the plates of a cell become short-circuited owing to buckling, remove them from the cell and straighten them.

When scraping battery plates of accumulated materials a wooden stick should be used to avoid short-circuiting the plates. Owing to the considerable amount of moisture given off by a battery the humidity in the battery room is very high and condensation occurs upon most objects, especially metal. This being acid in character causes corrosion of metal and also attacks the woodwork. Consequently acid-proof paint should be applied where possible, and vaseline should be used on parts such as connections between cells. Boiled linseed oil is also a good acid and moisture resistant for application to wood. Detailed instructions for cleaning and inspecting batteries follow:

Cleaning and Inspection

1. Wipe off glass covers, jars or tanks and all supporting insulation.
2. Keep the trays dry and clean.
3. After cleaning the wood tanks wipe them with a cloth saturated with boiled linseed oil.
4. Make sure that the overhanging lead on lead-lined tanks is pulled away from the sides of the tanks so that condensation will drop to the floor and not run down the sides of the tanks.
5. Coat the inside of the glass jars with vaseline about ½ in. down from the top.
6. Copper busbars and any other metal, except the connection between cells, which are exposed to acid fumes must be coated with acid-proof paint.
7. Wooden racks should have the same treatment.
8. The connections between cells should have a light coat of vaseline.
9. Wash the racks and the floor occasionally with bicarbonate of soda to prevent damage from acid.
10. Inspect the cells frequently for sulphation and internal short-circuits.
11. Keep all material from bridging the space between the plates or building up on the bottom of the jar or tank. A wooden stick passed between the plates and scraped over the bottom of the jar or tank will prevent a dangerous accumulation of such material. Never use a piece of metal for this purpose.
12. Fill the automatic pilot cell filler as often as is necessary to replace evaporation.

Instructions for Operating Air Pumps

FOR evacuating a condenser an air ejector is first used because it will handle a considerable volume of air against low vacuum. When 10 in. to 15 in. of vacuum is obtained by the ejector the air pump is brought into service since it will handle a smaller quantity of air against a high vacuum much more efficiently. To seal the bearings properly against the admission of air, water is used in the packing glands, which is discharged with the regular discharge of the pumps.

Starting Air Pumps

1. Admit water to seals of pump.
2. Open the hurling water-suction valve until the desired pressure is reached.
3. Start the air pump at low speed.
4. See that the oil rings on all bearings are revolving.
5. Bring the air pump to normal speed and note the vacuum produced by the air pump.
6. Open the air-suction valve slowly.

Shutting Down

1. Close the air-suction valve.
2. Stop the pumps.
3. Shut off the water from the seals.
4. Close the hurling water-suction valve after the pump has come to rest.

*Abstracted from the operating code of the Philadelphia Electric Company.

Comparison of Properties of Hard Rubber, Vulcanized Fiber and Laminated and Molded Phenolic Insulating Materials

Properties	Hard Rubber	Vulcanized Fiber	Phenolic Insulating Materials	
			Laminated	Molded
Surface restivity at 50 per cent relative humidity, ohms	10^{12} to $>10^{15}$		10^{11}	10^{11}
Phase difference (ψ) at radio frequencies, degrees	0.5	3.0 to.	1.5 to 4.0	1.5 to 4.0
Dielectric constant (K) at radio requencies	3.0	5.0	4.5 to 6.0	5.0 to 7.5
Dielectric strength (volts mm.)	10,000 to 38,000	9,00 to 16,000	27,000 to 45,000	9,000 to 40,000
Tensile strength (lb in.^{2})	3,500 to 6,500	9,000 to 20,000	10,000 to 25,000	3,500 to 7,000
Water absorbed in 24 hours, percentage by weight	0.02	26 to 45	0.2 to 1.0	0.05 to 0.2
Density (g cm^3)	1.12 to 1.40	1.3 to 1.5	1.3 to 1.4	1.3 to 1.4
Thermal expansivity (at 20 deg to 60 deg C.)	60 to 80×10^{-6}	27×10^{-6}	20 to 30×10^{-6}	25 to 45×10^{-6}
Effect of age	Deteriorates slowly, but if properly vulcanized and protected from the light it is not affected	Improves in quality by seasoning	Improves	No depreciation in physical or chemical properties; slight increase in hardness
Heat	At 65.5 deg. C. (150 deg F.) pure hard rubber softens perceptibly, at 100 deg. C. (212 deg F.) it is so soft it may be bent easily; at 115.5 deg C (240 deg F) it becomes leathery and may readily be cut with a knife; melts at 200 deg. C. (392 deg F.)	Will not melt under any circumstances; not readily inflammable; at very high temperature chars and becomes brittle; active combustion begins at about 343 deg. C. (650 deg F)	Not readily inflammable; will withstand continuously a temperature of 149 deg. C. (300 deg. F.); heat tends to complete the reaction and volatile substances are driven off; hence, when cooled it shrinks considerably and may split; shrinks and loses in weight above 60 deg. C.	See statement for laminated materials
Moist air	Hard-rubber compounds excepting those containing organic substances other than rubber are practically moisture-proof	Absorbs water freely, but without permanent injury; while saturated it becomes soft and flexible and swells; warps and twists upon drying	Absorbs slight amount of water, reducing dielectric properties	Absorbs slight amount of water, reducing dielectric properties
Steam	The only effect is that due to the high temperature	Same as above, except absorption is more rapid	Best grades not affected beyond slight absorption of moisture; after a few days in steam the cheaper grades will swell appreciably and split; superheated steam tends to warp and blister all grades of the material	Absorbs a slight amount of moisture; if steam is superheated, the high temperature will cause decomposition.
Solvents:				
Acetone	Attacks dissolving oils and free sulphur	No permanent effect	No effect	No effect
Alcohol	Attacks to a slight degree	No permanent effect	No effect	No effect
Ammonia	No effect	No permanent effect	Strong solutions may cause material to swell	No effect other than slight absorption of moisture
Analine	Softens it at ordinary temperature	Not known	Probably no effect	Probably no effect
Benzol	Softens it at ordinary temperature	No permanent effect	Probably no effect	Probably no effect
Carbon bisulphide	Dissolves small amount of hard rubber and any free sulphur	No permanent effect	Probably no effect	Probably no effect
Ether	Dissolves small amount of hard rubber and any free sulphur	No permanent effect	No effect	Probably no effect
Naphtha	Softens and swells to slight extent	No permanent effect	Probably no effect	Probably no effect
Oil of turpentine	Dissolves in boiling oil	No permanent effect	Probably no effect	Probably no effect
Oil:				
Mineral	Slight softening	Slight absorption	Practically impervious	Practically impervious
Organic	Unaffected	Slight absorption	Practically impervious	Practically impervious
Effect of weak acids	Unaffected	Swells due to absorbed water; may be attacked after some time	Practically unaffected except for absorption of water	Practically unaffected
Weak caustic alkalis	Unaffected	Swells due to absorbed water; may be attacked after some time	Does not successfully resist the action of alkali unless very dilute	Does not successfully resist the action of alkali unless very dilute
Stronger acids (HNO_3, HCl, H_2SO_4)	Not attacked by concentrated hydrochloric, hydrofluoric, acetic acids; not attacked by sulphuric acid of less than 1.53 specific gravity or nitric acid of less than 1.12 specific gravity	Cellulose fiber attacked; soon decomposes	Decomposes; rapidity depends on specific gravity and temperature of acid	Decomposes; rapidity depends on specific gravity and temperature of acid
Stronger caustic alkalis	No effect	Cellulose fiber attacked; soon decomposes	Binder and filler decompose	Completely destroys; speed of the reaction depends on the strength of the solution
Ozone	Oxidises and soon ruins it for electrical purposes	No effect	Not known	Not known
Metallic inserts	Rapidly deteriorated by contact with iron or copper, the metals themselves being corroded; the inserts should be coated with tin, paper, unvulcanized rubber or other mutually protecting medium	No effect	No effect	No effect
Machining qualities	Admits of a high polish; machines less accurately than would be supposed, due to great resiliency; the better the grade the more readily it is machined; quality may be judged roughly by color and texture, toughness, color and grain of a shaving; has tendency to warp; can be molded but not accurately to size	Admits of a fine finish; may be sawed, punched, drilled, stamped, embossed, turned, planed, bent, tapped; tough, resists shock; cannot be molded	Admits of a good polish; can be sawed, punched, drilled, stamped, turned, planed, knurled, embossed, milled, tapped either with or against the grain, though not as easily as hard rubber and vulcanized fiber; tough, resists shock; can not be molded	Admits of a fine lasting polish; can be machined, cut, filed, sawed with difficulty; can be molded accurately to size; quite brittle
Cost	About \$2 per pound in sheet form	50 to 80 cents per pound up to 1 in. in thickness; about \$5 per pound for 2 in. in thickness	About \$1 per pound	Cost varies with complexity of steel molds

Résumé of the Properties of Electrical Insulating Materials

A COMPARATIVE summary of the properties of hard rubber, vulcanized fiber and laminated and molded phenolic insulated materials is given in the table on page 544. This is based upon the results of many investigations and the experience of many users and manufacturers and has been compiled by J. H. Dellinger and J. L. Preston of the Bureau of Standards and brought together with other information on these materials in *Technologic Paper No.* 216 of the Bureau of Standards. Some of their observations follow.

The problem of the proper use of the proper insulating material has been at once facilitated and complicated by the advent of the laminated and molded phenolic materials. These materials lend themselves to many uses not satisfactorily filled by either hard rubber or vulcanized fiber, but they are likewise used where hard rubber or fiber might better be used. The phenolic insulating materials are for many purposes not hard-rubber substitutes. They are distinctly different. It is evident that the idea of phenolic insulating materials as a hard-rubber substitute has been overworked. This tendency may well be explained on the ground that the phenolic insulating materials are really quite new and yet in a state of development. Engineers have turned to this new material but have found little data at hand to direct them in its use.

The several makes and many grades of laminated phenolic insulating material are discussed quite fully in the paper. It is evident that any numerical value or statement given in the table is an approximation.

The molded phenolic insulating materials are subject to as many variations as hard rubber. There is probably not so much variation in the phenolic resin binder in the molded phenolic materials as there is in the crude or reclaimed rubber binder of hard rubber. There are many other chances for variation in the press pressure and temperature, length of curing in the presses and kind and quality of filler.

Most of the numerical data given are from tests made at the Bureau of Standards. The statements concerning the effects of various factors on the different insulating materials are based on the experience of various members of the Bureau of Standards staff and upon the experience of the manufacturers of these materials. The manufacturers' experience with hard rubber and vulcanized fiber extends over many years, while the experience with the phenolic insulating materials is much more limited.

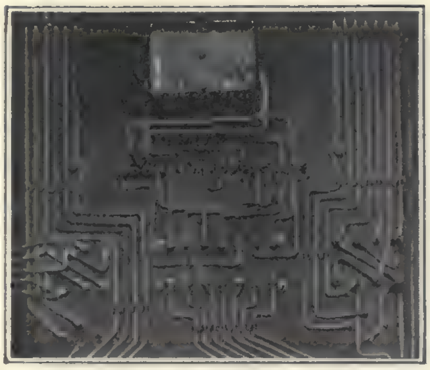
While it is possible to make up insulating materials which would give results different from those recorded for any particular property, yet it is believed that this table gives information in a condensed form which will serve to show some of the limitations as well as some of the possibilities of these various materials as now obtainable commercially.

Reactive Component Meters Used by Erie Company

BY J. P. GALLAGHER

Superintendent of Meter Department, Erie Lighting Company, Erie, Pa.

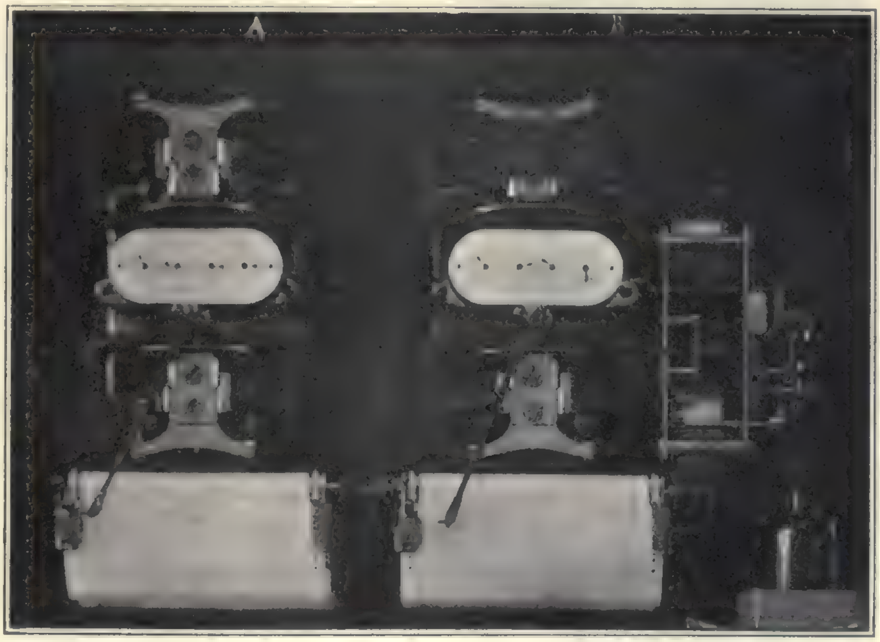
THE growing tendency of central-station companies to take into consideration the power factor of the customer's load in making rates has brought about the need of definite means of demonstrating to the satisfaction of the customer the effect of the actual and apparent power. After a careful consideration of the many methods offered, both direct and indirect, for the commercial measurement and determining of those factors which affect the cost of power service, the Erie Lighting Company, Erie, Pa., has installed a combination instrument (shown in the illustration) connected through a States block to a 3,000-hp. load.



BACK OF COMPONENT METER BOARD WITH REACTIVE COMPENSATOR

The instrument is of the block-interval type with a negligible time elapse between adjacent blocks, giving an integrated and indicated record of the reactive and power components of the system. The accuracy in the measurement of the various factors mentioned is comparable with that of the present high standard of watt-hour meters.

There seems to be a well-defined opinion existing in the industry that the power factor that is really wanted is that at the time of maximum demand. Since the ratio of the reactive to the power component of the circuit is the tangent of the angle whose cosine is the power factor of the system, then the



COMPONENT METER APPARATUS FOR 3,000-HP. LOAD

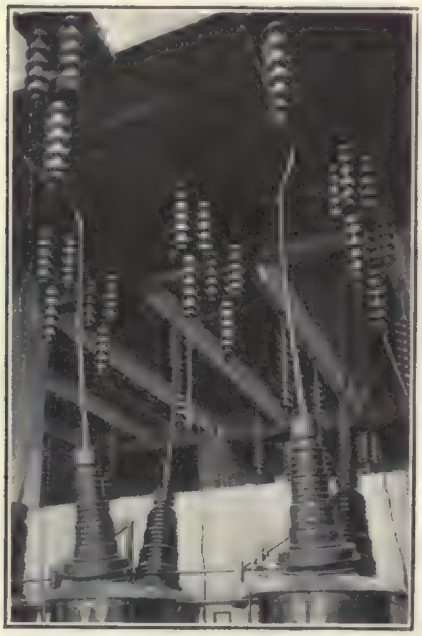
Element A measures the kilowatts or power in the circuit. Element B measures the reactive kilowatt-amperes. The operating power factor is 43 per cent; the average over the entire period is 53 per cent and at the time of maximum demand 70.7 per cent.

square root of the sum of the square of those factors equals the kva. with a synchronous chart travel. The kva., kw., power factor and reactive kva., at the time of maximum demand, are easily computed. It is also simple to demonstrate to the customer the possibility of a lower power factor at the time of maximum demand than the average for the billing period. In making calculations by this method it will be necessary to employ trigonometric tables. The relation between cosine and tangent, however, can be plotted in the form of a curve and be conveniently used by those not familiar with such tables.

All in all, the instrument referred to covers the field in the most complete fashion of all methods that have come to the writer's attention.

Pillar-Type Insulator for 150-Kv. Bus Structure

IN REBUILDING the 150,000-volt bus in the Eagle Rock substation of the Southern California Edison Company after the fire last January bus supports made up of pillar-type insulator units were used. The manner of installing the bus supports is shown in the accompanying illustration. This type of bus support not only has the necessary rigidity and mechanical strength, but has the further advantage that it is made up of standard insulator units which may be easily replaced when they become defective. The supports were made up in the company's shops and are composed of five porcelain pillar-type insulator units in each leg of the support. Three such legs are mounted on the ceiling in the form of a triangle with a steel plate at the lower end. To this plate is attached a single five-unit leg for supporting the bus. A similar type of support was used for the 220,000-volt bus in the Big Creek, No. 8, power house.



DEFECTIVE INSULATOR UNITS ARE EASILY REPLACED IN THIS TYPE OF BUS SUPPORT

Increasing the Rate of Setting Poles

By C. H. Kretz
Vice-President Oklahoma Power Company, Okmulgee, Okla.

THIS EQUIPMENT SETS AN AVERAGE OF FORTY-EIGHT 50-FT. POLES DAILY

BY THE use of an unusual arrangement for raising poles the Oklahoma Power Company has been able to erect forty-eight poles in rough country in an eight-hour day with only two men. This equipment was designed for erecting 50-ft. poles, while with a longer boom 60-ft. poles can be set. The A-frame illustrated was constructed of 3-in. x 3-in. x 12-ft. angle irons, while the braces were made of 2-in. x 2-in. x 12-ft. angle iron. The foot of the A-frame was attached to the channel irons of the chassis and the braces were fastened back to the body. The apparatus is assembled with pins and cotter keys so as to be erected quickly.

A cable from the boom is run through a single snatch block near the top of the A-frame and then to a drum. This boom has a sheave set in the upper end of it and is provided with a socket joint on the bottom end. The boom is easily attached to the truck by inserting the socket on the bottom of the boom over the ball, which is a part of all standard Warner trailer hitches. This in turn is attached to the chassis of the truck.

When building new transmission lines, a steel cable is used, but when erecting city lines, where work is done in close proximity to energized wires, a 1½-in. manila rope is substituted for the steel cable. This manila rope is wound over and on top of the permanent steel cable on the winch drum. By using this apparatus poles can be set at a maximum distance of 18 ft. from the rear of the truck, thereby enabling the line gang to set poles across a ravine or ditch while the truck remains on the main highway.

The parts can be assembled or taken down in about fifteen minutes. No detailed cost data have been kept, since only four pieces of angle iron were required, which were readily available in the company's shops. The labor cost was estimated to be about equal to the material cost. This apparatus is mounted on a 2-ton White truck equipped with a power winch driven by the engine.

This power winch has also been employed for pulling out copper wire by attaching a belt from the pulley on the winch to the pulley which is fastened to the reel. In taking down wire on a transmission line it is cut in sections of about a mile in length, then started around the reel, which is driven from the power winch by a belt so that tension on the belt is adjusted. The belt tension is then regulated so as to slip when too great a strain is put on the wire. The same apparatus can be used in pulling in the wire.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Merchandising and Public Relations the Chief Issues

S. M. Kennedy, Vice-President Southern California Edison, Frankly Discusses the Company's 40,000 New Customers and the Problem of Who Should Sell Appliances

THE Southern California Edison Company will connect up this year, in territory served outside of Los Angeles and Pasadena, from thirty-five thousand to forty thousand residents and commercial customers. Within the two cities named the company sells energy at wholesale only. The increase in connected load from new business signed up exclusive of socket appliances will probably amount to more than 200,000 hp. Already 156,000 hp. has been taken on the lines. This information was given to a representative of the ELECTRICAL WORLD by S. M. Kennedy, vice-president in charge of new business and customer relations of the Southern California Edison Company, who has just visited New York, where he attended several important meetings.

"At the beginning of the year the expectation was that 100,000 hp. would be the increase for the year," said Mr. Kennedy, "and it was estimated that this would mean $15,000,000 in business to the electrical industry of the section in the purchase of material, supplies and labor. This does not include the cost of development or transmission, but the expense of distribution and whatever the customer would spend for wiring, appliances and equipment. Before the year is over, therefore, at least $30,000,000 in productive business will have been created through this activity on the part of the central station for the one year's work, and the contractor, the dealer, the jobber, the manufacturer and the local laborer will enjoy the benefits. This does not include large budget appropriations which will be spent for power development, generation, transmission and substation buildings and equipment.

Asked what he considered the most vital issues before the central-station industry today, Mr. Kennedy stated emphatically that in his opinion the problems of merchandising and public relations deserve first place in the attention of central-station executives and that he considered the two of equal importance. "The matter of local trade relations—that is, the relationship between the various classes of electrical men within a community—is also of prime importance," said Mr. Kennedy. "It is becoming almost as important as the other two. We are standardized pretty well now on electrical methods. We can get all the money we want and all the material.

Three Immediate Needs

"What we will all need most urgently to develop in the years immediately ahead are proper methods of merchandising, a better basis of co-operative organization between the central station and the contractors, dealers, jobbers and manufacturers, and with it all a higher degree of understanding and harmony in our public relations. There has been a tendency to put merchandising aside. It has been considered a secondary or a tertiary matter by too many utilities, but our experience in Los Angeles has proved that it is a very vital matter.

"Five or six years ago the average annual income from a residence customer or an apartment consumer in our territory was eight dollars less than it is today. The growth is due almost entirely to the greater use of the many lamp socket appliances, additional income, improved load factor and better diversity factor. The value of such an increase is obvious.

"We estimate conservatively that there are four hundred thousand small household appliances on the lines in our territory. We calculate that we receive from each of these appliances an average income of one cent per day and therefore that we are selling $4,000 worth of energy each day to serve this household equipment. We believe that this is the largest installation of electrical domestic appliances in use in any community at the present time.

"The question naturally arises, Are these appliances used? We believe that they are, as the result of the surveys which we have made throughout our territory and the contact which our greater-service department maintains with our customers. It will be remembered that in 1906 our company placed an order for five thousand flatirons to be loaned to our customers. We did not stop until ten thousand had been put out on our lines. As a matter of fact, however, these appliances, which were really loaned to the consumers, were nearly all sold to the people who had been using them. Of course we have an exceptionally good country for the sale of this equipment. It is a new country with new houses and a class of people who go there in the spirit of enjoying themselves and with the desire to get along with the smallest possible amount of work.

Who Can Merchandise Best?

"Our experience has convinced us that there is nothing more important in the development of our company and our service to the public than a properly organized merchandising influence. Every appliance we put out makes us more important and useful to the customer and increases our contact with him. This brings with it, of course, an increased responsibility in the matter of public relations, for the more necessary you make yourself to the customer the more opportunity there will be for poor service to give annoyance and the more particular the utility must be to maintain a high degree of efficiency. At the same time, this closer contact and greater dependence on electric service on the part of the customer brings tremendous support in public relations. Let the customer be continually irritated by not getting what he wants and he listens to the agitator with a willing ear, but if the utility gives good service and

the householder recognizes his dependence upon it and appreciates the spirit in which he is served, then public ownership talk does not lodge in his mind.

"The problem is, of course, as to who should and can best do this merchandising of appliances. Some years ago the Southern California Edison Company withdrew from the sale of appliances in the interests of the local contractor dealers. We felt that if the opportunity of these men to make a larger thing of their retail business were increased they would be encouraged to put more time and thought and effort behind it. We are not satisfied, however, that under these conditions this market is being adequately served. As I said, we are connecting thirty-five thousand new household customers this year, and no one is going after them with sufficient energy to sell them the complete equipment which they require and would desire if they were properly approached and educated.

"This presents a very serious problem in which the entire industry is concerned. The question of whether the market is best served when the central-station company itself conducts an aggressive merchandising department, maintaining proper merchandising policies for the protection and encouragement of the local contractor-dealers and stimulating them by the example of a good store and good merchandising practices, has not yet been decided. One thing that the industry must bring itself to see is that it is not only in the public interest but in the interest of all electrical men that hardware stores, department stores and all ordinary sources of household equipment and supplies be encouraged to sell electrical appliances just as fast as each device reaches a staple stage where it can be sold as merchandise without any large amount of instruction or service.

"It is no time now for the electrical dealer or contractor to be sore because others are getting into the business. The market itself is greater than the electrical stores alone can hope to serve in the near future, and if we tie these added sources of supply into our public-relations picture by giving them sufficient intelligent co-operation and support, the merchandising of electrical appliances cannot be held back. Every appliance sold means more business, not only to the central stations, but to wiring contractors and dealers who sell other devices in which the customer will next become interested.

"As a result of all this we feel that the vital issue is merchandising and public relations. We believe that our experience will be repeated in every community and that great gains can be made by recognizing right now the considerable importance of setting up a proper merchandising situation so that the public may be adequately served and the market opened up without loss of time. For when we lose time in educating the public to use electric household appliances we are denying them a service to which they are entitled and losing ourselves income and growth of vital value to our stockholders."

Mr. Kennedy is a strong believer in co-operation and harmony in all branches of the industry in his part of the world, and any further development work in electrical merchandising, he says, must be carried out with the approval of all concerned. When asked about customer ownership, Mr. Kennedy said that in his opinion that was the ideal form of public ownership. He added that the Southern California Edison Company has now more than sixty thousand stockholders.

Electric Home Economics Now a High-School Course

HOME economics students in the new Keokuk (Iowa) High School will be taught how to purchase utility service economically just as they are taught how to shop for their groceries, according to an announcement made by the school board recently.

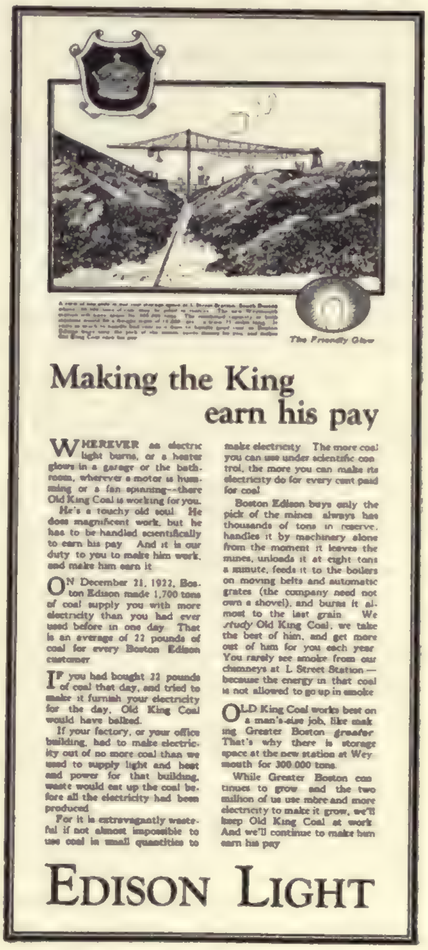
The Keokuk Electric Company, operated by Stone & Webster, has offered to electrify the home economics department of the new school so that students can be taught every known utilization of electricity for home convenience. Every appliance from a curling iron to a large electric range will be placed at the students' disposal.

Both gas and electric meters will be installed, and the students will be taught how to read their meters, figure their bills and practice economy in buying electricity.

The installation of this new branch of domestic science work has just begun in several schools of the country, and Keokuk will be one of the first in its state to offer the service.

Giving the Fuel Problem Personality

A REAL "human interest" story of the central-station coal problem is being told by the Edison Electric Illuminating Company of Boston in display advertising carried in the local press in connection with a series of announcements devoted to pointing out the co-operative interests of the company and the public in community and system development.



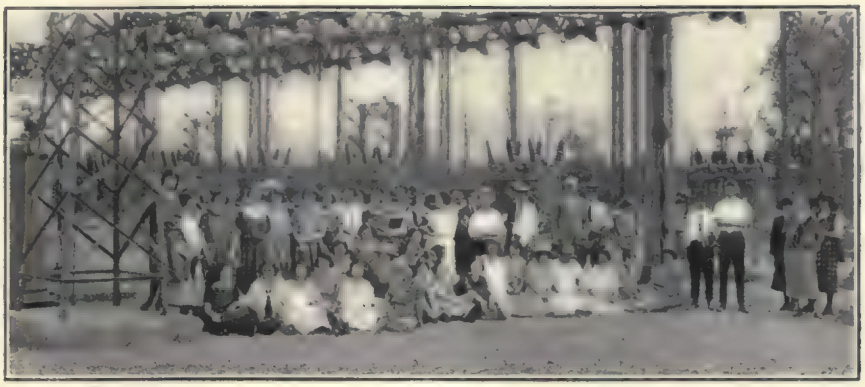
BOSTON EDISON TELLS OF ITS EFFICIENT USE OF COAL

Taking "Old King Coal" as its theme, the company contrasts the efficiency of electrical production from a large station with the inability of the small user to extract as many kilowatt-hours from a given weight of fuel and shows how the modern central station fundamentally serves the community more efficiently by its wholesale production of energy. The storage facilities in the present plant and those to be provided in the new Weymouth station are cited, with terse comment upon the demand growing business makes upon the fuel resources of a great public utility.

Students Are Shown Through Substation

APPRECIATING the educational value of showing visitors through its substations and power plants, the Idaho Power Company, Boise, has for some time made a practice of conducting inspection tours over its system. Business men, civic and commercial organizations and other interested persons have been the guests of the company on these occasions. Recently one hundred students of the Boise summer normal school were taken on an inspection trip to the company's main terminal substation in Boise. Members of the engineering department escorted the party through the plant and explained its functions and operation.

The range of questions asked by the students indicated a considerable knowledge of the theory and operation of a power system. A handsome illustrated booklet, entitled "Boise's Power Terminal," was given to each member of the party.



NORMAL SCHOOL STUDENTS ON TOUR OF INSPECTION AT THE IDAHO POWER COMPANY'S SUBSTATION

Three Letters that Tell Their Own Story

May 8, 1923.

Attention New-Business Manager.
BROWN ELECTRIC COMPANY.

GENTLEMEN: Under separate cover I am forwarding to you photostats of the contemplated house wiring which I am planning to install in my father's home, 51 Jones Avenue, during my vacation the last two weeks in June. My purpose in bringing these plans to your attention is that possibly you might suggest some further additions or conveniences I have overlooked in the wiring of this house. Any suggestions or criticisms you may desire to make will be appreciated.

Another matter on which I should like further information is this: Does your company handle the housewiring contracts directly or through some local contractor-dealer? If you do the wiring yourself, have you any deferred time-payment arrangement? I shall appreciate your advising me what system your company uses. Very sincerely yours, JOHN DOE.

May 29, 1923.

MR. RICHARD ROE, Manager
Brown Electric Company.

DEAR MR. ROE: Not having received any reply from my letter addressed to your new-business manager relative to your rates on house wiring, I am writing you direct for further information on this subject. On May 8 I also sent along some photostats of the contemplated house-wiring plan which I intend to install in my father's home at 51 Jones Avenue, during my vacation the last two weeks in June. My purpose in bringing these plans to your new-business manager's attention was that possibly he might have some suggestions in regard to the addition of more outlets or conveniences. Since the time is growing short between the end of June and the present, I shall appreciate any suggestions and criticisms you might make on these plans. If these plans have miscarried in the mails, I can furnish you with an extra copy.

Another item on which I wanted some more information was this: Does the Brown Electric Company handle the house-wiring contracts directly or shunt them to local contractors? And if you do the wiring yourselves, have you any arrangement on deferred-time payments? The reason I wanted this work done during my vacation was that I could possibly help in the work and direct some of the construction, since I wanted the installation finished before I must return to my work.

I will appreciate most keenly any information you can give me on this matter since I would like to let the contracts as soon as possible in order to start the work by June 19. Sincerely yours, JOHN DOE.

May 31, 1923.

MR. JOHN DOE.

DEAR SIR: Answering yours under date of May 29, I beg to advise that no communication from you has been received at this office. Very truly yours,

BROWN ELECTRIC COMPANY.
By Richard Roe, Manager.

What Other Companies Are Doing

Pawtucket, R. I.—About 5,000 persons visited a "Home Practical" in this city during a three-week exhibition under the direction of H. E. Dawson, secretary of the Rhode Island Electrical League, which included a large amount of electrical equipment in addition to gas-operated devices in which the Blackstone Valley Gas & Electric Company, operating in this section of the state, is interested. The electrical equipment included a washer, motor-driven ironer, ice-cream freezer, automatic refrigerator, fans, lamps, heating pads, pilot lamps, electric clock and other devices.

Malden, Mass.—The Malden Electric Company has established its sales department as a complete unit operating at an address independent of the main office of the company through the opening of an appliance store at 145 Pleasant Street, Malden. The new store contains an appliance stock room, service department, quarters for the advertising department and the new-business department, with records.

Portsmouth, N. H.—A new interconnection contract between the Rockingham County Light & Power Company and the Twin State Gas & Electric Company of Dover, N. H., enables the week-end load on certain of the Portsmouth company's feeders to be handled efficiently by utilizing surplus hydro-electric energy from the Dover system, so long as the amount of energy delivered does not exceed the load on these feeders. A new tie line is under construction to Dover with increased copper cross-section, and it is hoped to provide for a still more satisfactory utilization of surplus power when this is completed.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Hydro-Electric Development and Steam Equipment

Big Falls Development on Flambeau River.—L. B. BREEDLOVE.—A three-unit plant of 9,900 kva. capacity, operating under a net head of 52 ft. with an average flow of 1,600 sec.ft., is to be tied in with four other hydro-electric developments of the Lake Superior District Power Company. Two 3,300-kva. units are now installed. Interesting features described are the dam and spillway construction and the special reinforcing of the scroll case by means of steel bands secured to the rim of the speed ring.—*Power*, July 17, 1923.

Some Engineering Features of the Weymouth Station. — I. E. MOULTROP and JOSEPH POPE. — A five-page abstract of this paper presented at the summer convention of the A. I. E. E. may be found in the ELECTRICAL WORLD for July 7, 1923, on page 9.—*Journal of the A. I. E. E.*, August, 1923.

Sectionalization and Remote Control of High-Pressure Steam Lines.—P. P. DEAN.—The purpose of this paper is to bring out the need of protection other than that of hand-operated valves for high-pressure steam lines in case of failure of pipe or fittings. It deals with the remote operation of various types of valves by electric motor or steam piston in order to stop escaping steam quickly and safely. It is based on a careful study of valve construction and methods of power operation made by the author during the last few years and on experience gained with a large number of electrically operated valve installations which have been placed in nearly all the important power-generating stations in the country, and it gives particulars regarding construction of various protective devices, valves and motor-control systems that are available. — *Mechanical Engineering*, August, 1923.

Largest Steam-Turbo Generator in England.—F. KONN.—What is claimed to be the largest generating set in England has recently been put in operation in Rotherham. The turbine is rated at 40,000 kva., 1,500 r.p.m., 6,600 volts, 50 cycles, three-phase. The stator was tested with 14,200 volts between each phase and ground. The rotor withstood 1,500 volts for one minute while driven at 15 per cent overspeed. The generator is self-cooled, that is, its heat losses are dissipated within permissible thermal limits without any external blower. The internal reactance of the stator winding has been calculated to give five and two-tenths times normal current, or 18,200 amp., under short-circuit condition. This value has been checked by an actually made short circuit with an oscillograph in the line. The resulting oscillographic record is reproduced. The turbine is of the Curtis type, with fourteen stages. The diameter of the largest runner is 12 ft. — *Revue Générale de l'Electricité*, July 28, 1923.

Generation, Control, Switching and Protection

Neon "Glim" Lamps Used as Ground Detectors.—A. KASTALSKI.—If a narrow metal band is placed around a high-voltage bushing near its grounded end and a neon "glim" lamp is connected between this band and ground, the glowing of the lamp will indicate that the line is alive. The width of the metallic band and its distance from the grounded end clamp have to be varied for different operating voltages. On a three-phase wall - entrance bushing three lamps, arranged one for each phase, represent a very inexpensive ground detector. During normal operation all three lamps will burn with their usual brilliancy. In case of a fault or ground on one line the lamp on that phase will become dark. Overvoltages are indicated by intermittent flashing above normal brilliancy. The placing of the metallic band on the insulator should be done in such a way that the flash-over point of the bushing is not reduced.—*Elektrotechnische Zeitschrift*, July 26, 1923.

Distance Relay for Automatically Sectionalizing Electrical Networks. — L. N. CRICHTON.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. spring convention, May 5, 1923, on page 1028. —*Journal of A. I. E. E.*, August, 1923.

Transmission, Substations and Distribution

Mechanical Properties of Transmission Lines.—IVAR HERLITZ.—The author suggests the use of a simple diagram which facilitates the computation of deflection and stress for a given span under any condition of load and temperature. The customary approximation of replacing the catenary by a parabola is made, and a curve (a cubic parabola) is plotted on the length of the span and the ratio of deflection to length. The intersections of certain straight lines cn this curve give corresponding values of length of span, load, temperature, deflection and stress. With certain modifications of the diagram it is also possible to take into account different moduli of elasticity.—*Teknisk Tidskrift (Swedish), Elektroteknik*, July 7, 1923.

High-Voltage Lines in Mountainous Terrain.—H. GRÜNHOLZ.—This paper describes some of the problems which may be expected on a 50,000-volt, three-phase transmission line traversing mountainous regions. Elaborate calculations are given for the exact determination of the sag of lines spanned over an inclined ground, as, for example, on the slope of a mountain. The distribution and the magnitude of forces which result from unequal distance between adjacent towers are shown. Considering the possible side sway of the wire, the best cross-arm arrangement is developed. Suggestions are given for designing towers for long-distance spans in the least expensive way, one method, for example, being to omit the top grounding cable. Storm and sleet conditions are carefully considered.—*Elektrotechnik und Maschinenbau*, July 15, 1923.

Voltages Induced by Arcing Grounds. —J. F. PETERS and J. SLEPIAN.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. spring convention, May 5, 1923, on page 1023.—*Journal of the A. I. E. E.*, August, 1923.

Units, Measurements and Instruments

Standardization of Electrical Measuring Instruments.—H. B. BROOKS.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. summer convention, July 7, 1923, on page 21.—*Journal of A. I. E. E.*, July, 1923.

Absorption of Moisture by Various Fibrous Insulating Materials. — By utilizing the phenomenon of temperature rise caused by the absorption of moisture comparison is made of several different types of insulating materials. —*Journal of Institute of Electrical Engineers of Japan*, July, 1923.

Methods of Measurement of Properties of Electrical Insulating Materials. —J. H. DELLINGER and J. L. PRESTON. —The properties on which methods of measurements are given are phase difference and dielectric constant, radio frequencies, voltages at radio frequencies, volume resistivity, surface resistivity, density, moisture absorption, tensile strength, transverse strength, hardness, impact strength, permanent distortion, machining qualities, thermal expansivity and effects of chemicals.—*Scientific Paper No. 471, Bureau of Standards.*

Illumination

Modern Requirements in Street Lighting.—T. W. ROLPH.—Of particular interest in the paper is a chart showing the expenditure per capita for street lighting in the large and medium-sized cities of this country. A twofold increase in the present expenditure per capita is shown to be highly desirable and, in fact, an almost certain development of the next few years. With such an increase in expenditure and with the use of the most efficient street-lighting equipment installed according to the best modern practice, the streets of our cities can be made essentially as safe and con-

venient by night as by day. Light distribution with various types of reflectors and globes, illumination requirements of streets, the proper location of street-lighting units and the effect of mounting heights in regard to blinding are considered.—*Proceedings of American Society for Municipal Improvement*, 1922.

Quality of Incandescent Lamps.—J. W. HOWELL and HENRY SCHROEDER.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. summer convention, July 7, 1923, on page 19.—*Journal of A. I. E. E.*, August, 1923.

Illumination and Production.—A revision of the original bulletin contains considerable additional information under the following subjects: Indirect effects of proper lighting, direct effects of high-level lighting, prediction of results due to increasing the intensity of illumination, production tests, factors which affect the result, economics of productive lighting and a lighting survey and bibliography.—*Bulletin L.D. 106A* of *Edison Lamp Works.*

Motors and Control

Selecting a Railway Motor for a Given Cycle of Duty.—W. G. GORDON.—The author discusses the continuous capacity of railway motors, the effects of the different variables on motor performance and the varying conditions encountered during winter and summer months.—*Electric Railway Journal*, July 14, 1923.

Electric Drive of Rotary Printing Presses.—R. MOHR.—The very exacting requirements of speed regulation within widest limits make specially devised controlling apparatus essential for the drive of large printing presses of the rotary type. Depending upon the size of the press, a motor capacity of from 5 kw. to 50 kw. is required, or several individual motors may even be necessary. Modern presses of the duplex and quadruplex type, with their bulky and long constructions, make it necessary to start, stop and to regulate the drive from several points, so that remote control is used in almost all cases. The article goes into considerable detail concerning the semi-automatic and fully automatic control of direct current, three-phase and single-phase motors for these machines. For alternating-current motors speed regulation by the remotely controlled brush-shifting method is described. Complete wiring diagrams for direct-current and three-phase operation and for a large press drive with four motors are given. Contrary to previous belief, either alternating or direct current is suitable for these drives, provided the right type of motor is chosen. For alternating current the commutator type of motor gives the same economic range of speeds as the direct-current motor. For larger presses manual operation of the controlling apparatus is uneconomical. Fully automatic push-button control at as many points on the press as may be desired has been developed so perfectly as to insure fully reliable operation. Great saving of time, a smooth start and very rare breaks in the paper are advantages which soon pay for the initial cost of an automatic control.—*Siemens Zeitschrift*, July, 1923.

Heat Applications and Material Handling

Recent Developments in Resistance Welding Field.—H. LEMP.—Progress in the electric resistance welding field during the past year has been more in the application of known apparatus than in any radical departure from existing methods. A review is given of butt and flash welding, spot welding, seam welding, percussive welding, welding high-speed tool steel to ordinary shanks and the welding of pipes.—*Journal of American Welding Society*, June, 1923.

High-Speed Tool Steel Electrically Welded to Machine Steel.—Very material savings can be realized in the cost of cutting tools if a small piece of high-speed steel is welded to a shank of ordinary machine steel. In the past, however, the joint between the piece of high-grade steel and the shank has frequently been found to be very poor, particularly if this joint was made by brazing or by welding in an open fire. Even the electrically welded joint was not always satisfactory. The reason for this was that if the small cutting plate was brought in contact with the usually massive shank and the two were clamped between the electrodes of the electric welding machine, the current quickly overheated the small plate before the large shank came to proper welding temperature. This not only resulted in a poor joint but usually burned the high-grade steel plate. To overcome this difficulty the small plate is held firmly in a large copper block which surrounds it on three sides. The shank, on the other hand, is held lightly in a block of wrought iron. The large copper clamp will carry the heat away from the small cutting plate at such a rate that both pieces will become heated at about the same time. Cutters made with this clamping method show a perfect joint and stand up well even under fast feeding of the tool. The energy required for such a weld is about 31 kw.-sec. per square centimeter of welding surface. Hardened plates may be welded to the shank by this method without necessitating retempering.—*A. E. G. Mitteilungen*, July, 1923.

Electrophysics, Electrochemistry and Batteries

Magnetic Material of Very High Permeability.—H. D. ARNOLD and G. W. ELMEN.—The magnetic alloy described is a composition of about 78.5 per cent nickel and 21.5 per cent iron, and at magnetizing fields in the neighborhood of 0.04 gauss and with proper treatment it has a permeability running as high as 90,000. This is about two hundred times as great as the permeability of the best iron for these low magnetizing fields. This high permeability is attendant upon proper heat treatment and also upon other factors, among which is freedom from elastic strain. The presence of other elements than iron or nickel, and especially carbon, reduces the permeability, but slight variations in heat treatment produce large changes compared with those due to small quantities of impurities. The equilibrium diagram, electric conductivity, crystal structure, mean spacing between adjacent atom centers and density are among the physical properties which have been studied.—*Bell System Technical Journal*, July, 1923.

Traction

Electrification of Foreign Railways.—S. PARKER SMITH.—Taking as his starting point the country which has the largest proportion of its main-line railways electrified, the author traces the history and present development of electric railways in Switzerland. Direct-current, single-phase and three-phase systems are all in operation. The first is represented almost solely by single-track narrow-gage lines at 600/1,500 volts. The three-phase systems are confined to the Burgdorf-Thun and the Simplon Tunnel electrifications. Single-phase systems are most favored, the extensive developments on the Loetschberg, Rhaetian and Federal Railways being all single-phase. The Federal system has in contemplation the complete electrification of 1,529 km. of line by 1928; 429 km. of this has already been completed. The article includes numerous statistical tables and diagrams showing the characteristics of the various types of locomotive in use.—*Beama (England)*, July, 1923.

Telegraphy, Telephony, Radio and Signals

Carrier-Current Radio for Power Lines.—D. DRESSLER.—The usual system for a radio carrier-current communication between power stations makes use of the two-wave principle, which enables two-way conversation. The new system, described in this article, is based upon the single-wave principle. It does not permit two-way talking, but gives the much greater advantage that all substations on the network can be connected, a feature which is said to be impossible with the two-wave system. It gives a much louder communication, which is of value for the safety of operation and the bridging of complex and extended lines. Several "hook-ups" that have been tried out are given.—*Elektrotechnische Zeitschrift*, Aug. 2, 1923.

Super-Regeneration.—E. O. HULBURT.—A simple mathematical analysis of super-regeneration yields conclusions, in accordance with observation, that the super-regenerative system amplifies without distortion and that the amplification increases with increase of signal frequency and with decrease of variation frequency. Two single-tube super-regenerative circuits, interesting because of their simplicity, are described.—*Proceedings of Institute of Radio Engineers*, August, 1923.

Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

Conducted by PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N.Y.*

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Artificial Electric Line, Combined T and Π Type

An artificial line with lumped sections may be of either T or Π type and can be made to represent a "smooth" line correctly at one chosen frequency. When the frequency changes, the error in the T line is in the opposite direction from that of the Π line. We therefore have devised a combined T-Π line with which the frequency error is much smaller than for either of the previous types. For details see *Technology Reports* of the Tohoku Imperial University, 1923, Vol. 3, page 133.—*Heichi Nukiyama and Yoji Shoji*, Sendai, Japan.

Cables, Trailing on Coal-Cutting Outfits

In view of an element of danger involved in such cables, a questionnaire has been sent out particularly with the view to comparing "twin" and "concentric" cables. In almost every case concentric all-rubber covered cables were found preferable because they have a longer life, require less repairs, do not kink, do not become water-soaked and can be handled with less liability of shock to the machine operator.—*L. C. Ilsley and H. B. Freeman, Bureau of Mines, Washington, D. C.*

Lamp Fixture, Rigid, for Incandescent Street Lights

With the usual method of suspension, inherited from the old arc lamp, street lamps can swing freely. In stormy nights this swinging often caused breakage of leads because of fatigue stresses and was a source of considerable annoyance and expense. A new solid suspension link has been introduced which completely remedies this trouble. — *Rochester (N. Y.) Gas & Electric Company.*

Metals Fused in Vacuo, Gases, Evolved from

It has been found that the most satisfactory method of heating the metal samples for the extraction of gases under vacuum is by the use of a high-frequency induction furnace. This method of heating has eliminated many of the difficulties and sources of errors common to previous methods of vacuum fusion. The analyses of the evolved gases for oxygen and hydrogen are carried out gravimetrically by the use of a train of solid absorbents which satisfactorily absorbs the gases even at comparatively low pressures as rapidly as they are pumped out of the furnace.—*Bureau of Standards, Washington, D C.*

Resistance Material of High Resistivity

A new resistance material has been developed in the form of filaments which can be made in the order of 100,000 ohms per inch length. These filaments can be used as grid leaks in radio work and as cheap non-inductive high resistances generally. Telephone protectors have been devised, using this material, which filter out extraneous noise, particularly in connection with alternating-current railway operation. Where the limiting distance between feeder stations is indicated by telephone interference, the use of this new resistence material would make it possible to increase the distance between such feeder stations, and therefore reduce the cost of the installation as a whole.—*C. E. Skinner, Westinghouse Electric & Manufacturing Company, Pittsburgh.*

Safety Switch for Arc Welding

One of the notable achievements made during the past year in the field of alternating-current arc-welding apparatus has been the development of a safety switch which cuts the power from the welding line and primary circuit whenever the arc is not being drawn. The voltage at all times during welding is limited to a harmless value such as 30.—*W. L. Warner, American Bureau of Welding.*

Welding Metal to Porcelain or Glass, Process for

Extensive research work carried on by Thomas E. Murray of the New York Edison Company led to the discovery of a new process by which metal may be welded to porcelain or glass in all kinds of electric switches and fittings, giving a more simple and more inexpensive fastening than by use of machine screws or other means. The electric fitting is placed upon the porcelain, a copper rod or rivet is threaded through the fitting or porcelain and a pressure of one-half ton is applied during the space of a quarter of a second. Instantaneous heat is used and the cracking of the porcelain is prevented. The result is the fusing of the copper with the porcelain.—*E. W. Wells, New York Herald.*

In Progress or Purposed

Electrolysis Mitigation

Arrangements have been made with the utilities in Tulsa, Okla., and St. Louis, Mo., for electrolysis investigations to be carried on in those cities with special reference to the pipe-drainage method of electrolysis mitigation. The bureau has recently assisted in an attempt to solve the electrolysis problem in the city of Wilmington, Del. This situation has caused considerable difficulty to the public utilities for a number of years. Some further tests have been planned there, and arrangements made for carrying them out in co-operation with the bureau.—*Bureau of Standards, Washington, D. C.*

Heat Radiation, Reduction of, by Aluminum Paint

Coverings of conveyances, such as the tops of automobiles, ice wagons, etc., consist of cloth, the outside of which is often painted with a black composition which absorbs perhaps 90 per cent of the sun's rays. Practically half of this is re-radiated from the under side of the cloth. Tests are in progress which show that a coating of aluminum paint applied either to the outside or inside of such tops reduces by 50 to 60 per cent the intensity of the heat radiated from the under side into the interior of the conveyance.—*Bureau of Standards, Washington, D. C.*

Heat Radiators, Effect of Paint on

Many heat radiators are painted with aluminum or bronze paint. From the viewpoint of obtaining the maximum amount of heat from a radiator of a given size, this is one of the most inefficient paints that can be applied. Tests in progress on the emissivity of sheet iron covered with white paint, enamel and aluminum paint show that the aluminum paint emits only 27 to 30 per cent as much as a non-metallic paint or enamel. — *Bureau of Standards, Washington, D. C.*

Lamps, Incandescent, Extra-Large

The production of both the 10-kw. and 30-kw. coiled-wire radiator lamps is well through the development stage. Many difficult problems in construction peculiar to large lamps and high temperatures have been solved. A 100-kw. lamp has been designed, but not yet constructed. Prior to a year ago a 3,000-watt lamp was the largest ever in regular production.—*P. G. Nutting, Schenectady, N. Y.*

Street Lighting

A study is being made of the various systems of street lighting used in cities and towns throughout the country. This work is receiving the hearty co-operation of municipalities and operating utilities. Several hundred replies to questionnaires on engineering practice and contract requirements have been received and are being carefully analyzed. Very full engineering data have been furnished by thirty or more of the larger operating companies on the basis of which a survey of the best practice is being prepared as a part of a comprehensive report on street-lighting service.—*Bureau of Standards, Washington, D. C.*

Suggestions for Research

Cable Joints, Petrolatum Absorption Through

Petrolatum, which is used as a filling in high-tension cable joints, is likely to become almost fluid at high temperatures reached in cable operation. Since the paper insulation may be somewhat loose near the joints, owing to bending and handling, there is a possibility of the petrolatum being absorbed into the cable proper. Since the dielectric properties of petrolatum are inferior to those of regular impregnating compounds, the cable is thereby weakened. Experiments are desired on the amount of absorption of petrolatum under different operating conditions and on the resulting change in the dielectric properties of the cable.

Conductivity, Thermal, Increase of, by Ionization

It is known that the electric conductivity of solid dielectrics can be increased by subjecting them to the ionizing action of X-rays. Theoretically, thermal conductivity and electric conductivity should increase and decrease together. If the thermal conductivity could thus be artificially increased, many processes of heating, cooking and cooling could be facilitated. For example, if the thermal conductivity of meat could be increased during the process of cooking, it would take less time and less energy for frying, roasting, etc.

Spark Gaps, External Ionization of

It is well known that air can be ionized by ultra-violet rays or by X-rays. In some European insulation tests with steep wave fronts the sphere gap was exposed to an arc light rich in ultra-violet rays to accelerate the breakdown of the gap. It is possible that such a procedure (or an X-ray tube) may prove useful in some other tests, or even in connection with protective apparatus under actual operating conditions. Thus a comparatively slow protective gap in a station might be subjected to ionizing rays at the approach of a storm, to make it more sensitive and quick acting.

Spark-Over at Different Air Densities

In the design of protective apparatus and insulators it is sometimes necessary to predict their performance at different values of air density, especially at high altitudes. The general law governing the relationship between the spark-over voltage, the air density and the linear dimensions of the apparatus has been given by J. S. Townsend (law of similitude, *Electrician*, 1913, Vol. 71, p. 349). Some experiments have also been made by Peek and others on corona formation and flash-over at different values of air density. It is not known, however, whether the law of similitude is generally valid for complicated shapes used in practice, and a comprehensive series of tests is needed to establish the limits of its validity and to furnish data for its practical application.

Vehicles, Electric, Regenerative Braking of

Now that the regenerative braking of electric railway trains has been perfected, it is time to consider regenerative braking of electric trucks and other battery cars. A small axle-driven generator should be sufficient to excite the fields of the main motor in such a direction as to convert it into a generator for charging the battery. With present-day robust batteries it is possible to use electric vehicles in quite hilly places, but the expense and inconvenience of applying a mechanical brake down a long hill limits their application.

Welding, Arc, Effect of Cooling Rate

Further investigation is needed on the effect of heat treatment on arc welds, for the purpose of securing a better control over residual stress, weld strength, ductility, stress distribution, shock and fatigue resistance.—*O. H. Eschholz, Pittsburgh, Pa.*

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

For Rural Electrification

Committee of Promotion Is Organized by N. E. L. A., Farm Bureau and Other Interested Bodies

A MOVEMENT to stimulate a complete investigation of the application of electricity to agriculture which has been gaining momentum during the past year was put on a working basis at a meeting held in Chicago on Tuesday of this week and attended by H. M. Aylesworth, Marshall E. Sampsell and G. C. Neff of the National Electric Light Association and O. E. Bradfute, J. W. Coverdale and H. W. Moorehouse of the American Farm Bureau Federation. At this conference final approval was given to the formation of a committee on the relation of electricity to agriculture. This committee will consist of the three representatives of the American Farm Bureau Federation already named and of Marshall E. Sampsell, G. C. Neff, J. C. Martin and Arthur Huntington as representatives of the N. E. L. A.; R. C. Cosgrove, representing the manufacturers of farm electric plants; Prof. J. B. Davidson, representing the American Society of Agricultural Engineers, and S. H. McCrory, representing the United States Department of Agriculture. E. A. White has been employed as director to devote his full time to the work, with an office in the American Farm Bureau headquarters in Chicago.

The formation of this committee brings together various groups which are vitally interested in the problem of rural electrification and for the first time in American history enables the farmer through his own representatives to participate actively in solving the problems met in adopting a new form of power. The committee will endeavor to direct development work along sound economic and engineering lines, eliminating the cut-and-try method, and to insure maximum results at minimum cost. It recognizes that electric service on the farm offers great possibilities for improving living conditions and reducing the cost of production, but before these can be realized there are many economic and engineering problems to be solved.

Farm Power Survey

The first step in this direction taken at the request of the committee has been the undertaking by the United States Department of Agriculture of a national farm power survey to determine the amount of power used in agriculture, the power requirements for various farm operations, the types and sizes of prime movers used, the power requirements of various machines and what operations are still done by hand. Out of this survey should come the fundamental agricultural facts to form the basis for the economic studies and engineering developments necessary. Surveys will be conducted to determine for what operations electricity is used today and also to find out what obstacles stand in the way of its general application to farm operations.

Regarding this work, Mr. Coverdale, who is the secretary of the American Farm Bureau Federation, expressed his conviction that when rural electric lines become as popular as the rural telephone electricity will do as much to lighten the burden of the farmer and his wife as it has done in city homes. The committee, he said, has important work to perform in helping to lay the foundation for the development of rural electricity without exploitation. Mr. Aylesworth declared the electric light and power companies of the United States have already reached more than four hundred thousand rural customers. That, however, is less than 7 per cent of the farms of the nation, and in his opinion they will within eight years serve five hundred thousand additional farms.

Mercury Turbine Starts at Hartford Station

For the first time in electrical history power generated from heated mercury vapor was applied to commercial service when at 12:57 p.m. Sept. 7 the Hartford (Conn.) Electric Light Company phased in its pioneer mercury-turbine unit with other turbines at the Dutch Point and South Meadow stations. About 600 kw. was delivered to the bus.

Commenting upon this event before the New England Division of the N. E. L. A. at Swampscott, Mass., Vice-president Samuel Ferguson stated that this inauguration of commercial service from the mercury turbine marks the beginning of an experiment in central-station prime-mover development which will be continued until conclusions can be drawn as to the future of this type of apparatus in the field of modern electrical energy production. The development is being made by the General Electric Company, represented by W. L. R. Emmet, consulting engineer. T. H. Soren, vice-president of the Hartford company, represents the latter organization in the application of the mercury boiler and turbine to generating-plant service.

Ford to Reconsider Bid

Government Asks Him to Make New Proposal for Muscle Shoals with Gorgas Plant Eliminated

HENRY FORD has taken under consideration a suggestion by Secretary of War Weeks that he amend his bid for a long-term lease of the Muscle Shoals hydro-electric project so as to eliminate from this offer the bid for acquisition of the Gorgas steam plant on the Warrior River.

Mr. Ford, accompanied by his son and engineers who have handled the negotiations for Muscle Shoals in his behalf, conferred on Sept. 6 with Secretary Weeks and also with President Coolidge. Other than that the suggestion would be taken under consideration, there was no formal statement indicating the attitude of the Detroit manufacturer.

The Alabama Power Company, acting under the terms of the contract between it and the federal government when the Gorgas steam plant was extended by the government during the war, has notified the War Department formally that it desires the government to vacate this property and has offered to pay $3,000,000 for that portion of the plant which was built by the government. By high officials of the administration this price is considered fair. The Alabama Power Company has extended the time within which the government must reply to its offer until Sept. 24. Secretary Weeks had asked for a delay until Nov. 1 to give Mr. Ford more time.

During the months of discussion in Congress regarding the disposition of Muscle Shoals, when the Ford offer attracted much attention, Mr. Ford declined on several occasions to amend his proposal so as to exclude the Gorgas plant. His desire evidently is to have an auxiliary steam plant where coal may be obtained the cheapest, and Gorgas is at the mouth of mines on the Warrior River. It has been pointed out, however, that coal could be floated down the Tennessee River to an auxiliary plant at Muscle Shoals itself at very low cost for transportation.

A New York newspaper quotes Secretary Weeks to the effect that even if the Detroit manufacturer were so to modify his proposal, the Secretary would not advise Congress to turn over the power project to him. Mr. Weeks is said to regard the $5,000,000 offered by Ford as a mere fraction of what the power project is worth, and under the new proposal that sum would shrink to less than half.

Pennsylvania Men for National Superpower

State Officials Co-operate in Power Development—Public Relations Actively Discussed—Technical Reports of High Quality—Attractive Entertainments

PUBLIC relations, superpower, current technical and commercial practices, together with entertainment features, occupied the attention of delegates and visitors at the annual meeting of the Pennsylvania Electric Association at Bedford Springs, Pa., on Sept. 5-8. The family reunion was held in an atmosphere of optimism and enthusiasm over electrical prospects in Pennsylvania which bad weather did not damp.

In addition to the reports of the technical and commercial committees, several things stood out which testified the splendid conditions existing in the state and showed the broad perspective with which future developments are being planned. The national viewpoint on superpower found favor, and encouraging and able addresses were given by Philip P. Wells, Deputy Attorney-General of the state; William B. D. Ainey, chairman of the State Public Utilities Commission, and F. Herbert Snow, the chief of the engineering bureau of the commission.

These men clearly outlined local and national issues and the part the utilities should play in their solution. In a remarkably co-operative and appreciative spirit and speaking in their public capacity, they called upon the utilities for aid in securing for the state and nation better political, social and financial conditions. They emphasized the fact that in Pennsylvania the utilities and the state administration are working hand in hand to bring about better conditions for the public and for the utilities.

Chairman Ainey said that personal honesty and the personal consciousness of moral responsibility are the essential things needed to secure progress in local and national affairs. Legal decisions and legislative enactments in themselves, he said, are unhelpful props unless supported by individual rectitude.

Commission to Make Own Survey

Chief Engineer Snow outlined the great future in store for the utilities in Pennsylvania and told the utility representatives that this future could be more quickly realized by inducing all concerned to work co-operatively. He asserted that the development of natural resources is a question extending beyond the boundaries of any one state. As a direct aid to the development of the electrical resources of Pennsylvania he said that a survey is now being made under the direction of the commission in order to get accurate data for coordinating the power supply for the state. The first task will be to map the transmission lines in the state, the territories now covered by each property and the extensions of territory and lines planned for the near future. This study is not connected in any way with the water-power survey of the state which is being undertaken as the result of the recent legislative enactment. In the opinion of Mr. Snow, a state-wide power supply will make for greater standardization in the quality of service, more uniformity in rates and a greater degree of use of electric power.

Deputy Attorney-General Wells gave an unusually instructive talk on the mutual obligations and the individual obligations resting upon the state and the utilities in carrying out their contract. He accented the facts that the contract of agency leaves no room for hostility on the part of either the public or the utilities and that in order to carry on their business with best success the utilities should explain clearly their activities to the public. In his opinion, simplification in rate schedules will aid in bringing about better relations. Part of Mr. Wells' remarks are printed on the opposite page.

Public Relations Activities

The good public relations already so notable in Pennsylvania can, utility men hold, be made still better, and a great deal of interest and enthusiasm was aroused by the addresses and reports dealing with the subject. President H. H. Ganzer said that the utilities should never forget that the public is the real boss and is entitled to good service. He stated that there is increased necessity for educating the public concerning the utility business because of the hold superpower has gained on popular imagination. This development will not pass unheeded by the people or by the politicians, and it has become incumbent upon the utilities to educate the people in the matter in order to bring about a constructive development of the plan. He also declared that simplified rate schedules, simplified bills, wider publicity of facts about the business and the individual acknowledgment of every utility representative of his duty to help educate the public are matters where great improvement can be made. He advocated a greater degree of co-operation and activity in public relations work.

E. L. Smith, chairman of the Public Relations Section, said that more active interest on the part of utility executives would help in public relations work. Committees can only plan and the actual work must be done by the member companies.

Miss Clara Zillessen, in reporting for the women's public information committee, said that besides knowing her job thoroughly, every woman employee should be grounded in simple electrical knowledge such as meter reading, cost of lighting and the elements of illumination, generation and transmission, also a general knowledge of the practices and policies of the company.

In the Commercial Section public relations as influenced by the servicing of new customers were vividly portrayed by a two-act play staged by W. J. Edmunds, the chairman of the sub-committee, and one assistant. They showed with real histrionic talent a good and a bad way of handling a new customer applying for service.

An able address was given by E. A. Hirschman, secretary of the York Chamber of Commerce. He told the utility men how they appear to the outsider and said they should explain their business more clearly to the public. He then depicted the public to the audience by taking types and dwelling on individual psychology. Thus he showed that the public is a large number of individual units each of which must be treated differently.

Major J. S. S. Richardson, director of the Public Service Information Bureau, told of the bureau work and of the opportunity for general publicity activities. He stated that in one year a noticeable improvement had been made.

Walter H. Johnson, president of the National Electric Light Association, pictured clearly to the audience the magnitude and complexity of the electrical industry and showed the rapidity of its growth. He told of the work the utility leaders have done in guiding the industry along proper lines and how the N. E. L. A. and its committees are working earnestly on plans for still greater accomplishments.

Technical Reports Valuable

The technical committee reports were all well prepared and contained data of value and interest. Some of the reports should prove of national interest while others dealt with conditions local to Pennsylvania. The burning of anthracite coal by central stations was thoroughly covered in the report of the prime-movers committee. The report and the discussion that followed showed that high volatile content and uniformity in size are primary considerations in successful firing. Culm or No. 4 buckwheat has promise as a cheap fuel if a process of sizing, a suitable grate, a pulverizing system or a mixture system using some bituminous coal or oil can be developed for practical and economical use. The chief trouble with anthracite firing, it was asserted, arises from the necessity of keeping a thin bed of fuel on the grates and the inability to secure rapid forcing.

R. M. Riegel gave a thoughtful paper on the economics of adding supplementary hydro-electric plants or steam extensions to an existing steam system. He showed by graphs the limitations under which it would be more profitable to develop hydraulic sites. For the assumed conditions and with load factor the variable, the author showed an equality in cost of installation at a 28 per cent load factor and a higher cost for the hydro-electric plant for load factors exceeding this percentage.

Probably one of the most valuable papers was presented by Henry Muller,

chairman of the underground systems committee. This paper was prepared for the benefit of smaller utilities which contemplated changing to an underground system or were faced with the question of deciding upon its possibilities and costs. Costs and arguments pro and con and a great amount of valuable data were assembled. The paper will be particularly valuable for the utility executive who is called before a council on a few hours' notice to tell why he should not put his system underground.

The wooden-pole situation in Pennsylvania gave rise to an animated discussion under the stimulus of a splendid paper on the subject presented by G. S. Van Antwerp. Chestnut poles have heretofore predominated in the region, but they are now scarce because of a general blight. A trend toward the use of Western cedars was exhibited, although some questions as to the suitability of the Southern pine were raised. Most of those present eliminated the Southern pine on account of the repugnance of linemen to climb it and were of the opinion that it was unsuitable for use in city streets because of the exuding creosote. The opinion was expressed by Thomas Sproul that poles were too highly classified and that all poles should be classified only on a strength and butt-circumference basis.

The inductive-co-ordination committee, of which M. E. Skinner is chairman, discussed several specific cases of co-ordination and treated fully a paper by R. W. Wilbraham entitled "Notes on Field Practices as Relating to Co-ordination Problems." The author recounted the essential data to be obtained in determining a line-building program and illustrated his general statements by typical cases.

A feature of the report of the electrical apparatus committee, R. A. Hentz chairman, was a description of the Barbados Island plant of the Counties Gas & Electric Company. This island station was designed for simplicity and economy in operation.

Commercial Policies Outlined

The commercial aspects of the utility business in the state were well treated in a series of reports of the Commercial Section committees. An excellent paper on new-business policies was given by M. C. Huse. The author discussed the commercial aspects of a system as a whole and said that, broadly, two fundamental factors should be considered in connection with new business. The first was a choice of locality where spare capacity exists or can be installed most economically; the second was the effect of the new business on the general system. Points to consider, he said, are load factor, power factor, voltage regulation, investment per kilowatt of additional business and revenue per kilowatt of maximum demand. The effect of business cycles should also be carefully considered when taking on new load. The author then outlined the splendid type of new business that could be obtained by adding to the number of wired homes along existing distribution lines. He said that, despite a fairly efficient sales campaign, there was room for an increase of 50 per cent per customer in residential consumption in Philadelphia. The existing consumption is 360 kw.-hr. per customer, as compared with 275 kw.-hr. a few years ago.

A store-lighting demonstration was well received, and papers were presented and discussed on vehicles, training of salesmen and other commercial activities.

Entertainment Features

The entertainment committee provided an unusually fine program for the delegates and the ladies. Golf, tennis, swimming, cards, motion pictures and dancing occurred as usual, and an added feature was an outdoor dance with special illumination and vaudeville entertainment.

The officers elected are: President, J. H. Shearer; first vice-president, G. M. Gadsby; second vice-president, W. E. Long; treasurer, P. J. Morrissey. J. Cox Thompson, P. H. Chase and E. C. Stone were elected to serve two years on the executive committee. More than seven hundred delegates registered.

Water-Power Act Charter of Liberty, Says Wells

Declaring that the public has been led to expect great things from the electrical utilities and has become convinced that the superpower systems mean much in its affairs, Philip P. Wells, Deputy Attorney-General of Pennsylvania and a member of Governor Pinchot's Power Board, speaking before the convention of the Pennsylvania Electric Association at Bedford Springs last week, went on to say: "I wonder whether you gentlemen realize the expectations you have raised among the people. The great men of your industry — engineers and managers — have prophesied a new economic era, have announced that it is now at hand. You have induced the rest of us to believe that you can and will do for power what the railroad did for goods in the last century, that is, bring it to every man's door in any desired quantity, of standard quality, and at prices substantially uniform for the same class of service. That is a large order, but we mean to hold you to your promise that you will fill it. If you fail, we shall not cease to expect it and will look for another agent to do it for us. It is up to you and to us to see that it is done. I have confidence in your success. The administration is preparing to help you through the 'Giant Power Survey,' and it asks you to be ready to help that enterprise. We see this thing bigger than any company's exclusive territory, yes bigger than any single state, and yet serving every hamlet and nearly every farm. We believe that you will bring in a new economic era and will transform the social life of our people. We desire to help you and we ask you to see this thing as big as your biggest men have pictured it and to help us in making their prophecy come true.

"As you know, we are basing our state policy on the federal water-power act and are trying to harmonize our state laws and administration with its principles. We have secured the co-operation of some fifteen states for its defense in the Supreme Court of the United States in the suit brought by the State of New York to annul the act. The declared purpose of the State of New York to monopolize for herself the use of the power of navigable waters of the United States upon and within her boundaries, to the exclusion of Pennsylvania and New England, is proof enough, if proof were needed, that the federal water-power act is a charter of liberties for the power industry of Pennsylvania. As such it deserves your support."

Cost of Coal to Operators Put at $1.20 to $2.80 a Ton

The agreement for the resumption of work at the anthracite-coal mines brought about through the mediation of Governor Pinchot of Pennsylvania will shift public interest again in part to the conditions underlying soft-coal mining. The government's fact-finding commission has just reported to the President that the cost of a ton of bituminous coal to a mine operator ranges between $1.20 and $2.80. The cost study was based on statistics from 266 mines in four states and covered operations in 1918, which was selected because conditions throughout that year were considered approximately uniform.

The commission has declared that the national interest requires the establishment of a fixed code for the settlement of industrial disputes.

St. Lawrence Waterway Plan to Come Before Congress

In the hope of favorable action from Canada within the next six months, plans for influencing Congress to get behind the Great Lakes-St. Lawrence Waterway project were revised last week at a meeting in Chicago of the Council of States of the Great Lakes-St. Lawrence Tidewater Association.

The election of Sir Adam Beck by an overwhelming majority to the Ontario Legislature on a hydro platform made leaders in the waterway project feel confident that Ontario will soon take a definite step in favor of the plan.

It was pointd out that the development of power along the proposed waterway route in Ontario rests entirely in the hands of the officials of that province, though the navigation of the river is controlled by the Dominion government at Ottawa. Sentiment in New England is rapidly changing in favor of the deep waterway, H. C. Gardner, president of the association, declared.

Four Commissioners at Swampscott Meeting

Reports of Progress in Public Relations, Commercial Developments and Engineering Mark the Annual Convention of New England N. E. L. A.

HEARTENING addresses by four public utility commissioners, accounts of gratifying progress in accident prevention and customer ownership, evidence of a broadening outlook upon commercial problems and reports of noteworthy advances in engineering and accounting were features of the fifteenth annual convention of the New England Division of the National Electric Light Association, attended by 450 members and guests, on Sept. 5 to Sept. 7, at the New Ocean House, Swampscott, Mass.

The commissioners who attended were C. C. Elwell of Connecticut, H. C. Attwill of Massachusetts, T. W. D. Worthen of New Hampshire and Samuel E. Hudson of Rhode Island. Each voiced sympathetic appreciation of the problems of the modern public utility, and their addresses contained a number of helpful suggestions to executives and their subordinates. Among these suggestions was Mr. Elwell's recommendation that poor-mannered applicants for utility positions be rejected, that rest and comfort facilities be provided for customers in central-station offices, that the higher executives of utilities keep open hours at announced regular times for customers and others, and that high-school classes be invited to visit plants and offices. The policy of "telling it to the public and telling it first" was urged by Mr. Hudson, who advocated informing the press and municipal authorities of all proposed rate changes whenever they were filed with a commission.

Public Relations Sessions

Two public relations sessions were held, the convention beginning and ending in this way. H. P. Gifford, treasurer Salem (Mass.) Five Cents Savings Bank, outlined the growing interest of savings-bank officials in public utility bonds and urged the balancing of stock and bond issues to enable these banks to invest more largely in this field. H. A. Lemmon, Stone & Webster, Boston, gave an inimitable talk upon "How Bill Jones, Mr. Average Voter, Indicts the Public Utility," and W. W. Freeman, president Cincinnati Gas & Electric Company, outlined the fundamentals of public relations. M. H. Aylesworth, executive manager N. E. L. A., pictured the necessities of farm electrification, the progess of superpower, despite the obstructive attitude of such states as Maine, and the growth of good feeling toward utilities on the part of customer-owners and the general public. E. L. Milliken, chairman of the New England Public Relations Section, presided at both sessions.

President Barrows' address emphasized the importance of continuing the divisional taxation committee, the growth of better public relations and absence of trade secrets within the electrical industry. The membership committee, J. J. Buckley chairman, pointed to 1,528 members on the divisional list and showed how the year's work had been along the line of attaining "quality" membership rather than mere numbers.

The Merchandising Problem

An unusual feature of the commercial sessions was a prepared discussion of the policy of "To Merchandise or Not to Merchandise?" for the central station. H. E. Duren, Greenfield, Mass., contended that better public relations, more active co-operation by contractor-dealers, broader trade prosperity and more efficient commercial service to customers result from the non-merchandising policy. E. S. Hamblen, Franklin, Mass., and A. B. Lisle, Providence, R. I., presented vigorous arguments in favor of appliance retailing, the latter citing figures to show that nothing like the sales volume attained by central-station effort would have been had without it.

F. M. Feiker, Society for Electrical Development, New York, gave an inspiriting address upon the place of electricity in cutting the costs of modern business and industry. He outlined the benefits of applying nationally measured ideas to local problems. Miss Alice Carroll of the society emphasized the importance of getting the housewife's viewpoint in appliance sales and servicing. H. N. Brown, New England Bakers' Association, Worcester, Mass., gave a brief but well-timed address upon the possibilities of co-operation between the electrical and baking industries. The Merchandising Bureau report was read by Cyrus Barnes, chairman.

V. M. F. Tallman, chairman National Power Bureau, urged executives to place more responsibility upon power engineers and challenged the latter to fit themselves for broader work. Several speakers cited recent advances in industrial electric heating which had resulted in marked improvements in the quality of products.

Features of the afternoon session Thursday were addresses upon lighting by J. Daniels, Boston; A. L. Powell, Harrison, N. J.; C. A. B. Halvorson, Lynn, Mass.; D. H. Tuck, Holophane Company, and W. D. Gorman, Hartford, Conn. R. S. Hale outlined the benefits of recent authorized changes in the National Electrical Code; N. T. Wilcox, chairman National Commercial Section, voiced the value of central-station merchandising along sound lines; H. Corning, Bangor, Me., spoke briefly on behalf of the Rate Bureau, and E. S. Mansfield and A. L. Kebbe touched respectively upon recent advances in electric transportation and in new-business work. Edgar J. Rich of the Boston bar gave a scholarly address upon the conflict of law and economics in rate making.

Technical Papers

At the technical sessions, S. B. Swan chairman, a comprehensive paper upon "The Possibilities of the Future Cable" was presented by S. J. Rosch and E. F. Reid, National Conduit & Cable Company, New York. In this paper many data were given upon current problems in advanced cable design and testing. C. A. Powel, Westinghouse Electric & Manufacturing Company, read an instructive paper on "Relaying Interconnected Systems," and Henry Schroeder, General Electric Company, gave a thorough chronology of the incandescent lamp. I. E. Moultrop and J. Pope, Boston, discussed the engineering features of the new Boston Edison Weymouth station, which have already been described in the ELECTRICAL WORLD.

A protracted accounting session was held Friday afternoon under I. S. Hall, chairman, with reports of the merchandising and jobbing committee by P. M. Scott, transportation accounting by J. F. Lyons, credits and collections by W. D. Dyer and preservation of records by J. H. Bissel, the respective committee chairmen. Abstracts of papers, reports and discussions of general interest will be presented topically in later issues.

High-Tension Conference

International Gathering to Discuss Trunk-Line Voltage Will Meet at Paris on Nov. 27

THE second international conference on electrical superpower systems will be held in Paris this year from Nov. 27 to Dec. 1, according to an announcement recently made by M. J. Tribot-Laspière, general secretary of the Union des Syndicats de l'Electricité. This conference has been considered desirable because the exchange of opinions, personal contact and other benefits which were afforded by the first conference in Paris, in 1921, when twelve countries were represented and more than two hundred delegates were present, proved very useful. As before, the purpose of the conference will be to discuss any timely subjects connected with the design, construction and operation of trunk lines which are to be operated at high voltages. Already the general secretary in Paris has been definitely advised of a number of technical reports that will be submitted.

The American Institute of Electrical Engineers has been asked to appoint delegates to the conference and to state what reports if any will be submitted. The matter has been referred to the United States committee of the conference. Of this committee Dr. C. O. Mailloux is the president and Dr. C. H. Sharp is secretary. The committee welcomes for consideration the names of any persons who could contribute to

the papers and discussions and who could make the trip to Paris incidental to a pleasure or business visit abroad. Consideration is now being given to the selection of the delegates.

Among the reports which are already scheduled for presentation by delegates from other countries than this are the following: Communication between central stations (Meyer); construction of high-voltage, high-capacity contact lines (Leboucher); construction of foundations for towers (Duval and Lavanchy); technical regulation of high-tension lines (Meyer and La Fontaine); influence of discharge and nature of water on insulator tests (Sailly); construction of porcelain and porosity of insulators (Bertrand); equipment of a million-volt laboratory at Ivry-Port (Groutelle); protection of high-tension hydro-electric lines (Gillespie), and methods of measurement and protection in high-tension tests (Bellon).

PAPERS FROM UNITED STATES

American contributions announced so far will include: American practice in outdoor substations (Young); the latest progress in insulation (Jackson); choice of voltage for high-tension lines (Hanker); latest progress in oil circuit-breaker development (MacNeill); relay protection for large high-voltage networks (De Jong), and insulators for high-tension lines (Bennett).

Four-Million-Dollar Electrification for Boston

Electrification of the Shawmut branch of the New York, New Haven & Hartford Railroad in conjunction with an extension of the Dorchester tunnel of the Boston Elevated Railway system south of Andrew Square will shortly be started as a result of the acceptance this week by the Boston City Council of an act of the last Legislature providing for this improvement. By this development it will be possible to operate rapid-transit trains from the Milton district into the heart of the city. The estimated cost is $4,000,000.

Pennsylvania Utility Plans Bonds for $50,000,000

Stockholders of the Pennsylvania Water & Power Company are to meet on Oct. 30 to vote on issuing $50,000,000 first refunding 5 per cent bonds for retiring $11,878,000 bonds outstanding and for future additions to facilities. The proposed issue is thought to be bound up with the plans to build a great hydro-electric plant on the Susquehanna River near Conowingo, Md. These plans are fathered by the Susquehanna Power Company, which holds a preliminary permit from the Federal Power Commission to construct a dam extending to the tailrace of the Holtwood power dam at McCall's Ferry. An ultimate output of 360,000 hp. at Conowingo is contemplated at a cost of $30,000,000.

Another Utility Bureau

Oregon Organizes a Committee to Spread Information, with F. T. Griffith at Head

OREGON is the latest state to organize a body for dissemination of facts and figures concerning its public utilities. The Oregon Public Utility Information Bureau was organized last week with Franklin T. Griffith, president Portland Railway, Light & Power Company, as chairman, and John A. Laing, vice-president Pacific Power & Light Company, as secretary-treasurer. The other members are C. M. Brewer, vice-president and general manager Mountain States Power Company, Albany; J. P. Lottridge, vice-president and general manager Eastern Oregon Light & Power Company, Baker; Paul B. McKee, vice-president and general manager California Oregon Power Company, Medford; Guy W. Talbot, president Portland Gas & Coke Company, and L. T. Merwin, vice-president and general manager Northwestern Electric Company, Portland. The seven utility companies represented are among the largest in the state, with an invested capital of about $125,000,000. They serve two hundred thousand customers with light, power, heat and gas.

This committee has selected as director of the bureau W. P. Strandborg, for the past eight and one-half years in charge of the publicity and advertising department of the Portland Railway, Light & Power Company. The headquarters of the bureau will be Suite 820, Electric Building, Portland.

The Oregon committee is the thirtieth to be formed, and several of those in existence cover more than one state.

New Project for Development on Green River

Early development of hydro-electric power on the Green River in Utah is possibly foreshadowed in an application filed with the State Engineer for a permit for a combined power and irrigation project at the so-called Split Mountain site near Vernal. This new project is understood to be backed by Col. A. E. Humphreys, a capitalist of Denver. On account of new features involved it is believed that the proposal eventually will be turned over to the Federal Power Commission for action and that it will be necessary for a license to be obtained from that body.

The Utah Power & Light Company has filed an application for a preliminary permit for a comprehensive project which includes a unit of development at the Split Mountain site. In all probability this company would not be ready to develop this particular site for a number of years, because the market conditions for power would not justify an early development, so if the backers of the new project are prepared to construct in the near future the high dam they contemplate, they undoubtedly would receive serious consideration from the commission. It would be necessary to create a market for power developed at the Split Mountain site, or at least for a large part of it, which probably would mean that an electrochemical or electrometallurgical industry would be brought into the region as a consumer.

Edison Illuminating Companies Meet Next Week

Meeting at Dixville Notch, N. H., on Sept. 18 to Sept. 22, the Association of Edison Illuminating Companies will carry out a technical program along the customary lines. Besides the committee reports, there will be prepared and impromptu discussion on reserve capacity, standardization of voltage and frequency, and operating troubles. Addresses will be made by Eugene McAuliffe on "The Bituminous Coal Situation in 1930," by Dr. Charles A. Eaton on "Industry and the Man," and by E. W. Rice, Jr., and W. L. R. Emmet. The application of full automatic substations to the Edison system at Kansas City will be discussed by H. C. Blackwell and A. E. Bettis, high-voltage cables by D. W. Roper, high-voltage practice by G. Faccioli, centralized supervision and control of power systems by R. J. Wensley, power transmission at high voltage by F. C. Hanker, and residence rates by D. C. Jackson. A masked ball is to be held, and entertainment will be provided as usual for the delegates and ladies accompanying them.

Wyoming Oil-Refining Company Plans Electrification

Plans have been completed for the construction of a ten-million-dollar electrification project by the Midwest Refining Company in the heart of the famous Salt Creek oil field of Wyoming. The power station will be at Shannon, 6 miles north of the Salt Creek fields. The plan was adopted after a voluminous study and report by A. W. Peake, general superintendent for the company, and after officials of the Midwest Refining organization had become convinced that the field will cease to be a flowing district in two years and will become entirely dependent upon pumps. Mr. Peake's estimates show that a great saving will be effected by substituting electricity for steam power in both pumping and drilling operations. When completed, the Salt Creek field, it is said, will be the largest electrically operated oil field in the world.

Electricity will be derived from a superpower steam-turbine plant. Fuel for the boilers will be natural gas from the wells in the field. One of the first steps in the huge project will be to impound behind a dam 900 ft. long, 40 ft. high and from 100 ft. to 200 ft. wide at the base, the floodwaters of Salt Creek. The present water supply is scant and injurious to the boilers.

Advocate Public Ownership

Meeting at Toronto, League Members Attack Private Companies and Praise Ontario Hydro

ONE hundred delegates from all over the United States attended the convention of the Public Ownership League of America, which was held at the King Edward Hotel, in Toronto, this week, on Sept. 10, 11 and 12, under the presidency of Willis J. Spaulding, Commissioner of Public Works, Springfield, Ill.

President Spaulding declared that Ontario possesses the most successful publicly owned hydro-electric enterprise in the world. In Springfield, he said, without the advantage of water power, the commission was able to secure bituminous coal at $1.60 per ton and produce electricity at prices which compare very favorably with the cheapest rates in the Ontario Hydro-Electric system. He asserted that municipalities in the United States are beginning to realize that they will have to act quickly if they are not to find themselves permanently under the control of large private syndicates operating public utilities. In Illinois the private electrical corporations are linking up scattered producing stations with a view to creating state-wide and even larger distributing systems. As a result it is becoming increasingly difficult, Mr. Spaulding said, for cities to launch their own publicly owned light and power systems. "We hope to be able," he concluded, "to take preliminary steps toward securing federal legislation which will enable us in the United States to link up numbers of cities and municipalities into state-wide or province-wide systems such as are in operation in Ontario."

SENATOR JOSEPH ATTACKS GENERAL ELECTRIC

Senator George W. Joseph of Oregon attacked the General Electric Company as responsible for throttling public ownership and hydro-electric development in Oregon. Although Oregon is the third state in the Union in potential energy, which is in excess of 6,000,000 hp., he said, there is less than 200,000 hp. developed. The Senator took the ground that the water powers of Oregon should be developed for the people in the same manner as Niagara and other provincial powers had been developed for the people of Ontario.

The secretary of the league, Carl D. Thompson of Chicago, spoke on "Superpower the Supreme Issue." He quoted extensively from United States papers and periodicals in an endeavor to show that private enterprise is quickly getting control of the great water-power resources of the States.

On Monday evening the convention was addressed by Sir Adam Beck, chairman of the Ontario Hydro-Electric Power Commission, who declared that Canada in general and Ontario in particular would oppose with all possible strength any increased diversion of the waters of the Great Lakes at Chicago through the Drainage Canal, which carries the sewage of that city to the Mississippi valley.

Other addresses were by E. W. Bemis on "Utility Appraisals" and Cornelius Sheehan of New York City, Deputy Commissioner of Water Supply, Gas and Electricity, on "Failure of Regulation in New York." Mr. Sheehan's paper dealt with the subway traction situation.

Manufacturing Companies Get Further Word from Japan

The International Western Electric Company has received a cable from P. K. Condict, vice-president of the company, anxiety about whose safety in the Japanese disaster was reported in these columns last week, saying that he is safe and uninjured at Osaka. The cable was filed on Sept. 5 and received in New York on Sept. 8. Mr. Condict reported also the safety of Kunihito Iwadare, managing director of the Nippon Electric Company, an associated company of the International Western Electric, and of Dr. Oi, director of the Nippon company. The death of Walter T. Blume was confirmed, but Mrs. Blume and her infant are safe. Robert F. Ashbaugh and Stanley Bracken, members of the engineering staff of the Western Electric Company at Chicago, who were in Japan, are reported safe at Kobe.

Mr. Condict cabled that the modern concrete buildings of the Nippon Electric Company were destroyed but that the older brick buildings are intact. The concrete structures were built under rigid specifications especially to withstand earthquakes. About one hundred persons were killed in the collapse.

A cablegram from I. F. Baker, manager of the Westinghouse Electric International Company at Tokio, confirms the previous Shanghai dispatch regarding the safety of four Westinghouse men in the danger zone. Besides Mr. Baker these men are C. A. Johnson, general engineer; R. D. McManigal, railway engineer, and John J. Mylin, service representative. Mr. Baker has been in Japan three years.

Despite contradictory cablegrams, the General Electric Company feels assured that all its American representatives, with possibly one exception, are safe and are either at Kobe or on the ocean on the way home. The possible exception is Mr. Amrine, whom a press dispatch has included, with his wife and child, as among the killed. The company's laboratory building at Kawafaki, half way between Tokio and Yokohama, was destroyed with total casualties of about seventy in killed and injured, including prominent native engineers and department heads. No word has come from the Shibaura Engineering Works, in which the General Electric Company is interested, and they may or may not be standing.

San Francisco Supervisors Are for Municipal Distribution

Unqualified indorsement of municipal ownership and the direct distribution of Hetch Hetchy power was given in a resolution passed by the Board of Supervisors of San Francisco at a special meeting held Sept. 11 to settle the question of the disposition of the electrical energy which will be available upon the completion of the city's 70,000-kw. Moccasin Creek power plant. The resolution expressed unalterable opposition to the sale of power through any private corporation and declared municipal distribution direct to consumers to be the basic policy of the city.

It further provided that steps be taken at once for the purchase of a distribution system within the city limits, preferably that of the Pacific Gas & Electric Company. The City Engineer is directed to complete the Moccasin Creek power house and build a transmission system to a point within the city limits without delay and to proceed forthwith with the preparation of plans and specifications for a complete municipal distribution system capable of supplying the city, the householders and the industries of San Francisco with electrical energy.

Cahokia Plant at End of a Year's Construction

THE above illustration shows the state of construction last month of the first of the four contemplated sections of the Cahokia plant of the Union Electric Light & Power Company of St. Louis, on the Illinois bank of the Mississippi south of Free Bridge. The ultimate capacity of this plant will be 320,000 hp., or three times the all-year rating of the plant at Keokuk Dam.

Rocky Mountain Division to Take Up Many Subjects

Meeting for its fourth annual convention in conjunction with the Colorado Public Service Association, which is to hold its twentieth, the Rocky Mountain Geographic Division of the National Electric Light Association will on Sept. 17 to Sept. 19, at the Hotel Colorado, Glenwood Springs, Col., carry out the following well-balanced program:

MONDAY, SEPT. 17

Morning.—Address, Retiring President J. F. Dostal, Colorado Springs; address of welcome, Mayor W. G. McDonald, Glenwood Springs; address, Ernest C. Stenger, president Colorado Public Service Association, Denver; address, D. C. McClure, president Rocky Mountain Division, N. E. L. A., Denver; "Timely Topics," C. N. Stannard, Denver; "Illuminating Engineering as an Asset to the Electrical Industry," George H. Stickney, Edison Lamp Works, Harrison, N. J.; "The Constitution and Reasonable Rates," Paul W. Lee, Fort Collins, Col.; "What the Electrical Co-operative League of Denver Has Accomplished," S. W. Bishop, Denver.

Afternoon.—Reports of wiring committee (S. W. Bishop), membership committee (George E. Lewis) and committee on relations with financial institutions (W. C. Sterne); "Generating Good Will," John W. De Maine, Minneapolis; "Public Utility Financing," James N. Wright, Denver; "Publicity and Advertising Activities of the N. E. L. A.," George F. Oxley.

Evening.—Address, "The American Constitution," John T. Barnett, Denver.

TUESDAY, SEPT. 18

Morning.—Report Public Relations Section, E. A. Phinney, Golden, Col.; report Accounting Section, J. E. Loiseau, Denver; report Technical Section, H. H. Kerr, Denver; "Purposeful Publicity," Horace M. Davis, Lincoln, Neb.; "Our Relations with Our Employees," Ben S. Read, Denver; "Public Utilities—History, Causes of Unpopularity, Menace of Municipal Ownership," Charles R. Brock, Denver; "Promotion of Electric Cookery," Mrs. Alma E. Hunt, Pueblo, Col.

Afternoon.—Report Commercial Section, E. H. Coe, Denver; reports of accident prevention committee (F. A. Tewksbury), company employees' organization committee (C. H. Elliott) and rural lines committee (Carl Luscombe); "The Relation of Protective Apparatus to Continuity of Service," E. E. F. Creighton, Schenectady, N. Y.; "Present-Day Problems," George A. Hughes, Chicago; "Customer Ownership of Public Utilities," W. H. Hodge, Chicago, discussion by V. L. Board, Denver.

WEDNESDAY, SEPT. 19

Morning.—"N. E. L. A. Activities," Executive Manager M. H. Aylesworth; "Future of Application of Electricity from Commercial Department Standard," E. A. Hawkins, New York; "Supervision of Public Utility Organizations," R. E. Burger, New York; "Activities of Rocky Mountain Committee on Public Utility Information," George E. Lewis, Denver.

Afternoon.—Business sessions; election of officers.

Pacific Coast Jobbers Meet in Oregon

The electrical jobbers of Portland, Ore., were the hosts at the quarterly meeting of the Pacific Division of the Electrical Supply Jobbers' Association held at the New Gearhart Hotel, Gearhart, Ore., on Sept. 5-7. The attendance was well above the average so far as delegates from the Northwest were concerned, though from the more distant points it was somewhat less than usual.

Besides the business discussions at the closed sessions on Wednesday and Thursday afternoons, two papers were presented—one, entitled "My Competitors," by George A. Boring, Pacific States Electric Company, Portland, and the other, on the cost of sales solicitation, by Harry Byrne, North Coast Electric Company, Seattle. A. C. McMicken, commercial manager Portland Railway, Light & Power Company, was in the chair.

At the open session on Friday afternoon an address was given by John A. Laing, vice-president and general attorney Pacific Power & Light Company, Portland, on "State Ownership of Utilities." He was followed by Frank Branch Riley, who spoke of the importance of tourist trade. The banquet on Friday evening and the social features of the convention were very successful.

Brief News Notes

Next Week's McGraw-Hill Radio Talk.—H. C. Parmelee, editor of *Chemical and Metallurgical Engineering*, will give a radio talk on Wednesday, Sept. 19, on "The Work of the Chemical Engineer." This will be the third of the radio talks to be given by editors of McGraw-Hill papers in September.

Kansas City, Kan., Asks $4,000,000 for Light and Water Departments.—An ordinance providing for a bond issue of $4,000,000 for the Kansas City (Kan.) light and water departments will probably be voted on at a special election soon. The money is to be used for extensions and improvements, and half will go to the lighting department.

American Gas & Electric Absorbs Charleston (W. Va.) Company. — The West Virginia Water & Electric Company of Charleston has been acquired by the American Gas & Electric Company of New York. The West Virginia company furnishes Kanawha City and Dunbar, W. Va., with electric service, as well as Charleston, and is completing an extension to Malden.

Portable Substations.—The first portable electric substation used by the Interstate Public Service Company was "hooked on" at Taylorsville, Ind., recently. The station, which is a 500-cycle plant, was built at the company's shops at Scottsburg. Other like plants will be built and put in use by the company. They can be transported from one station to another to supply additional power when needed.

General Electric Company Uses Airplane to Expedite Mail to Its Assembled Salesmen.—Morning papers and important mail were delivered by airplane to the two hundred members of the General Electric Company's sales conference at Camp Lovejoy, Association Island, Ontario, last week. The flight was made from Schenectady, 132 miles away, in about two hours.

Keokuk Power for Galesburg, Ill.—Power from the Keokuk dam will be brought to Galesburg within a year, according to predictions being made by officials of the Illinois Power & Light Company and the Sante Fé railroad. The transmission line will be built on the Santa Fé right-of-way and will cost approximately $750,000. It will run within four miles of Monmouth, and the line may be tapped to afford cheaper power to that city.

Monument to Alfred Noble.—The Alfred Noble Memorial Committee, which has in charge the erection of a suitable monument to that distinguished American engineer, who died in 1914, has selected a design for the fountain which it is the purpose to erect in Rawlins Square, Washington, at a cost of $100,000. An earnest request is made to engineers and members of allied professions to contribute to the fund being raised for this object. Robert Ridgway, 49 Lafayette Street, New York, is the treasurer.

Ornamental Substation for San Diego.—A new 6,000-kva. substation has recently been placed in operation by the San Diego Consolidated Gas & Electric Company. On account of its location in a semi-residental district special attention was given to the appearance of the building. The Spanish type of architecture was used, and the building is artistically decorated in keeping with the other structures in the vicinity. Vines and shrubs will beautify the structure and will serve to conceal the lighting units for night illumination.

Contracts for English Railroad Electrification.—In an item with reference to the pending electrification of the Southeastern & Chatham division of the Southern Railway in England printed in this column on July 28 it was stated that the railroad had accepted the offer of the Metropolitan-Vickers Electrical Company to build 508 electric motors and control gear. As a matter of fact, information comes, the contract for the supply of the electric motors was placed with the English Electric Company, the Metropolitan-Vickers Electrical Company being awarded the contract for the control gear.

Power Sites in Texas.—Plans for water-power development as well as flood control, reclamation and irrigation of land are involved in a topographic survey of Texas regions which was begun on Sept. 1 by engineers of the United States Geological Survey in co-operation with the State Water Board. The work will take two years. The Geological Survey plans to expend nearly $100,000 a year upon it, and the state will match this appropriation.

Further Extension of Louisville Plant Necessary.—Owing to the continued growth of its residential and industrial load a further extension of the Riverside plant of the Louisville Gas & Electric Company has become necessary, and it is planning to enlarge the boiler room at a cost of about $520,000, work to begin early in the winter. The horsepower to be added to the steam unit will be about 20,000, making a total of 120,000 hp. The company is now com-

pleting a two-and-a-half-million-dollar extension to its plant and has already installed a 20,000-kw. turbine. In order to make room for the proposed extension the plant office building will be razed.

Georgia Company to Rebuild Dam.—The Baker County Power Company, Newton, Ga., will soon begin work on rebuilding the dam across Notchaway Creek, which was washed out in January. The Mees & Mees Company of Charlotte, N. C., are the engineers in charge of the work. The cost of replacement will approximate one hundred thousand dollars.

Powers of Alabama Commission May Be Circumscribed.—A bill has been introduced in the Alabama Legislature to take away from the Alabama Public Service Commission the power to halt the extension of hydro-electric lines to all sections of Alabama. This measure would repeal the sections of the present law giving to the commission the authority to grant certificates of convenience and necessity to public utility companies which desire to extend their service. The bill was inspired, it is thought, by the action of the commission in denying permission to the Alabama Power Company to erect a transmission line from Huntsville to Muscle Shoals and to build a hydro-electric plant on the Warrior River at Lock 17.

West Penn's Charleroi Substation.—The new "super-substation" of the West Penn Power Company at Charleroi, Pa., one of the largest in the country, which is already in service, although only partly completed, is now the central point of the West Penn transmission and distribution system. Power from the company's generating plants at Springdale and Connellsville, Pa., and Beech Bottom, W. Va., is fed into this new station over steel-tower lines, and outgoing lines radiate to all points of the compass. When the plans are completed power can be fed into a common point at Charleroi and distributed to any desired point on the system. The substation will be an important factor in the economical operation of combined water-power and steam generating plants.

Hydro-Electric Plant with 3,000-Ft. Drop for Clark County, Nevada.—Nevada newspapers give particulars of a hydro-electric plant to be built at Indian Springs, 45 miles from Las Vegas, Nev., which will develop, according to former Deputy State Engineer Ira MacFarland, 5,000 hp. and supply power and light to Las Vegas and the adjacent territory in Clark County. Much of the power will be used for pumping water for irrigation. The water for the power plant, Mr. MacFarland is quoted as saying, comes from eleven springs in the Charleston Mountains, which will be brought to one point of contact at Indian Springs, 12 miles from the source, the total drop being 3,000 ft. A substation for distribution is to be built at Las Vegas, from which the supply to that town will be provided, and lines will also run to the gypsum and borax plants in that region.

Seattle Sticks to 26,000-Volt Distribution.—An effort made by the Electrical Craftsmen's Union of Seattle to have distribution at 33,000 volts substituted for the 26,000-volt system already adopted was defeated by the City Council recently at the instance of Superintendent J. D. Ross, who said such a change would necessitate two sets of transformers and eventually add $45,000,000 to the cost of Skagit River energy. "Seattle's distribution system," said Mr. Ross, "is the only one of its kind in the world. It is a modified form of one adopted here about fifteen years ago which during the intervening time has proved immensely superior in economy and service."

Radio Exhibit at Chemical Exposition.—How radio is finding a use for many of the rare metals will be shown at the composite radio exhibit at the National Exposition of Chemical Industries, which opens at the Grand Central Palace, New York, on Sept. 17. A number of well-known firms have contributed products of their manufacture which deal directly or indirectly with the construction or operation of radio instruments. Thorium, tellurium, selenium, tantalum, molybdenum — all metals rarely getting into commerce on a broad scale—will be demonstrated. In addition to the metals, carborundum crystals, synthetic resins, hard-rubber radio parts, extremely fine precision instruments for electrical work and a number of other important features of the radio constructions will be demonstrated. Alundum tubes for use in measuring high temperatures, particularly in furnaces for drawing tungsten tube wire, will also form part of the exhibit.

Springfield (Mass.) Company Repairs Fire Damage in Record Time. — A notable achievement was made by the United Electric Light Company of Springfield, Mass., in re-establishing its power circuit so that no West Springfield industry lost an hour's time as a result of the temporary disruption of the company's lighting and power service for that town when the North End bridge across the Connecticut River was destroyed by fire on Saturday afternoon, Sept. 8. The fire destroyed three street-lighting, two house-lighting and one power cable which ran underneath the wooden flooring of the bridge. As soon as it was possible to begin work cables were laid across the new Memorial Bridge and new wires spliced to the damaged cables. By night the power service was connected, and the industrial plants were enabled to reopen Monday morning as usual. By 10 o'clock Sunday morning one house-lighting circuit had been replaced and by late afternoon the second house-lighting service was connected. Monday night the street lights were restored. The work involved the rerouting of ten or twelve miles of circuits.

Associations and Societies

Big Attendance at Denver Meeting.—More than three thousand persons listened to Dr. Charles P. Steinmetz, chief consulting engineer of the General Electric Company, in the Denver municipal auditorium on Sept. 4, at a meeting held under the joint auspices of the Rocky Mountain Division of the N. E. L. A. and the Colorado Chapter of the A. I. E. E. The subject of Dr. Steinmetz' lecture was "The Electric Power Industry," and a special amplification system was installed in the auditorium for the occasion. Clare N. Stannard, vice-president of the Public Service Company of Colorado, was chairman. George H. Stickney of the General Electric Company will be the principal speaker at a meeting to be held in Denver on Sept. 20, under the auspices of the Electrical Co-operative League of that city, as a preliminary to lighting campaigns contemplated by the league.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

Conference of Electrical Leagues—Association Island, Sept. 17-19. Society for Electrical Development, New York.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 17-19. O. A Weller, 900 15th St., Denver.

Association of Edison Illuminating Companies—Dixville Notch, N. H., Sept. 17-21. P. S. Millar, 84th St. and East End Ave., New York.

Michigan Electric Light Association—Grand Rapids, Sept. 18-20. Herbert Silvester, Detroit Edison Co., Ann Arbor.

Illuminating Engineering Society—Lake George, N. Y., Sept. 24-28. S. G. Hibben, 29 West 39th St., New York.

Association of Iron and Steel Electrical Engineers—Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

International Association of Municipal Electricians—Reading, Pa., Sept. 25-28. C. R. George, Houston, Tex.

Great Lakes Division, N. E. L. A.—French Lick Springs, Sept. 26-29. R. V. Prather, 305 Illinois Mine Workers' Bldg., Springfield, Ill.

Indiana Electric Light Association—French Lick Springs, Sept. 26-29. T. Donahue, Northern Indiana Gas & Electric Co., Lafayette, Ind.

American Electrochemical Society—Dayton, Ohio, Sept. 27-29. Colin G. Fink, Columbia University, New York.

National Safety Council—Buffalo, Oct. 1-5.

American Institute of Electrical Engineers—Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

Empire State Gas and Electric Association—Lake Placid, N. Y., Oct. 8-9. C. H. B. Chapin, Grand Central Terminal, New York.

Association of Electragists International—Washington, Oct. 8-13. Farquson Johnson, 15 West 37th St., New York.

American Electric Railway Association—Atlantic City, N. J., Oct. 8-13. J. W. Welsh, 8 West 40th St., New York.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Oct. 19-20. Herbert Smith, Robson-Prichard Bldg., Huntington.

Telephone Pioneers of America—Atlantic City, N. J., Oct. 19-20.

Electric Power Club—French Lick Springs, Ind., Nov. 19-22. S. N. Clarkson, 900 B. F. Keith Bldg., Cleveland.

Recent Court Decisions

Evidence as to Depreciation.—In an action brought by the Van Wert Gaslight Company against the Public Utilities Commission of Ohio, the Ohio Supreme Court declared that in proceedings by a public utilities commission to fix rates, dependent on the valuation of the property of a public utility, where the commission admitted all evidence offered by the company, including an inventory filed by the company, and also itself took an inventory and decided the rates on its own inventory, the court will not say as a matter of law that the order fixing the rates disregarded evidence as to depreciation. (140 N. E. 137.)*

Constitutionality of North Dakota Utilities Acts Sustained.—The legislative acts conferring upon the State Board of Railroad Commissioners of North Dakota the power to regulate rates and practices of public utilities have been declared valid in a decision handed down by the State Supreme Court in an action brought by the Hughes Electric Company of Bismarck for an injunction to prevent the commission from holding a hearing affecting rates for electricity and steam heating. The plaintiff maintained that the law was void as vesting legislative or judicial powers in administrative officers.

Commission May Regulate Rates of Corporation Not a Public Utility Where These Involve Contract Rates of a Utility.—The Ohio Mining Company and others made complaint before the Public Utilities Commission against the rates for electricity of the Hocking Power Company, the Athens Electric Company and the Southern Ohio Power Company. The Athens Electric Company and the Hocking Power Company filed answers denying that the rates were unreasonable and unlawful. The Southern Ohio Power Company filed a motion in which it asked that it be dismissed from the action on the ground that it is not a utility within the meaning of the public utilities act of Ohio since it disposes of its entire stock of electrical energy by private contract to the other two companies, whose stock it owns. The latter plea was accepted by the commission, and the dispute was carried to the Ohio Supreme Court, which has reversed the finding and sent the case back to the commission. The court held that, although the mere fact that a corporation sells its entire product upon contract to public utilities which in turn sell that product to consumers does not make such corporation a public utility within the definition of the law, where, by the process of incorporation, the ownership of a property is nominally divided between two or more corporations, but is in fact the same, and the business of such corporations is but a single enterprise, a dedication of the property of a nominal owner thereof to the public service is attributable to the real owner thereof and is a dedication of the entire property involved in the common enterprise. (140 N. E. 143.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Rules of Procedure in Public Service Commission Cases in Indiana Courts.—In City of New Albany vs. Public Service Commission of Indiana, a case in which complaint was made of gas rates fixed by the commission, the Supreme Court of Indiana ruled that under the special statute affecting court procedure in commission cases strict rules of pleading under the Civil Code did not control, and that by supplemental complaint facts occurring after the suit was begun could be brought in. (140 N. E. 433.)

Criticism of the Reproduction-Cost Theory of Valuation.—In upholding the Wisconsin Railroad Commission against the Waukesha Gas & Electric Company, which appealed from the commission's decision refusing it an increase of rates, the Supreme Court of Wisconsin said that no court could interfere with a rate made by the commission on any ground except that it was unreasonably high or unreasonably low; that in Wisconsin where a utility operated under an indeterminate franchise in the nature of a monopoly, with an agreement that the municipality might take over the plant at any time at a fair valuation, the property of such utility could not at any time be of greater value than that which the municipality might purchase; that such value was the value of the plant of the utility as a whole for the purpose of supplying the public with its commodity at a price regulated by law. The court discussed the weight to be given to reproduction cost new less depreciation in arriving at a valuation, concluding that: "It is the property that the constitution affords protection and not any special theory of valuation. . . . The theory of cost of reproduction new less depreciation is unsound for the reason that cost of reproduction can only be established theoretically. Every-day experience in structures about to be erected confirms this. When applied to property of a public utility purchased under conditions which no longer exist and incorporated into the property of the utility under circumstances that cannot be reproduced, it is not only theoretical but highly speculative. If the cost of reproduction is to be given special weight when prices rise, it must be accorded the same value when they drop. . . . Materials entering into the construction of a plant of a public utility lose their individual identity and become part of a whole to be valued as a plant and not as materials not so incorporated."

Commission Rulings

Commission Should Not Interfere in Questions of Management.—In an appeal against the rates of the Lisbon Light & Power Company exception was taken to expenditures made by it for an oil engine and an extension. The New Hampshire Public Service Commission declared that such expenditures belonged to the realm of management, not that of supervision, and that they were not subject to interference by the commission, except possibly in cases where the cost was clearly unwarranted.

Depreciation of Overhead Expenses.—The Michigan Public Utilities Commission in its valuation of the property of the Detroit United Railway held that the theory of not depreciating overhead expenses is defensible only upon the hypothesis that the property is to be continuously maintained in operating condition from operating revenues and that no capital contributions are to be made thereto. The commission held that probably those overheads allocable to property whose maintenance is constantly paid from operating revenues and not charged to the capital account ought not to be depreciated as a matter of accounting practice. It was pointed out that the Interstate Commerce Commission depreciated certain overheads and that the Supreme Court of the United States in its review of the Galveston case did not hold that no overheads should be depreciated, although it was said that many items included in the overhead cost of original construction might properly be excluded in calculating the amount of the depreciation annuity.

Company Ordered to Connect Farmers at Actual Cost Because of Alleged Misrepresentation.—Complaint having been made that the Badger Public Service Company was attempting to charge farmers $200 each for connection with its lines, although, it was asserted, the company's representatives had before the line was built led the farmers to believe that the charge would not be more than $65, the Wisconsin Railroad Commission has ordered the company to connect farmers living directly along the transmission system at actual cost excluding the cost of metering equipment. The commission blamed the company for failing in this instance to apply the accepted rules of the commission for rural service, though previous to an actual determination the commission did not say that the charge of $200 was excessive. The farmers contended that a proportionate charge should be made against certain villages served from the line. They also asked that where three or four farmers live on adjacent land it be made possible for them to get energy from one transformer.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

C. S. Banghart Now Staten Islander

Charles S. Banghart, who was recently appointed vice-president of the Staten Island (N. Y.) Edison Company and the Richmond Light & Railroad Company, as was announced in the Sept. 8 issue of the ELECTRICAL WORLD, has been associated with the electrical industry since 1892, when he entered the employ of the Thomson-Houston Electric Company to electrify the street-railway system at Allentown, Pa. From that year until 1914, a period of twenty-two years, Mr. Banghart was engaged in railway work with the Union Railway Company of New York City, the Flushing & College Point (N. Y.) Lighting, Power & Railway Company, the Interstate Railway Company of Reading, Pa., and the New York & Queens County Railway Company, Long Island City, N. Y. In 1914 he went to Binghamton, N. Y., as vice-president and general manager of the railway and electric company there, remaining until 1919, when he went to Augusta, Ga., as general manager of the Augusta-Aiken Railway & Electric Corporation. It was this position Mr. Banghart relinquished to accept the appointment in Staten Island.

Mr. Banghart occupied an enviable position in Augusta both as a public utility executive who took charge of a badly run down property, built it up and restored public confidence and as a popular citizen who co-operated in every enterprise for the advancement of the city's interests. The properties on Staten Island are under the management of the J. G. White Management Corporation of New York City. R. L. Rand, formerly vice-president and manager of the Richmond Light & Railroad Company, will continue with the successor company as general manager.

Malcolm H. Hendee, commercial and purchasing agent of the Augusta-Aiken Railway & Electric Corporation, Augusta, Ga., has been appointed assistant secretary and treasurer of the company to succeed F. Bayard Culley, recently made general manager. Mr. Hendee has been connected with the company since 1908.

Arthur Williams, general commercial manager of the New York Edison Company, returned from abroad last week on the Cunard liner *Aquitania*. Mr. Williams reports that American equipment and methods are being adopted in Europe and that that continent is turning more than ever before to electrical development. Judging from the tendency which is evident at present, he believes that in a short time every available source of water power in Europe will be utilized.

J. H. Shearer Heads Pennsylvania Electric Association

J. H. Shearer, vice-president in charge of operation of the Penn Central Light & Power Company, Altoona, was elected president of the Pennsylvania Electric Association at the convention which the association held last week at Bedford Springs. Mr. Shearer

J. H. SHEARER

entered the service of the Thomson-Houston Company in 1890 and after a short association with this organization and the Poulton Electric Company he went to Mexico with Rosenswag & Company, agents for the Westinghouse company in Mexico City. Subsequently he became identified with the Santa Gertrudio Jute Mill Company, Orisaba, then with the Cia de Luz y Fuerza Motiz, Guadalajara. Following service in the Spanish-American War, he joined the General Electric Company at Schenectady, but returned to Mexico shortly after to take charge of the Cia National de Luz Electrica. When a consolidation of all the electric utilities of Mexico City and surrounding territory was effected in 1903 he formed the construction firm of Gardner & Shearer. This partnership was dissolved in July, 1907, and in August he organized the Shearer Electric Construction Company, which continued in business until August, 1911, when, on account of the revolution in Mexico, he sold his interests and returned to the United States. From 1912 to 1914 he was with the Kelvin Engineering Company of New York City. Later he was made superintendent of the Eastern Shore Gas & Electric Company with headquarters at Salisbury, Md., which subsequently came under the management of Day & Zimmermann, Inc. In May, 1916, he was offered and accepted the position of general superintendent of the Penn Central Light & Power Company, also under the management of Day & Zimmermann, and early in 1923 he was elected vice-president in charge of operation, the office he occupies at the present time.

Prof. J. W. Miller, who has served as head of the department of electrical engineering of the Oklahoma Agricultural and Mechanical College for several years, is now mechanical and electrical research engineer at the engineering experiment station of the University of Arkansas. Mr. Miller will devote his time exclusively to research work on problems of interest to the industries of the state. He is a graduate of the University of Texas and of the Massachusetts Institute of Technology.

Obituary

John Braxton of Kokomo, Ind., one of the first promoters of the Indiana Railways & Light Company, later merged into the Northern Indiana Power Company, died suddenly at his home in that city. Mr. Braxton, who was seventy-nine years of age, took a prominent part in the early industrial development of Kokomo.

Henry W. Harris, associate editor of the *Stone & Webster Journal*, died suddenly upon the golf links at Marion, Mass., Sept. 9. Mr. Harris was born in 1871 at Flushing, L. I., and was graduated from Yale University in 1895. He entered the public utility industry about nine years ago and was on the staff of the Northern Texas Traction Company, Fort Worth, Tex., from 1914 to 1921. He went to the Boston office of Stone & Webster, Inc., about two years ago and for most of that time was engaged in editorial work.

Morton J. Fitch, sales manager of the motor division of the S. A. Woods Machine Company, Boston, and one of the best-known commercial engineers in the New England central-station and manufacturing fields, died Sept. 5. Mr. Fitch was born in Chicago in 1872. For twenty-eight years he was in the employ of the General Electric Company, with headquarters at the Lynn (Mass.) works. Several years ago he resigned to become associated with the Woods organization.

Langdon Gibson, who had been associated with the General Electric Company thirty-one years when he resigned two years ago because of ill health, died Sept. 5 at Criehaven, Me., where he was spending the summer. Death was due to cerebral hemorrhage. He was a native of Boston and was fifty-eight years of age. Mr. Gibson was production manager of the General Electric Company, Schenectady Works, at the time of his resignation and was well known in the industrial world.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

The High Cost of List-Price Changes

What These Mean to Catalog Costs—How List Price Changes Have Increased—Comparison with Other Industries a Troublesome Distribution Cost

NOT long ago a certain jobber of electrical supplies wrote a letter and sent it out to the important manufacturers of wiring devices. He said:

We are constantly annoyed by the great number of changes made in list prices from time to time, which it seems to me has become quite acute during the past six months. It just means that a concern getting out a catalog today will suffer because that catalog will become practically worthless inside of a year.

Prior to the period of the war there were comparatively few changes made in list prices, and during the height of the high prices we were told that adjustments would be necessary in order to meet the increased cost of manufacture. We find that since that time prices have changed several times. Let us take, for example, the pull socket, which changed from 60 to 50 cents, from 50 back to 60, and now has been reduced from 60 to 55.

We should like very much to get out a catalog within the next twelve months, but are thoroughly convinced that until the manufacturers have followed some definite plan of action in order to make a catalog worth while we certainly shall not go ahead with it. I think this is a detriment to a manufacturer who is anxious to have a jobber display his material in the jobber's catalog. I don't mean to infer that this applies only to your company. It applies to all manufacturers—of wiring devices in particular. In fact, I should like very much to get an expression from you as to what the jobbers may expect and the possibility of the changes being minimized in the future.

I realize that the manufacturer has his own problem, but it strikes me that there should be a way to meet this common problem by having a separate schedule for items which may be subject to radical changes that could be adjusted by a change in the discount rather than in the list price.

This letter describes a situation which apparently is becoming steadily more of an issue between the electrical jobbers and their suppliers. As it states, the condition applies particularly to the wiring-device lines, but this has come to be a very comprehensive term, until today the materials included within the group have come to bulk well near the three-fourths of the average jobber's stock and a very large proportion of his catalog and of his salesmen's time. Trouble in the wiring-device lines is therefore a very serious matter to the distributor of electrical supplies, and any waste and loss that affects him so extensively becomes a burden on the cost of electrical materials and the concern of the industry generally.

What Catalogs Cost

The average jobber's catalog represents an expenditure of from $4,000 to $10,000. These catalogs are printed and distributed at this heavy expense because they are considered by the trade and industry an essential service. Nowhere else can there be found in one book a complete list of the full variety of electrical supply lines, embracing the products of the many manufacturers. Dealers, contractors, industrial plants and central stations use these books in planning installation work, in selecting and specifying, in calculating costs and the ordinary routine of quoting and ordering. The price figures listed in these catalogs are the most vital feature in them. It is of the utmost importance, therefore, that these prices be correct and remain so as long as possible, for just as soon as the prices listed in the book become no longer correct and dependable then the book becomes useless. And by the book is meant the many catalogs of all the jobbers. Since there are about 500 jobbers of electrical supplies in the United States and probably one-fourth of them publish catalogs about every three or four years, we can conservatively estimate an annual expenditure of, say, $150,000 paid out perpetually, each year, for jobbers' catalogs.

These books are published every four years, understand, not because the lines change but because the prices change. New devices introduced and added to the jobber's line can be appended to the book by extra sheets. But when too many of the prices change the value of the book is gone. If it were possible to reduce the rapidity of list-price changes that affect this book, the life of a jobber's catalog might be greatly lengthened. And if it could be doubled, say, it would mean a saving of $75,000 or more a year in the expense of selling electrical supplies, and the entire industry will agree that this would be worth while.

But that is not the only expense that is caused by this constant changing of list prices. The theory of the list price and discount system is that by setting a high list men may become familiar with the base element in the cost of a commodity. One may learn the discount he receives and the other discount that he gives his customer, and when it becomes necessary to change the price, because of some fluctuation in a raw material, for instance, the discount may be changed, but the list is not changed. Such a change of prices at best entails a troublesome and expensive routine on the part of the jobber. The quotation check must be notified and he must change his price sheets. Salesmen must be notified and they must make the change in their price books. Notices are very often also sent to customers on important price changes, and for some time it becomes necessary to explain changes and meet objections. Consider how much more labor and expense is caused when in addition to unavoidable changes in discounts come list-price changes at frequent intervals?

How Lines Compare

The question is, Can it be avoided? Would it be possible to reduce the number of price changes, increase the life of catalogs and lighten the burden on personnel? Here are some interesting comparisons for which a number of prominent jobbers are authority:

On outlet boxes list prices have changed once in ten years.

On bushings and lock nuts there has been one change in ten years.

Cable boxes are very steady and so are elbows and canopies.

Fuses have changed list only once in ten years.

Fans change list infrequently.

Lamps have changed often, there being five or six changes in list price on one lamp, for example, in the last four or five years.

Heating devices, particularly flatirons, have changed often.

Porcelain sockets and receptacles, switch plates, push-button switches and several other devices have been changing list frequently. In addition, there are in fact three different lists on switch plates, covering thin, medium and thick plates, varied for two-gang, three-gang, four-gang and so on, whereas one thickness of plate would be enough, according to general opinion. These goods, together with plug cut-outs, fuse plugs, pull and key sockets, represent the bread and butter of the jobbing business. And it is upon these that the greatest number of list price changes has come.

Every day they say there come in from sources on all sides new lists of changes. One day recently one manufacturer alone announced 113 changes in list prices. In a large organization it takes the equivalent of the full time of one clerk to keep list-price schedules up to date. This constant change inevitably leads to a very large number of errors in quoting and in billing that occasion in the aggregate a heavy loss, and the influence of this instability in the very fundamental of cost knowledge —the memory of prices—entails an amount of mental anguish and exasperation that can be imagined.

If former history and the practice of other industries counts for anything, this present epidemic of list price changes is more of a habit than anything else, an outgrowth of the agitated years of the war and post-war periods. For formerly there were but few such changes. List prices carried on year after year with very little disturbance, and so, in fact, it is today in the hardware, mine supply and plumbing industries. The following summary statements by electrical jobbers who maintain departments selling in these fields is impressive evidence, it would seem, that list price stability can be maintained:

A Connecticut jobber says that he has complained so much against the evil that he has the reputation among manufacturers of being a "common kicker." He states that he is in favor of the manufacturer adopting a sufficiently high price so that it will stand. By doing this the manufacturer would be able to revise his discounts and take care of fluctuations in cost. He is of the opinion that list prices in the electrical industry are too low.

A West Virginia jobber states that he would like to see steps taken to remedy the evil that at present exists in the continual change of list prices. He states that his concern handles such articles as bolts, extras on rails, extras on steel, pipe fittings, belting and many goods of similar kinds on which one change in list price in five years would cover the average. He says there are many articles, like spring cotters, emery wheels, etc., on which there have been no changes in five or six years. The list on pipe fittings has not been changed in many years.

A Tennessee jobber says that he is in favor of list prices fixed high enough in order to afford room for fluctuations in net prices. He states that on wood screws there were no changes in list prices from 1903 to 1922. Recently, however, there have been a few changes in the list. This was done in order that the manufacturers could give uniform discounts. On machine bolts no change has been made since 1912. On pipe no change has been made since 1913.

A Wisconsin jobber says that he is in favor of adopting list prices that will stand. In the plumbing supplies line conditions are very much better and changes are few. He states that the list price and discount in the plumbing supplies line are much higher than in the electrical line.

A Rhode Island jobber states that the manufacturers of builders' hardware have made very few changes in list prices. He states that the list prices are changed practically only once a year and at that time new catalogs are published by the manufacturers showing the new lists.

An Ohio jobber says there are more changes in list prices in the electrical line than any other line which he handles, and his concern is in favor of doing away with lists and discounts and adopting only net prices.

Another Ohio jobber says that he has just finished a new catalog and the list price changes that have come along make him feel that his catalog is of little value. He states that in the hardware line most of the manufacturers change discounts rather than lists.

Another jobber writes:—"There is so much dissatisfaction among all the jobbers as to the price changes on wiring devices and the expensive way in which these changes are sent to the jobbers that something must be done. On a line of material like wiring devices it seems a crime to have fifteen or twenty different discounts on eight or ten different schedules and everything combined to make it so complicated that it costs the jobber too much to make a price change. Then he is hardly through with making one change when the manufacturer makes another one."

It would seem that a situation exists that should be studied carefully in the interests of the industry at large. The cost of distribution is everybody's trouble today. If we have here one avoidable element of cost — small though it may be in comparison with other factors—still it is worth consideration and reform.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

AFTER several very quiet weeks in which the electrical trade throughout the country has been in a condition of more or less suspended animation, with little buying pressure and the general flavor of declining prices, the forerunner of the fall market has made its appearance in the East. Both the Boston and New York markets report a decided improvement in demand, and if precedents are not to fail, this present quickening of trade along the Atlantic Coast is the beginning of the great buying period which will carry through the fall and winter and extend gradually across the United States. Such waves of seasonal fluctuation in the market usually have their inception in the Northeast and rapidly work westward to the Pacific.

Both manufacturers and jobbers have noted increased demand in the Eastern territory for practically the entire commodity list. The heaviest demand in the present market is for materials which enter into new building, and wiring devices and fixtures have shown the greatest activity in this improving market. Manufacturing circles report sufficient stocks of all wire, cable and wiring devices, but manufacturers of heavy machinery complain that their situation is being hampered considerably by lack of labor. Trade in used electrical machinery, however, is quiet.

During the week several large orders have come from Japan for copper and brass. It is yet too early, however, to estimate how much business America will receive for the restoration of power and light stations in the devastated section of that country.

Controller Business Exceptionally Large

RECENT increases in orders for motor-control equipment have begun to crowd existing manufacturing facilities so hard that there is little immediate prospect of improvement in delivery conditions in this branch of electrical apparatus production. Shipments are still being made on a reasonably satisfactory basis where special

designs are not involved. The importance of placing controller orders early for fall business is being emphasized in well-informed circles, and the purchaser's desire to keep inventories low is cited as an obstacle to the rendering of the best possible service on the part of the manufacturer. Time must be allotted for proper engineering analysis and for the design of equipment in applications of special character. To quite an extent, controller sales at the close of the summer have attained a momentum that bids fair to carry this class of business well into the winter without any marked diminution in volume. While it is true that midsummer sales were relatively quiet in some quarters, the "overhang" of last spring's very heavy demand is still being felt in manufacturing quarters.

Prices are firm and a great deal of interest is being shown in allied products like magnetic clutches and rheostats. An extremely active demand for radio rheostats has sprung up recently with every prospect of an intensely vigorous fall business, which some observers believe will tax manufacturing facilities to their utmost.

New England Collections Show Much Improvement

COLLECTIONS in New England show a distinct gain this month over August, and the outlook for the rest of the year is most encouraging. Some of the leading jobbers in this section still report very poor collection results for last month, and it is doubtful if the handling of accounts is as yet on a basis as satisfactory as that which prevailed during the spring. Public utilities, railroads and industrial concerns of all sorts are paying the jobber with reasonable promptness, and even the recent slump in textile production has not had much effect on credits. In that and other fields business is quickening all along the line. Steady improvement is expected from now on for several months. Dealer collections are the slowest, and new accounts are being closely scrutinized. Average settlements run from fifty-five to seventy days.

Outlook Improving for Electric Household Boilers

A DECIDEDLY encouraging outlook is indicated for electric household boilers in considering autumnal business prospects. This equipment has been passing through a period of development during the last year or two, and it has now apparently reached a degree of standardization that includes the usual 5, 10, 20 and 30-gal. tanks, with more recently added sizes up to 80 gal. Manufacturing facilities have been developed for the production of still larger units for special service when required. During this year the design has been improved by the use of heavy-gage copper for the inner tank in place of the former galvanized steel. This necessitated a price increase last spring, but since then prices have been steady and no immediate changes are in sight. Business this year has exceeded that of a year ago and negotiations are under way for the appointment of new agents in various quarters. Increased interest in the marketing of this product has lately been manifested in jobbing circles.

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	\$0.0337	\$0.0337	\$0.028
Cold finished shafting, per lb.	0.0433	0.0428	0.036
Brass rods, per lb.	0.1741	0.1825	0.1666
Solder (half and half), per lb.	0.276	0.276	0.228
Cotton waste, per lb.	0.1231	0.1231	0.1458
Washers, cast iron (½-in.), per 100 lb.	4.66	4.66	4.00
Em ry, disks, cloth, No. 1, 6-in. diameter, per 100	3.08	3.08	3.11
Machine oil, per gal.	0.349	0.349	0.36
Belting, leather, medium, off list	37%	37%	43½%
Machine bolts, up to 1-in. x 30-in., off list	44½%	44½%	53½%

Electrical Exports Show Increase of \$1,700,000

EXPORTS of electrical materials from the United States during July of this year exceeded the shipments made in the same month of 1922 by almost \$1,700,000, bringing the average for this year up to a point well in advance of the 1922 figures. A substantial increase was also shown over the June exports of electrical goods. Heavy power machinery, together with radio apparatus and bare copper wire, showed the largest gain during July. Unusually heavy shipments of large motors and electric meters were also made. Decreases as compared with the previous month were mainly in appliance lines and supplies. The following figures are supplied by the Bureau of Foreign and Domestic Commerce:

ELECTRICAL EXPORTS FOR JULY, 1923, COMPARED WITH CORRESPONDING MONTH A YEAR AGO

	Value July 1922	Value July 1923
Turbines	\$120,831	\$6,000
Generators:		
Direct-current:		
Under 500 kw.	41,271	66,638
500 kw. and over	20,882	53,215
Alternating-current:		
Under 2,000 kva.	35,392	4,989
2,000 kva. and over	82,378	95,848
Accessories and parts for generators	251,709	59,757
Self-contained lighting outfits	52,571	56,723
Batteries:		
Primary	71,007	104,979
Storage	107,377	218,863
Transforming and converting apparatus:		
Power transformers	449,132	360,772
Other transformers	48,578	62,107
Rectifiers, condensers, double-current and motor-generators, dynamotors, synchronous and other converters	156,119	53,326
Transmission and distribution apparatus:		
Switchboard panels, except telephone	274,906	228,861
Switches and circuit breakers over 10 amp.	180,776	186,134
Fuses and fuse blocks	14,525	18,386
Meters and measuring instruments:		
Watt-hour and other measuring instruments	20,539	45,161
Volt, watt and ampere meters and other recording, indicating and testing apparatus	84,103	87,665
Lightning arresters, choke coils, reactors and other protective devices	23,988	92,961
Motors, starters and controllers:		
Motors under 1 hp.	70,944	117,295
Stationary motors, 1 to 200 hp.	172,002	189,334
Stationery motors over 200 hp.	155,061	100,789
Railway motors	46,746	196,416
Electric locomotives:		
Railway	....	273,246
Mining and industrial	8,809	5,852
Other motors	14,278	8,136
Rheostats, controllers and other starting and controlling equipment	39,346	142,030
Accessories and parts for motors	97,706	159,900
Electrical appliances:		
Electric fans	51,463	50,147
Electric lamps:		
Incandescent—		
Carbon-filament	5,629	4,168
Metal-filament	84,769	82,949
Other electric lamps	13,024	17,989
Flashlights	21,240	52,974
Searchlights and projectors	5,056	52,164
Motor-driven household devices	34,928	71,207
Domestic heating and cooking appliances	36,116	54,476
Industrial electric furnaces and ovens	12,618	27,177
Therapeutic apparatus and X-ray machines, galvanic and faradic batteries, etc.	42,307	78,106
Signal and communication devices:		
Radio and wireless apparatus	385,861	682,885
Telegraph apparatus	9,979	43,091
Telephone apparatus	240,310	....
Magneto telephones	....	32,950
Other telephones	....	23,976
Magneto switchboards	....	475
Other telephone switchboards	....	12,033
Railway signals, switches and attachments	124,359	53,983
Bells, buzzers, annunciators and alarms	5,145	10,223
Other electrical apparatus and appurtenances:		
Spark plugs, magnetos and other ignition apparatus	80,446	162,520
Insulating material	87,217	107,352
Metal conduit, outlet and switch boxes	27,202	47,700
Sockets, receptacles and lighting switches	34,070	83,490
Other wiring supplies and fixtures	89,738	146,602
Other electrical apparatus	444,901	742,258
Globes and shades for lighting fixtures	28,675	44,498
Electrical glassware, except for lighting	15,326	17,643
Electrical porcelain	86,570	143,820
Electrical carbons, carbon brushes and electrodes	99,286	215,289
Insulated wire and cable (iron and steel)	16,296	53,160
Other manufactures of aluminum	79,901	169,919
Copper:		
Bare wire	130,184	218,227
Insulated wire and cables	145,186	256,021
Total electrical machinery, apparatus and appurtenances	\$5,078,777	\$6,754,858

Demand Improves Sharply in the Eastern Market

A SHARP advance in the demand for electrical supplies featured the Eastern market Monday, current orders being well distributed as to localities and diversified as to material listed. Jobbers are looking for a very busy fall. Stocks are comfortably equal to immediate requirements and prices have become quieter. Considerable new life is appearing in the retail trade. The credit situation is improving to a marked degree over midsummer conditions. Central-station financing continues steadily to reflect the expanding demand for service, and plant developments are widespread. Wiring devices are active and the demand for insulated and bare wire is considerable being accompanied by spotty price conditions on large order quotations. A movement against appliance price cutting has begun in a quiet way.

General business is healthy; money is easy where collateral is of recognized quality, and labor conditions are giving little trouble. Building contracts ran ahead of last year for the latest reported week. Interest in radio apparatus has continued to grow during the past week although the market is heavily supplied with low-cost material.

San Francisco Business Helped Greatly by Effective Campaigns

RETAIL business is improving noticeably owing to the excellent constructive work of the several associations and societies. An intensive "better illumination" campaign is being planned for the fall by these bodies. Household device sales are improving, several well-established lines have been strengthened, and there are the usual rumors of invasion by new firms. In general the field is stronger than it was a year ago and is marked by the increasing importance of the neighborhood store as compared with indiscriminate door-to-door solicitation.

Copper wires have decreased somewhat, lamp cord is 10 per cent lower, bare and weatherproof bases are 50 cents lower, Rubber-covered shows weakening tendencies, but other lines are again in equilibrium, and some predict that the period of price recession is almost over.

No Important Changes in Chicago Territory

JOBBERS in the Chicago territory find business just about the same as during the last three weeks. There have been no important changes in prices and stocks remain about the same. Pole-line hardware demand was a little better this week than last because several jobbers bought considerable quantities of this material this week.

The conduit situation is just the same with regard to jobbers' stocks on hand. Prices are firm and there is no indication of an immediate advance in conduit prices. Building activities improved a little this week, and considerable interest has been aroused over the situation which has arisen between the Landis award committee and the contractors. It is at first reported that twelve contractors had refused to sign up with the Landis award committee, but this report was denied, it being asserted that several of the contractors named have been out of business for some time and that the others named in the report have renewed their pledges.

The Metal Market

DOMESTIC demand for copper shows no improvement and the price remains the same as two weeks ago. Japanese demand for copper has spurted, and a leading interest which always handles business from that country has received numerous inquiries. None of these is for a large amount but individually they run from 100 tons to 300 tons, and the aggregate of all the inquiries that have been received is substantial.

NEW YORK METAL MARKET PRICES

	Sept 5, 1923 Cents per Pound	Sept 12, 1923 Cents per Pound
Copper, electrolytic	13 7	13 75
Lead, Am.S.& R.price	6 75	6.80
Antimony....	7.605	7.50
Nickel, ingot......	27.00 to 32.00	27.00 to 32 00
Zinc, spot...........	6.55	6.50
Tin, Straits ..	43 00	41.75
Aluminum, 98 to 99 per cent..........	25.00	25.00 to 26.00

Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Allis-Chalmers Unfilled Orders Are at $13,000,000

"Unfilled orders as of Sept. 1 totaled about $13,000,000," said Otto H. Falk, president of the Allis-Chalmers Manufacturing Company. "Bookings and billings are about equal at present. While there has been a slight falling off in business, we look for an early increase in volume. Production is somewhat hampered by shortage of labor. With more men, especially skilled labor, operations could be increased."

Larger Plant for Walker Vehicle

Completion in the latter part of September of an addition to the new factory of the Walker Vehicle Company, Chicago, manufacturer of the Walker "balance drive" electric trucks, is anticipated. The present factory, at State and Eighty-seventh Streets, was erected two years ago. The addition now under construction is a strictly modern and fireproof building, 360 ft. x 100 ft., of steel, concrete and brick. The new building is to house four new electric heat-treating furnaces and the frame assembly department.

The press of orders which has kept the present Walker factory busy day and night is responsible for the addition. It is estimated that this addition plus the new manufacturing facilities of Walker Vehicles, Limited, of England, will more than double the total Walker production this year.

Standard Turbine Appointments

The Standard Turbine Corporation, Wellsville, N. Y., announces the appointment of H. R. Geiger as its New York manager. Mr. Geiger is well known as an engineer and sales representative in metropolitan engineering and trade circles. His office is at 350 Madison Avenue, New York City.

Standard Turbine also announces the appointment of the Percy E. Wright Engineering Company as its Seattle agent with office at 2012 L. C. Smith Building, Seattle.

Hawthorne Works of Western Electric Now Employs 33,700

More than 33,700 men and women now are employed in the shops and offices of the Hawthorne works of the Western Electric Company. This is approximately 5 per cent of the total working force of Chicago industries. The Hawthorne works have now reached a point where they are almost twice as big as any other manufacturing organization in Illinois.

During the last five years the number of workers has more than doubled. On Sept. 10, 1918, there were 16,000; on Aug. 12 of last year there were 25,900, and on Jan. 1 of this year 28,400. During the past two weeks it is estimated that 700 additional employees have been brought into the organization. The continued expansion of the Bell Telephone System and the steady demand for Western Electric communication equipment are chiefly responsible for this rapid growth.

Edison Appliance Honor Tablet Awarded to New York District

The Hotpoint "tablet of honor," which is awarded from time to time to the sales districts of the Edison Appliance Company, Inc., Chicago, for unusual performance in upbuilding the business of that company, has just been given to the New York district salesmen in charge of W. B. Pierce. More than 20,000 "Headlite" heaters were sold in a campaign running in June and July in New York, Pennsylvania, Connecticut, Maryland, Virginia, West Virginia, Delaware and the District of Columbia,

which are included in the New York district.

The campaign just ended is the second to be recorded on the tablet. The first, the "expansion campaign," was won by the Pacific Coast district, P. H. Booth in charge, for sales in April and May. The company recently started its third contest, to run through September, to promote sales of holiday goods.

Uehling Instrument Appoints Southern Representatives

The Uehling Instrument Company, Paterson, N. J., combustion engineers and manufacturers of steam-power-plant economy apparatus, including CO_2 records, has appointed three new Southern representatives, namely, the Connor-Hudson Company, Southwestern Life Building, Dallas, Tex.; Gibbens & Gordon, Inc., 532 Canal Street, New Orleans, and the Cornell Mathews Company, 10 Oak Street, Orlando, Fla. These new representatives are fully equipped to give the personal service demanded by the growing business in the Gulf States.

Westinghouse Brooklyn Edison and Pennsylvania Railroad Orders

The Westinghouse Electric & Manufacturing Company is now executing orders for the Brooklyn Edison Company to the amount of approximately $2,225,000. These orders are for electrical machinery and include the largest transformers ever built. Special freight cars had to be constructed to transport the apparatus. One unit was so large it had to be shipped in sections. This is part of central-station expansion caused by increased industrial development and the continued selling activity in Brooklyn. The development project of the Brooklyn company will aggregate about $26,000,000.

The Pennsylvania Railroad Company has placed an order amounting to approximately $300,000 with Westinghouse for railway motors and control apparatus to equip three new-type electric locomotives. Four of the big motors, the largest single-phase commutator-type traction motors ever built, will be installed on each locomotive. The motors have a continuous rating of 768 hp. The mechanical parts of the locomotives are now being built at its Altoona shops by the Pennsylvania Railroad Company.

Magee Furnace Plant Enlarged and Representation Increased

R. P. Burton, vice-president Magee Furnace Company, Boston, in speaking to a representative of the ELECTRICAL WORLD last week, declared that electric range sales are running ahead of last year's by at least 25 per cent and that the outlook for fall business is decidedly good. At the Taunton (Mass.) factory of this company an addition, 25 ft. x 140 ft., has just been completed to furnish much-needed additional foundry facilities. Mr. Burton said that deliveries are in excellent shape and that while the demand is active for "straight" electric ranges, much interest is also being shown by the public in combination coal and electric ranges. Combination gas and electric ranges are selling too, but in relatively smaller numbers on account of the double expense of wiring and gas-piping connections involved. Tabler & Lyons, Inc., 315 Baronne Street, New Orleans, manufacturers' agents, have been appointed representatives of the Magee company for Alabama, Arkansas, Florida, Louisiana and Mississippi.

The Union Carbide & Carbon Corporation, 30 East Forty-second Street, New York City, has arranged an appropriation of more than $5,000,000 for extensions in its plants in different parts of the country. The Linde Company division is commencing the erection of a plant at Tulsa, Okla., of which the first unit will cost about $250,000, with equipment.

The Illinois Wire & Cable Company, Sycamore, Ill., has secured additional manufacturing space, in which drawing and stranding equipment for the manufacture of the finer sizes of bare copper wire and cable is being installed.

The General Electric Company has at present unfilled orders on the books at the rate of an annual volume of $300,000,000. Inquiries are said to be very encouraging. At the close of the year orders aggregating $242,739,000 stood on the books. Business has fallen off slightly—perhaps 10 per cent—from the peak of the year, but the volume coming in is entirely satisfactory and the future looks encouraging. Foreign orders stand about on a par with those of last year, and this part of the business shows a prospect about as good as the domestic business.

The Triumph Electric Company has opened a district office at No. 500 South Brevard Street, Charlotte, N. C., with J. McL. Jones as district manager. Mr. Jones has been intimately connected with the electrical industry in North and South Carolina for the past twelve or fifteen years, with the Southern Utility & Power Company, under James B. Duke.

The Mianus Diesel Engine Company, Stamford, Conn., recently formed with a capital of $1,500,000, will succeed to the business of the Mianus Motor Works, Inc., continuing in the manufacture of internal-combustion engines, with particular activity in the line of Diesel units. The new company is headed by M. E. O'Connell and Charles F. Bailey, 2226 Loring Place, New York.

The Line Material Company, Milwaukee, announces the establishment of offices and warehouses in two Eastern cities—one at 524 East 134th Street, New York City, and the other, a New England office and warehouse, at 120 Sidney Street, Cambridge, Mass. At the same time the former Eastern office at Albany, N. Y., will be discontinued. The New York office and warehouse will be under the direction of the company's Eastern manager, J. M. Kline. The New England office and warehouse will be in charge of H. J. Eslow. This company maintains a Cleveland warehouse, which has been considerably increased in size, at No. 8009 Wade Park Avenue. It is in charge of K. F. Ruthenberg.

The Irvington Varnish & Insulator Company, San Francisco, has taken over the selling agency of the output of the Harvey Wire Company, Newark, N. J., manufacturer of enameled wire, silk and cotton-covered wire, etc.

The Western Transformer Company has moved to new and larger quarters at 618 East Eleventh Street, Oakland, Cal.

Bernard Minn has been elected president of the Safety Highway Engineering Company, Milwaukee, at 1409 Fifteenth Street. This company has been capitalized at $1,000,000 and will manufacture an electric highway traffic signal, holding patent rights in the United States and Canada for the device. Other officers elected are: H. C. Hoppman, vice-president; W. A. Richter, secretary-treasurer; P. W. Kramer and Hal Cunningham, directors.

The Page & Hill Company of Minneapolis has appointed Lawrence E. Morier Eastern sales manager, with headquarters at Dayton. Mr. Morier has long been connected with the pole industry, having served for seventeen years in this field. Early in 1922 he left this industry to act as treasurer of the V. & O. Press Company of Brooklyn, N. Y., but now returns to his original line.

The Pelton Water Wheel Company, San Francisco, has completed plans and will soon take bids for the erection of a new addition to its plant to provide for considerable increase in production. It will cost approximately $100,000, with equipment. W. W. Hanscom, 848 Clayton Street, is engineer.

The Packard Electric Company, Warren, Ohio, is completing revised plans for the erection of its proposed new plant addition and expects to take bids on a general contract at an early date. The factory will be three-story and basement, brick, 85 ft. x 200 ft., on Dana Avenue. Keich, O'Brien & Hasken, Western Reserve Bank Building, are structural engineers, in charge.

The Steel City Electric Company, Pittsburgh, announces that it has added the State of Connecticut to the territory served by Kearton & Nagle, 71 West Twenty-third Street, New York City.

The Acme Electrical Manufacturing Company, formerly of Milwaukee, has removed its factory and offices to Madison, Wis. This company announces that it has increased its capitalization and is now developing a line of electrical devices including household utensils, soldering irons, cigar lighters, a general line of heating devices and electric controllers and starters.

Foreign Trade Opportunities

INQUIRIES FOR ELECTRIC BREAD-BAKING OVENS IN JAPAN.—Inquiries for commercial electric bread-baking ovens have been received by H. F. Hawley, United States Consul, Nagoya, Japan. The Consul asks American manufacturers interested in the Japanese market for this line to send descriptive literature, etc., to his office at Nagoya, in order that it may be available to persons interested.

EXTENSIONS PROPOSED TO ELECTRIC PLANT IN GUATEMALA CITY, GUATEMALA. — An expansion program, which includes the reconstruction of the present transmission line, the erection of a new 60,000-volt transmission line from Guatemala City to Galin, installation of a new 600-hp. water turbine at the Zapote plant and the purchase of two high-voltage transformers for the Guatemala City substation, has been announced by American Foreign Power & Light Company, Guatemala City. The cost is estimated at $261,250.

INCREASING DEMAND FOR X-RAY APPARATUS IN HONGKONG DISTRICT, CHINA.—An increasing demand for X-ray apparatus in Hongkong, *Commerce Reports* states, is evidenced by the fact that leading importing houses are making arrangements to handle such goods. The Hongkong district, which comprises the nearby provinces of China, contains over fifty military and civil hospitals and a large number of foreign missions equipped with modern hospital apparatus. The yearly imports of X-ray apparatus and auxiliary parts are estimated at $50,000. Only the best grade of portable equipment is used. The current supply is 110 volts and 220 volts, alternating current or direct current, varying in different cities in South China. A list of importers and dealers in X-ray equipment may be obtained from the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, at Washington, D. C., or any of the bureau districts by referring to file No. 99,837.

PROPOSED EXTENSION OF ELECTRIC SERVICE TO RURAL COMMUNITIES IN FRANCE.—In the closing days of the session of 1923 the French Parliament, according to *Commerce Reports*, passed a long-advocated measure for the extension of electrical service to rural communities. More general use of electricity on the farms, it is believed, will partly offset shortage of farm labor caused by the depletion of man power during the war. Besides, household industries, now hard pressed by manufacturers in the great industrial centers, will be strengthed, thus assuring the continuance of one of the supplemental sources of income which is important in many of the departments of France. The general purpose of the new law is to place at the disposition of the National Office of Agricultural Credit a maximum sum of 600,000,000 francs to be employed in rural electrical development through advances of cash to be made to the smaller political units or associations of individuals. The detail of administration is to be provided by regulations issued by the government to supplement the terms of the law.

New Apparatus and Publications

CONTROL PANEL. — The Automatic Electric Heater Company, Warren, Pa., has brought out a new "Speco" flush-type timeter control panel for use with its electric water heaters.

MAGNETIC SEPARATOR.—Bulletin No. 66 issued by the Magnetic Manufacturing Company, Milwaukee, describes and illustrates its new type "H" magnetic separator.

SERVICE SWITCH. — The Johns-Pratt Company, Hartford, Conn., has published a new catalog covering its new "Noark" universal service switch.

DESK SET AND ELECTRIC LAMP.—The Weidlich Brothers Manufacturing Company, Bridgeport, Conn., is manufacturing a combination desk set and electric lamp.

FLASHLIGHT.—The Yale Electric Corporation, Brooklyn, N. Y., has developed the new Yale "3-in-1" flashlight, which may be equipped with either one red, one green and one white bulb or with three clear "Mazda" bulbs.

ELECTRIC IRONING MACHINE.—The Manco Manufacturing Company, Bradley, Ill., has brought out a new "Keystone" electric ironer.

SOLDERING IRON.—The Rohne Electric Company, Minneapolis, has developed a soldering iron, "Sta-Warm." This device is made ready for use by simply screwing it into a lamp socket.

ELECTRIC RANGE. — The Walker & Pratt Manufacturing Company, 31 Union Street, Boston, has announced through its distributor, the Western Electric Company, 195 Broadway, New York City, its new "16-80" Crawford cabinet electric range.

ELECTRIC RESTAURANT.—The DuCharme Electrical Manufacturing Company, 2618 Detroit Avenue, Cleveland, has brought out the "DuCharme" electric restaurant type "00," equipped with three combination units and a hot plate. The company also makes a model A-5 for use in the home.

ELECTRIC STOVES. — The Stoughton (Wis.) Manufacturing Corporation has placed on the market its "Clark" line of electric stoves. These stoves may be obtained in two, three and four-burner models and without the oven.

VIOLET-RAY OUTFIT. — A new two-piece violet ray, known as No. 199, has been brought out by the Shelton Electric Company, 16 East Forty-second Street, New York City.

ELECTRIC COOKER. — The Martin Products Company, 625 Market Street, San Francisco, has placed on the market an electric portable cooker, "Kercher," which can be attached to any lamp socket.

SMALL ELECTRIC RADIATOR.—The Simplex Electric Heating Company, 35 Sidney Street, Cambridge, 39, Mass., has placed on the market its "Sunbowl Junior" radiant heater.

POPCORN POPPER AND PEANUT WARMER.—A new electric popcorn popper and peanut warmer, No. 993, has been placed on the market by the Kingery Manufacturing Company, Cincinnati.

WINDSHIELD SPOTLIGHT.—The Clymer Manufacturing Company, Denver, has developed a new windshield spotlight which can be turned instantly in any direction desired.

COMBINATION BENCH MACHINE.—The "Pony" bench machine manufactured by William B. and John E. Boice, 114 Twenty-third Street, Toledo, Ohio, includes a bench saw, drill, sander, grinder, polisher and buffer for working in wood and soft metals.

IRONING MACHINE. — The Holland Maid Company, Holland, Mich., has brought out an electric ironing machine with several new features.

WASHING MACHINE. — The Victor Manufacturing Company, Leavenworth, Kan., has developed a new electric washing machine, "Wonder," of the vacuum type.

SMALL ELECTRIC WASHER. — The Geyser Electric Company, 5508 Bloomingdale Avenue, Chicago, has brought out a small-sized electric washer for use in apartment houses.

ELECTROTHERAPEUTIC HIGH-FREQUENCY APPARATUS. — The William Meyer Company, 1644 North Girard Street, Chicago, has placed on the market an electrotherapeutic high-frequency apparatus, known as G405, which is smaller than the usual portable type.

PORTABLE HEATERS.— The Edison Electric Appliance Company, Inc., 5600 West Taylor Street, Chicago, has added four new models to its "Hedlite" line of heaters. Model A-29 furnishes three de luxe types of these heaters, which are finished in antique bronze, florentine relief and old ivory. Model A-30 is finished in mahogany and has a 12-in. reflector.

ELECTRIC RANGE. — The Rathbone-Sard Electric Company, Aurora, Ill., has brought out a new electric "Acorn" range, provided with baking oven and broiling oven.

New Incorporations

THE OHIO FARMERS ELECTRIC COMPANY, Mansfield, Ohio, has been incorporated by D. R. Whitlock, E. H. Barrett, C. W. Wolf, J. M. Hepp and H. O. Wolf. The company is capitalized at $15,000.

THE SNO-MON ELECTRIC COMPANY, Snohomish, Wash., has been incorporated with a capital stock of $100,000 by T. N. Bennett and others.

THE ST. CHARLES (KY.) ELECTRIC LIGHT & POWER COMPANY has been incorporated with a capital stock of $2,000 by W. L. Morse, H. E. Kinnett and M. T. Cranor, all of St. Charles.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

EVERETT, MASS. — The Boston Elevated Railway Company, 108 Massachusetts Avenue, Boston, is completing plans for the erection of the superstructure for its proposed local power plant. Jackson & Moreland, 387 Washington Street, Boston, are architects.

SALEM, MASS.—The Salem Terminal Company, operated by Charles H. Tenney & Company, 201 Devonshire Street, Boston, engineers, has purchased a site on Derby Street for the erection of a steam-operated electric generating plant to cost close to $500,000, to be of superpower type, for local commercial service.

PROVIDENCE, R. I.—Electric power equipment will be installed in the three-story addition to be erected by the Davol Rubber Company, Point and Eddy Streets, to cost about $75,000.

MILFORD, CONN. — The Connecticut Light & Power Company will soon commence the construction of a new power plant on the Housatonic River, to cost about $675,000, with machinery.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 18, for one motor-generator set, 500 kw. capacity, complete with three-panel switchboard. (Schedule 1281.)

HORNELL, N. Y.—The Holland Lumber Company is reported to be considering the construction of a power house at its proposed new mill.

NORTH TONAWANDA, N. Y., The Ontario Paper Company, Thorold, Ont., plans for the construction of a power plant at its proposed local paper mill on Little Island, estimated to cost $3,000,000. Warren Curtis is general manager.

NORWOOD, N. Y. — Electric power equipment will be installed in the new local plant to be erected by the Martin Pulp & Paper Company, estimated to cost $150,000.

TOTTENVILLE, N. Y.—The Staten Island Edison Company will make extensions and improvements in the street-lighting system in different parts of Richmond Borough, including the installation of new lamps.

KEARNY, N. J.—Plans are being perfected for extensions and improvements in the street-lighting system on main streets, including the use of 1,200-cp. and 600-cp. units instead of present arc lamps.

WALLINGTON, N. J.—Bids will be received by the Passaic Valley Sewerage Commissioners, 24 Branford Place, Newark, until Oct. 2, for two 10-kw. generators and other electrical equipment for installation at the local pumping station. Joseph H. Quigg is clerk.

WESTMONT, N. J.—Plans are being perfected for the installation of electrically operated pumping machinery at the municipal waterworks at Crystal Lake.

BALLY, PA.—Gehman Knitting Company will build a one-story power house at its mill.

HANOVER, PA.—The Hanover Power Company plans for extensions in its transmission lines in Hanover Borough and Penn Township.

NAZARETH, PA. — The Confederated Home Abattoir Company, 314 American Casualty Building, Reading, Pa., plans for the construction of a power house at its proposed plant on the Mauch Chunk Road, to cost about $65,000. The Gorman-Brown Engineering Company, 40 Rector Street, New York, is engineer.

NEW CUMBERLAND, PA.—Plans are being considered for the installation of an electric fire-alarm system.

PHILADELPHIA, PA. — Arrangements are being perfected for the installation of an improved street-lighting system on Broad Street, using 1,000 cp. units to replace present arc lights. The city Electrical Bureau is in charge.

PHILADELPHIA, PA. — The Sandy Creek Township Power Company, French Creek Township Power Company and Greenfield Township Power Company, now being organized by C. A. McClure and associates, plan for the installation of transmission lines and substations in the respective territories. James C. Jones, Bullitt Building, is representative.

PHILADELPHIA, PA.—Electric power equipment will be installed in the six-story plant addition to be erected by the Edward G. Budd Manufacturing Company, Hunting Park Avenue, manufacturer of automobile bodies, estimated to cost $800,000.

PHILADELPHIA, PA.—Plans are being arranged by the Department of Public Works for the installation of electrically operated pumping equipment at the municipal waterworks, Germantown and Southampton Avenues.

ANNAPOLIS, MD.—The Annapolis & Chesapeake Bay Power Company is arranging for a bond issue of $800,000, of which about $200,000 will be used for extensions and improvements.

BALTIMORE, MD.—An electric-steam power house will be erected at the new plant for Archer's Laundry, Mulberry and Howard Streets, estimated to cost $500,000, of which about $200,000 will be expended for machinery.

CECILTON, MD.—Plans are under consideration for the installation of a municipal electric lighting system. An appropriation is being arranged.

JENNINGS, MD.—The Morgart Coal Mining Corporation will install electric power and mechanical equipment at its mines in the northern section of Garrett County. The entire property will be electrified. William A. Morgart is president.

WESTPORT, MD. — The Consolidated Gas, Electric Light & Power Company has arranged an appropriation of about $1,000,000 for additions in its local generating plant, to increase the capacity to 53,000 hp. Extensions will also be made to the Penn Street power plant, Baltimore, to cost approximately $100,000.

BRADY, VA.—The Brady Mining Company, McLean, Va., plans for the construction of a power house at its local copper properties. F. N. Hagman, Vienna, Va., heads the company.

DAMASCUS, VA.—The capital stock of the Damascus Light & Power Company has been increased from $10,000 to $50,000.

MONETA, VA.—The Moneta Mineral & Mining Company plans to build a power plant at its local feldspar properties.

SALEM, VA.—The Crown Coal Company, recently formed with a capital of $250 000, contemplates the installation of electric power and mechanical equipment at its properties. M. J. Anderson is president.

CHARLESTON, W. VA.—The Virginian Power Company has purchased property in the vicinity of its electric generating plant at Cabin Creek Junction and contemplates the construction of an addition.

LOGAN, W. VA.—The Guyan Machine Shops have inquiries out for several transformers, 10, 15 and 20 kva. capacity, with fuses, hangers, lightning arresters, etc.

WESTON, W. VA.—The Monongahela-West Penn Power Public Service Company, Fairmont, it is stated, contemplates erecting a high-tension transmission line from Weston to Buckhannon, a distance of 15 miles.

North Central States

DETROIT, MICH.—Construction of an addition to the municipal power plant will be commenced, with equipment installation to increase the capacity from 10,000 kw. to 25,000 kw., for which bonds for $1,000,000 recently were voted.

GRAND RAPIDS, MICH.—A permit has been granted to the Kliss Manufacturing Company for the erection of a power plant at 50 Cottage Grove Street, S.W., to cost $10,000. Contract has been awarded for the building.

IRON MOUNTAIN, MICH.—Plans have been prepared by A. Kahn, Marquette Building, Detroit, for a power house for the Ford Motor Company, Highland Park.

RAMSAY, MICH.—The Castile Mining Company plans for the construction of a power house at its new shaft, including machine shop and other structures, estimated to cost $350,000.

ST. JOSEPH, MICH.—The Auto Specialties Company contemplates the construction of a new power house in connection with general plant expansion, estimated to cost $200,000.

WINONA, MICH.—Plans are being considered for the installation of electrically operated pumping machinery in connection with extensions and improvements in the municipal water plant. Alvord, Burdck & Howson, 8 South Dearborn Street, Chcago, Ill., are engneers.

ZILWAUKEE, MICH. — Superstructure work will soon be commenced on the proposed local electric generating plant of the Consumers' Power Company, estimated to cost $1,250,000.

HAMILTON, OHIO.—The City Council, it is understood, has engaged the Froelich & Emory Company, Toledo, to prepare plans for the proposed new municipal electric plant, for which $650,000 in bonds has been voted.

TORONTO, OHIO.—The Ohio River Edison Company has applied to the federal engineers at Pittsburgh, Pa., for permission to construct and operate an electric generating plant on the Ohio River, near Toronto, to cost about $1,000,000, to include coal-handling plant, ice breakers, harbor terminal and other subsidiary works.

DAWSON SPRINGS, KY.—Bids will be received at the United States Veterans' Bureau, Room 790, Arlington Building, Washington, D. C., until Sept. 29 for construction complete of outside service lines for heating, drainage, hot and cold water supplies and electric current for recreation building and four duplex officers' quarters under construction at the United States Veterans' Hospital No. 79, at Dawson Springs.

HOPKINSVILLE, KY.—The Kentucky-Tennessee Light & Power Company will commence the construction of its proposed steam-operated electric power plant, estimated to cost $300,000. It will be designed for an ultimate output of 9,000 kw., with initial installation approximating 3,000 kw.

MADISONVILLE, KY.—The North Star Coal Company plans to install electric power and mechanical equipment at its local properties.

PARIS, KY.—The Paris Gas & Electric Company is planning for the rebuilding of the portion of its power plant, recently destroyed by fire.

SOMERSET, KY.—The Kentucky Utilities Company, it is stated, has appropriated $200,000 for the erection of a 33,000-volt transmission line from Somerset to the Dix River and a substation in Somerset.

INDIANAPOLIS, IND.—The Excelsior Laundry Company, 222 North Alabama Street, has plans for the construction of a two-story electric-steam power house at its new plant on North New Jersey Street, estimated to cost $300,000. Blaine H. Miller is president.

MACOMB, ILL.—The Department of Public Works and Buildings, Springfield, Ill., has plans in preparation for the construction of a power house at the local State Teachers' College, estimated to cost $125,000. E. A. Martin, 304 South Wabash Avenue, Chicago, Ill., is architect.

SHAWANO, WIS.—The installation of an ornamental lighting system on Main Street is under consideration, the cost to be paid by property owners.

EAU CLAIRE, WIS.—A movement has been started to extend the ornamental lighting system from the downtown section to the Omaha railroad station.

TWO RIVERS, WIS. — The municipal street program for 1924, to cost $97,000, includes a provision for an extension to the ornamental lighting system.

MANITOWOC, WIS. — The Municipal Public Utilities Commission contemplates extending the electric light and power lines along the Plank Road and also to the Menchal subdivision of the city.

ST. JOSEPH, MO.—The St. Joseph Railway, Light & Power Company, it is reported, is planning to build a new electric plant, to cost about $1,000,000.

KANSAS CITY, MO.—The Kansas City Power & Light Company has plans in preparation for the construction of a one-story power plant, 80 ft. x 140 ft., at Sixth and Penn Streets, to cost about $60,000.

ST. CLOUD, MINN. — Permission has been granted to the Pike Rapids Power Company, St. Cloud, to build a hydro-electric plant.

WATERLOO, IOWA.—Work will soon ocmmence on the installation of a street-lighting system on West Fifth Street, Jefferson to Washington Street, and on East Fourth Street, Mulberry to Walnut Street.

COLUMBUS, NEB.—An election will be held in October to vote on the proposal to issue $15,000 in bonds for the installation of an electric plant by a proposed corporation of a rural electric light district. The company plans to erect a transmission line to supply electricity to all farms in the lighting district. Energy will be secured from the Columbus Light, Heat & Power Company.

STANTON, NEB.—The Council is considering the erection of an electric transmission line to connect with the transmission system of the Continental Gas & Electric Corporation, Omaha, to secure electricity, instead of generating it at the municipal plant.

TOPEKA, KAN.—Surveys are being made for a double-circuit, steel-tower transmission line from the new power plant at Tecumseh to Atchison, following the right-of-way of the Santa Fé railroad between Meriden and Atchison, to be erected by the Topeka Edison Company and the Atchison Railway, Light & Power Company.

WICHITA, KAN. — The Crystal Ice & Fuel Company plans to build an addition to its power house on North Osage Street.

Southern States

ASHEVILLE, N. C.—The Asheville Light & Power Company has purchased the plants and system of the North Carolina Electrical Power Company on the Ivy and French Broad Rivers for a consideration of $500,000 and will consolidate the property. Extensions are planned in transmission systems for interchange of service.

SYLVIA, N. C.—The Carolina Pole Company contemplates the construction of a power house at its new pole-treating plant on the Cullowhee Road, to cost approximately $75,000. J. L. Dilliard is secretary.

MACON, GA.—Plans are under consideration for the installation of electrically operated pumping machinery, in connection with waterworks expansion, to cost about $100,000.

SYLVESTER, GA.—Plans are being considered for the installation of electrically operated pumping machinery at the municipal waterworks to replace present steam equipment.

TALLAPOOSA, GA.—The Tallapoosa River Power & Textile Corporation, recently formed with a capital of $500,000, contemplates the construction of a hydro-electric power plant on the Tallapoosa River to cost close to $175,000. W. W. Summerlin, Camp, Ala., heads the company.

CORDELE, GA. — The Crisp County Lumber Company plans for the rebuilding of its power house and mill, recently destroyed by fire with loss estimated at $100,000, including equipment.

RUSSELLVILLE, ALA. — The Alabama Power Company, it is reported, contemplates the erection of a transmission line from Montgomery to Russellville.

TALLADEGA, ALA.—The City Council is planning to install electrically operated centrifugal pumps of 1,750 gal. per minute capacity at the dam to be built at Taylor's Mill.

ORLANDO, FLA.—The proposal to issue $525,000 in bonds for extensions to electric light and waterworks systems is under consideration.

TAMPA, FLA.—The Whiting Railway Motor Car Company contemplates the installation of a power house at its proposed local plant for the manufacture of gasoline-operated railway cars. J. A. Whiting is vice-president.

LAKEWORTH, FLA.—The Council is considering an issue of $60,000 in bonds for extensions to the municipal electric light plant and waterworks.

JOHNSON CITY, TENN.—The Council contemplates calling an election to vote on the proposal to issue $40,000 in bonds for the construction of an incinerator plant, electric fire-alarm system and ornamental lighting system.

MEMPHIS, TENN—The Jones & Laughlin Steel Corporation, Pittsburgh, Pa., contemplates the construction of a power house at its proposed local steel works on waterfront site, recently acquired.

BATON ROUGE, LA.—At an election to be held in September the proposal to grant a franchise to the Baton Rouge Electric Company will be submitted to the voters. Extensions and improvements, involving an expenditure of about $500,000, are under consideration by the company.

PADEN, OKLA.—Bonds to the amount of $25,000 have been voted for the erection of a transmission line, distribution system and for pumping equipment. Gantt & Baker, First National Bank Building, Oklahoma City, are engineers.

CHICKASHA, OKLA. — The Chickasha Gas & Electric Company is planning to erect a transmission line between Minco and Pocassett.

PICHER, OKLA.—The Keltner Mining Company contemplates rebuilding its plant and power house, recently damaged by fire. The loss is estimated at $100,000.

ORANGE, TEX.—The Orange Ice, Light & Water Company contemplates extensions to its transmission lines, to cost about $50,000.

FORT WORTH, TEX.—The Fort Worth Power & Light Company contemplates erecting a transmission line from Twenty-fifth and North Main Streets to Lake Worth, a distance of 6 miles, to cost from $25,000 to $30,000.

DALLAS, OAK CLIFF STATION, TEX.—The installation of an ornamental lighting system on Tyler Street is under consideration. O. T. Cox is chairman of committee.

COLEMAN, TEX.—The West Texas Utilities Company is negotiating for the purchase of the municipal electric plant. The transmission system will be extended and substation equipment installed.

Pacific and Mountain States

SEATTLE, WASH.—The Puget Sound Light & Power Company has plans for the erection of a substation at Western and Union Avenues, estimated to cost $50,000.

TACOMA, WASH.—Plans have been authorized for extensions and improvements in the municipal power house to cost about $58,000.

BEND, ORE.—The Cove Power Company will build an addition to its power plant, with additional outdoor-type substation and line extensions, estimated to cost $100,000.

PRINEVILLE, ORE.—Extensions are contemplated by the Deschutes Power Company, including the installation of an additional generating unit in the Cove power plant, the construction of a new concrete building to house the new and present units, a concrete spillway, a new outdoor substation at the lower tower, etc., to cost between $80,000 and $100,000.

BAKERSFIELD, CAL.—Plans are under consideration for the installation of a street-lighting system in the East Bakersfield district.

BRAWLEY, CAL.—The Holton Power Company, Riverside, is planning to install an ornamental lighting system to be maintained by underground wires.

CARMICHAEL, CAL. — Petitions have been circulated calling for an election to vote on the proposal to establish a public utility district for the distribution of electricity to each tract in the district.

GLENDALE, CAL.—Plans have been ordered prepared for the installation of an ornamental lighting system on Central Avenue, between Wilson and Arden Avenues, using single-light standards, and on the same street, between Wilson and San Fernando Avenues, two-light standards.

LAKE ARROWHEAD, CAL.—The Southern California Edison Company is planning to erect a new steel-tower transmission line from City Creek Canyon to Lake Arrowhead.

LOS ANGELES, CAL.—The City Council has adopted an ordinance calling for the installation of ornamental lamps on West Washington Street from Main to Vermont Street and from Hobert to Eighth Avenue. The installation of ornamental lamps on Vermont Avenue between Third and Middlebury Streets has been recommended by the Council.

QUINCY, CAL.—A. J. Watson and associates plan the construction of a hydro-electric power plant and have made application to the State Water Department for permission to use waters from the Red Clover and Last Chance Creeks. The proposed plant is estimated to cost $675,000.

SAN LEANDRO, CAL.—Plans are under way for extensions in the ornamental lighting system on Davis Street. Robert Goodwin is city engineer.

SAN LUIS OBISPO, CAL.—The Southern Pacific Railroad Company will build a new power house at its local shops, estimated to cost $55,000.

SANTA BARBARA, CAL.—Steps are being taken for the installation of an ornamental lighting system on State Street through the business district. The local Commercial Club is interested.

SEAL BEACH, CAL.—The Associated Oil Company, Los Angeles, is planning for the construction of an overhead transmission line across the entrance to Anaheim Bay.

LOGAN, UTAH.—Contracts have been awarded by the City Council for the construction of a new municipal hydro-electric plant in the Logan Canyon to cost about $200,000.

NOGALES, ARIZ.—The Southern Arizona Power Company has issued bonds for $675,000, a portion of the proceeds to be used for extensions.

Electrical Patents

Announced by U. S. Patent Office

(Issued Aug. 21, 1923)

1,465,688. Incased Circuit Connecting and Controlling Device; Joseph Sachs, Hartford, Conn. App. filed Jan. 12, 1918. Fuses may be inserted or removed from exterior without unsealing or opening cabinet.

1,465,709. Brush-Holding Means for Electric Motors; P. I. Chandeysson, St. Louis, Mo. App. filed March 24, 1922. Spring arrangement adapted to large range of adjustment.

1,465,732. System of Communication; R. A. Heising, East Orange, N. J. App. filed Sept. 23, 1919. Signaling capacity equivalent to that of a plurality of land lines.

1,465,735. Pull-Socket Current Tap; J. W. Lavine, Bridgeport, Conn. App. filed Aug. 1, 1921. Provided with constantly "live" supplemental terminals.

1,465,753. Advertising Apparatus; Albert Angel, Cleveland, Ohio. App. filed Dec. 9, 1920. Attention called to apparatus by light or sound.

1,465,757. Electrical Wave Filter; A. M. Curtis, East Orange, N. J. App. filed Oct. 8, 1917. Composed only of resistance and one form of reactance.

1,465,758. Electrical Wave Filter; A. M. Curtis, East Orange, N. J. App. filed Oct. 8, 1917. Unidirectional element between adjacent filter sections.

1,465,809. Electric Heating Apparatus; G. R. Conklin, Norman, Okla. App. filed Nov. 14, 1921. Separate heating units may be connected to both sides of three-wire distributing system.

1,465,816. Adapter; G. W. Goodridge, Bridgeport, Conn. App. filed May 27, 1918. Edison receptacle may be converted into an Ediswan receptacle.

1,465,820. Power-Operated Chuck; H. M. Hay, Wenonah, N. J. App. filed Feb. 8, 1921. Motor field and armature members of annular form, one being fixed to chuck body and other rotatable about hub.

1,465,838. Hair Iron; J. P. Caneavri, Port Arthur, Tex. App. filed Aug. 1, 1921. For crimping or straightening the hair.

1,465,872. Headlight-Dimming Device; A. N. Schoenung, Chilton, Wis. App. filed July 11, 1922. For controlling the brilliancy of illumination.

1,465,873. Trolley Wheel; F. C. Schoenthal, Alden, N. Y. App. filed March 30, 1922. Casting of aluminum bronze.

(Issued August 28, 1923)

15,682 (reissue). Automatic Telephone System; W. T. Powell, Rochester, N. Y. App. for reissue filed Sept. 10, 1920. Selector apparatus.

1,465,932. Multiplex Radio-Telegraph System; E. H. Colpitts, East Ornage, N. J. App. filed Sept. 11, 1915. Method of overcoming difficulty of making and breaking large power currents.

1,465,961 and 1,465,962. Wireless Signaling System; E. F. W. Alexanderson, Schenectady, N. Y. App. filed April 19, 1916. Overcoming static disturbances.

1,465,972. Transmission-Regulating Circuits; George Crisson, Hackensack, N. J. App. filed March 7, 1921. For communication lines.

1,465,985. Electrical Switch Inclosure or Cabinet; B. D. Horton, Detroit, Mich. App. filed May 26, 1922. Means for holding grounding lug.

1,465,995. Electric Cooking and Heating Apparatus; R. E. Pearson, Yonkers, N. Y. App. filed March 16, 1922. Cooking element water-tight so that utensil may be immersed in water to be cleaned.

1,466,013. Electrode Steam Boiler; Jacob Buchli, Baden, Switzerland. App. filed June 2, 1921. Method of eliminating steam bubbles from electrodes.

1,466,033. Method of Manufacturing Filigree Metal Lamp Shades; A. E. Shepherd, Flint, and E. G. Lovering, Detroit, Mich. App. filed March 11, 1922. By electrical deposition of metal over non-metallic filigree backing.

1,466,036. Speed-Controlling Apparatus for Prime Movers; J. G. Aceves, New York, N. Y. App. filed Oct. 15, 1919. By means of counter-torque device.

1,466,069. Means for and Method of Reducing Capacity-Current Losses in Electric Cables; A. M. Taylor, Birmingham, England. App. filed April 7, 1923.

1,466,110. System of Street Lighting and Apparatus Therefor; C. G. Beckwith, Cleveland, and W. E. Davis, Lakewood, Ohio. App. filed Nov. 17, 1919. Lighting of streets and roadways where posts stand close to roadways.

1,466,111. Electric Heater; Julius A. Berninghaus, St. Louis, Mo. App. filed Jan. 21, 1922. Reflector type with means for forcing heated air into room.

1,466,124. Measured-Service Telephone System; E. D. Fales, Western Springs, Ill. App. filed June 14, 1919. Arrangements for automatically controlling coin-collecting device.

1,466,126. Electrolytic Refining or Depositing of Tin; Colin G. Fink, Yonkers, N. Y. App. filed Feb. 1, 1922.

1,466,139. Traveler's Set; David Michie, Irwin, Pa. App. filed Dec. 7, 1922. Electric iron and cooking equipment.

1,466,158. Telephone Exchange System; S. B. Williams, Jr., Brooklyn, N. Y. App. filed March 27, 1919. Connections established with devices including selectively operable switches.

1,466,198. Electrically Heated Waffle Iron; William Sickinger, Chicago, Ill. App. filed July 21, 1921.

1,466,208. Rotating Electrode Closed Treater for Petroleum Emulsions; H. C. Eddy, Los Angeles, Cal. App. filed Feb. 28, 1921. For separating water from petroleum.

1,466,209. Ignition System; Herman W. Eichbaum, Venice, Cal. App. filed Sept. 15, 1919.

1,466,220. Automobile Signal Device; J. B. Young, Oakland, Cal. App. filed Oct. 1, 1920. Rear direction signal.

1,466,232. Spark Indicator and Amplifier; Bassett Jones, Mahwah, and James T. Holmes, Bogota, N. J. App. filed March 12, 1920.

1,466,233. Telephone System; C. W. Keckler, Newark, N. J. App. filed Oct. 21, 1919. Method of making connections between lines terminating at manual and automatic exchanges.

1,466,234. Telegraph System; M. B. Kerr, Rosebank, N. Y. App. filed Feb. 1, 1922. Synchronous multiplex apparatus.

1,466,253. Ventilating System for Reactance Coils; M. E. Skinner, Wilkinsburg, Pa. App. filed Sept. 11, 1920. By series of baffles.

1,466,258. Electrical Regulator; A. A. Tirrill, Pittsburgh, Pa. App. filed Dec. 20, 1918. Increasing working range of relays of voltage regulators.

1,466,260. Electrical Protective Device; R. J. Wensley, Edgewood Park, Pa. App. filed April 4, 1918. Frequency responsive relays for use with induction motors.

1,466,263. High-Frequency Signaling System; E. F. W. Alexanderson, Schenectady, N. Y. App. filed April 10, 1922. System for producing interrupted continuous high-frequency signaling currents.

1,466,277. Phase Balancer; C. Le G. Fortescue, Pittsburgh, Pa. App. filed April 4, 1919. Special auxiliary machine furnishes exciting currents to alternators.

1,466,284. Detecting System; J. B. Harlow, Upper Montclair, N. J. App. filed June 24, 1919. For detecting presence of marine or submarine vessels.

1,466,285. Control System; A. L. Harvey, Wilkinsburg, Pa. App. filed Jan. 16, 1920. Reversing control and apparatus for dynamic braking.

1,466,287. System of Control; R. E. Hellmund, Swissvale, Pa. App. filed March 11, 1919. Speed regulation or power-factor adjustment of single-phase commutator motors.

1,466,288. Control System; H. D. James, Edgewood Park, Pa. App. filed May 12, 1919. Automatic accelerating and reversing apparatus.

1,466,293. Rheostat; W. L. Brooks, Schenectady, N. Y. App. filed Dec. 27, 1921. Multiple-unit rheostats for tube-filament control.

1,466,304. Dynamo-Electric Machine; P. A. Koch (deceased), Charlottenburg, Germany. App. filed May 9, 1922. Effective flux varies directly in proportion to ampere-turns producing it.

1,466,307. System of Generating and Distributing Electric Currents; L. J. Le Pontois, Lakewood, Ohio. App. filed June 28, 1915. Automobile generator for charging batteries and for ignition.

1,466,310. Separator; M. R. Mann, Portland, Ore. App. filed Jan. 14, 1922. For separating metal particles from grain.

1,466,327. Advertising Device; T. R. Wiwi, Chicago, Ill. App. filed Dec. 10, 1921. Traveling-tape type.

1,466,350. Flashlight; E. R. Barany, Brooklyn, N. Y. App. filed July 8, 1922. Double-ended flashlight.

1,466,351. Connecting Head for Multiple Telephone and Other Circuits; F. G. Brockett and C. C. Wright, Chicago, Ill. App. filed April 5, 1922. For connecting any number of receivers to wireless apparatus.

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The Code—

Is It an Aid or a Hindrance to Advance?

THE National Electrical Code admittedly contains the only recognized guide for electrical construction practice which has so far been evolved. Some disagree with certain of its provisions. At times those charged with its production and modification were slow to recognize desirable changes; at times those charged with its administration were either too lax or too zealous in their interpretation of its provisions. But, on the whole, it has performed a service for the industry, and, as this paper has had opportunity to remark several times in the past year, recent modifications in the code have done much to promote the advance of electrical service.

The code is the industry's own. Through a certain lack of organization and sense of responsibility in the electrical industry, insurance men have borne the brunt of its development in the past, but the action of the American Engineering Standards Committee in adopting it as an "American standard" was a very forward-looking and constructive one, and it at once placed the code in such a position that the electrical industry now has both the opportunity and the responsibility of seeing that modifications of its provisions are made in an intelligent and a fully constructive way. The full benefit of having the code an "American standard" will not be realized unless it is administered not only according to the letter but also according to the spirit of A. E. S. C. procedure.

This leads directly to the question of the use and modification of the code to allow and assist the greatest sound expansion of the industry. Whatever his opinion of the code, no one will deny that the industry's practices have grown up around it. It is therefore of industry-wide interest and importance when changes are made. Above all, there must be nothing in the procedure with reference to the code that will hamper legitimate development. The industry itself, its various practices, its equipment, are all constantly changing, and the code, with the industry, must be administered to allow progressive development. But, on the other hand, there is only one way to change the code if it is still to have the respect and support of the entire industry—and that way, let it be emphatically repeated, is according to A. E. S. C. procedure, which means that every one interested shall have ample opportunity to study any proposed change and to express an opinion before any change is made. By all means, let there be opportunity for constructive progress. Let the code do all it can to aid development. But those directly responsible for changes should bear in mind that they are trustees for the industry and that it is their privilege and duty to allow changes in the code only in such a manner that confidence in it will be maintained and that it will fully serve to aid the industry as a whole.

Reginald Bernhard Gerhardt

A leading spirit in bringing about the electrification of the steel industry.

AMERICAN leadership in the steel industry has largely been maintained by the use of power for every process. With the rising costs of labor, fuel and materials, electricity and electrical equipment were necessary to maintain existing standards of production, and, moreover, they opened new vistas of mammoth mills impossible of attainment with mechanical power.

The electrification of the steel industry has been accomplished by very high-grade engineering talent, which has largely been developed by the steel companies. The men who applied electric power equipment to steel production were forced to learn all about the steel business before they were competent to specify the requirements for electrifying the industry.

Typical of these pioneers in steel-mill electrification is R. B. Gerhardt, electrical superintendent of the Sparrows Point plant of the Bethlehem Steel Company in charge of design, operation and construction. He has helped the growth of electrification in the industry and has been very influential in securing simplification of reversing-mill control and a greater degree of railroad yard electrification.

Born in Martinsburg, W. Va., Aug. 2, 1884, he soon moved with his parents to Harrisburg, Pa., where he received his public school education. At fifteen he started work as an electrical apprentice with the Pennsylvania Steel Company and was promoted to the grade of electrician in one year. Leaving the steel industry, he received an engineering education at Pennsylvania State College and a degree from Cornell in 1907.

After completing his education he returned to work with the Pennsylvania Steel Company and then spent four years as electrical and mechanical engineer with the Spanish-American Iron Company at Felton, Cuba.

He returned to the United States in 1913 as electrical superintendent of the Maryland plant of the Bethlehem Steel Company at Sparrows Point, Md., and continues in this position. Mr. Gerhardt has been very active in many electrical organizations and has written valuable papers on electrical applications in the steel industry. After serving in various capacities as an officer in the Association of Iron and Steel Electrical Engineers, Mr. Gerhardt was elected president last year and has led the organization splendidly during a year of progress. He is noted for his co-operation in working out the electrical problems in the steel industry and has been influential in developing standard practices in steel-mill electrification.

Editorial Comment

Electrical World, September 22, 1923

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If This Be Propaganda, Make the Most of It

THE word "propaganda," which had its origin in the Latin name of an ecclesiastical body organized to spread the Christian faith, has come to bear a sinister significance. To the man in the street it denotes attempts to "put something over" by the dissemination and repetition of one-sided, partisan, if not actually mendacious, statements, through which run as alternate threads the suppression of the true and the suggestion of the false, just as since time began they have run through the reasoning of unscrupulous paid advocates. In our sophisticated days search for the hidden motive, the ulterior purpose, is never relaxed. If a man predicts rain, he is suspected of having umbrellas to sell, and if he advocates a vegetarian diet, it is proof all but positive that he is a market gardener.

It is therefore not at all surprising to find a speaker at the Toronto meeting of the Public Ownership League of America — an association which should certainly recognize propaganda when it sees it—class under this head the publicity programs of the utility companies, even though these companies used to be attacked, and sometimes with justice, for their secretiveness. Nor can one wonder that arguments for the taxation of public bonds are similarly classified, though here is a question which surely admits of honest discussion pro and con if any constitutional question ever did. But why, as a third—and, indeed, a leading—instance of public utility propaganda should campaigns to sell securities to customers be cited? If too great profits are made by the companies, here is a way for the customers to share them. If a voice in company management is wanted, here is a way to acquire it. Property rights will never be upset by the United States courts, but utility customers have the opportunity to make the companies mutual affairs somewhat after the manner of the great insurance societies, which are no longer subjected to attack. Indeed, carry the principle far enough, and what is to hinder the customers from gaining majority control and turning the companies over to political management—if they want to?

Superpower Will Eliminate Industrial Steam Stations

IT IS interesting to speculate on the result of central-station power-plant development as affecting industrial power plants. Several new stations are now under way in large light and power systems that will produce a kilowatt-hour for about 15,000 B.t.u. if the expectations bound up in their design are realized. This extremely high energy production efficiency, together with the development of interconnection and the resultant advantages obtained in better load and diversity factors, should have a very material influence in eliminating industrial power plants. Considered still more broadly, every development toward a national power system must necessarily mean the elimination of the uneconomical small steam plants, and the owners of these plants should welcome the changes, for they will insure a cheaper and more reliable power supply.

But, aside from the fact that the economics of the situation will be to the advantage of the power systems, there are other elements that will prove advantageous to the owners of the industrial plants. They will obtain a cheaper, more flexible and practically unlimited energy supply and will be relieved of troubles associated with fuel supply, accident hazards, growth of their factory loads, obsolescence of equipment and other conditions inseparable from the operation of their own power plants. The factory energy will be, as it should be, an incidental element in the manufacturing process for which the factory executives will not be responsible.

From the central-station standpoint the great advantage of the new developments will arise from the reduction in costs of energy. Once the private-plant owner is convinced that he is losing money by operating his own plant, the contract for central-station energy is as good as signed. It is very stimulating to visualize the amount of new load that will be available for connection to the light and power systems as a result of the expected gains in thermal efficiency, for there are a great number of existing privately owned and operated plants that should be discarded as a result of the new era in energy production, and this will result in an enormous building program for the utilities.

Industry Must Be Stable if Central Stations Are to Meet Energy Demands

MOST electric light and power companies in the larger industrial centers east of the Rockies are now having difficulty in building stations rapidly enough to supply the demand for energy. Many of them are fairly staggering in their attempt to carry the present peak demands with their installed capacity. Numerous others have refused to make more power contracts. In other words, under present conditions, the demand for electrical energy has outstripped the installation of generating equipment.

Such a situation seems very auspicious for the central-station industry at first glance, and it may also lead the casual observer to remark that the central-station companies have been backward in foreseeing the growth in load demand. But a little analysis shows that many elements enter into the situation which make it difficult for central-station organizations to predict industrial demands. Of these elements the primary one is the fact that industry is not stable when viewed over a period of years. It is a succession of peaks and valleys which are often occasioned by unforeseen happenings. The present healthy condition

of industry has come about, for example, despite the predictions of economic experts that there would be a bad slump during the summer just past. The slump did not occur, and the horizon shows no indication of gathering industrial clouds.

The electric light and power company cannot build and tear down to meet the changing conditions in industry. Power stations are, of course, permanent structures involving an immense investment which is restricted to a limited return in prosperous times and has no guarantee of any return in bad times. Moreover, the element of time enters into the situation, for it takes at least three years to plan and build a large central station, and this time element places a tremendous burden on those who venture to predict load demands far in the future.

So the real situation is that the central-station companies are forced to be conservative in their building programs because of the unstable conditions existing in industry. A measure of relief from this situation lies in the active participation of central-station executives in every plan of economics and politics that will tend to render industry more stable and uniform in its growth.

Revival in Electric Furnace Activity

THE war gave a great impetus to the use of electric furnaces in the iron and steel industry, and it is encouraging to note that these furnaces are again resuming operations. In addition new applications and new types of furnaces are being developed which will afford a still greater field for the use of electricity in the metal trades.

Sweden is the only nation that has found it economical to produce pig iron directly from the ore in an electric furnace. In all other parts of the world the blast furnace using coke has proved generally more economical. Developments are occurring that may extend this use of electricity, however. One of these takes the direction of indirect smelting of the ore by using two reduction processes, the first using coke and the second using electricity. The other development is in the direction of using high-grade iron ores and changing them directly to steel by means of the electric furnace.

A very important application of the electric furnace is in the production of ferro-alloys. Of the twenty-three alloys now in use all but two can be economically produced in the electric furnace. The electric furnace process gives a higher recovery of the alloying metals, a richer and more uniform alloy and one that is lower in carbon. These advantages offset to a great extent the higher cost of electricity as compared with coke.

But the most encouraging sign of a greater use of electric furnaces is in the melting and refining processes required to make steel or high-grade pig iron. There are thirty different types of electric furnaces of this character in this country, and the total number of installations in 1923 in the United States was 406. The most recent developments in this application lie in foundry processes. So-called "synthetic pig" can be made readily and economically in certain localities, and malleable-iron foundries are studying the suitability and economics of the electric furnace for their needs. Steel castings also are becoming increasingly popular and offer a field for electric furnace applications.

The induction furnaces have proved their merits in the brass industry and are rapidly eliminating all other types. In addition, many special furnace applications, annealing ovens and electric welding equipments are being used more extensively in the metal trades.

Fortunately for the central station which supplies energy to these applications, many of the service problems were solved and adequate control equipment was developed during the slack period following the war. It now is generally true that furnace loads are desirable ones for central stations to carry, and an opportunity is offered them, particularly in foundry practice, to help bring about a more widespread use of electric furnaces.

Power Salesmen as Load Builders

QUIETLY, unceasingly and efficiently, the electric motor is doing the jobs in industry. In a few short years it has won supremacy in the industrial field and has relegated most of its competitors to the scrap heap. The very fact that no radical developments in motor design have occurred recently shows how wisely, rapidly and clearly the manufacturers realized the utmost possibilities in the assembly of known materials. It does not seem possible to better the design of the motors customarily used in industry from an efficiency standpoint, and improvements in design now are largely concerned with insulation, bearings and frame structure.

The real problem in motor application to industrial jobs is concerned with making the motor and the machine it operates a working unit. Notable advances have been made along these lines in the machine-tool industry, but much remains to be done even in this field. For many other branches of industry the ground has scarcely been scratched, because each motor application has been treated as a special job which called for a special installation.

The proper application of a motor to a job involves more than a decision as to the relative merits of a gear, belt, chain or direct connection of the motor to the work. It involves securing the installation of the equipment in a minimum factory space and an arrangement to obtain maximum production through use of high speeds and convenient and accurate controls. In many ways the power salesmen of the central-station companies are best fitted to advance the state of the art in these respects. They are generally competent engineers who are familiar with a large number of industries using a variety of motor applications. Through their connections they learn quickly of new devices and developments of the manufacturers, and they have the training to apply them adequately to industrial needs. They are becoming more and more service-consulting engineers to power customers. The central-station company reaps a reward for their services through acquiring satisfied customers, high-power-factor installations and a growth in energy sales.

Not only in motor applications but also in heat applications there is a big opportunity for the power salesman to promote the electrification of industry and to benefit his company and its customers. Very many industrial heating processes now done with gas, oil or coal could be done better and cheaper with electricity if it were possible to bring the attention of the industrial executives to these possibilities. Every day it becomes increasingly evident that the central-station power-sales

engineer has a place in the industry sufficiently important to merit more consideration than it has received in the past.

Machine Switching in Long-Distance Telephony

AUTOMATIC telephony is usually associated with local exchanges, and for a long-distance connection the intervention of a human operator is considered necessary. A recently opened automatic telephone exchange in Bavaria is so arranged that not only local but also long-distance connections to neighboring communities are obtained by dialing. From an account of this unique installation in the July issue of the *Siemens Zeitschrift* it is learned that each subscriber has a meter which registers in "talkfest" units (presumably so many million paper marks for every three minutes of local conversation). When, however, the subscriber dials a distant station, the meter rate is doubled, tripled, etc., depending upon the number dialed. Ten seconds before the expiration of every three minutes he hears a warning buzz which leaves him just enough time to say "Ja wohl" and "Auf Wiedersehen." Exactly on the minute the connection is seemingly broken, and he has to push a button to restore it in case that he feels in a mood to talk some more. There is no uncertainty about the charges, either. For example, if he talked, say to the fourth zone, for six minutes, this is equivalent to $4 \times 2 = 8$ local conversations, and before he hangs up the receiver he can hear eight strokes of a bell, irrevocably registering the corresponding number of talk units in his meter.

Such a system may offer considerable advantages in sparsely settled communities by providing twenty-four-hour service without an operator and taking care of long-distance charges. Other useful applications may suggest themselves in metropolitan districts, among associated business houses, in police work, and so forth. This idea may also be of interest in electric power transmission work, where communication among distant substations is effected by means of a public telephone system.

Extension of Research to Commercial Problems

AN INDIRECT result of wider application of research to industrial problems and to human psychology has been an extension of systematic experiments to purely commercial problems. For example, some tests have recently been made on the relationship between the illumination of a show window and its "drawing power." Typical windows were selected and the illumination increased by stages to 110 foot-candles, the number of people stopping to examine the windows being noted. In two stores where tests were made an increase from 15 foot-candles to 100 foot-candles increased the drawing power by 40 per cent and 100 per cent respectively. On the average, an increase from 15 foot-candles to 40 foot-candles attracts 33 per cent more persons, and an increase to 110 foot-candles 100 per cent more. If the same wattage is employed, the use of colored light increases the drawing power about 40 per cent (*Transactions Illuminating Engineering Society*, Vol. 17, page 683). A few years ago no one would have thought of such experiments and the best value of illumination would have been chosen in accordance with the horse-sense judgment of some experienced and practical man.

How many of the methods and data inherited and used in our commercial and administrative activities will stand the scrutiny of accurate and systematic tests? Most of them, not unlike English spelling and good literary usage, go back to past ages and to conditions which do not obtain any longer. Here is a big and virgin field for engineers trained in physical, chemical, mechanical and electrical laboratories to apply general scientific methods to human problems. There is still much to be found out and recorded as to the best ways of advertising, selling, creating good will, instructing customers, keeping employees satisfied, promoting order and efficiency, and generally learning what human beings are and what they will do under certain imposed conditions. Merely thinking what a group of human beings will do in response to a definite move made by a public utility company does not insure their doing so any more than thinking that elephants are yellow makes them of that hue.

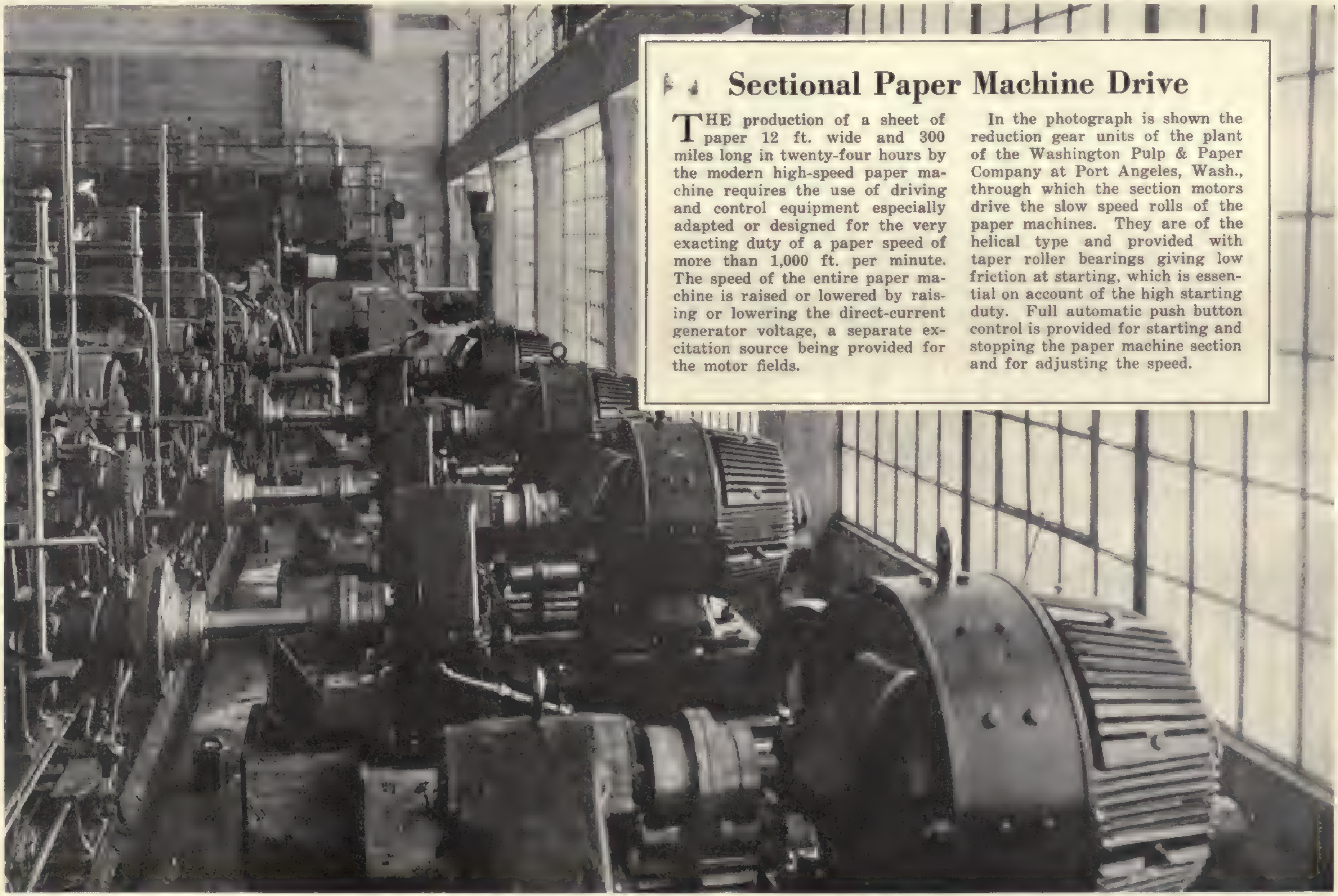
Penalizing Poor Power Factor by Kva.-Demand Billing

THE light and power companies have been trying for some time to obtain a revenue based on both investment and operating charges. Unfortunately this has proved to be a difficult task, because the pioneers in the industry set a precedent by using the watt-hour-meter readings as the sole basis of billing. However satisfactory this may have been in the early days, with the advent of the industrial load difficulties arose in getting an adequate return on the investment, because the investment is based on kilovolt-ampere ratings and the watt-hour-meter readings take no account of power factor.

Through a process of evolution the combined kw.-demand-and-energy charge basis of billing has been developed in a very satisfactory manner and takes care of most of the elements in the situation except power factor. But power factor has been and still is a stumbling block because of the inherent difficulty of establishing a rate clause or developing a metering equipment that can be used commercially. Many systems of metering and many types of power-factor clauses have been tried, but at best they have proved to be makeshifts.

A general acknowledgment by the utilities that rate systems should be simple and intelligible to consumers, coupled with the unsatisfactory results of the many attempts to administer a power-factor clause, have recently caused still further study of this question, resulting in a proposed system that seems to meet with widespread approval.

This system involves billing on a kva.-demand basis to secure a revenue based on the investment and on a watt-hour basis to secure a return based on operating charges. It has the merit of obviating any necessity for mentioning or explaining power factor to consumers and yet incorporates an effective method for penalizing those consumers having poor power factors. The only drawback to a widespread adoption of the kva.-demand method lies in the fact that adequate and economical meters have not yet been developed. But reports indicate that great advances in this respect may be expected in the near future, and it can safely be said that the metering problem will be solved at an early date.



Sectional Paper Machine Drive

THE production of a sheet of paper 12 ft. wide and 300 miles long in twenty-four hours by the modern high-speed paper machine requires the use of driving and control equipment especially adapted or designed for the very exacting duty of a paper speed of more than 1,000 ft. per minute. The speed of the entire paper machine is raised or lowered by raising or lowering the direct-current generator voltage, a separate excitation source being provided for the motor fields.

In the photograph is shown the reduction gear units of the plant of the Washington Pulp & Paper Company at Port Angeles, Wash., through which the section motors drive the slow speed rolls of the paper machines. They are of the helical type and provided with taper roller bearings giving low friction at starting, which is essential on account of the high starting duty. Full automatic push button control is provided for starting and stopping the paper machine section and for adjusting the speed.

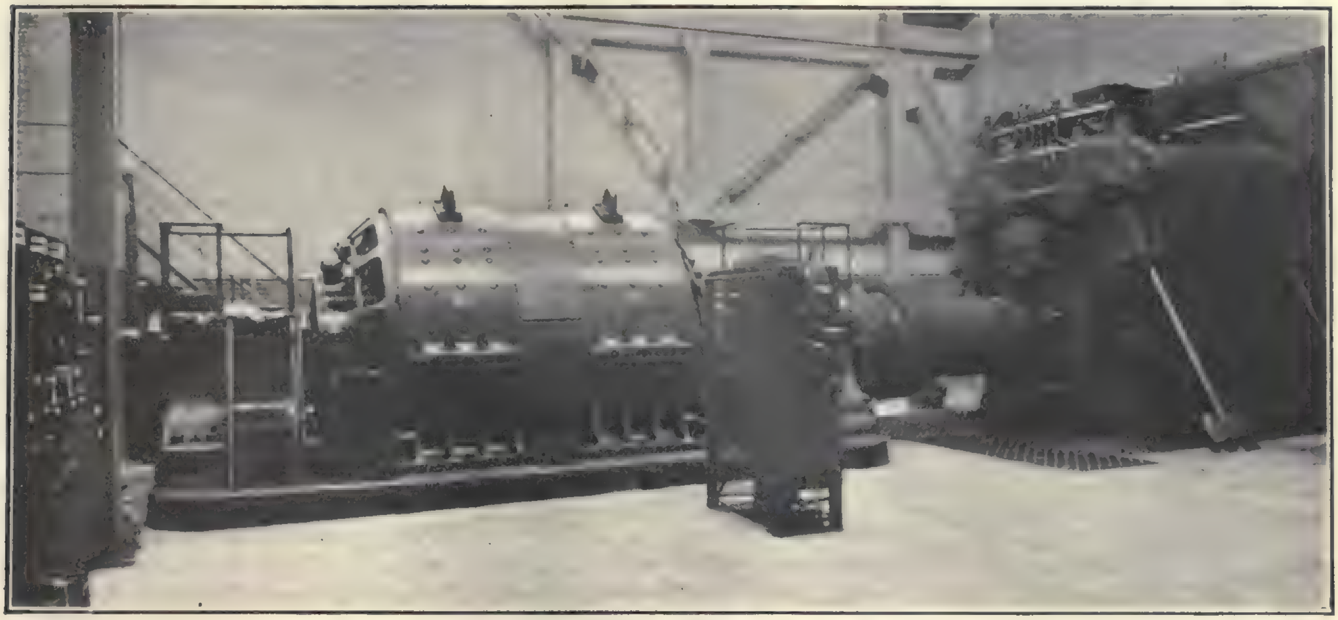


FIG. 1—DOUBLE UNIT REVERSING MOTOR

Rated at 4,000 hp., 50 deg. C. rise, 80/135 r.p.m., driving 30-in. reversing skelp mill at the Youngstown Sheet & Tube Company. Also shows pinion stand, direct-current circuit breaker and a portion of the switchboard.

Electric Drive of Reversing Mill

Third in Same Plant to Be Converted from Steam Drive—Rolling Requirements—Special Features Embodied in Main Mill Motor—Provisions for Starting Reversing and Regulating Load

By C. B. HUSTON

Power and Mining Engineering Department, General Electric Company

THE recent electrification of a reversing skelp mill at the Youngstown plant of the Youngstown Sheet & Tube Company marks an important step forward in the electrification of old steam-driven mills. This is the third mill at this plant on which a steam engine has been replaced by electric drive, this last one having been put into operation on June 18 of this year. In this particular case the engine had well served its purpose for many years of operation, but, since it was badly worn and somewhat too light for the service, a new drive had to be considered. With this improvement in view, the Youngstown Sheet & Tube Company decided to go a step farther and at the same time replace the old mill with an up-to-date one.

Skelp is the form of material from which welded pipes are made. It consists of what may be termed either strip or plate, according to the width of the material. On this particular mill the skelp can be truly termed "plate." It is rolled from slabs from 3.5 in. to 5 in. thick by about 6 ft. long, varying in weight from 1,200 lb. to 3,700 lb., depending upon the width, which ranges from 15 in. to 45 in. The finished plate is reduced to a thickness depending upon the size of the pipe and the service for which it is intended. Materials as narrow as 7 in. or 8 in. may be rolled on this reversing mill, but it is not economical to use such a type of mill for the smaller sizes. Instead such stocks are rolled on some form of a continuous mill.

The mill, which was manufactured by the Mackintosh-Hemphill Company, Pittsburgh, is of the type commonly known as the two-high Universal reversing plate mill. There are two horizontal rolls between which the metal is squeezed for reducing the thickness from the slab to a plate stock. These rolls are each 30 in. in diameter. There are also four vertical rolls, two on each side of the horizontal rolls, by means of which the width of the plates is accurately maintained. By removing these vertical rolls and replacing them with horizontal feed rolls, plates up to 72 in. in width may be rolled on this same mill. However, for the usual service this mill will not be operated in this manner.

The top horizontal roll is balanced by two hydraulic cylinders, and by means of a separate auxiliary motor the roll is raised or lowered. Further adjustment is obtained by a special equalizing device to change the elevation on one end of the roll alone, by means of which the surfaces of the two horizontal rolls may be kept parallel to each other. The side rolls are adjusted for movement in and out by an independent auxiliary motor-driven mechanism. The driving of the vertical rolls, however, is from the same source as the horizontal rolls, each being connected to the pinion stand to which the main motor itself is connected.

On each side of the mill there are table rolls for transferring the metal to and from the mill. These are likewise driven by separate auxiliary motors and are grouped on each side in what are termed front and rear live tables, approach and delivery tables.

In the operation of the mill there is very little manip-

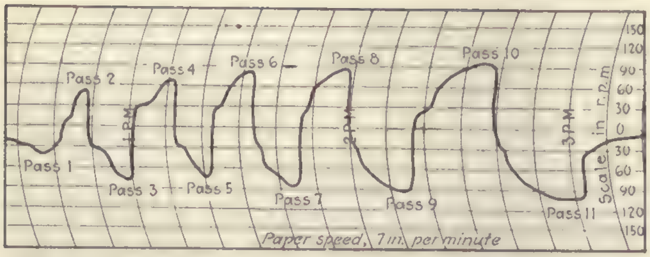


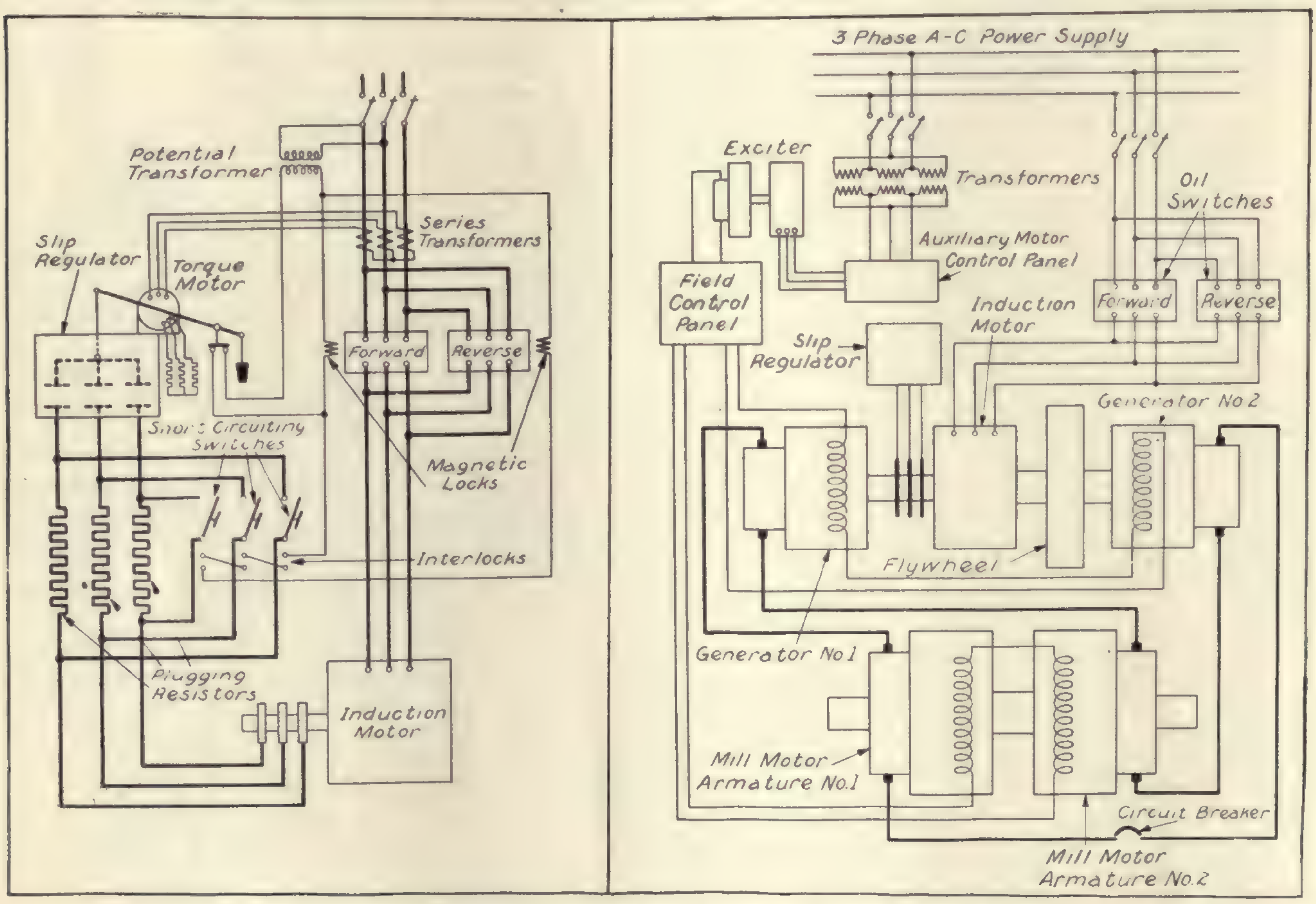
FIG. 2—SPEED-TIME CURVE OF ACTUAL CYCLE

For rolling one slab in eleven passes to plate or skelp from which welded pipe is made. Speed is in terms of r.p.m. of mill and direct-connected motor. This chart represents the speed and the direction of operation of the mill and shows clearly the number of passes and the number of reversals in the cycle of rolling each slab. The chart speed was 7 in. per minute, from which it is figured that the cycle is repeated every seventy seconds.

ulation of the metal required, it being necessary only to operate the "screw-down" to adjust the draft, make a slight adjustment in the setting of the vertical rolls and reverse the table-roll drive each time the piece is reversed to run it through the mill in the opposite direction. Thus the reversing service on the main drive must necessarily be extremely rapid in order to keep pace with the operation of the auxiliaries. (See Fig. 2.)

The complete electrical equipment for this reversing drive (which applies to all reversing-mill service such as reversing blooming mills, reversing plate mills and reversing skelp mills) is illustrated diagrammatically in Fig. 3. It will be noted that all equipment is served directly or indirectly by the three-phase alternating-current lines. Thus the operation of the equipment is dependent only on the one source of power. The main mill motor is served by a three-unit flywheel motor-generator shown in (Fig. 5). In this case there are two generators, each rated at 1,800 kw. and 650 volts direct-current. The alternating-current driving motor, which is the slip-ring type of induction motor, is rated at 2,500 hp. at 500 r.p.m. and 6,600 volts, three-phase, 25 cycles. The flywheel which forms a part of the set weighs 78,000 lb., which, at the speed of 500 r.p.m., has a stored energy of 132,000 hp.-seconds. Load equalization is accomplished by means of a liquid slip regulator. Forced ventilation is a special feature of the flywheel set, two generators and the one induction motor being served by one air-conditioning equipment supplying 30,000 cu.ft. per minute.

In the design of the main mill motor as well as all the controlling apparatus the rapid reversing service of this mill was given special consideration. The motor was designed in two units, mounted on a common shaft, the armatures of which were made as small in diameter with a corresponding increase in length of stacking as is practicable in machines of this type. The advantage gained by such a design is low stored energy in the motor armatures. Thus the power and, correspondingly, the time required for reversing the unit are minimized. Not only does such a feature in the design help out on the reversals, but it also greatly influences the available



FIGS. 3 AND 4—ESSENTIAL PARTS OF MILL CONTROL, FACILITATING STARTING, REVERSING AND LOAD EQUALIZATION

The top electrodes of the liquid slip regulator are operated by a torque motor which is supplied with current from a three-phase current transformer connected in the primary circuit of the induction motor just ahead of the reversing oil circuit breakers. The torque motor, therefore, receives a current proportional to the primary load current of the induction motor, and in case of an overload or load beyond the regulator setting it operates to raise the movable electrodes. Thus the resistance in the motor circuit is increased, the speed caused to drop, and energy is thereby given up by the flywheel. When the load falls off the motor accelerates the wheel to its original speed and the energy is restored ready for the next peak demand.

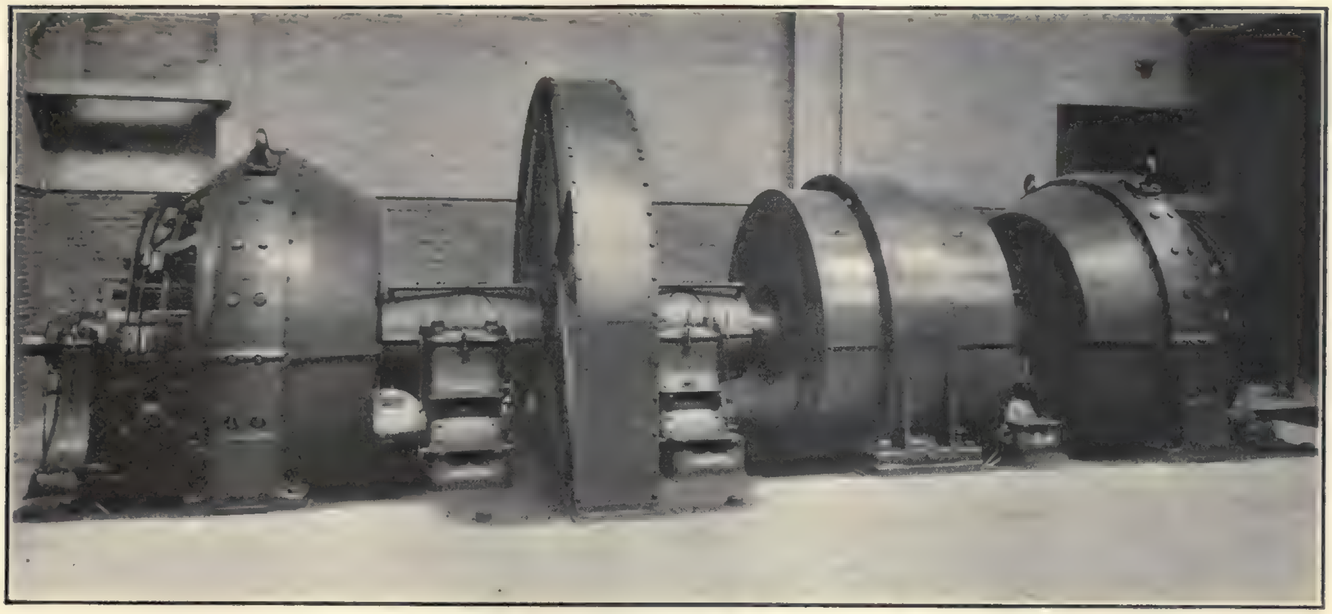


FIG. 5—FLYWHEEL MOTOR-GENERATOR USED FOR EQUALIZING LOADS
Consisting of two 1,800-kw., 650-volt direct-current generators, one 2 500-hp., 6,600-volt induction motor and one 78,000-lb. flywheel.

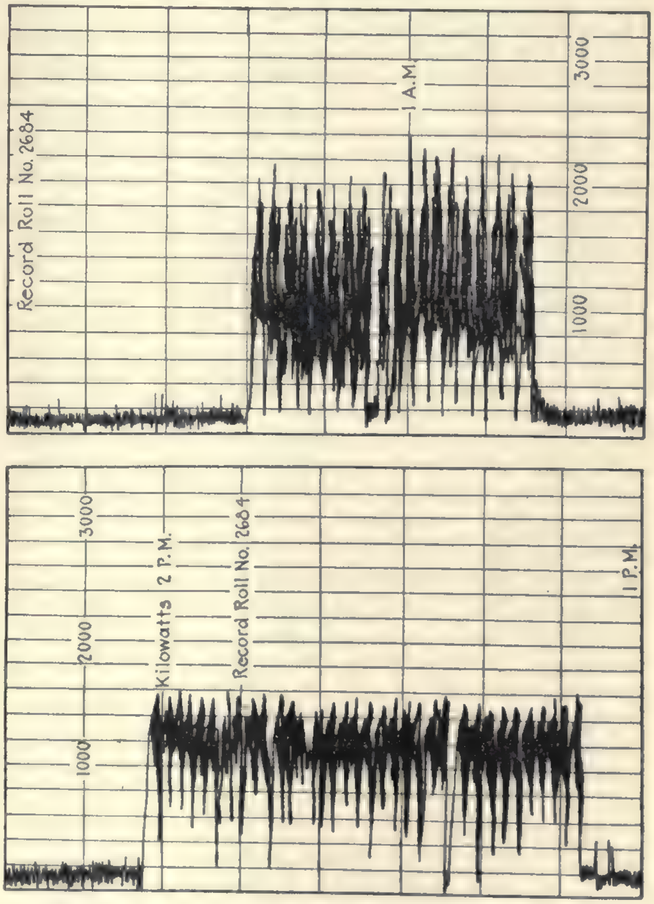
capacity for acceleration with metal in the rolls. That is, the less the stored energy in the motor armature, the less energy is required for acceleration, and thus a greater amount of power is available for rolling, and the rate of acceleration would under such conditions be greatly increased. This fact is especially true in the operation of this reversing skelp mill on account of the long passes toward the end of each cycle of operation. It is impracticable to enter the metal at a speed desirable for rolling. Therefore the motor must accelerate the mill after the metal has entered, and to do so with excessive stored energy in the armatures would be a decided handicap in the operation of the electric drive.

The main-drive motor, shown in Fig. 1, has a normal rating of 4,000 hp. at 80 r.p.m. to 135 r.p.m., which corresponds to 262,000 lb. torque at 1-ft. radius. It develops a maximum momentary torque of 592,000 lb. at 1-ft. radius at any speed from 0 r.p.m. to 80 r.p.m. From 80 r.p.m. to 135 r.p.m. the torque falls off in inverse proportion to the speed.

The control of the main mill motor is essentially a Ward-Leonard type combined with some motor field points. Both motors and generators are separately excited from a 250-volt exciter. The fields of the two motor units are connected in series and likewise the fields of the two generators. The speed of the motor up to base or full-field speed, which is 80 r.p.m. is governed by generator-field control and the speed from 80 r.p.m. to 135 r.p.m. is governed by motor-field control. The field circuits are handled directly by magnetic switches under the control of a master switch. Such a field-control equipment for the operation of a reversing mill must provide the following features:

1. Selection of direction of rotation on mill motor.
2. Definite number of hand-controlled operating speeds.
3. Means of automatically obtaining the proper sequence from point to point.
4. Means of controlling rate of speed change, acceleration and retardation.
5. Means of protection against excessive loads, overspeed and full protection against improper manipulation by the operators.

The hand-operated master switch which is mounted in the mill pulpit provides control of the reversing field contactors to determine the direction of rotation as well as control of the operating speed points. There are six points of generator-field control giving speeds up to 80 r.p.m. and four points of motor-field control giving speeds from 80 r.p.m. to 135 r.p.m.



FIGS. 6 AND 7—EFFECT OF REGULATOR ADJUSTMENT
Section of record from curve-drawing wattmeter showing input to induction motor taken before and after adjustments had been made in the liquid slip regulator. Rolling cycle of the mill remains the same.

The adjustment in the regulator is first by choice of the proper current ratio for operating the torque motor; second, change in resistance in secondary of torque motor, and, third, adjustment in the weights which balance the electrodes. In setting the regulator the load cycle must be very closely studied. If made too sensitive, too great an amount of speed reduction will be caused at the early stages of the cycle and there may not be sufficient time for the flywheel to be brought back up to speed before the second cycle begins. As a good illustration of the effectiveness of load equalization on this reversing-mill drive, attention is called to Figs. 6 and 7. These give the kilowatt input to the induction motor before and after adjustments had been made in the liquid slip regulator. Before the regulator had been adjusted the load peaks reached as high as 2,400 kw., but after the regulator had been put into operation these peaks were reduced to 1,600 kw.

The slip regulator also serves the purpose of a starting resistor for the induction motor. With the electrodes raised to their minimum height, the resistance of a normal solution of electrolyte is sufficient to limit the starting input to about normal. When plugging the motor to bring the set to rest quickly it is usually necessary to have a separate bank of grid resistors inserted in series with the regulator. Provision must then be made to short-circuit the plugging resistor during normal running service. This may be done by either hand or magnetic switches. The primary reversing switches are equipped with magnetic locks energized by an interlock on the slip regulator, by which it is necessary that the electrodes be in the position of maximum resistance before either switch may be closed.

The transformers which serve these auxiliaries are provided with half-voltage taps on the secondaries from which a starting bus is energized, and thus separate starting compensators are eliminated. It is necessary to have the ventilating air circulating through the mill motor and generators before they can be safely operated. The control of the pump, blower and exciter motor is, therefore, interlocked so that starting must be in the sequence mentioned, and the shutting down of either motor on the air washers will shut down the exciter and thus render the rest of the equipment inoperative.

From 5 to 17 Foot-Candles

By E. L. Connell
Chief Engineer Van Dorn Electric Tool Company, Cleveland, Ohio

How a Cleveland Factory Improved Production of One Department by More than Tripling Illumination. Type of Equipment Used

FROM the time the armature-winding department of the Van Dorn Company first operated with a lighting intensity of 5 foot-candles to the time the present equipment, giving 17 foot-candles, was installed considerable study was devoted to the proper use of illuminating equipment in such work. Analysis of the various operating conditions from a lighting standpoint were made with the assistance of the engineers of the National Lamp Works. When it was decided some time ago to move and expand the armature-winding department, it was felt that an increase in the illumination of the department could be profitably made. The old location had been at one end of the assembly floor where the illumination had not been very good. The illumination there had been provided by rather widely spaced 75-watt lamps with bowl reflectors. These were reinforced with lamps and reflectors for each individual operator. So the general illumination was only about 5 foot-candles, and the operators found it necessary to shift and turn their lamps every time light was needed on some particular spot on the work. In addition to the loss of time, the continual bending of the flexible arms caused breakages, resulting in loss of light for the individual workman and short circuits. As the distribution circuits ran along the rear of the benches and fed the entire row, a blown fuse meant interruptions to the entire group until the electrican could find and repair the short circuit. These delays often ran from ten to thirty minutes, constituting a real hindrance to production. Another factor was the constant complaints of the operators about the lighting.

In the winding of armatures the illumination must be placed where it is most desired. Since the small stators are held in a vertical plane by a revolving fixture, the light must be very good inside the stator, even though the operator holds his hand on one side, shutting off the light from that side. For winding armature connections illumination of the correct intensity is also imperative, especially in sizes where the commutator is hardly over 1 in. in diameter and the wire No. 28 or smaller. Small-coil winding requires much skill, which is principally dependent upon good eyesight. Accordingly, for improving the health of the operators as well as increasing production, eye strain must be made as little as possible. Unusual stress laid on these requirements in this case is due to the high quality of workmanship maintained.

Temporary Equipment

When the change was decided upon an ivestigation of what makes for good industrial illumination was conducted. After a preliminary study, a section on the fourth floor of the building was chosen, and lighting equipment consisting of 200-watt bowl enameled lamps and "RLM" reflectors was installed. The spacing was varied to give a uniform lighting distribution, and the heights from the plane of work were also changed to determine what the most effective lighting would be.

When this preliminary work was finished the intensity on the benches averaged about 12 foot-candles. Although this value was more than that which had previously been considered necessary in armature-winding establishments, the management felt that an increase would not be harmful; it even thought that 20 foot-candles might be desirable. The factors involved

FIG. 1—ARMATURE-WINDING ROOM
Showing mounting height of the forty "RLM" reflectors which give uniform intensity of 17 foot-candles on the benches.

in good lighting as revealed in this experimental work were:

1. There must be sufficient intensity on the vertical, horizontal or oblique planes and the older method of individual lamps which must be juggled should be avoided.

2. This intensity must be comparable with that on the walls to avoid annoying and harmful eye adjustments as the men look up from their work.

3. There must be absolute freedom from glare or reflection for the same reason.

4. The diffusion must be such as to avoid sharp contrasts or shadows.

5. The entire system must be simple, reliable, easily maintained and, of course, reasonable in its initial and operating costs.

To meet these requirements the equipment permanently installed consists of forty 300-watt bowl enameled units with "RLM" reflectors spaced on 10-ft. x 12½-ft. centers with a mounting height 11 ft. above the floor, or 8 ft. above the working plane. This arrangement, shown in Fig. 2, solved the entire problem of intensity and diffusion as well determining what our future installations should comprise. The distribution curve for each of the lighting units is shown in Fig. 3. An intensity of 17 foot-candles is maintained, although when new and entirely clean this value was actually 20 foot-candles. The 17 foot-candles is the lighting intensity at night or on dark days. This section of the armature-winding department is furnished with excellent daylight illumination through large windows closely spaced, as shown in Fig. 1. The building runs north and south, giving good western and southern exposure. The bays produced a problem in laying out the lighting system due to their absorption of light, which had to be compensated for by an additional allowance in illumination

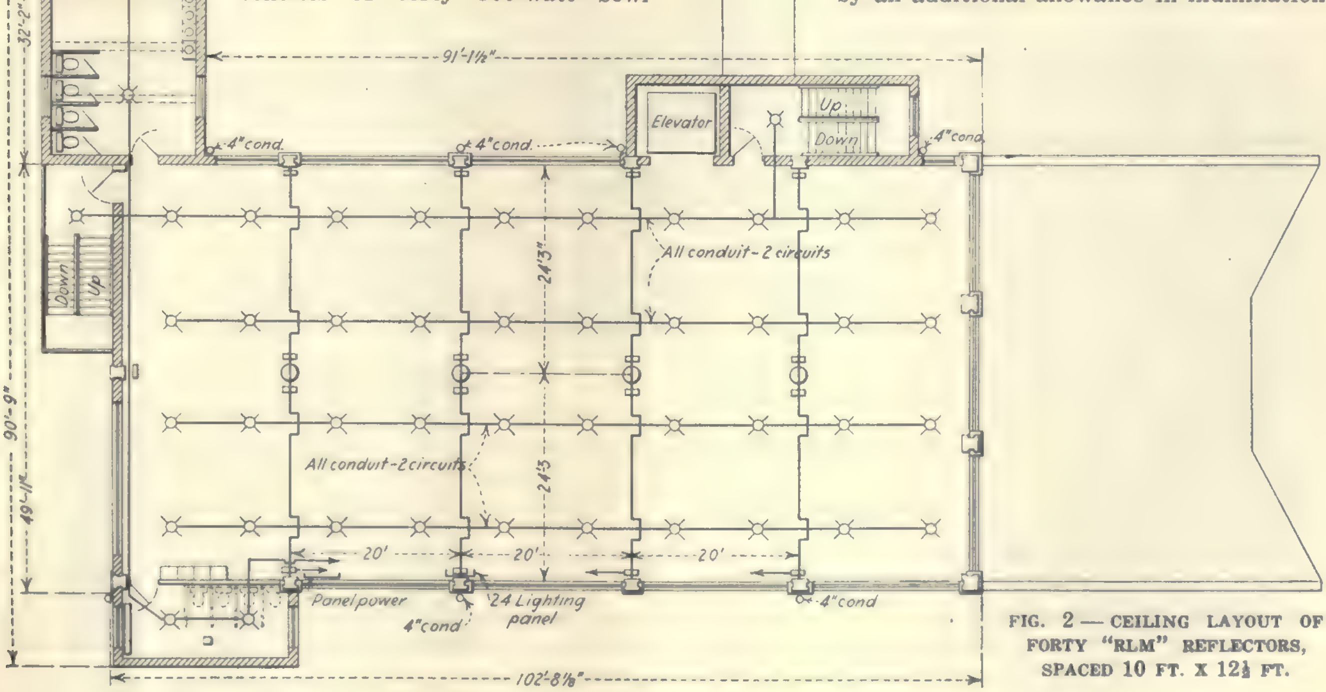


FIG. 2 — CEILING LAYOUT OF FORTY "RLM" REFLECTORS, SPACED 10 FT. X 12½ FT.

intensity. This effect was noticeable at the benches nearest the windows more than at those in the center of the room. The uniformity of the illumination is depicted in Fig. 3. It is interesting to know that when the opinions of the workmen were requested many of them compared the new system with daylight illumination and were pleased with the results attained.

The system as installed is easily maintained, and a time schedule for washing lamps and reflectors is used to keep the illumination up to its full value. Just how frequent cleansing such a schedule shall prescribe in any particular case depends on the factory conditions and of course will vary between departments, depending on the character of work and the amount of dirt. In this installation an annual cleaning has been found sufficient.

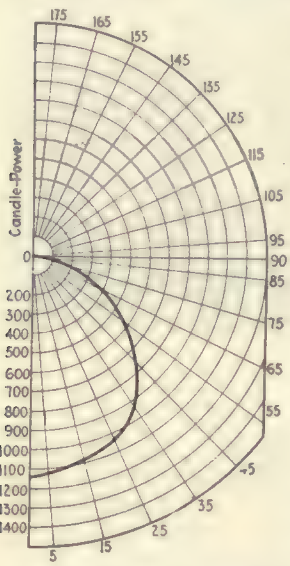


FIG. 3 — LUMEN DISTRIBUTION OF 300-WATT BOWL-ENAMELED LAMP IN "RLM" STANDARD REFLECTOR — TOTAL LUMENS, 4,900

Angle	Candle-Power	Zone	Lumens
0	1,137	....	...
5	1,120	0-10	107
15	1,087	0-20	416
25	1,040	0-30	898
35	944	0-40	1,491
45	759	0-50	2,079
55	588	0-60	2,608
65	406	0-70	3,009
75	197	0-80	3,217
85	27	0-90	3,248

LIGHTING COST RATIOS LOW

Any consideration of cost of illumination must take into account many factors. In this case the forty operators in the room are highly trained and well paid. Delays caused by poor lighting mean equivalent loss in time, and it would be foolish to put too much stress on the cost of a lighting installation to the exclusion of the question of lost production. Another factor is the physiological and psychological one produced by working conditions. Pleasant surroundings such as are created to a considerable extent by good lighting are certainly more conducive to good work than unpleasant environment. Since an operator's day is measured in operations that are performed in seconds rather than in minutes or hours, it is short-sighted to worry over the cost of illumination when proper lighting means the saving of those seconds and at the same time better performance of the work.

Unfortunately there are no definite figures available to show the increase of production. To get these figures and have them mean something involves more careful research work and a closer control of production conditions throughout the tests than were deemed necessary in this case. The production figures have been mounting since the installation of the system, and in addition the quality of the product, which was necessarily affected when the lighting was poor and many operations were hard to carry out, has shown an improvement. The ratio of the cost of the increased illumination to the total cost of the product has been so low that the accuracy of the available figures has been questioned. When it is realized that in such cases as this the cost of illumination is a very small part of the total cost of the product, it will be seen that illumination values can be run up to a high figure before becoming an important factor in the total. Another factor to consider is that the artificial illumination is used only at night or on dark days, so that the cost is not that of continuous operation.

The results of the installation in this department have been such that the company is convinced of its value and plans changes in the illumination of other departments to effect a similar improvement in lighting conditions.

Automobile Industry Highly Electrified

FEW if any American industries are more highly electrified than the automobile manufacturing industry. The industry as a whole reported to the United States Census Bureau that at the beginning of 1920 the installed primary power totaled 544,242 hp., of which 384,537 hp., or 70.8 per cent, represented the electric power purchased from central-station companies. It must be remembered, however, that a very large proportion of the remaining 159,705 hp. of primary power was used in the propulsion of electric generators in private generating plants, a total of 111,172 hp. being the average load of these private plants. The total electric power, therefore, used in the automobile industry was on the average about 495,709 hp.

Michigan leads in the manufacture of automobiles, the plants of that state using on the average 179,854 hp. of electrical energy and the portion of the industry known as "automobile bodies and parts" using 83,231 hp. of electrical energy. In the repair of automobiles, however, California easily leads in number of plants or garages, which reported a total of 8,424 hp. primary power, of which 7,932 hp., or 93 per cent, was electrical.

The accompanying table shows the distribution of power in the automobile industry, as indicated by the census of 1919.

DISTRIBUTION OF POWER IN THE AUTOMOBILE MANUFACTURING AND REPAIR INDUSTRY—U. S. CENSUS of 1919

State	Number of Establishments Reporting	Primary Horsepower: Total	Steam Engines	Steam Turbines	Internal-Combustion Engines	Water Power	Electrical Horse-power Purchased	Electrical Horse-power Generated in Private Plants of Industry
Total Automobile Industry								
United States..	2,830	544,242	78,343	67.869	12,927	566	384,537	111,172
Michigan....	271	284,127	37,539	59,177	8,567	18	178,826	84,259
Ohio........	281	79,039	8,555	440	877	0	69,167	3,723
New York...	344	42,474	8,212	332	493	540	32,897	6,326
Indiana.....	172	39,481	7,026	3,375	230	0	28,850	5,450
Pennsylvania	202	23,363	3,540	150	729	5	18,939	1,323
Wisconsin...	95	22,892	5,710	0	559	0	16.623	4,198
Illinois......	229	15,098	1,065	670	248	0	13,115	455
Automobile Manufacturing								
United States...	315	287,323	45,423	59,109	861	0	181,930	93,426
Michigan.....	68	180,702	22,620	57,707	146	0	100,229	79,625
Ohio........	44	37,473	6,113	400	228	0	30,732	3,061
Wisconsin...	15	14,864	5,025	0	11	0	9,828	1,663
Indiana.....	27	13,564	2,830	0	0	0	10,734	626
Illinois......	25	6,263	380	670	■	0	5,213	72
Automobile Bodies and Parts								
United States..	2,515	256,919	32,920	8,760	12,066	566	202,607	17,746
Michigan....	203	103,425	14,919	1,470	8,421	18	78,597	4,634
Ohio........	237	41,566	2,442	40	649	0	38,435	662
New York...	316	27,976	3,317	0	493	540	23,626	848
Indiana.....	145	25,917	4,196	3,375	230	0	18,116	4,824
Pennsylvania	177	17,950	2,912	150	509	5	14,374	1,183
Automobile Repairing								
United States...	15,507	82,691	1,721	42	17,571	132	63,225	518
California...	1,648	8,424	■	0	482	2	7,932	6
Pennsylvania	1,359	7,109	621	0	1,431	9	5.048	90
New York...	999	5,897	43	■	759	5	5,090	2
Illinois......	785	4,278	72	■	608	0	3,598	14
Ohio........	540	3,678	180	0	735	0	2,763	6

Material Handling in Industry

Many Types of Electrically Operated Equipment Used by Industrial Plants and Transportation Companies Effect Notable Savings in Time, Money and Labor

WITH the present overtaxed condition of the railroads, the scarcity and high cost of labor and increased industrial activity, the development of electrically operated equipment has gone far to increase production by speeding up the handling of material and thus releasing hand labor for more profitable work. Material handling has resolved itself into a broad problem embracing the utilization of electric trucks, industrial tractors, cranes, hoists, elevators, conveyors and lifting magnets either singly or in various combinations, depending upon the duty to be performed.

Today engineers and architects recognize the time, labor and money-saving value of such equipment, with the result that new factories, warehouses and docks are designed to accommodate machinery of this type. There are, however, numbers of old buildings many of which have been equipped with material-handling devices upon which exceedingly high economies have been realized. On pages 584 and 585 are depicted various kinds of equipment used in the moving, handling and transporting of material in different stages of manufacture from raw material to the delivery of the finished product to the consumer.

Industrial tractors and trucks are being very generally used, particularly in warehouses and industrial plants, because they do away with hand trucking and release men for other work.

Industry has become so dependent upon electric cranes and hoists, designed to meet different conditions of material handling, that they are accepted as a matter of course. What these machines save in the labor of thousands of men every year is impossible to estimate, because modern industry has never used manual labor to perform the work done by cranes. There are, however, further savings possible in the operation of cranes and derricks by the use of other electrical equipment which releases still more labor. The addition, for instance, of a lifting magnet for handling iron and steel not only increases the speed of the crane, but it can be operated by one man, whereas two or more would otherwise be needed. For other materials the use of grab buckets or automatic devices performs the same function in lessening the manual labor necessary.

In processes of manufacture and for handling finished products in factories, warehouses, at freight houses and on wharves many different forms of conveyors have been developed. For continuous operation this equipment has been installed as an integral part of the industrial equipment. There is also a large field for the use of portable apparatus such as box-car loaders, portable baggage conveyors, bag filing or stacking machines, barrel- and keg-handling elevators, coal-handling conveyors and so forth. This type of apparatus has been found particularly useful in speeding up loading and handling operations, with a reduction of hand labor to the minimum, and as a general rule the power requirements are very small.

Another combination, that of the electric magnet and belt conveyor, is found in the magnetic separator. Material transported in bulk becomes contaminated with tramp iron or steel, and where the material is to be ground, crushed or pulverized these pieces of metal may cause considerable damage or a shutdown.

Elevators for moving freight and merchandise present an interesting phase of material handling.

Conveyors a Necessity to Industry

For handling raw material, package goods, ores, fuels, chemicals and other industrial products a great variety of conveyors are available. These conveyors speed up the movement of material, reduce hand labor to a minimum and require little energy to operate.

CRANES, BUCKETS AND HOISTS ARE INDISPENSABLE TO INDUSTRY

TYPICAL WORK DONE IN INDUSTRY BY MAGNETS, CRANES AND TRUCKS

Applying the Induction Furnace to an Industrial Brass Foundry

By J. G. CRAWFORD
Superintendent E. Stebbins Manufacturing Company, Springfield, Mass.

Advantages of Electric Melting Include Economies in Production, Improved Quality of Poured Metal, Closer Control of Product and More Favorable Operating Conditions—Results of a Test Run

FIG. 1—FURNACES IN OPERATION WITHOUT FUMES

RECENT improvements in the design and manufacture of the induction brass furnace open the way toward the realization of marked economies in the production of controlled-quality metal. Combustion types of furnaces are generally handicapped by heavy shrinkage losses of valuable material during the melting process. The control of mixtures is difficult with such equipment, and there is much uncertainty as to the cost of maintenance. With the desire to utilize the latest developments in melting furnaces capable of raising the quality of poured metal to the high plane demanded by present-day market conditions and keeping it there, the E. Stebbins Manufacturing Company, through its president, F. W. Parks, undertook a year or more ago to investigate the problem of furnace selection. The result was a decision to install two repulsion-induction furnaces. Business conditions have fluctuated considerably since the installation of these units last April, but despite this handicap upon minimum operating cost per unit of output the management is thoroughly convinced that this installation is an economic proposition. It is turning out a better product at lower cost than was previously attained in these works.

Nearly a year was spent in investigating the whole subject of brass melting. In the Stebbins company's case the object was not only to reduce the cost of production but otherwise to utilize the space taken up by the pit-fire crucible furnaces formerly used. These burned hard coal and were of a type which has been common to foundry practice for hundreds of years. Studies of certain types of arc furnaces convinced us that there is only one correct principle in the application of heat to brass, and that is to apply it at the bottom of the furnace. Gas furnaces were investigated and an installation was tested without satisfactory results, the shrinkage and control being undesirable and objectionable. Oil furnaces disclosed the disadvantage of attempting to melt uniform-quality metal in the presence of a combustion process. The indicated solution was by the repulsion-induction furnace, with its freedom from combustion, cleanliness of operation, accuracy of control and simplicity of design.

In 1922 the General Electric Company brought out a new design of repulsion-induction furnace for melting copper and all brasses and bronzes. The principle of operation is that of a transformer in which the coil is the primary circuit and a molten ring of metal the secondary. When a suitable voltage is applied to the coil, a low voltage is induced in the ring of molten metal, resulting in a heavy current. Heat is generated by the passage of this current through the metal, positive unidirectional flow of the metal being obtained by placing the coil in such a relation to the ring of metal that a repulsive force is exerted in one direction, causing the metal to flow out through a duct to the main bath and to return through another connecting duct to the heating chamber. This insures the absence of local overheating and effects a thorough stirring of metal and consequent homogeneity.

Two of these furnaces are in operation at the Stebbins plant. Each of these furnaces has a pouring capacity per heat of 750 lb. and requires a maximum power input of about 75 kw. at 440 volts, single-phase. The holding capacity is 1,200 lb. of molten brass. The difference of 450 lb. must be kept in the furnace in a molten condition at all times unless a source of liquid

metal is available for priming. The radiation loss is so small that an input of from 12 kw. to 14 kw. per furnace is sufficient to maintain the metal in liquid from during stand-by periods. Practically no attention is needed when the furnace is not in production. The power-factor rating is about 75 per cent, and from the central station standpoint the furnace is more desirable than the average induction motor load of equal horsepower rating.

In the earlier and simpler forms of induction electric furnace the outfit consisted of an annular channel-shaped crucible in which the entire charge was contained and a primary winding interlinking with a laminated iron core which was common to both. When an alternating voltage was impressed on the primary winding, heat was generated by a secondary current flowing around the circuit of molten metal within the crucible. The very low resistance of this secondary circuit, combined with the high-leakage reactance, resulted in a very low power factor and made it difficult to introduce large amounts of power into the furnace. These objectionable features were exaggerated with metals of higher conductivity. It was impossible to operate one of these earlier designs of furnace on such metals as brass or copper, since the magnetic field surrounding the secondary became so powerful as to cause magnetic choking. This severed the continuity of the molten metal in the channel, causing periodic interruptions of the current and a continuous agitation of the molten metal. All these difficulties have been overcome in the newer design.

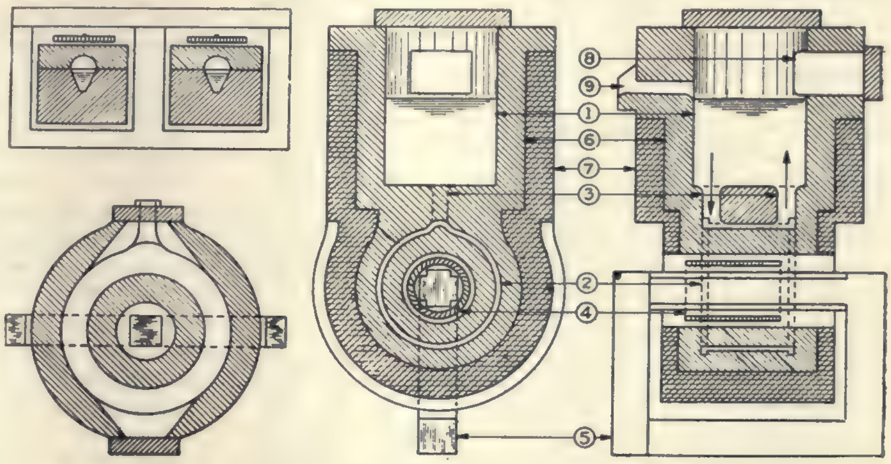


FIG. 2—CROSS-SECTION OF REPULSION INDUCTION FURNACE

The melting pot and molten metal secondary or heating element have been segregated in the present design. The secondary circuit completes itself without passing through the melting pot. Although the heat is generated and utilized in entirely different parts of the furnace, the free, automatic, unidirectional circulation of molten metal results in a small variation in temperature throughout the bath. Another result attained with this circulation is the elimination of the possibility of magnetic choking. These features of design make it possible to force the furnace to any extent feasible for the primary winding and core, and so particularly adapt it to the me'ting of high-conductivity metals as well as metals of lower conductivity. The size and rating of such furnaces, if at all, is limited only by such considerations as mechanical strength and reliability of refractory linings, which may appear in large sizes. Preformed and prefired linings are available and can be installed in a fraction of the time and at a fraction of the cost required for the ordinary rammed linings, and all parts of the linings can be thoroughly inspected before installation.

The electrical equipment of this installation is simple. Each furnace is provided with an auto-transformer and control panel. The transformer is mounted on the back of the panel and is provided with five taps for various voltages for controlling the power input and so the furnace temperature. On the front of each panel are mounted an ammeter, air circuit-breaker and tap selector switch, together with a watt-hour meter. For cooling the coil of each furnace about 500 cu.ft. of air per minute at from 3 oz. to 6 oz. pressure is required, and for this supply two No. 20 Sturtevant blowers, each driven direct by a 1-hp., 440-volt motor, are installed. Each feeds air to the nearer furnace through a 4-in. galvanized-iron pipe, and these feeds are cross-connected to enable either fan to supply both furnaces in case one unit is shut down.

A substantial saving in the first cost of this installation was effected by the availability of the furnaces in a 440-volt, single-phase design. Energy is supplied to the Stebbins plant by the United Electric Light Company of Springfield through a 5,500-volt, two-phase feeder which also serves a number of other industrial establishments in the same district. The Stebbins plant has a total connected motor load of 180.5 hp., and the two furnaces are connected to the regular power service and treated in the power rate like additional induction motors of a combined additional connected load of 200 hp. The incoming 5,500-volt service is equipped with a four-pole non-automatic oil switch and protected by 60-amp. expulsion fuses, one in each phase wire. Two 250-kva. power transformers step the voltage down to 440 for motor and furnace service. The two furnaces are fed each by one phase of a three-wire, two-phase line running from the transformer secondary coils through a three-pole oil circuit breaker to the furnace panels. Automatic air circuit breakers are provided for the furnaces, as stated. The blower motors are connected outside the furnace watt-hour meters, and an allowance of about 200 watts per blower motor must, in computing totals, be added to the energy consumption of each furnace.

The installation of the furnaces reduced the cost of electricity in this plant from an average of 3¼ cents to 2½ cents per kilowatt-hour, applied to the combined motor and furnace loads. The use of a standard power transformer makes it unnecessary for the Stebbins company to carry any extra transformer unit, since the United company can immediately furnish extra transformer facilities in case of trouble. The service is by underground cable, which safeguards against interruptions. In case of a failure of electrical supply, the furnaces will hold their molten metal for approximately one hour without "freezing," after which a new lining must be installed. This can be done in about two days, recent improvements in lining manufacture in the way of shaping having been accomplished that obviate some of the field work formerly necessary. It is interesting

to note that the United Electric Light Company reports that no fluctuations in circuit voltage or power factor on the Stebbins feeder can be traced to the operation of these furnaces.

The first cost of the complete furnace installation, with wiring, based on current prices of labor and materials, totals about $16,000. The floor space required by the two furnaces and switchboard panels is about 500 sq.ft., against 800 sq.ft. for the twenty pits formerly used. The installation is particularly adapted to the Stebbins company's conditions because of the company's desire to remelt its own chips. The castings here are small, faucets comprising the leading product; hence the percentage of chips made is relatively high. The company machines all its own castings. Such a condition does not exist in the ordinary commercial foundry. Under normal conditions the company uses about 20 per cent of chips per heat, but this fluctuates widely because of the accumulation of chips. The brass composition here is 65 per cent copper by weight, 33 per cent zinc and 2 per cent lead. The life of linings is still a variable quantity. These are guaranteed for thirty days, and at the time of writing one lining is in service which has been running twelve weeks, while others have exceeded or not equaled the guarantee. One man can handle two furnaces at full output with some occasional aid from a second when convenient. Two men at $1,000 per year each were released for other service when the installation was finally in running order. It is possible to pour from seven to eight melts per furnace in a nine-hour day, and under normal operating conditions the energy consumption does not exceed 200 kw.-hr. per ton of metal melted.

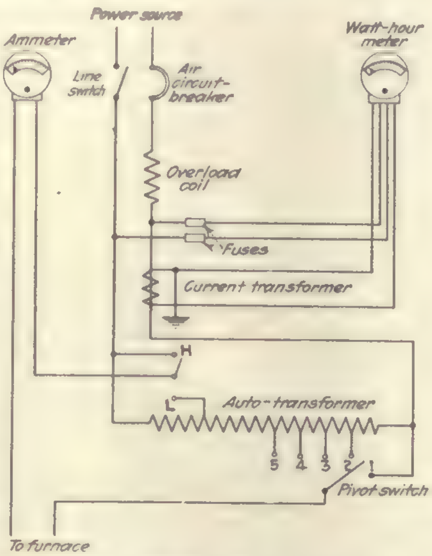


FIG. 3—SIMPLICITY OF CONTROL FOR INDUCTION FURNACE

During the four weeks ended June 16 the company melted 38,000 lb. of its own chips, along with gates, spills, defectives, etc., and during this period it was obliged to use 19.4 per cent new ingots, whereas with the old pit fires about 60 per cent new ingots would have been required. The time required to charge a furnace is about ten minutes. The absence of oxidation in melting is a great advantage, saving material and also doing away with the need of skimming ladles, with its associated hazards.

At the present price of anthracite coal in Springfield ($16 per ton), the cost of melting by electricity is no greater than with the old pit-fire furnaces. The quality of the product is superior, owing to the uniform melting temperature, the absence of opportunity for the metal to absorb impurities from gases and the reduction of shrinkage. The salvage on chips at from 4 cents to 7 cents per pound means a saving of 1,400 lb. per day under full normal operation. Based on last year's output of this plant, the saving of oxidation or shrinkage amounts to a carload of ingots valued at $6,000 in a year's run of these furnaces. About seventy minutes is required to bring the metal to a boil after starting the furnace. The foundry operates one shift per day.

Many interested companies having asked whether this furnace could successfully melt charges consisting entirely of chips and turnings, the Stebbins company offered to operate one of its furnaces on borings alone for an entire day in order to demonstrate that this material could be successfully melted in the repulsion-induction furnace. This test was carried out on July 24, 1923, under the direction of L. S. Thurston of the General Electric Company.

A total of three 750-lb. charges, consisting entirely of chips and turnings, was melted in one of the furnaces during the test run. Charging the first heat was started at 9:37 a.m., and the second heat was held in the furnace one hour and twenty-five minutes after being ready to pour, while the observers were out at lunch. The third heat was poured at 4:12 p.m., so it is obvious that several more heats could have been obtained during the regular shift.

In the accompanying tables the records of the three heats and a summary are given.

It should be noted that the metal was poured at a high temperature, it being brought to the boiling point before pouring. The temperature of the metal when poured was probably in the neighborhood of 2,100 deg. to 2,200 deg. F. The first heat took somewhat longer than would normally be necessary because the furnace was emptied to a lower point than usual before the starting of this heat. Consequently there was not so much molten metal as is usually left in the furnace and the rate of melting was slowed down during the first portion of the heat.

The castings obtained from the metal melted from the chips and turnings were as good as those from the regular run of ingot and scrap. No accurate figures were secured as to the weight of castings produced.

When using the induction furnaces the amount of dross is very small, amounting to possibly not more than 20 per cent of that obtained from the crucible furnaces. A sample of the dross accumulated since the operation of the induction furnaces, including some floor sweepings, analyzed approximately 24.4 per cent copper content. The number of rejected castings when using the induction furnace metal is considerably less than when using metal melted in the pit fires.

MELTING BRASS TURNINGS IN INDUCTION FURNACE

	Watt-Hour Meter Reading
Heat No. 1	
9:37 a.m.—Began charging borings	52,335
11:07 a.m.—Total of 750 lb. charged and metal boiling	52,435
11:10 a.m.—Began to pour.	
Heat No. 2	
11:26 a.m.—Began charging	52,441
12:45 a.m.—750 lb. charged, metal boiling (Metal held in furnace until 2:20 P.M. awaiting return of visitors.)	52,530
2:20 p.m.—Began to pour	52,565
Heat No. 3	
2:37 p.m.—Began to charge	52,571
4:02 p.m.—750 lb. charged, metal boiling	52,666
4:12 p.m.—Began to pour	52,671

Summary

	Heat Number			
Heat number	1	2	3	Average
Pounds borings melted	750	750	750	750
Time to melt and bring to boiling point, hours and minutes	1:30	1:19	1:25	1:25
Kw.-hr. to melt and bring to boiling point	100	89	95	94.7

Servicing Industrial Loads

Good Practices in Handling This Class of Business—Transforming, Metering and Housing Equipment—Contracts and Servicing Methods—Typical Installations for Overhead and Underground Services

THE servicing of large users of electricity by central-station companies has become increasingly important because of the great magnitude of the business and the necessity for rendering reliable and economical service. The central-station and industrial executives and engineers are all concerned because the business and engineering features are very complicated and reflect themselves in so many ways. Transforming equipment, housing facilities, metering methods, contract clauses, costs, control, protection, maintenance and operation are some of the elements in the problem, whose ramifications extend even into the realms of legislation and public relations.

The industrial executive is concerned primarily in getting an installation, a rate and an operating procedure at a low cost that will give him absolutely reliable and economical service under all contingencies of operation. He knows that his production costs in manufacture are directly affected by the type and kind of service he obtains.

The central-station executive wishes to satisfy the service demands of the user in the most satisfactory and economical manner. Yet he must provide service reliability for all customers as well as the individual consumer and in so doing often encounters many restrictions, legal, physical and operating.

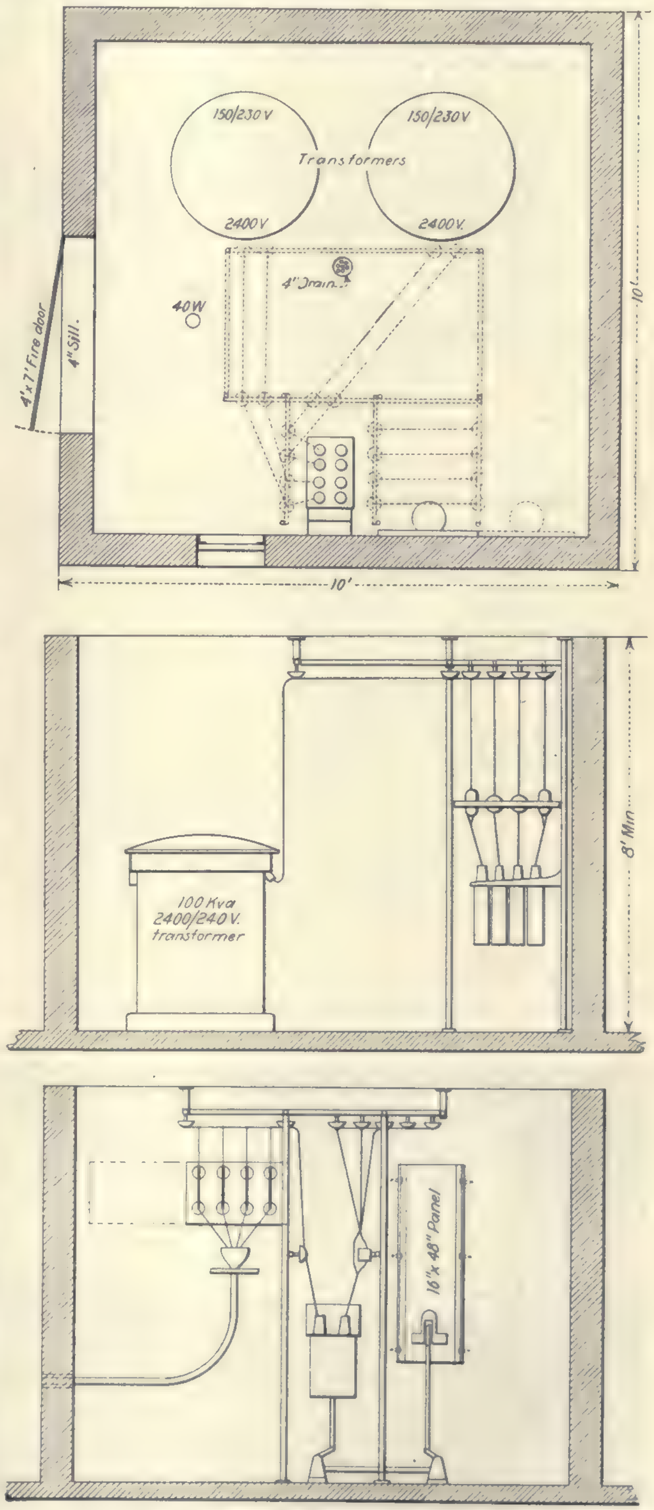
The engineers of the utilities and the industries are faced by many electrical, civil and mechanical engineering features in selecting an installation and the equipment for it from among a very great number of posibilities. In addition, they encounter vexations and complicated problems connected with the arrangement of the equipment and its location, metering, control, protection and operation.

Thus a co-operative study is required to obtain best results on each industrial power installation, and the cost involved determines the extent to which this study can be carried.

LOCATIONS DETERMINED BY MANY ELEMENTS

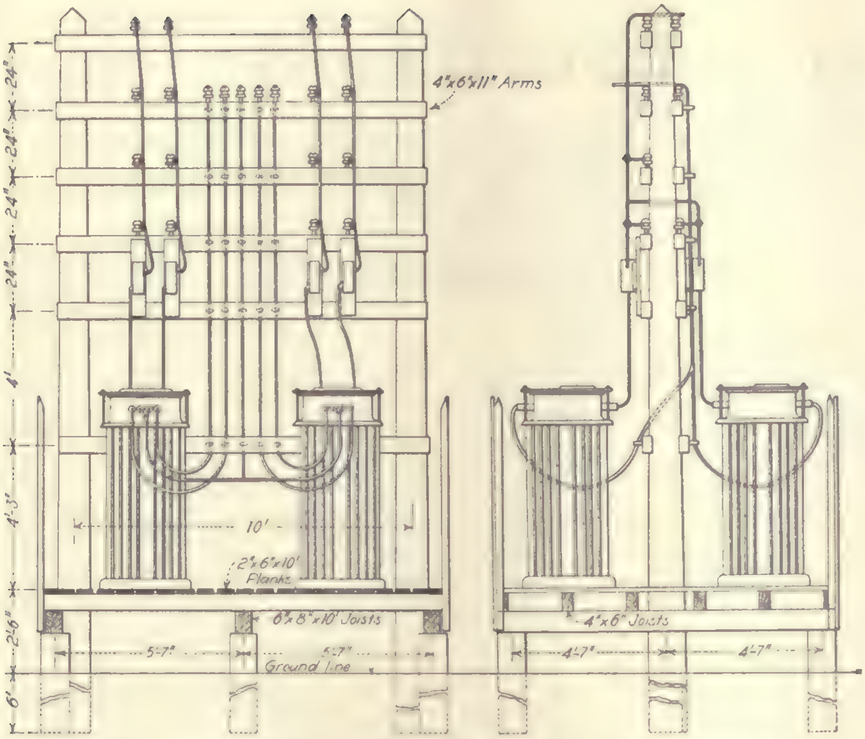
A fundamental principle in supplying any load is to locate the control and transforming equipment at the center of gravity of the load. In many cases, however, practical difficulties prevent the exact application of this principle—for example, the voltage that it is safe or logical to use, whether the service is overhead or underground, fire hazards and insurance restrictions, operating exigencies and the availability of suitable locations.

Depending upon conditions, the substations may be located entirely outdoors, in a separate fireproof building, in a fireproof basement vault, in a room in the factory building, or on a raised platform adjacent to the building. Fundamental requirements are that civic ordinances must be satisfied, fire hazards must be minimized, simplicity in layout must be obtained, safety must be a governing element, accessibility and convenience for maintenance, operation and repair must be secured, costs must be reasonable, provisions must be



TRANSFORMER AND SWITCH VAULT FOR TWO 100-KVA. TRANSFORMERS, HARTFORD ELECTRIC LIGHT COMPANY

The walls and ceiling are of fireproof material and there is 12 sq.ft. of ventilating opening to the outside air. Secondary wiring and transformer ground wire are to be supplied by customer.



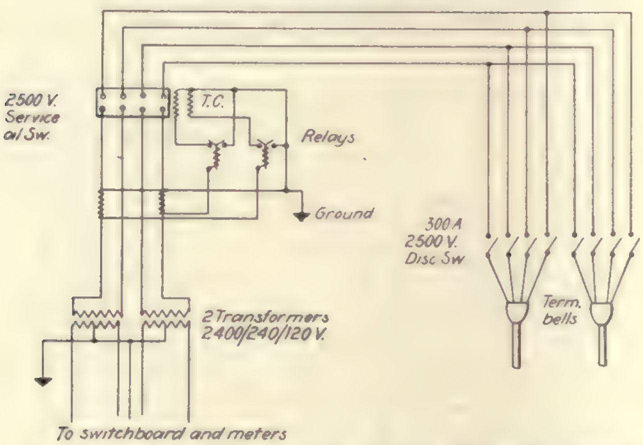
SPECIAL TRANSFORMER PLATFORMS FOR FOUR 150-KVA. TRANSFORMERS, HARTFORD ELECTRIC LIGHT COMPANY

made for future extensions or changes, and the control and protection of the equipment must be simple and reliable. And it is not easy to make general statements about these conditions, for each load is a specific problem and has local conditions that are decisive in making an installation.

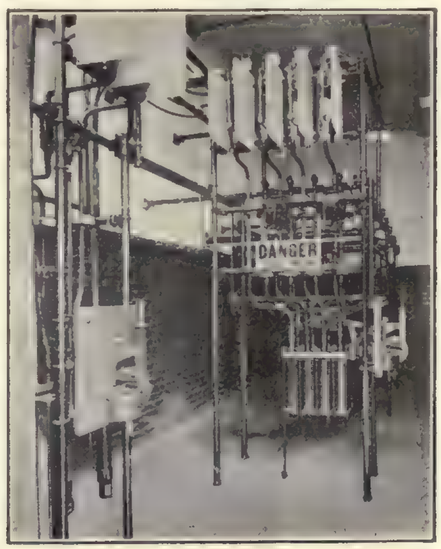
In some degree, however, standardized practice can be used. Substation buildings of the unit type can be standardized in design; transformer vaults can be standardized in arrangement and layout; outdoor substations can be standardized in arrangement, and for all services protective and control equipment can be standardized to a great degree. Even the metering equipment and methods, contracts and servicing practices can be pretty well standardized for any one operating system.

In the electrical layout for alternating-current power systems the type of supply, whether single-phase or some polyphase type, has a bearing on possible practice, and in addition the value of the primary and secondary voltages and the available locations affect the choice and arrangement of the substations. In general, incoming lines go first through disconnecting switches; then they may or may not go to a bus or be protected by some type of arrester, thence to an oil breaker or fuse preceded perhaps by an instrument potential transformer, thence to instrument current transformers, and so to the primary windings of the transformer. The secondary side leads usually run to an oil breaker or switch on a panelboard, and where metering is done on the low-tension side the instrument transformers will be installed in the secondary leads.

But, in addition to the opportunity for choice in apparatus and its arrangement in the fundamental layout, there is opportunity for choice in the equipment and methods used for control, safety, protection, repair, operation and maintenance. The type and kind of relays, the number of meters and their connection, the use or



TWO-PHASE, 2,400-VOLT SERVICE STATION WITH OIL SWITCH AND RELAYS, HARTFORD ELECTRIC LIGHT COMPANY



SAFETY IS FEATURED IN PUBLIC SERVICE COMPANY INSTALLATION
At left, typical secondary installation; at right, typical 2,400-volt installation.

Terms and Conditions Subject to Which Service Is Accepted

1. Bills for service furnished under this contract shall be payable upon presentation.

2. No change shall be made in the customer's equipment nor in the type, size or total electric capacity of the devices connected to the service, nor shall the electrical energy be used except for the equipment scheduled, nor shall any other electric service be introduced or permitted in connection with such equipment without previous written notice to and written consent of the company.

3. At the expiration of the stated term this contract shall continue in force until terminated by five days' written notice from either party.

4. The company will furnish meter and service appliances necessary to connect the customer's equipment with its mains. All appliances furnished at the expense of the company shall remain its property and may be removed by it at any time after the termination of this agreement or the discontinuance of service. The wiring, equipment and appurtenances shall be furnished by the customer and shall conform to the National Electrical Code and to the rules and regulations of the company and to all lawful municipal regulations.

5. All repairs to customer's property shall be made by the customer, who shall maintain the equipment in the condition required by the Fire Underwriters or by the company.

6. The customer shall not permit access, except by authorized employees of the company, to the meter or other appliances of the company, nor interfere with the same, and their safe keeping shall be provided for by the customer. In case of loss or damage to the property of the company from the act or negligence of the customer or his agents or servants, or of failure to return apliances supplied by the company, the customer shall pay to the company the value of such property.

7. The company shall use all due diligence in providing a regular and uninterrupted supply of electrical energy, but in case the supply of electrical energy shall be interrupted or be defective or fail by reason of accident, federal, state or municipal interference, or other cause, the company shall not be liable therefor, but should such interruption, defect or failure in the service result from causes within the control of the company, the customer may terminate this agreement by written notice immediately delivered to the company.

8. The company shall have right of access to the premises at all reasonable times during the period of this agreement, and on its termination, for the purpose of reading meters, inspecting or repairing appliances used in connection with its service, removing its property, or for any other purpose proper under this agreement.

9. The company shall have the right to suspend its service in case the customer fails to comply with or perform any of the conditions or obligations of this agreement, or of any other agreement with the company for electrical service. In case for such cause service shall be suspended, or through any act or negligence of the customer the company shall be prevented from suplying the service, there shall then become due and payable to the company in lieu of returns for such service during such suspension or discontinuance, as stipulated damages and not as a penalty, the sum here below named as a minimum charge.

10. The company shall not be liable for damages resulting from the use of electrical energy or the presence of its appliances on the customer's premises.

11. The customer shall obtain or cause to be obtained all permits necessary to give the company or its agents access to the equipment and to enable its conductors to be connected therewith, together with all permits and certificates, municipal or otherwise, required by law or the rules of the company and the company shall not be obliged to furnish the service herein specified unless and until such permits and certificates shall have been produced to the company.

12. The rate fixed herein is the uniform rate as filed with the Public Service Commission of the state and now in force and is subject to such changes as the state may require, authorize or allow from time to time; and whenever such change is made, authorized or allowed, whether less or more than herein specified, such changed rate shall be deemed, taken and considered as the rate herein for electricity furnished under this contract.

non-use of overload or low-voltage protective devices, the use or non-use of thermal indicators, the use of air, oil or water-cooled transformers and the arrangements for drainage and circulation—all these elements must be decided from the governing standpoint of getting an economical and reliable installation that is convenient to service.

A study of the practices of ten representative companies shows that little uniformity has been attained in handling large power-service installations. Voltages used are 550, 2,300, 4,800, 6,600, 7,800, 12,000, 13,000, 13,200, 22,000, 26,000, 66,000, with 11,000, 13,000 and 13,200 predominating.

In nearly every instance the commercial or power sales department conducts all negotiations with prospective customers, including the signing of the contract. In most cases the power salesman acts as the medium of contact with the customer after service is rendered and serves as his adviser on the service installation.

The engineering, estimating and construction departments, depending on the size of the organization, lay out and supervise all service installations. The meter department installs, reads and tests the meters used on the service. The majority of the light and power companies bill on a demand and energy basis and in general provide rules which must be followed in installing the customer's equipment to insure good construction and to safeguard the system.

The general practice is to require the customer to furnish all the substation equipment, the transformers, the transformer vault or the outdoor installation. Some companies furnish all high-tension equipment, transformers and meters, but this is exceptional. The following paragraphs show the variation in practices:

1. The light and power company furnishes a metering panel and oil breakers. The customer furnishes the transformer vault or, if overhead, a concrete platform.

2. The light and power company delivers energy at the consumer's property line. The customer furnishes transformers, oil breakers, meters and other equipment.

3. The light and power company furnishes truck-type

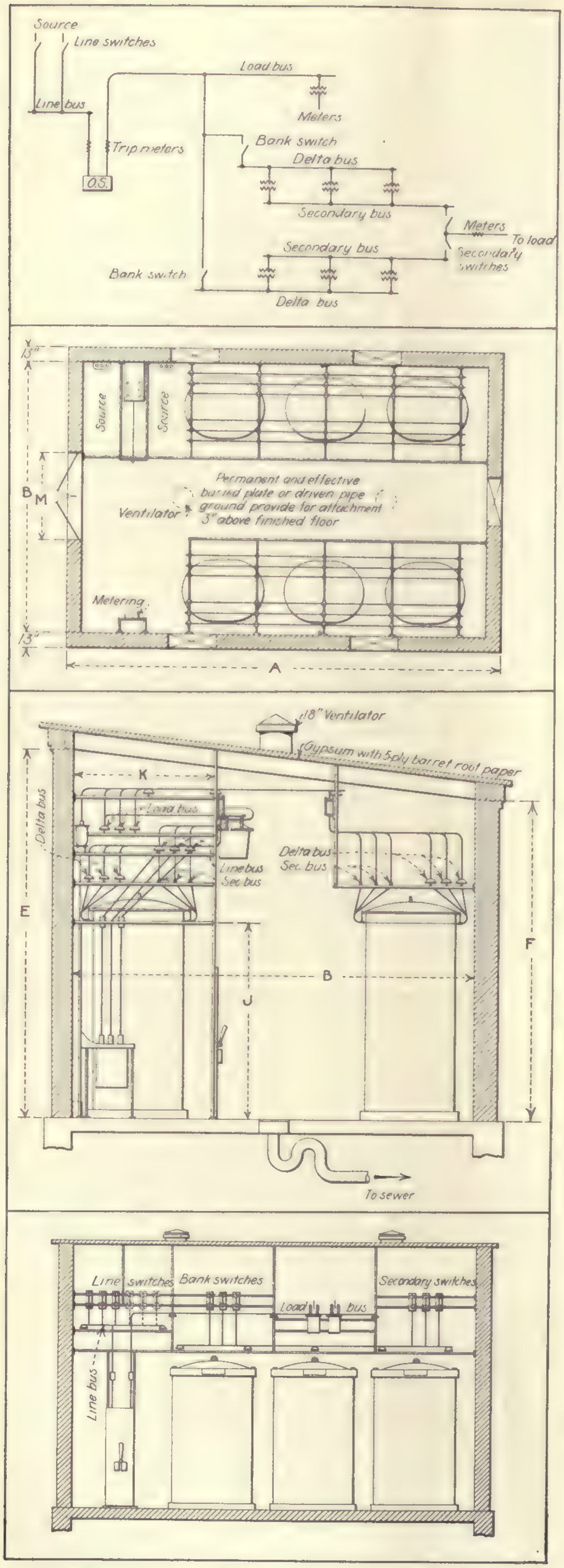
High-Tension Installation, with Two Feeders, for Ice Company

(UNITED ELECTRIC LIGHT & POWER COMPANY, NEW YORK)

No. Required	Description	Manufacturer
2	Type "B-13" 600-amp., 15,000-volts, oil circuit breakers, Double-trip coils	W.E. & M. Co.
2	Type "EM-13" 13,200/7,700-110-volt voltage transformers with mounting brackets, no fuses...	G.E.
6	Type "KB" 300/5-amp. current transformers.....	W.E. & M. Co.
2	Type "KB" 50/5-amp. current transformers..	W.E. & M. Co.
4	Type "CO" relays..	W.E. & M. Co.
2	Type "CR" relays, 315-amp., scale.	W.E. & M. Co.
2	Type "CRA" relays........	W.E. & M. Co.
1	Type "DSW-6" watt-hour meter, three-wire, three-phase, 60-cycle for 50/5-amp., current transformers and 70/1-voltage transformers, with printometer contacts..	G.E.

No. Required	Description	Manufacturer
1	Recording demand meter, type "PS-2," wound for 18-volts direct current.	G.E.
1	Clock type "CS-4," wound for 110-volts, 60-cycles, fifteen-minute demand....	G.E.
5	Pothead covers.......	Electrose
24	Disconnect contact bushings..	Electrose
4	Tubes, No. 7252, 4 in. long..	Thomas
3	Tubes No. 7253, 8 in. long....	Thomas
18	Cast solder type lugs.	Dossert
12	Male disconnect contacts.....	United
12	Female disconnect contacts.	United
2	Relay test blocks and covers..	United
1	Meter test blocks and cover...	United
1	Set cross-board connection straps with cover..........	United

No. Required	Description	Manufacturer
2	Sets sliding voltage contacts with cover..	United
4	"CO" relay pans.....	United
4	"CR" relay pans...........	United
1	Watt-hour meter pan.........	United
1	Demand-Meter pan..........	United
1	Clock pan..................	United
24	Dry cells.....	
2	Truck frames complete with locking device, shutters, tracks, track extensions, grounding device, cable clamps and tube clamps....	United
4	10 in. "Conducell" pot-heads..	United
1	14 in. "Conducell" pot-heads..	United
1	8x9-in. fuse box with one to two-pole plugs, fuse block and two 30-amp. fuses......	
3	333-kva. transformers........	



STANDARD TRANSFORMER VAULT CONSTRUCTION AND WIRING OF CONNECTICUT LIGHT & POWER COMPANY. SEE TABLE FOR DIMENSIONS

DIMENSION SHEET FOR SIX-UNIT TYPICAL SUBSTATION BUILDING

	Capacity of Transformers											
Dimension	100, 150 and 200 Kva.		250 and 333 Kva.		400 and 500 Kva.		667 and 833 Kva.		1,000 Kva.		1,250 Kva.	
	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In
A	21	[illegible]	22	0	24	0	28	0	30	0	36	0
B	15	0	16	0	17	0	18	0	20	0	22	0
C	..	..	..	..	..	..	..	..	..	..	..	
D	..	..	..	..	..	..	..	..	..	..	..	..
E	19	2	20	6	22	2	22	2	22	10	22	10
F	18	0	19	3	20	10	20	9	21	3	21	1
G	9	8	11	0	13	0	13	0	13	10	13	10
H	7	0	7	0	7	0	7	0	7	0	7	0
J	10	2	11	6	13	2	13	2	13	10	13	10
K	5	8	6	0	6	6	6	8	7	3	7	6
L	..	..	..	..	..	..	..	..	..	..	..	..
M	6	0	6	0	6	0	7	0	7	0	8	0

L shall be equal to K for hand-operated remote-control switch, K dimension is maximum and varies with type of transformer.

switches and metering equipment for the vaults. The customer furnishes the transformers and secondary equipment.

4. The customer furnishes all equipment inside the property line except the meters.

5. For primary service the light and power company furnishes only cut-outs and lightning arresters. For transmission-line service the company furnishes only horn gaps, fuses and arresters, and the customer furnishes transformers, tower, oil breakers and "disconnects."

6. The light and power company furnishes cables, oil switches, transformers and bus work. The customer supplies a transformer vault or laterals to the base of the pole.

7. The customer furnishes all equipment beyond the curb line in underground work and all but the first span on overhead services.

In general it is good practice for the light and power companies to lay out and install the high-tension equipment. They know best how to do the job, and this practice makes for standardization. If the installation is left to unskilled hands or is optional with the customer, no uniformity or standardization can be expected and system hazards may be introduced. It is usually feasible to do this work on the basis of cost plus a percentage, and the light and power company can usually purchase the equipment at a lower figure than the customer.

The majority of companies meter on the primary side, but several prefer the low-tension side. They argue that transformer losses can be predicted very accurately and

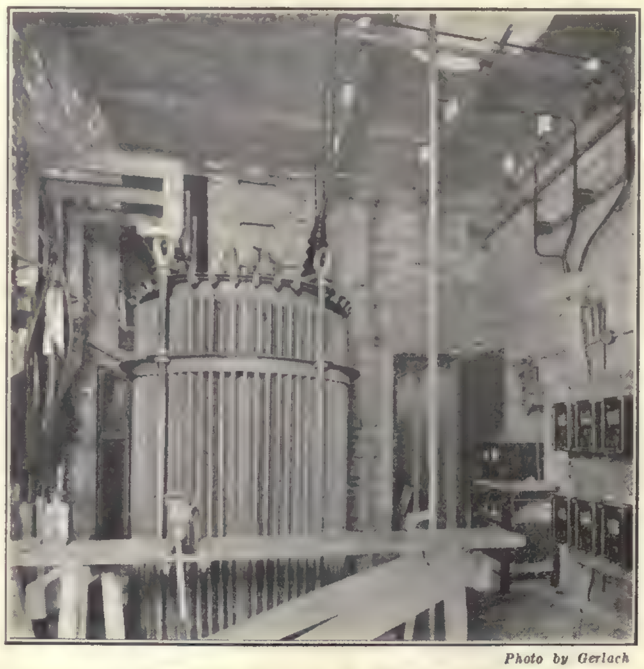


Photo by Gerlach

PROTECTIVE APPARATUS IN THIS COMMONWEALTH EDISON SUBSTATION OPERATES IN CONJUNCTION WITH A 24-VOLT STORAGE BATTERY

that the cost and errors introduced by high-tension metering make secondary metering preferable. Some metering practices follow:

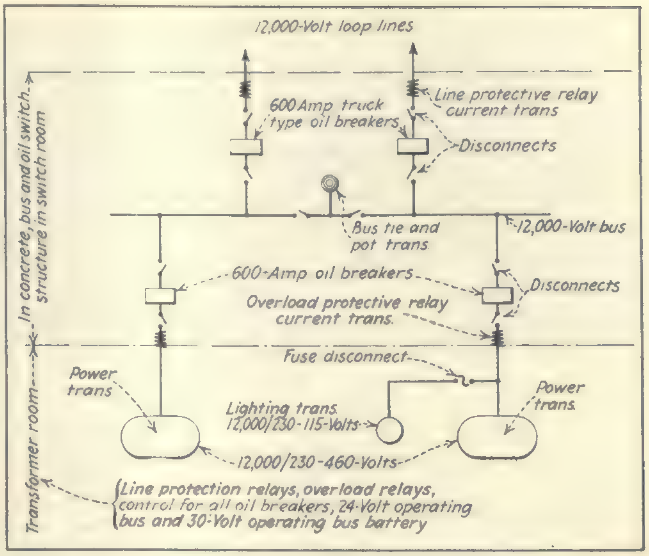
1. Meter on high tension or low tension side as desired by customer. Use watt-hour and reactive-watt-hour meters, demand meter and sometimes reactive-demand meters.
2. Meter on high-tension side only and use watt-hour and curve-drawing wattmeter.
3. Meter on high-tension side only and use printometer and integrating watt-hour meters.
4. Meter either on high-tension side or low-tension side but prefer low-tension metering. Use watt-hour meters and graphic and indicating demand meters.
5. Meter on high-tension side only and use printometers on all installations over 100 kw.
6. Meter on high-tension side and use watt-hour meters and curve-drawing demand meters.

The meter department tests, reads and inspects the meters on the installations. In some cases the power sales department handles the billing of the larger power customers. Routine inspection, minor repairs and emergency service are in the usual case given the customer's installation at his expense.

POWER CONTRACTS OF MANY TYPES

Because of the great diversity in rate systems the power contracts are not uniform as to clauses and rates. Some companies use a simple form with few detailed terms and conditions, but the majority use a power-contract form that has a formidable legal aspect and contains provisions for every contingency. This type of contract affords a definite contract in the event that disputes arise and clearly delineates the duties of each party to the contract and their respective obligations under every contingency that may be foreseen.

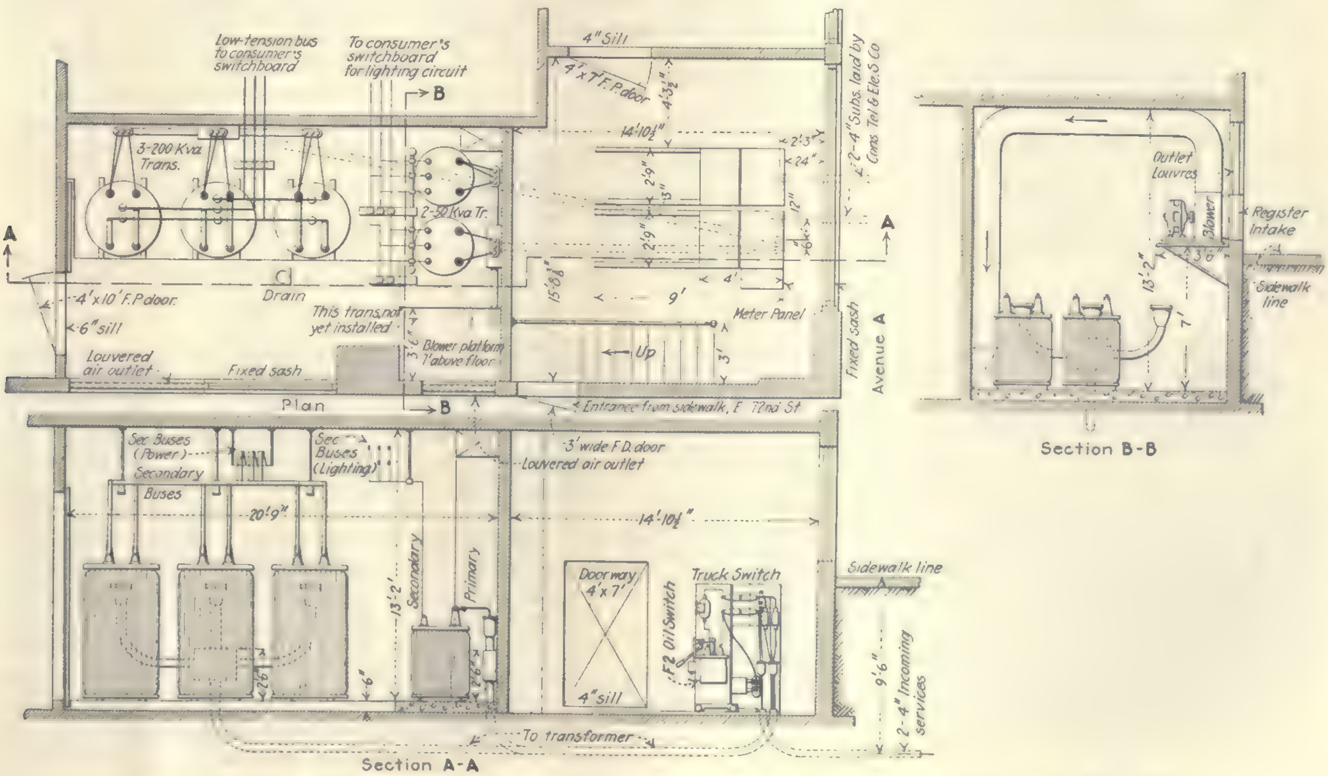
The advocates of the simpler form assert that a voluminous contract is depressing in its effect on customer relations and makes legal steps instead of negotiations the usual way for customers to settle disputes. A middle method followed by some properties is to incorporate service rules and regulations in a published pamphlet and incorporate a general clause only in the power contracts.



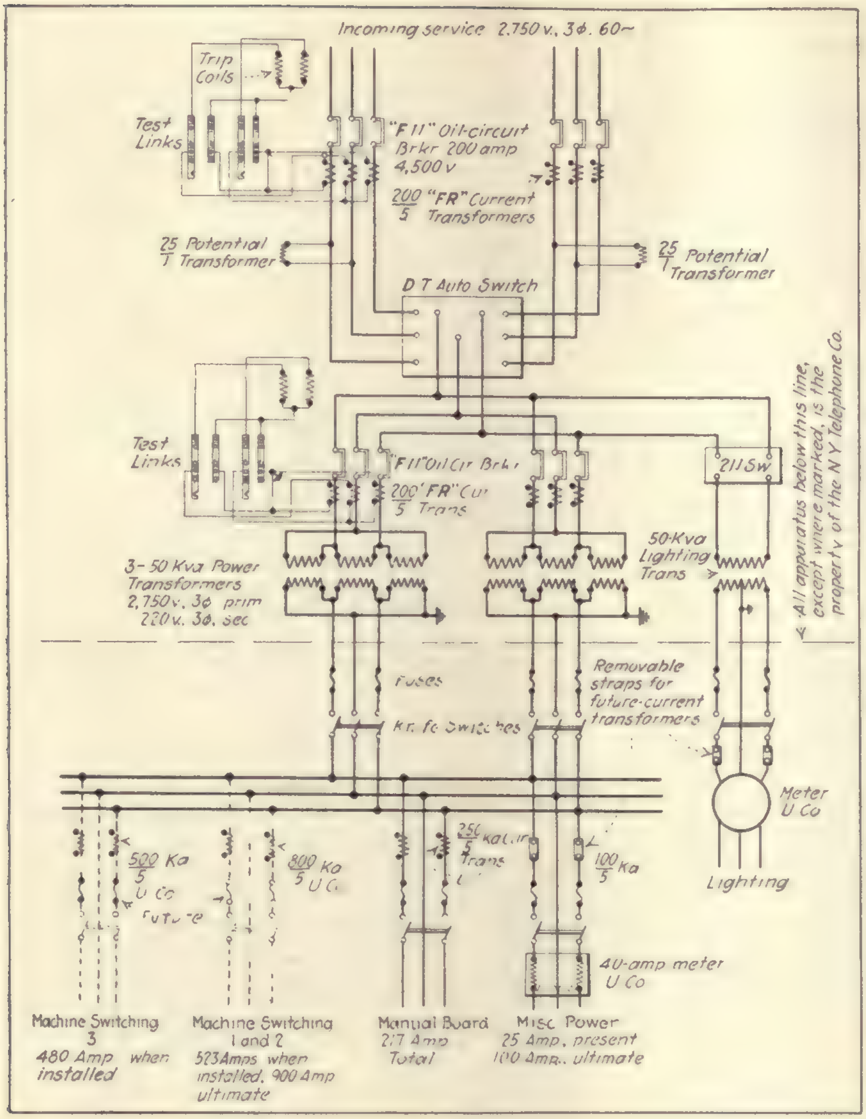
TYPICAL 12,000-VOLT INDUSTRIAL POWER INSTALLATION OF COMMONWEALTH EDISON COMPANY

CONCLUSIONS

A study of existing practices shows that a great improvement can be made in the methods and equipment used in servicing power customers. Standardization will simplify and make less expensive this business and add to its quality. It seems fundamental that the experience, facilities and position of the light and power company make it the logical agency for designing, installing and selecting the equipment to be used by the customer. It also is logical for the customer to pay for the equipment and work done on his installation.



TRANSFORMER VAULT AND SWITCHROOM LAYOUT OF UNITED ELECTRIC LIGHT & POWER COMPANY



SERVICING OF TELEPHONE COMPANY BY UNITED ELECTRIC LIGHT & POWER COMPANY

Power Contract

The undersigned hereby makes application to the Light & Power Company for electric service to be supplied to the premises known as .... Street. .... City, for a term of .... year for an equipment of ....

The electricity and service hereby applied for will be furnished and taken at the rates and in accordance with and subject to the terms, conditions and contract provisions set forth in the company's schedules with amendments thereof and additions thereto on file from time to time with the Public Utilities Commission of the state, which are hereby made a part hereof.

The rate applicable to the service applied for at the date hereof is .... and the initial demand is ....

In case this application is for a term of one year or longer, it is agreed that upon expiration of such term, this agreement shall continue in force until either party hereto shall have given thirty days' written notice of the termination of the same.

The applicant agrees to give immediate notice on ceasing to occupy the premises supplied hereunder and, in case of neglect so to do, to be liable, jointly and severally, with any user of the electricity on said premises for all the electricity used thereon.

The installation of the meter shall be considered as the acceptance of this application and contract by the company.

....

TYPICAL CONTRACT USED FOR ALL POWER CUSTOMERS

Legal reasons in connection with liability for fires or accident hazards render it difficult for a power company to own or maintain equipment on premises over which it has no jurisdiction. A locked room or building is the best remedy, but in cases where this is impracticable the power company should exercise the right of periodical inspection of the equipment connected to its lines.

The power sales department should serve as the medium of contact between the company and the customer. In many cases it has been found good practice to allot power salesmen on an industrial division basis so that their services can become better through specialized knowledge of a particular industry and the group of customers in that industry. In this event the power salesmen rapidly develop into consulting engineers for the customers and wield a tremendous influence in holding up the quality and quantity of the service rendered.

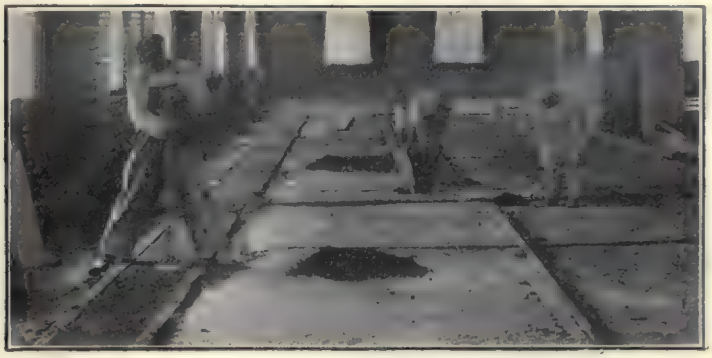
A great deal more standardization can be had in meters and in metering practices. Investigations are needed covering this matter from a broad operating viewpoint. In general high-tension metering is the trend and watt-hour and demand meters are necessary for nearly all installations.

The servicing of industrial loads is becoming increasingly important in view of the widespread extensions of power lines. The practice of standardization together with the development of equipment that needs a minimum of attention and introduces little hazard to the system would seem to be a very logical forward step for the consideration of central-station organizations. That there is room for improvement is evident from a study of present practices.

Drainage Area of St. Lawrence River

THE drainage area of the Great Lakes and the St. Lawrence River at Montreal is 480,000 square miles, and the flow of water is very constant as the seasonal variation in water level on any of the lakes is never more than 6 ft. and averages less than 2 ft. The average discharge at the head of the St. Lawrence is 254,400 cu.ft. per second, and the average rate of maximum to minimum flow is 1.91. This regularity of flow in such volume has no counterpart in the world and serves to make the St. Lawrence River a remarkable stream for the continuous development of electrical energy in hydraulic plants.

The development of the water-power possibilities of this great drainage area is contingent upon treaty provisions between the United States and Canada. No indication of a consummation of a treaty now exists and Canada is busy developing her internal water powers. But the near future should see renewed activity toward securing the adequate development of the St. Lawrence.



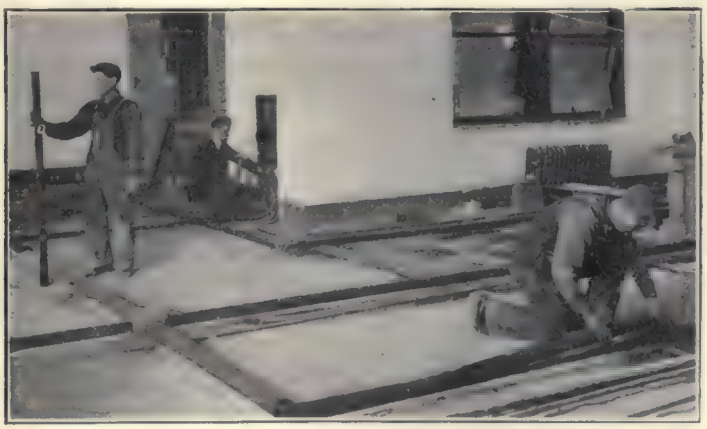
Underfloor Duct System

Installed in Twenty-two Buildings, Costing More than $62,000,000, to Provide Electric Service with the Least Expense and Maximum Flexibility of Distribution —Opinions of Architects, Engineers and Contractors

TWENTY-TWO buildings, representing an investment of more than $62,000,000, have been erected since 1920 or are now under construction which embody a relatively new underfloor distribution system that in the opinion of some architects, engineers and contractors solves long-endured and perplexing problems. Some industrial plants in the design stage will also incorporate this new feature. Forty-six leading architects, engineers and contractors have been concerned in the design and construction of these buildings. The lowest-priced building which now embodies this system cost $100,000 and the highest-priced one cost $15,000,000. Despite the density of floor distribution in the twenty-two buildings, records of bids on the electrical work indicate that the average cost for the underfloor system was only 0.64 per cent of the building cost. According to the engineers and contractors who favor it, its economy is largely due to the low unit price of the material used and the ease of installation. They point out that it affords flexibility of distribution that has never been obtainable with any other system at so low a cost. This and other merits claimed by the advocates of the system are disputed by some firms and individuals. The interests of all from whom opinions can be obtained are so diversified that the ELECTRICAL WORLD can at this time do no more than describe the system and record the arguments for and against it. The system will have to stand or fall on its merits, and these can be proved only by experience.

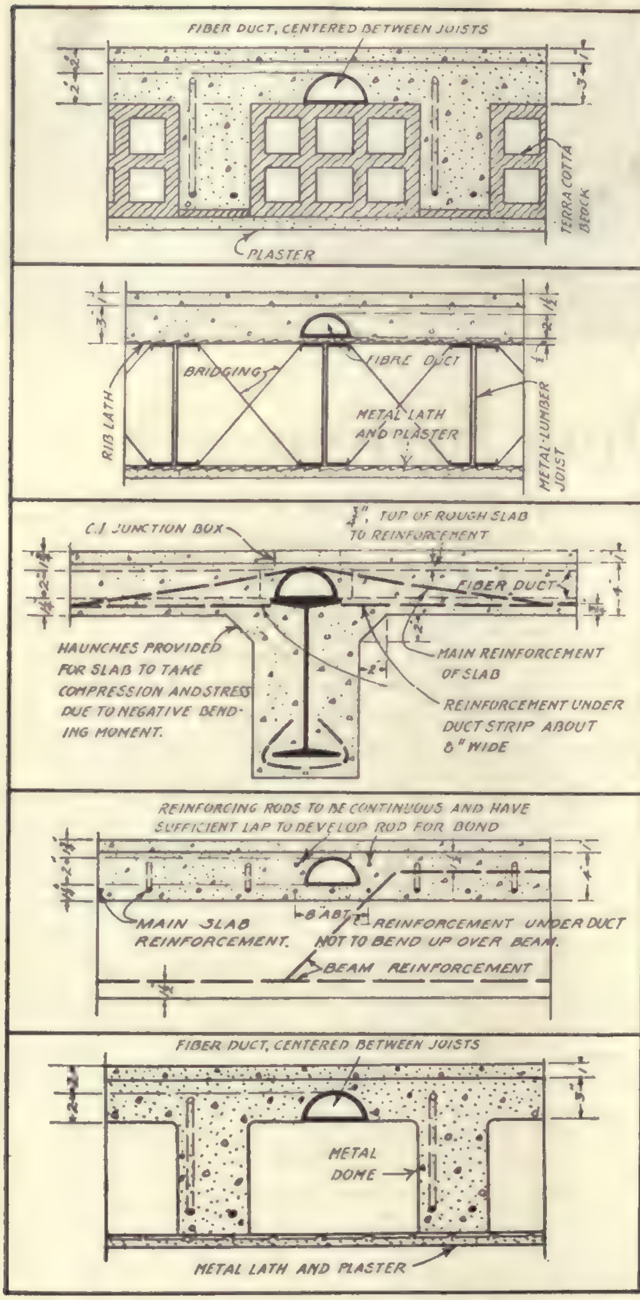
For years architects and engineers have been confronted with the problem of installing sufficiently flexible systems of floor distribution for light, power and signal circuits to care for future requirements. Of late the problem has been aggravated by the tendency toward open offices, with the consequent uncertainty of desk location, and by the need in industrial plants of changing motor locations or feeder circuits because of changes in production processes, new ideas in motorization and growth of industry. With concealed systems of distribution which have been used in the past it has been found expensive to provide a system that will adequately allow in advance for these changes. Consequently, when outlets had to be relocated it was often necessary to remove the floor covering, channeling the concrete to accommodate the new circuit or adopting some less desirable expedient. As a result, office or plant operations had to be disturbed or the change-over undertaken during non-working periods. Even where only the initial requirements have to be met, the floor construction often has to be held up until a final decision can be made on services. This frequently results in considerable friction or misunderstanding between the contractor and the client.

In general, the new system consists of a grid, loop



FOUR STEPS IN PROCESS OF PREPARING FOR AND LAYING AN UNDERFLOOR DUCT SYSTEM

To serve as a level support for the underfloor duct system concrete pads are laid on the floor slab in the form of a grid and tamped and troweled smooth. After the duct and junction boxes are laid in place and sealed to the pad with roofing pitch the floor fill can be poured and the floor finished. Floor outlets can be installed before or after the floors are finished.



FIVE TYPES OF FLOOR CONSTRUCTION SHOWING APPLICATION OF UNDERFLOOR DUCT SYSTEM

or any other preferred arrangement of half-round fiber ducts connected at intersections by junction boxes which are merely laid in position (not actually attached to the components of the system) and the whole incorporated in the floor fill so that outlets can be placed at the beginning or after the floors are completed. Either single-duct or double-duct systems can be installed, depending on whether the electric power and signal circuits are grouped in the same duct or separated. If the latter is done, both types of circuits can be made available at closely adjacent points without the complexity of grid crossings by using interlocking grids, one for power and one for signal circuit.

In this grid of underfloor ducts the backbone of each grid serves as a header, while the ribs or branch ducts at right angles to the header extend to the floor wiring centers. Access to the duct is obtained through inserts or outlet fittings placed at the start or after the floor is finished. If placed first and subsequently abandoned they may be easily closed in a simple manner, being, however, immediately available again if wanted. Usually in laying out the system one duct is run parallel to the outside wall of the building, about 3 ft. to 3½ ft. therefrom, and other ducts laid parallel thereto at intervals depending on the flexibility of service desired. Maximum flexibility can be obtained by placing them 5 ft. apart because in this position any desk is bound to come over one of the ducts. Headers are spaced solely on the basis of estimated wire density (20 ft. to 40 ft. apart), as the wire can be snaked any distance met with in ordinary modern buildings.

It is the claim of the architects, engineers and contractors in favor of the system that it is adapted to any medium or high-class fireproof floor construction where there is sufficient fill for service systems installed in the normal way; that is, where there is 4-in. to 5-in. fill above the concrete slabs. In such cases the foreign piping must be installed below the upper 3-in. stratum to avoid cross-overs. Where this is impossible it is suggested that the foreign piping be molded in the slab or grouped where possible and the concrete slab channeled to accommodate it. Where this is impossible special cross-under fittings can be used in connection with the underfloor duct system. With proper co-operation of the building constructor it is possible to place the fiber duct in the neutral axis of the slab without weakening it.

Where there is sufficient fill above the concrete slab to accommodate the underfloor duct system as well as the foreign piping, concrete pads are laid on the slab in grid formation with their upper surface at least 3 in. below the surface of the floor. Where single ducts are to be placed on them they need be only 8 in. wide, while for double-duct systems they should be 13 in. wide. The operation of laying these pads is relatively simple, as shown by the accompanying illustration. According to figures kept on an installation, 100 ft. of concrete pad can be laid and finished in two and one-half hours. This refers to a double-duct pad 13 in. wide. The cost of these pads, including material and labor, amounts to 10 cents to 15 cents per lineal foot for single-duct pads and about 15 cents to 20 cents per lineal foot for double-duct pads.

Where it is impossible to prevent the foreign piping coming above the surface of these pads by any of the expedients mentioned previously—and this occurs very infrequently where laying of the underfloor duct is co-ordinated with the building construction in advance —a gentle slope of cement can be built over the foreign piping where it does not extend too high to facilitate snaking the conductors over it. In such cases the conduits would be cut to conform with the obstruction. If many cases of interference of this character were to be met, the concrete pad would usually be built with its surface a less distance below the element floor level and smaller fiber duct laid on top of it.

After the concrete pads have set, junction boxes are laid at each intersection of the pad and the lap-joined fiber duct is placed on the pad about as fast as they can be laid. The operation does not require much skill, it being necessary only to line up the junction boxes and ducts so that after the floor is finished the junction boxes will give an exact indication of where the ducts are placed in the floor.

To keep the ducts and outlet boxes in place awaiting the pouring of the floor fill various methods have been employed. For example, tie wires have been cast

in the concrete pads, plaster of paris or cement has been used to incase the ducts, but the most economical and desirable method is to pour hot roofing pitch along the edges of the duct and the junction boxes where they meet the concrete pads and over the joints between ducts and also where they join the junction boxes. When this pitch sets it holds the ducts and junction boxes very firmly in place and also serves to exclude moisture of the floor fill when it is poured. One contractor finds that 9.6 cents per lineal foot of duct is a conservative figure for laying the ducts and junction boxes, where boxes are placed every 40 ft.

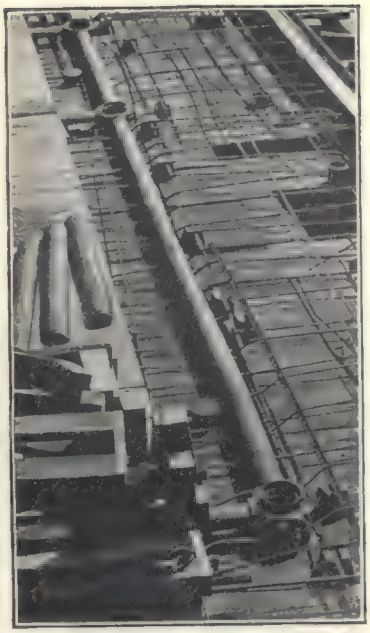
There is some debate among users of the system whether the floor outlets should be laid before or after the floor is completed. Those in favor of placing the floor outlets in advance claim that it can be done more quickly and with less expense, whereas the other side maintains that because an outlet can be connected with an underfloor duct in a finished floor in such a short time, it is advisable to install them afterward.

If the floor outlets are installed in advance of the floor fill, the underfloor duct is tapped at the point where outlets are desired and the outlet is threaded into place and protected from injury. According to experience on actual installations, floor outlets have been installed in finished floors in twenty minutes. This included the time of cutting the linoleum, drilling the concrete floors, cutting the fiber duct, screwing the outlets into place and grouting in position.

Before the floor fill is poured it is necessary to level the upper part of the junction boxes, which lie flush with the floor surface. This is relatively easy to accomplish because of the adjustment provided in the surface of the box, but it is the one job which requires the most skill. Some building constructors take advantage of these leveled outlet boxes for determining the surface of their floors.

While no serious trouble has been experienced on existing installations with moisture from the floor fill seeping into the ducts and accumulating in the duct ways, the users of this system prefer to allow a reasonable time between pouring of the floor fill and pulling in wires in order that any moisture which might collect may evaporate or be swabbed out in case this operation is necessary. On account of the cross-section of the ducts, evaporation is greatly facilitated and swabbing is very easily accomplished.

With a cross-section of more than 6 sq.in. in one of these half-round fiber ducts it is geometrically possible to accommodate as many as forty pairs of rubber-covered wires in one duct. However, this capacity, even if practically obtainable, is never needed in the most congested office buildings. Half-round 4-in. ducts are used in most cases to facilitate location of them after the floors are laid. Smaller ducts can be and have been used where desirable. In industrial plants where large circuits are required it is possible that ducts even larger than 4 in. might be provided. Because of the cross-section of the underfloor duct system, it is decidedly easier to fish and snake wires and cables than in systems of smaller cross-sections. Though no tests have been run to determine the maximum speed of installing wires, 100 ft. per hour have been easily snaked and pulled under normal working conditions. In one installation eight armored cables have been pulled into half-round 4-in. underfloor ducts, and it is claimed by some contractors that as many as ten can be pulled in without crowding the capacity of the duct. In another installation fourteen pairs of telephone wire and three forty-pair telephone cables were pulled into one duct.



UNDERFLOOR DUCT TO BE CAST IN FLOOR SLAB

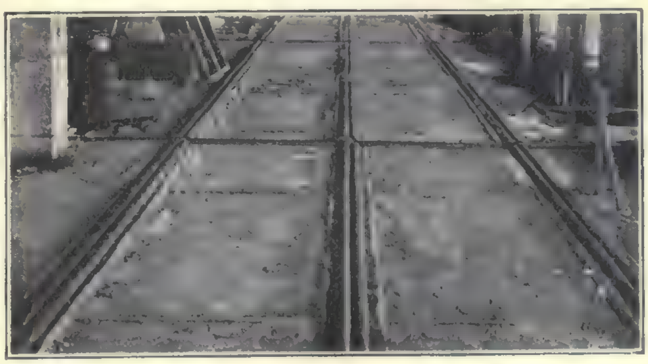
Abrasion of the insulation is not considered a serious factor because the conductor is not subjected to any more abuse than if it were pulled out on the cement floor for measurement prior to being pulled into an ordinary conduit system.

According to records of several contractors, the cost of installing this underfloor duct system exclusive of wiring is between 40 and 50 cents per lineal foot for single-duct systems. This is based on having junction boxes about 40 ft. apart and on metropolitan conditions where the cost of a journeyman electrician and helper amounts to a little more than $1 per hour.

Inability to accommodate this system in certain floors is an objection raised. Certain limitations are recognized by the advocates of this system and have been discussed in the early part of this article.

Some engineers raise the point that the system would not be economical nor desirable where each floor is divided into separate offices by partitions or where a floor is rented instead of being occupied by the owner. While the advocates of this system recognize its maximum advantages in connection with open office spaces and industrial plants where flexibility of distribution is essential to allow for future changes of outlets, they contend that even many partitioned offices may be economically served from a simplified underfloor duct system which would consist chiefly of trunk lines with branch circuits of metal conduit extending to the individual offices. It is also contended that no office building owner can be sure that partitions will stay in the same place during the life of the building or that the owners will occupy only those floors which they set aside for themselves in the beginning. Hence the flexibility of the system may be desirable even in these cases.

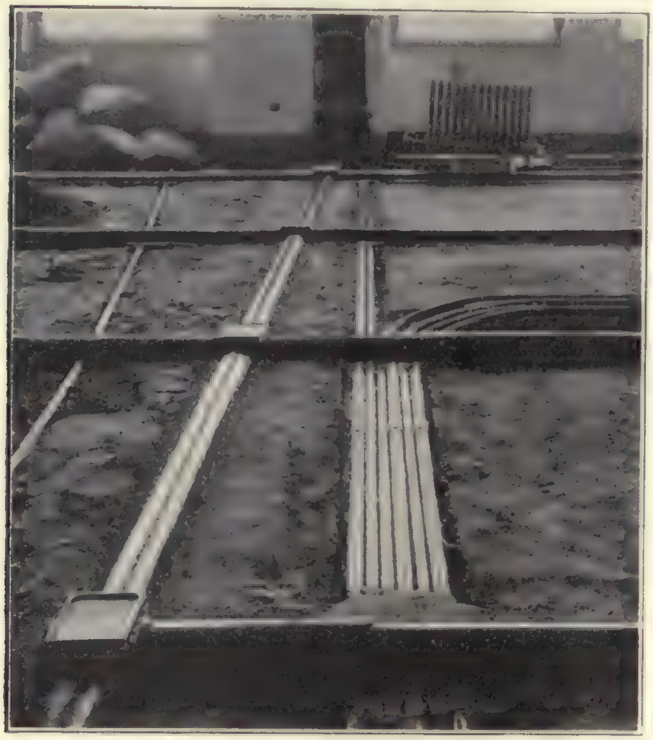
The cost of the underfloor system is raised as another objection. From the costs which have been quoted



INTERMESHING DOUBLE-GRID SYSTEM

readers can decide for themselves, remembering that this system is not advocated except where flexibility and congestion of service require that ducts be provided having capacity equal to or greater than that of two ¾-in. conduits.

The fragility of fiber duct is feared by some, but the wastage due to rough handling is not great because broken ends can be sawed off and the remainder still joined in the usual manner. According to experience, the only breakage comes from very rough handling. The breakage of the duct while in place awaiting floor fill is negligible according to experience on an installation where 12,250 ft. of duct lay exposed on the concrete pad for two weeks without breakage, despite the fact that workmen were walking over the ducts and boards were laid across them on which to roll wheelbarrows.



SINGLE-DUCT SYSTEM SERVED FROM DISTRIBUTION CABINET IN BACKGROUND. NOTE FOREIGN PIPING IN FLOOR SLAB

Liability of the fiber duct to crack or spread when the floor fill is tamped is another possible objection. However, the users of underfloor duct systems point out that floor fill is not ordinarily tamped, since it is poured in place, being in liquid form, and leveled off with a straight edge. Furthermore, nothing but the roughest abuse in tamping could cause the trouble anticipated.

Weakening of the floor surface is feared by some skeptics. While hairline cracks occurred over some early installations of ducts which were insufficiently covered with cement, this trouble has been eliminated by specifying 1 in. as minimum cover. Where this is impossible chicken wire or expanded metal over the duct have been found beneficial. Tests have shown that heavy safes can be rolled over the finished floors without injury thereto.

Seepage of moisture and chemicals from the concrete fill into the duct-way is feared by some contractors, but others who are using the system maintain that if ordinary care is employed in sealing the edges of the ducts and junction boxes where they join each other and touch the concrete pad, especially by the pitch method, what little moisture will enter the duct-way will readily dry out or can be swabbed out. Several contractors who have been installing the system say that no serious seepage occurs. The possibility of leakage of water through the floor boxes is present in every installation and is believed to be no more hazardous in this system than in others.

Objection to running both power and signal circuits in the same duct is raised by some, but such construction is not necessary if the double-duct system is used. However, it may be pointed out that power and signal circuits have been installed in the same duct in at least one large installation. In most cases power circuits are run in armored cable, although one installation is now being made where ordinary rubber-covered wire has been allowed for both power and signal circuits.

Absence of a grounded inclosure for the circuit is advanced as an objection by some interests, but some representatives of the Underwriters have pointed out that the only reason the code requires grounding of conduits is that the conduit itself is a conductor and will become alive and constitute a life or fire hazard if a conductor comes in contact with it. In the underfloor duct system there is no metal inclosure, hence there is no need of grounding even if there were the opportunity. The same interests expect that the concrete inclosing the duct will be of as great protection against fire as metal conduits, if not greater. At present the junction boxes are not grounded, although they could be. It is pointed out by certain insurance interests again that the situation is almost comparable to that of a toaster or flatiron in which the metal part is not grounded but still liable to contact with an electric circuit. Others maintain, however, that the outlet boxes are more liable to contact with the circuit because of the possibility of water and chemicals getting into the junction box when floors are being mopped.

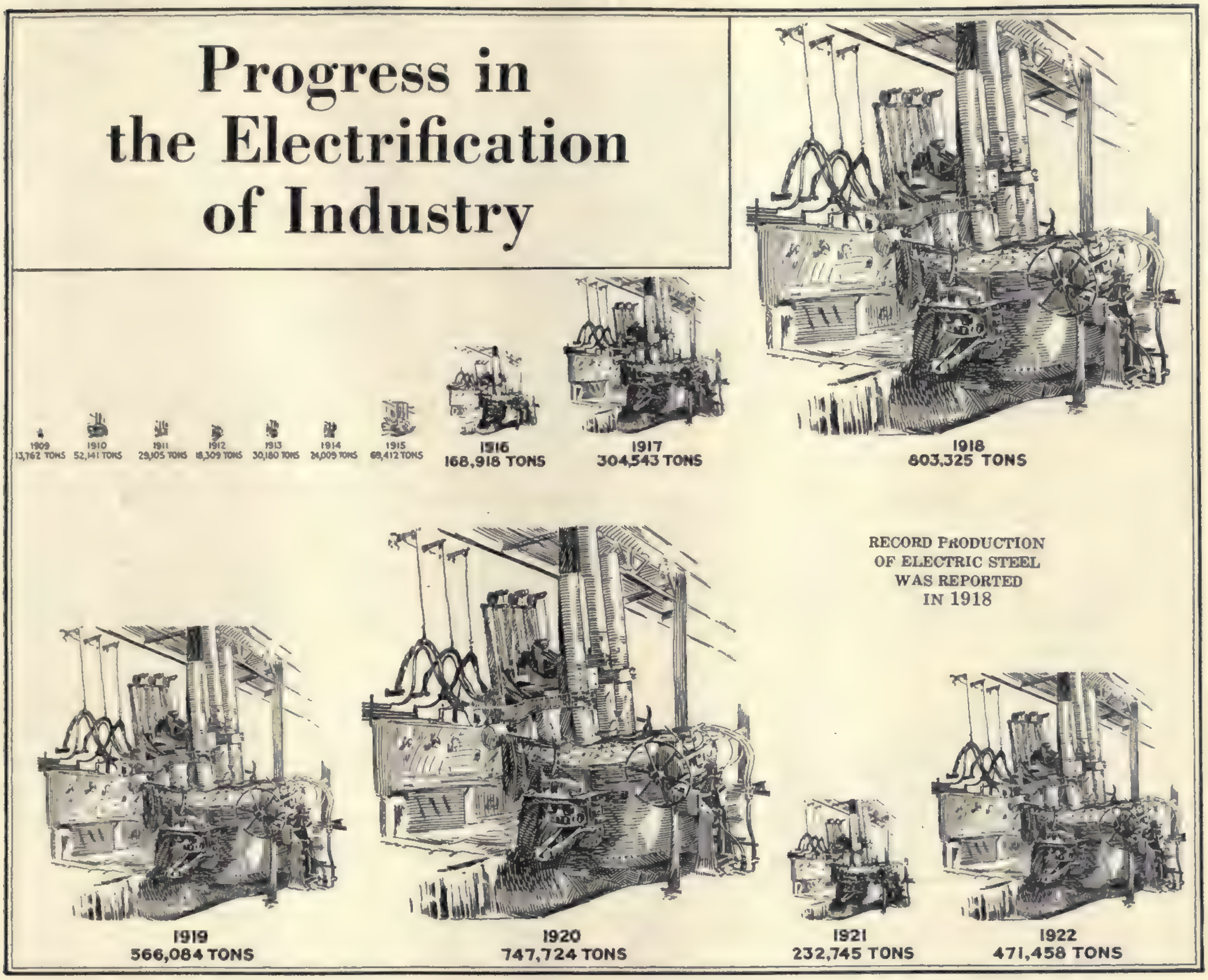
Some contractors point out that the underfloor system is not adapted to wall construction. This is admitted by its advocates, but they point out that metal-conduit systems in the walls can be tied in with the underfloor system very easily and to advantage.

The flexibility contemplated by this system is not necessary, in the opinion of some, and imposes a yearly carrying charge which would be greater than the expenses of making extensions to ordinary systems. However, in view of the changes necessary in outlet locations in open spaces, whether offices or factories, and the uncertainty of where these outlets will be needed, the advocates of the system maintain that only time can prove whether the inflexible or the flexible system should have been installed. In many cases which can be cited the cost of the flexible system could have been more than paid for by the cost of changes.

It is feared by some that when extensions or changes in circuits are to be made with the underfloor system the armored cable lying in the duct will be hooked up through an opening in the floor, with possible damage to the conductor, and that the joints will be made without soldering or taping. However, it is maintained by the other side that this possibility exists in any installation. The logical thing to do would be to run a new circuit from the new floor outlet to the nearest junction box.

Combustibility of fiber duct and the possibility of producing dense smoke are other objections raised. However, the advocates of the underfloor duct system have conducted tests which show great difficulty in igniting an installed duct by short-circuiting branch circuits owing to the small wattage involved, the concrete inclosure, and the absence of air circulation.

Progress in the Electrification of Industry



AMERICAN industrial and commercial men pride themselves on their progressiveness, on their constant desire to improve their methods of production and distribution and on their unremitting search for better ways of doing things that have been done well before. In every branch of American activity men trained in the sciences are bringing natural forces more and more into subservience to man and his work, and theory is today frowned upon except as it can be made practical in the solution of man's problems.

The three forces of nature which are playing the greatest direct part in American industry today are water power, steam power and electric power. Of these three, electrical energy, although the youngest in length of service to man, is playing by far the leading part, and the supremacy of this force is becoming more pronounced each year. It was only twenty years ago when the total amount of electrical energy consumed by the industries of this country in one year was only about six hundred million kilowatt-hours, or slightly less than one-quarter of the total electrical consumption of the city of Chicago during 1922. It was only twenty years ago when but two-thirds as much electrical energy was used for power purposes as for lighting.

What an entirely different picture is presented today! In 1922 more than twenty-two billion kilowatt-hours of electrical energy was consumed by the manufacturing plants, mines, wells, quarries and irrigation plants of the country, while only about eight billion kilowatt-hours, or about one-third as much, was used for lighting. Bulk energy consumption has taken a strong hold on the electric light and power industry.

GIANT STRIDES IN ELECTRIFICATION OF INDUSTRY

There are approximately three hundred thousand manufacturing establishments in the United States using mechanical power of some kind. To this number must be added the thousands of mining companies, quarries, wells and irrigation plants as well as electric railways. Based upon the United States Census of Manufactures and the probable growth since 1919, it is estimated that the installed primary power of the manufacturing plants of this country totaled 30,500,000 hp. on Jan. 1, 1923. In 1902 the installed primary power was approximately 12,000,000 hp., indicating a multiplication of about two and one-half times during this twenty-year period. In 1902, as indicated above, electrical drive was in its infancy, the records indicating only about a million installed motor horsepower. On Jan. 1 of the present year, however, the motor installation in manufacturing plants had grown to 19,000,000 hp., an increase of 1,800 per cent during the twenty-year interval, or a growth twelve times as fast as indicated for the total installed primary power of the

Table I—Savings Effected by the Use of Electric Arc Welding in a Large Railway Shop

Operation	Cost of Welding	Cost of Replacement or Repair by Other Methods
Plugging 51 holes in expansion plate holes, 1 in. dia. x ½ in. deep	$2.75	$10.15
Cutting four 6-in. holes in tender deck sheets ½ in. thick	1.08	8.35
Building up jaws of two pedestal caps	3.49	10.[illegible]
Welding cracks in bulkhead in tender tank	2.33	[illegible].00
Repairing mud ring	2.32	29.40
Welding cylinders	.76	13.80
Welding door holes	4.53	10.51

Table II—A Few of the Many Large Users of Electric Trucks

Company	No. Electric Trucks
American Railway Express Company	1,407
Ward Baking Company	967
Marshall Field, Chicago	276
Commonwealth Edison Co., Chicago	251
New York Edison Company	156
Cushman's Sons, Inc.	149
Shults Bread Company	132
Macy's	57
Bush Terminal	57
Gimbel Brothers	56
Philadelphia Electric Company	54
Consolidated Gas Company	51
Westcott Express Company	51
Stern Brothers	44
The Fair, Chicago	37
United Electric Light & Power Company	32
New York Transfer Company	32
New York & Queens E. L. & P. Co.	26
H. J. Heinz Company	26
Horn & Hardart, New York and Phila.	25
John Wanamaker	23
Curtis Publishing Company	21

Table III—Electric Motor Trucks Purchased by the American Railway Express Company

Year	Purchased During Year	Total Electric Trucks in Use
1908	1	1
1911	51	52
1912	283	335
1913	96	431
1914	14	445
1915	93	538
1916	202	740
1917	122	862
1918	75	937
1919	54	991
1920	30	1,021
1921	39	1,060
1922	268	1,328
Industrial trucks		250
Total electric trucks, 1922		1,578

Table IV—Distribution of Types of Installed Power in Manufacturing Industries, 1869-1922

	Census Years*	Number of Establishments	Total Intalled Primary Power, Hp.	Steam Engines and Steam Turbines, Hp.	Waterwheels and Turbines, Hp.	Internal Combustion Engines, Hp.	Purchased Power Other Than Electric, Hp.	Run by Purchased Energy, Hp.	Run by Energy Generated in Private Plants, Hp.	Total
Horsepower	1869	....	2,346,142	1,215,711	1,130,431	....	....	....	....	....
	1879	....	3,410,837	2,185,458	1,225,379	....	....	....	....	....
	1889	....	5,938,635	4,586,089	1,255,045	8,930	88,571	....	....	15,569
	1899	207,514	10,097,893	8,189,564	1,454,112	134,742	136,913	182,562	310,374	492,936
	1904	216,180	13,487,707	10,917,502	1,647,880	289,423	191,313	441,589	1,150,886	1,592,475
	1909	268,491	18,675,376	14,228,632	1,822,888	751,186	123,639	1,749,031	3,068,109	4,817,140
	1914	275,791	22,437,072	15,591,593	1,826,443	991,905	129,883	3,897,248	4,938,722	8,835,970
	1919	290,105	29,504,792	17,037,973	1,765,263	1,259,400	94,600	9,347,556	6,969,721	16,317,277
	1922*	....	30,500,000	15,705,000	1,720,000	1,400,000	75,000	11,600,000	7,400,000	19,000,000
Per cent of total installed primary power	1869	....	100.00	51.82	48.18	....	....	....	....	....
	1879	....	100.00	64.07	35.93	....	....	....	....	....
	1889	....	100.00	77.23	21.13	0.15	1.49	....	....	0.26
	1899	....	100.00	81.10	14.40	1.33	1.36	1.81	3.07	4.88
	1904	....	100.00	80.94	12.22	2.15	1.42	3.27	8.54	11.81
	1909	....	100.00	76.19	9.76	4.02	0.66	9.37	16.42	25.79
	1914	....	100.00	69.49	8.14	4 42	0.58	17.37	22.01	39.38
	1919	....	100.00	57.75	5.98	4 27	0.32	31.68	23.62	55.30
	1922*	....	100.00	51.50	5.64	4 58	0.25	38.00	24.28	62.28

* 1922 data estimated by "Electrical World."

Table V—Distribution of Types of Primary Power by Groups of Manufacturing Industries, 1919

						Electric Motors			
								Total	
Groups of Industries	Total Installed Primary Power, Hp.	Steam Engines and Steam Turbines, Hp.	Waterwheels and Turbines, Hp.	Internal-Combustion Engines, Hp.	Purchased Power Other Than Electric, Hp.	Run by Purchased Energy, Hp.	Run by Energy Generated in Private Plants, Hp.	Hp.	Per Cent of Total Installed Primary Power
Chemicals and allied products	2,043,525	1,313,552	9,464	85,049	3,591	631,869	512,093	1,143,962	56.0
Food and kindred products	2,571,157	1,305,963	193,062	150,973	6,283	914,876	396,584	1,311,460	51.0
Iron and steel and their products	8,082,692	5,033,264	44,495	654,414	21,719	2,328,800	2,665,467	4,994,267	61.8
Leather and its finished products	389,130	225,219	4,933	8,247	6,593	144,138	117,972	262,110	67.3
Liquors and beverages	415,361	315,836	1,353	7,556	2,898	87,718	85,898	173,616	41.8
Lumber and its manufactures	3,417,941	2,829,797	81,831	56,832	10,107	439,374	333,787	773,161	22.6
Non-ferrous metals and their products	988,688	487,052	13,209	20,497	5,968	461,962	214,738	676,700	68.4
Paper and printing	2,348,999	799,990	916,654	22,824	3,050	606,481	410,315	1,016,796	43.3
Railroad repair shops	648,345	381,481	841	7,557	3,470	254,996	295,161	550,157	84.9
Stone, clay and glass products	1,569,719	349,071	17,866	122,122	1,904	578,756	316,080	894,836	57.0
Textiles and their products	3,274,090	1,833,574	450,972	15,256	15,302	958,986	715,950	1,674,936	51.2
Tobacco manufactures	43,397	28,213	402	345	7	14,430	13,447	27,877	64.2
Vehicles for land transportation	880,496	286,557	2,734	38,304	6,456	546,445	235,289	781,734	88.8
Miscellaneous industries	2,831,252	1,348,404	27,447	69,424	7,252	1,378,725	656,940	2,035,665	71.9
All industries, United States	29,504,792	17,037,973	1,765,263	1,259,400	94,600	9,347,556	6,969,721	16,317,277	55.3

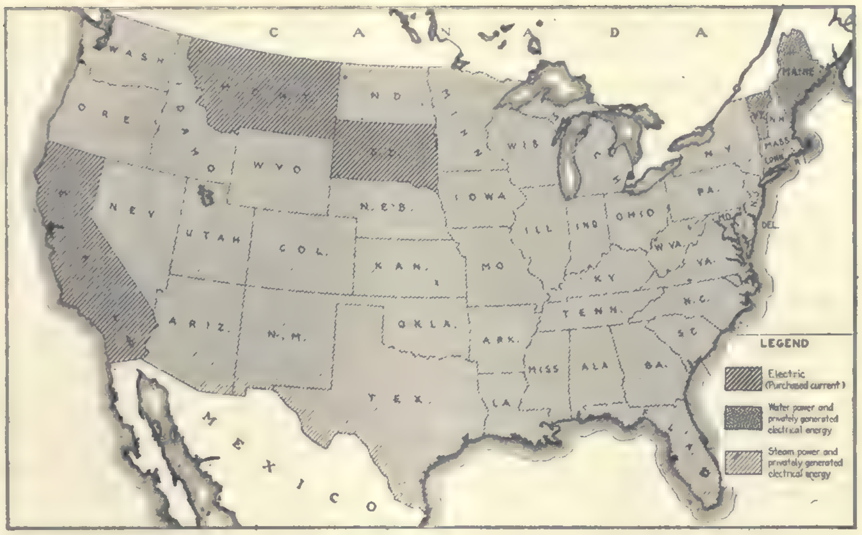
Table VI—Distribution of Types of Installed Primary Power in Mining Industries in 1919

							Electric Motors		
Industry	Total Installed Primary Power, Hp.	Steam Engines, Hp.	Steam Turbines, Hp.	Internal Combustion Engines, Hp.	Waterwheels and Turbines, Hp.	Purchased Power Other Than Electric, Hp.	Run by Purchased Energy, Hp.	Run by Energy Generated in Private Plants, Hp.	Total, Hp.
Anthracite coal	899,783	730,141	50,665	1,284	......	.....	117,693	185,723	303,416
Bituminous coal	2,155,412	1,166,862	195,779	21,219	74	347	771,131	707,341	1,478,472
Petroleum and natural gas	1,821,342	532,734	....	1,237,407	40	6,523	44,638	28,164	72,802
Iron ore	370,869	231,184	28,521	5,397	8,375	10	97,382	67,595	164,977
Copper	523,591	245,398	123,223	16,327	1,510	1,165	135,968	161,024	296,992
Lead and zinc	229,541	42,821	35,420	35,415	3,871	140	111,874	22,884	134,758
Gold and silver, lode mines	149,680	20,133	4,750	11,149	14,405	580	98,663	18,892	117,555
Limestone	213,717	109,778	10,701	5,043	865	.....	87,330	11,421	98,751
Granite	55,674	30,231	2,360	1,343	777	60	20,903	1,520	22,423
Sulphur	15,291	11,581	3,320	390	......	.....	....	1,284	1,284
Sandstone	33,869	19,081	....	2,116	......	.....	12,672	4,696	17,368
Phosphate rock	49,639	17,140	17,751	12,085	......	.....	2,663	33,107	35,770
Clay	21,243	15,653	100	1,179	......	40	4,271	1,815	6,086
Basalt	37,307	21,099	1,225	520	......	.....	14,463	1,049	15,512
Gold, placer mines	35,632	40	....	719	2,647	.....	32,226	601	32,827
Gypsum	15,032	6,132	....	572	334	.....	7,994	1,447	9,441
Slate	20,613	8,669	....	8	101	.....	11,835	44	11,879
Marble	15,628	5,619	....	15	387	.....	9,607	480	10,087
All other	59,923	23,992	170	8,958	4,726	.....	22,077	9,708	31,785
All mining industries	6,723,786	3,238,288	473,985	1,361,146	38,112	8,865	1.603,390	1,258,795	2,862,185

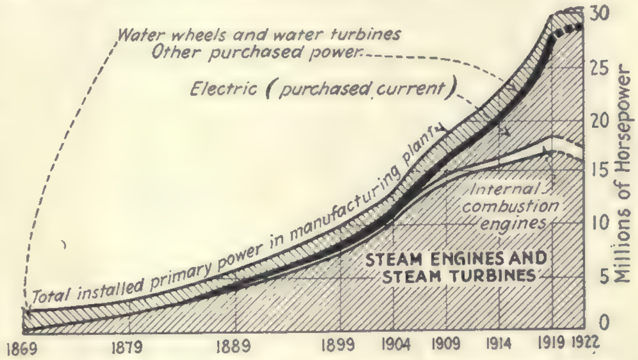
country. Growth in the use of electrical energy for industrial purposes has, therefore, not followed the beaten tracks of national industrial growth, but has cut a path of its own which has resulted in the electrification of more than 60 per cent of the total installed primary power of the country.

The spectacular but fundamentally sound growth in the use of electrical energy for industrial purposes is clearly indicated in Table IV. Back in 1869 the total installed primary power was only a little over two million horsepower. Steam engines and waterwheels furnished the motive power, the total being about evenly divided between the two types of power. Electrical power makes its first appearance in the census of 1889, when only 15,569 hp. installed motor rating was reported. From that date, however, the rise of the electric motor has been by leaps and bounds, the total installed motor rating overtaking the total waterwheel and turbine rating during the interval between 1904 and 1909 and gradually gaining on the steam drive until the period subsequent to the peak war activity, during which reports indicate that electric drive has far outdistanced steam drive in the manufacturing plants of America.

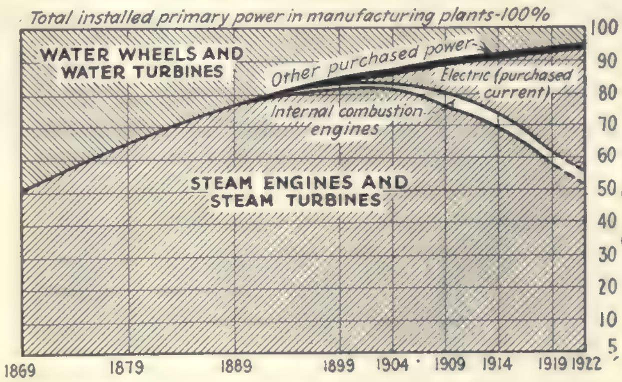
Within the electric light and power industry itself the passing years have furnished another interesting panorama as between private and central-station generation of the electrical energy used in manufacturing plants. At the time of the census of 1899, which contains the first record indicating the relation between generated and purchased electrical energy in manufacturing plants, only about 38 per cent of the installed motors were run by central-station energy. By 1904 the private generating plants occupied an even more enviable position in that only 28 per cent of the installed motors in manufacturing plants were run by central-station energy—a fact due to the rapid growth in the number of private plants and the comparatively slow growth of the central stations during this interval, that is, in so far as the extension of central-station service to manufacturing plants was concerned. But by this date the central station was beginning to attain its rightful place, and subsequent censuses record an ever-increasing central-station influence in the industrial life of the country. In 1909 more than 36 per cent of the rating of motors installed in manufacturing plants was run by central-station energy, in 1914 more than 44 per cent, in 1919 more than 57 per cent, and on Jan. 1, 1923, it is estimated that 61 per cent of the installed motor rating was run by energy generated in central-station generating plants. However, it must be borne in mind that the generators installed in private generating stations of manufacturing plants, mines, quarries and wells total about 6,130,710 kw., which is approximately 43 per cent of the total central-station generator installation of the country, and that in 1920 the consumption of privately generated energy totaled 14,242,200,000 kw.-hr., as against 19,040,000,000 kw.-hr. purchased from central-station generating plants. How much further the ascendency of the central stations will continue is problematical because there are undoubtedly certain industries, such as the iron and steel, paper and electrochemical, in which bulk



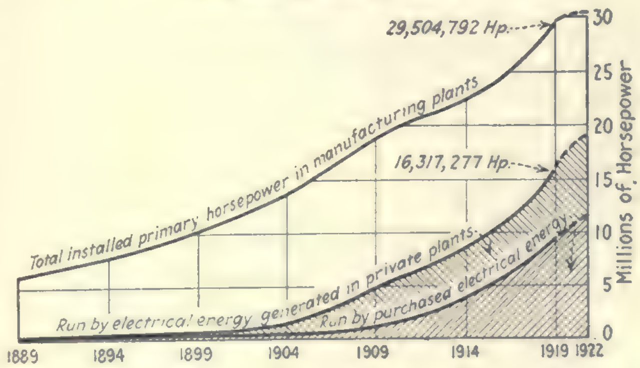
IN ONLY THREE STATES DOES THE CENTRAL STATION FURNISH THE MAJOR PORTION OF THE PRIMARY POWER USED IN MANUFACTURING PLANTS—1919



INSTALLED PRIMARY POWER IN MANUFACTURING INDUSTRIES BY TYPES OF POWER—1869 TO 1922



PERCENTAGE DISTRIBUTION OF INSTALLED PRIMARY POWER IN MANUFACTURING INDUSTRIES BY TYPES OF POWER—1869 TO 1922



THE CENTRAL STATION OVERTOOK AND PASSED THE PRIVATE GENERATING PLANT DURING THE PERIOD 1914 TO 1919

consumption of electrical energy will warrant the continuation of private generating plants.

IRON AND STEEL INDUSTRY LEADS IN RATING OF MOTORS INSTALLED

The predominance of the iron and steel industry as a user of electrical energy is clearly indicated from Table V. In 1920 almost 62 per cent of the total installed primary power in the iron and steel industry was electrical. This, however, does not give a proper conception of the use of electrical energy by that industry since hundreds of millions of kilowatt-hours were used for industrial heating purposes in addition to the electrical energy used in the operation of the installed motors. More than half the installed motor rating in iron and steel mills is run by privately generated energy, this being the only industry, with the exception of railroad repair work, which in 1919 reported a major percentage of motors run by privately generated energy.

It was in 1891 that the first electric motors were installed in a steel mill, these being three direct-current motors in the Edgar Thomson Works of the Carnegie Steel Company. Other installations soon followed, but the enormous power requirements and the severe service seemed beyond the scope of electric motors, and it was not until about 1905 that the problem of electric drive for the main rolls of the steel mills was solved.

The iron and steel industry, however, is not the most highly electrified in the country. This distinction is held by the group of industries coming under "vehicles for land transportation," which group reports that 88.8 per cent of the installed primary power is electrical. The high degree of electrification of this industry is undoubtedly due not only to the fact that automobile

Table VII—Types of Electric Furnaces Installed in the United States and Canada

Type	Jan. 1, 1923 U. S.	Jan. 1, 1923 Canada	Jan. 1, 1923 Total	United States and Canada Jan. 1, 1922	Jan. 1, 1921	Jan. 1, 1920	Jan. 1, 1919	Jan. 1, 1918
Heroult	166	15	181	179	177	170	163	146
Snyder	51	2	53	54	54	49	48	35
Rennerfelt	18	0	18	18	17	18	13	13
Greaves-Etchells	26	2	28	28	25	18	11	12
Gronwall-Dixon	11	1	12	12	12	13	13	12
Ludlum	14	0	14	13	13	12	11	6
Girod	5	0	5	5	5	5	5	5
Booth	10	0	10	14	14	12	11	4
Moore (Pittsburgh)	52	1	53	36	24	20	12	4
Induction	3	0	3	3	3	3	3	3
Webb	2	0	2	2	2	2	2	2
Stassano	1	0	1	1	1	1	1	1
Greene	27	0	27	23	18	11	8	1
Vom Baur	5	0	5	6	5	4	2	0
Wile	0	0	0	0	0	0	0	1
Detroit	3	0	3	3	1	1	0	0
Volta	2	11	13	13	8	...	...	...
Swindell	2	0	2	0	0	0	0	0
Special, etc.	8	18	26	28	20	24	27	24
Totals	406	50	456	438	399	363	330	269

Table VIII—Number of Electric Furnaces Installed—1909 to 1923

Year	United States	Canada	Total	Year	United States	Canada	Total
July 1, 1913	19	3	22	Jan. 1, 1919	287	43	330
Jan. 1, 1915	41	2	43	Jan. 1, 1920	323	40	363
Jan. 1, 1916	73	8	81	Jan. 1, 1921	356	43	399
Jan. 1, 1917	136	19	155	Jan. 1, 1922	388	50	438
Jan. 1, 1918	233	36	269	Jan. 1, 1923	406	50	456

Table X—Chemicals Produced by the Aid of Electricity in 1919

	Number of Establishments	Quantity	Value
Total:			
1919	114		$82,590,005
1914	36		29,661,949
1909	19		18,451,461
1904	21		7,068,246
1899	14		2,045,535
Chlorine bleaches, lb.:			
Chlorine	14	91,141,000	
For sale		34,392,000	1,425,917
Made and consumed	.....	56,749,000	.....
Hypochlorites (calcium and sodium, chiefly calcium)	16	252,850,000	4,781,348
Hydrogen, cu.ft.	40	137,082,000	851,397
Oxygen, cu.ft.	39	131,477,000	1,855,911
Potassium hydroxide (caustic), lb.	3	7,460,000	1,892,438
Sodium hydroxide (caustic), lb.	15	189,686,000	.....
For sale	....	173,021,000	6,228,682
Made and consumed	.....	16,665,000	....
Other commodities in order of value, with number of establishments: Aluminum, 4; abrasives (silicon carbide and aluminous, including forms), 4; calcium carbide, 5; ferroalloys, 7; sodium and sodium cyanide, 4; chlorates, 5; phosphorus, 2; carbon bisulphide, 8; vanadium, 1; tungsten and molybdenum, 3; hydrochloric acid, 3; magnesium metal, 4; bromine, 5; other metals and alloys, 4; miscellaneous, 10	....	....	65,554,312

	Sodium Hydroxide Tons	Sodium Hydroxide Per Cent	Potassium Hydroxide Tons	Potassium Hydroxide Per Cent
Total production	333,361	100.0	4,192	100.0
Electrolytic	94,843	28.5	3,730	89.0
Other processes	238,518	71.5	462	11.0

Table IX—Motors Installed in Plants Manufacturing Chemicals and Allied Products, 1919

Branch of Chemical Industry and Allied Products	Motors Run by Purchased Energy: Number	Motors Run by Purchased Energy: Hp.	Motors Run by Energy Generated in Plants: Number	Motors Run by Energy Generated in Plants: Hp.	Number	Total Motors Rating: Hp.	Per Cent of Total Run by Purchased Energy	Per Cent of Total Run by Energy Generated in Plant
Sulphuric, nitric and mixed acids	795	16,185	714	11,906	1,509	28,091	57.6	42.4
Coal-tar products	2,162	27,376	3,345	26,317	5,507	53,693	51.0	49.0
Coke	1,950	74,551	3,969	134,612	5,919	209,163	35.6	64.4
Salt	381	6,706	745	1,136	1,126	2,842	85.5	14.5
Druggists' preparations	4,789	20,556	2,353	8,808	7,142	29,364	70.0	30.0
Essential oils	18	142	47	350	65	492	28.9	71.1
Explosives	1,058	16,486	1,621	22,819	2,679	39,305	41.9	58.1
Fertilizers	3,758	79,886	777	13,225	4,535	93,111	85.8	14.2
Manufactured gas	1,413	33,363	1,822	22,040	3,235	55,403	60.2	39.8
Natural dyestuffs and extracts	294	2,692	245	5,649	539	8,341	32.3	67.7
Paint and varnish	3,168	43,268	1,522	20,973	4,690	64,241	67.4	32.6
Linseed oil	189	8,196	123	2,679	312	10,875	75.4	24.6
Bone, carbon and lampblack	34	491	0	0	34	491	100.0	0
Petroleum refining	3,576	51,385	3,089	57,240	6,665	108,625	47.3	52.7
Soap	1,097	8,672	3,080	21,977	4,177	30,649	28.3	71.7
Turpentine and rosin	5	19	0	0	5	19	100.0	0
Wood distillation	147	1,533	144	3,278	291	4,811	31.9	68.1
Miscellaneous	48,165	844,197	37,231	609,155	85,396	1,453,352	58.1	41.9
Totals	73,019	1,235,704	60,827	962,164	133,846	2,197,868	56.3	43.7

manufacture lends itself to the use of electrical propulsion to a high degree but also to the fact that the full development of this industry has taken place subsequent to the time when the electric motor came to be acknowledged as the most practical type of propulsion. Other group industries which are highly electrified are the leather, 67.3 per cent; non-ferrous metals, 68.4 per cent, and railroad repair shops, 84.9 per cent.

As is indicated in Table VI, the mining industry, taken as a whole, is also a large consumer of electrical energy and ranks next to the iron and steel industry in rating of installed motors. The industry is only a little over 42 per cent electrified, however. This is the sole industry in which the internal-combustion engine comes near to being the controlling factor as a prime mover.

One of the oldest industrial uses of electrical energy is that of electric arc welding. Back in 1887 Bernados received a patent covering the use of the electric arc for this purpose. A few years later Salvianoff introduced a process for casting metal into blowholes of defective castings by producing an arc between an electrode consisting of a metallic rod and the metal being welded.

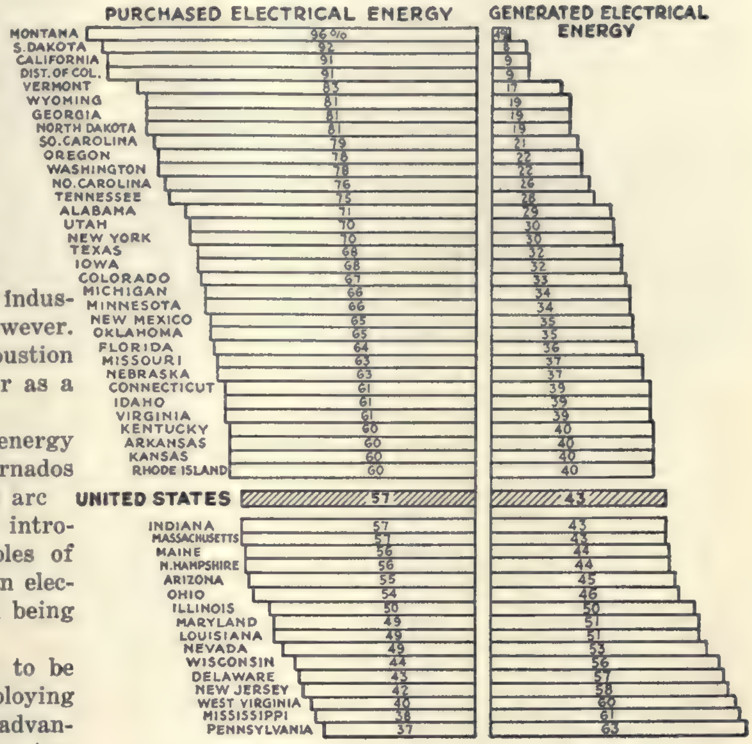
The field of electric arc welding may be said to be virtually unlimited. Almost every industry employing iron and steel or other alloys can utilize it to advantage. The process is used not only for joining two pieces of metal, but also for cutting metal, building on or adding to other metal parts. New fields for its successful use are being discovered every day. Table 1 gives the saving effected in a large railway shop by the use of the electric arc as reported a year or so ago.

One of the later uses of electrical energy is its adaptation to the locomotion of trucks. As far as can be ascertained, there are no reliable national data on the use of the electric truck. The Electric Truck and Car Bureau of the National Electric Light Association gives some valuable data in its 1923 report on the use of trucks in the metropolitan New York district, as well as a list of the larger users of this form of commercial transportation. Tables II and III give this data. Dr. Charles P. Steinmetz, consulting engineer of the General Electric Company, has the following to say on the subject of electric trucks:

"If electric trucks were now in use where gasoline trucks and horse-drawn vehicles are doing less efficient work, the saving in operating costs in the United States would total more than half a billion dollars annually—$575,-000,000, to be exact. In New York City alone the annual saving to present users of electric trucks over other types of equipment is $6,900,000, and more than $50,000,000 could be saved if the electric trucks were used for those purposes for which it is best suited. Electric trucks can operate more economically than gasoline trucks for 37 per cent of the commercial vehicle needs, 10 per cent of the motorbus needs and 10 per cent of motor farm needs."

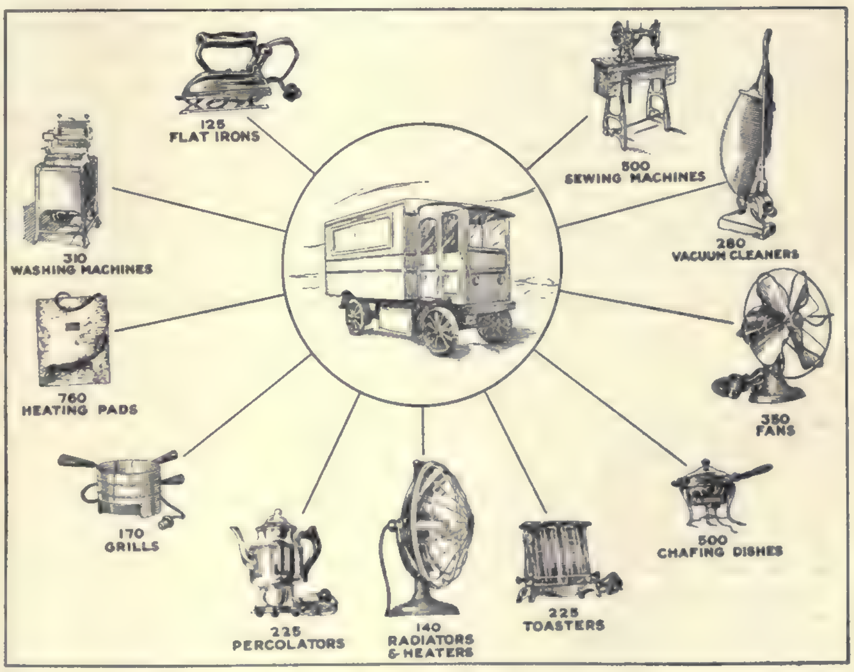
The value of the electric truck to the

PER CENT OF TOTAL HORSEPOWER OF INSTALLED ELECTRIC MOTORS

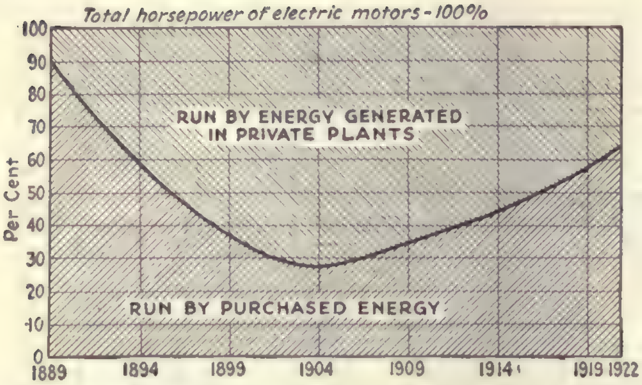


IN ONLY NINE STATES IS A MAJOR PORTION OF THE MOTOR LOAD CARRIED BY PRIVATE GENERATING PLANTS—1919

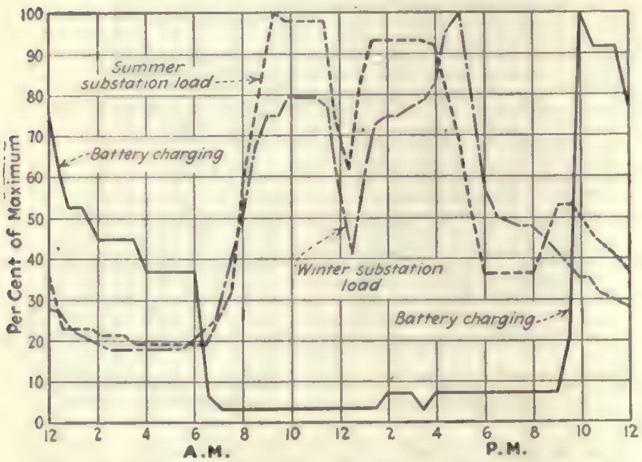
central station as a consumer of electrical energy is clearly indicated below. The consumption of electrical energy for charging purposes at the New York garage of the American Railway Express Company during 1922 was 1,646,780 kw.-hr. This is more than ten times the amount of electrical energy which an average office building of the same size would require for light and power and five times the consumption of a modern hotel of similar volume. It has been estimated that one electric truck customer is equivalent to the consump-



YEARLY ELECTRIC TRUCK ENERGY CONSUMPTION COMPARED WITH YEARLY ELECTRIC CONSUMPTION OF VARIOUS TYPES OF DOMESTIC APPLIANCES



IN PERCENTAGE OF MOTOR HORSEPOWER OPERATED THE PRIVATE GENERATING PLANT REACHED ITS ZENITH IN 1904



ELECTRIC VEHICLE BATTERY CHARGING COMPARED WITH TOTAL SUBSTATION OUTPUT

(Actual figures from station log sheets, New York City)

tion of between three thousand and four thousand average residential customers. In addition, the company acquiring this business has only the cost of servicing one customer, as against three thousand to four thousand. The electric truck appears to be on the eve of greatly increased sales, and central stations appreciating the growth of the electric truck transportation business are following the lead of New York, Chicago, Boston, Hartford, New Orleans and Los Angeles in establishing departments equipped with the necessary expert talent to give advice on problems connected with electric truck transportation.

The powerful stimulus of the war left its imprint as a dominant force in the various branches of the chemical industry. With the shutting off of all sources of supply from foreign countries, upon which American industry had heretofore been dependent, and the enormous increase in the demand for other products vitally necessary for the conduct of modern warfare, the American chemist was forced to meet an unprecedented situation. Enormous plants were erected to produce chemical and electrochemical products heretofore obtained from abroad. The chemist has been greatly aided in the accomplishment of this task by the application of electricity. Today the chemical industry as a whole is the second largest user of electrical energy in the United States.

Use of Electrical Energy in Chemical and Allied Industries Expanding Rapidly

Nor has this tremendous activity in the use of electrical energy as a source of heat been confined to the production of chemicals. Because of the unusual demand for metals, particularly copper, zinc, aluminum and alloy steels, the commercial development of electrometallurgical and electrolytic processes has been equally rapid. The heavy consumption of alloy steels, the increasing demands for ferro-alloys and the shutting off of the imports of alloys and other raw materials—all these are contributing causes for the rapid extension of the use of the electric furnace and electrochemical processes. Similarly, the continually expanding market for copper and zinc has brought about the perfection of electrolytic processes for producing these metals.

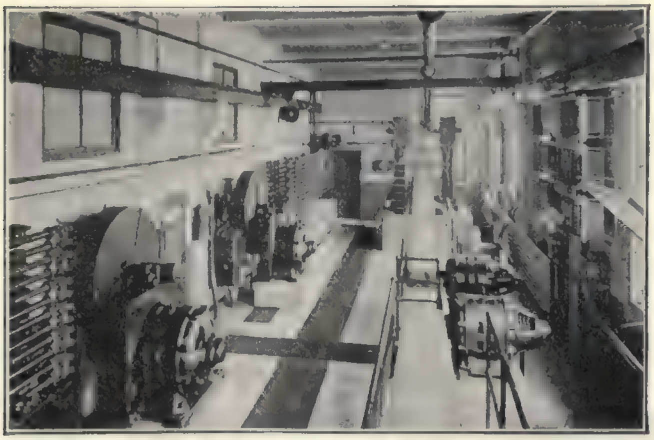
According to data collected by the American Iron and Steel Institute, a total of 471,458 gross tons of steel was produced by electric processes during 1922, of which 346,039 tons was steel ingots and castings and 125,419 tons was alloy steel. The total steel production in 1922 was 37,276,422 tons, of which about 1.3 per cent was produced by electric processes.

The growth in the production of electric steels has been rapid. In 1909, the first year for which reports are available, a total of only 13,762 tons of electric steel ingots and castings was produced. The record production of electric steel was reported in 1918, when a total of 802,325 tons was produced, of which 511,364 tons was steel ingots and castings and 290,961 tons was alloy steel. In 1920 another large production was reported with 747,724 tons.

According to the *Iron Age*, there was a total of 456 electric furnaces installed in the United States and Canada on Jan. 1, 1923, of which 406 were located in the United States and fifty in Canada. This is a net gain of eighteen furnaces during 1922, as against thirty-two in 1921, thirty-three in 1920, thirty-six in 1919, fifty-four in 1918, ninety-seven in 1917, sixty-three in 1916, thirty-two in 1915 and twenty-two from July, 1913, to Jan. 1, 1915. These figures probably do not represent the actual number of sales of electric furnaces, since there were undoubtedly a number of discontinuances and dismantlements. The Heroult furnace leads all makes with 181, followed by the Snyder and Moore with fifty-three installations.

Table XI—Electric Steel and Total Steel Production in United States (Gross Tons)

Year	Open-Hearth	Bessemer	Steel Ingots and Castings: Crucible	Steel Ingots and Castings: Electric	Steel Ingots and Castings: Miscellaneous	Alloy Steels: Open-Hearth, Bessemer, Crucible	Alloy Steels: Electric	Total Production	Per Cent Electric
1909	14,943,936	9,330,783	107,355	13,762	9,185	....	....	23,955,021	0.580
1910	16,504,509	9,412,772	122,303	52,141	3,194	....	....	26,094,919	0.200
1911	15,598,650	7,947,854	97,653	29,105	2,844	....	....	23,676,106	0.123
1912	20,780,723	10,327,901	121,517	18,309	2,853	....	....	31,251,303	0.058
1913	21,599,931	9,545,706	121,226	30,180	3,831	....	....	31,300,874	0.096
1914	17,174,684	6,220,846	89,869	24,009	3,662	....	....	23,513,030	0.102
1915	23,679,102	8,287,213	113,782	69,412	1,527	....	....	32,151,036	0.216
1916	31,415,427	11,059,039	129,692	168,918	604	....	....	42,773,680	0.395
1917	34,148,893	10,479,960	126,716	304,543	495	....	....	45,060,607	0.675
1918	34,459,391	9,376,236	115,112	511,364	329	1,496,891	290,961	46,250,284	1.740
1919	26,948,694	7,271,562	63,572	384,452	2,952	1,299,556	181,632	36,152,420	1.590
1920	32,671,895	8,883,087	72,265	502,152	3,535	1,434,720	245,572	43,793,226	1.710
1921	15,589,802	4,015,938	7,613	169,499	945	746,302	63,246	20,593,345	1.130
1922	29,308,983	5,919,298	28,606	346,039	....	1,548,077	125,419	37,276,422	1.265




MOTORS ARE USED EXTENSIVELY IN ELECTRO-BLEACHING AND GRAPHITE PLANTS

Left—This view shows two 75-hp. type "CS" motors geared to line shafts from which are driven various machines throughout the plant of the Electro-Bleaching Gas Company, Niagara Falls, N. Y. Two 50-hp. type "CW" motors belted to ammonia compressors located in the same room with the other machines are also shown in this illustration.

Right—20-hp. "CS" motor, belted to crusher (International Acheson Graphite Company, Buffalo, N. Y.)

Motors for Chemical Plants

Alternating-Current Motors Favored—Special Application Conditions—Precautions to Prevent Corrosion and Abrasion—Typical Installation of Motors

By J. L. MCK. YARDLEY
General Engineer Westinghouse Electric & Manufacturing Company

THE motorization of industry has come about very rapidly, and there exists a widespread acceptance of the fact that electrical motors can best serve the needs of industry from the standpoint of both power cost and economical production. A comparatively few types of motors have been developed which serve the whole range of applications found in industry, and along with motor standardization has come standardization in voltage, frequency, protection and control so that the costs inherent in special applications are eliminated.

Probably the greatest element in industrial motorization has been the fact that alternating current has been proved most economical to generate, transmit, distribute and apply, and in addition it can be obtained under the most economical conditions from the large central-station plants which have been developed. All industry with the exception of those involving electrochemical processes can be served by alternating current and alternating-current motors, and even in the electrochemical industries alternating-current motors are preferred as there is less copper surface exposed to chemical action and the moving contacts subjected to abrasive action from dust particles are reduced to a minimum. Moreover, in many chemical industries the absence of spark hazards often results in the use of alternating-current motors.

In spite of this general use of alternating-current motors, there are in every plant a number of applications that can be served best by direct-current motors. Those jobs requiring a great range of speed, high starting torque, frequent reversal and exact control during a duty cycle cannot be served well by alternating-current motors of the existing types, and it is necessary to convert the alternating current to direct current for supplying energy to this type of application.

The general advantages of motor drives are well understood, and experience has proved that individual motor drives are preferable to group drive for most applications requiring any considerable energy expenditure. The great extent of modern factories, the frequent extensions and changes required by production variations and the accuracy required in cost-accounting systems have virtually eliminated all drives but electric from consideration.

In the application of a standard motor to a job much leeway is offered in choice of mechanical connection to the work. Direct connection, flexible connections, belt connections, chain connections and gear connections are all used, and the motor can be installed on the floor, ceiling or in a vertical position, depending upon the application and the desires of the engineers in charge. In the chemical industries several special conditions often exist which must be considered in determining the location of motors, the type to use and their mechanical connection to the equipment. Chief of these elements is the fact that motors are used under conditions which may affect the insulation injuriously or cause corrosion of active metal parts.

Oil may splash upon, drip upon or even flood a motor; dripping water, often acidulated, may fall upon the motor; leakage of steam and chemicals may produce a moisture-laden and corrosive atmosphere; abrasive dusts may occur as a result of the manufacture; alkaline dust or fumes are frequently encountered, and any of these conditions must be considered carefully when applying the motors to their work.

It may prove economical to install the larger motors at a distance from the application and in separate well-ventilated rooms, but the smaller motors cannot be treated in this manner. Distance cannot be used to insure separation where fumes, dust or a corrosive atmosphere exists because of the effect on the metals forming the driving mechanism. Many applications

under 7½ hp. are direct-connected, and it becomes necessary for the motor to withstand any bad operating conditions. The squirrel-cage induction motor is very popular for this type of application as there are no exposed moving contacts, and the windings, frame, bearings and connections can be protected from corrosion, abrasion or moisture.

The rotors can be dipped in a protective varnish, and the insulation on the stators can be impregnated with a linseed or asphalt compound which, after being baked, hardens but still retains some elasticity. The material used in impregnating the coils can be chosen as determined by the particular conditions existing for each application. For very severe conditions a higher-grade insulation, such as fish paper and mica, can be used, impregnated and baked. No great trouble or cost is involved in insuring adequate protection to the windings. The use of open slot construction permits the coils only to be treated and makes for easy repair in the field, but the use of closed or semi-closed slot construction requires that the whole rotor be treated as a unit after winding. The frames and bearings can be protected from corrosion by the use of varnish or paint of the proper type, and abrasive effects can be eliminated by using inclosed frames and bearings, if there are no heavy acid fumes about. Totally inclosed motors are not suitable for operation amid heavy acid fumes unless they are provided with specially piped ventilation, for the reason that acid gradually collects inside the case owing to breathing.

A typical outline of the treatments accorded motors for general industrial service is as follows on motors up to 25 hp. or 50 hp., at 600 volts, depending upon the speed:

With open slot construction the uninsulated coils are each given at least one dip in asphaltum-base varnish and a treated cloth wrapper is used. The insulated coils are each given not less than one dip in a linseed-oil-base varnish. The partially closed slot construction, with untaped end windings, is given two or more dips in asphaltum-base varnish.

Special conditions which have been discussed would be met as follows:

1. Oil—splashing, dripping or flooding.

With open slot construction, at least two dips in linseed-oil-base varnish for the uninsulated coil are given. A fish-paper and mica wrapper is employed. Not less than two dips of the same varnish are given for the insulated coil.

With partially closed slot construction the end windings are all taped and at least one dip in asphaltum-base varnish followed by at least one dip in linseed-oil-base varnish is given.

2. Severe moisture conditions—dripping water, steam, high humidity.

Open slot construction is treated the same as No. 1.

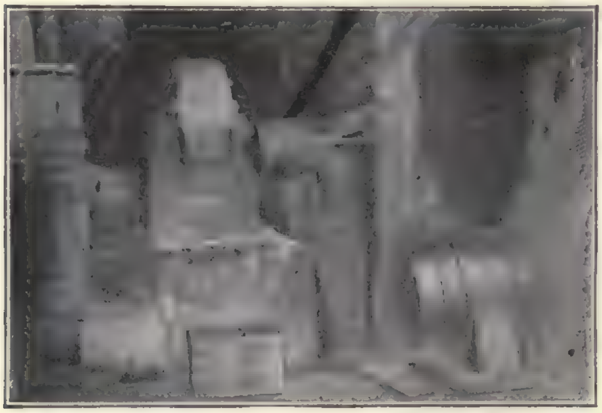
Partially closed slot construction is treated the same as No. 1 except that all dips are made in asphaltum-base varnish.

3. Carbon, iron, graphite, coal, coke and abrasive dusts.

With open slot construction, which is recommended, the uninsulated coils are given at least two dips in linseed-oil-base varnish. A fish-paper and mica wrapper is employed. The insulated coils are given at least four dips in the same varnish, and the whole stator is given at least four dips in this varnish.

When partially closed slot motors are employed in this service at least four dips in asphaltum-base varnish for the completely wound stator are recommended.

The special purpose to be accomplished by all this dipping and baking is to procure a smooth, glossy surface with no breaks or rough spots for abrasive dusts to act upon, and to give increased dielectric strength, owing to materials of the No. 3 class being such good conductors.



TYPICAL MOTOR APPLICATIONS TO THE CHEMICAL INDUSTRY

Upper left—7½-hp., 440-volt, three-phase, 60-cycle motor driving potash drier. The speed of motor, 685 r.p.m., is changed through reduction gear to 50 r.p.m. Control switch is mounted on concrete wall below the potash drier. (Southwestern Portland Cement Company.)

Lower left—30-hp. motor driving blower and conveyor for handling alumina tailings. The motor operates in a cloud of alumina dust and soon becomes completely plastered over with the alumina material.

Right—5-hp. type "CS" motor, mounted on wall, and belted to agitator in caustic shed of the Isco Chemical Company, Niagara Falls, N. Y. The motor is subjected to fumes from the agitator.

Linseed oil is hard to dry where not exposed to air, and when not perfectly dry its insulating capacity is appreciably reduced. Asphaltum-base varnish is a good insulator whether hard or not.

4. Nitric, hydrochloric, sulphuric acid; ammonia; caustic soda or potash, alkali fumes.

With open slot construction, which is recommended, a complete, perfect coating is essential with no fibers protruding. The varnish is largely plastic asphalt with some linseed oil and gum, and not less than two dips are given to the uninsulated coil. A fish-paper and mica wrapper is employed. The insulated coil is given at least four dips, and the completely wound stator is given not less than six additional dips. This varnish has good filling quality and good dielectric strength. It produces a fairly hard coating of sufficient elasticity and unaffected by atmospheric impurities. It bakes in eight hours at 110 deg.

When partially closed slot motors are employed in this service at least six dips in the same varnish are recommended for the completely wound stator.

There are four general classes of applications in the chemical industry: Liquids are pumped, lifted, stirred, agitated and settled; solids are ground, mixed, crushed, screened and conveyed; materials are separated; elevators and hoists are used for production purposes.

MOTOR DRIVING CONVEYOR BY MEANS OF BELT (BUFFALO FERTILIZER COMPANY)

In handling liquors direct-connected high-speed vertical motors may be used on centrifugal pumps, group drive may be used for smaller plunger pumps, stirrers, agitators and for vacuum pumps, and in this case distance may protect the motor to some extent, and motor-driven air compressors at a distance may be used to produce the air for conveying corrosive liquids. For agitating and stirring in tubs, vessels or closed pots very little energy is required, each device taking only from 1 hp. to 2½ hp. The paddles or impellers are usually driven by bevel gears from a jackshaft supported on the vessel structure, and this shaft is belted through fast and loose pulleys to a common countershaft operating at 120 r.p.m. to 160 r.p.m. This countershaft may serve a number of vessels, plunger pumps, vacuum pumps, crushers and lifting devices for handling solids and other miscellaneous equipment. The countershaft is driven by a constant-speed motor belted through a single-speed reduction or by a gear-connected constant-speed motor.

In grinding and mixing solids, individual motors may be used through direct connection or flexible connection. Moreover, belt-driven applications can be used, and for low-speed devices a reduction gear and countershaft is commonly used with a group-drive arrangement. For crushing solids individual drives with flywheels are used having either belt or gear connection. For worm and stirrer types of mixers the energy requirements often warrant the use of individual drives, but for cylinder and ball mills group drive is used. In screening, where small aggregate energy is required, the operations take up room, and it is usual to connect the screens as a unit to the grinding equipment for driving by one motor. In settling tanks for separating materials centrifugal pumps are required to fill and empty the tanks. These pumps may be geared up and driven by a standard motor or a special high-speed motor. Special treatment of the motor is necessary if corrosive liquids are handled by these pumps.

For elevators and hoists direct-current motors are usually employed. Unless they can be installed in a chamber separate from the elevator shaft, the control gear must be totally inclosed and specially ventilated, and the motors must be inclosed and specially ventilated or else provided with special insulation. The elevator shaft should not be used as a location for the motor or its control gear, as it acts as a chimney and draws up the vapors produced in the building.

The application of motors in the chemical industry involves many difficult problems because of the type of product produced and the exacting requirements of the manufacturing processes, but motor manufacturers and the engineers in the plants have been able to attain very excellent results and have proved that it is easier to adapt the electric motor to the conditions than it is any other type of power equipment. A feature of the industry is the flexibility in the application of electricity to its needs, for, in addition to the motors, electricity is used in ovens, process work, ventilating work and in special illumination applications.

Electrical Energy in the Metal Trades

ONE of the most important industries of the Northeastern section of the country is that of the metal trades. There are more than a thousand plants in the United States in which work in brass, bronze and copper products is being done. These establishments in 1920 reported to the Census Bureau the use of 265,688 primary horsepower, of which 143,311 hp. was purchased from central-station companies. Of the remaining primary power a considerable portion was used in the generation of 40,598 hp. in private electric generating plants. The table shows the distribution of power in the brass, bronze and copper products branches of the metal trades industry.

DISTRIBUTION OF POWER IN THE BRASS, BRONZE AND COPPER PRODUCTS INDUSTRIES—U. S. CENSUS OF 1919

		Primary Horsepower						
State	Number of Establishments Reporting	Total	Steam Engines	Steam Turbines	Internal-Combustion Engines	Water Power	Electrical Horsepower Purchased	Electrical Horsepower Generated in Private Plants of Industry
United States....	1,092	265,688	61,862	54,655	3,540	2,320	143,311	40,598
Connecticut..	75	121,319	25,250	45,712	435	2,305	47,617	26,403
New York...	213	32,352	9,473	5,483	881	0	16,515	5,597
Michigan.....	80	27,912	7,880	1,000	230	0	18,802	671
Massachusetts.	72	15,511	3,610	200	47	15	11,639	60
Wisconsin....	36	13,096	5,010	1,950	0	0	6,136	4,534
New Jersey....	67	11,656	4,730	10	253	0	6,663	497
Ohio	92	10,915	1,792	300	904	0	7,919	835
Pennsylvania..	125	10,577	3,127	0	606	0	6,844	1,621

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Basic Lining for Electric Steel Furnace

To the Editors of the ELECTRICAL WORLD:

I read with interest the article entitled "Electric Furnace Demonstrates Flexibility in Steel Foundry," by J. L. McK. Yardley, in the Sept. 8 issue of the ELECTRICAL WORLD. One comment which might be made on this very complete discussion is in reference to the selection of a basic lining for a furnace which is to be used exclusively for the production of steel castings.

It has been my experience that if the castings require the smooth and perfect surface finish which has come to be a standard in the small steel-casting industry, it will usually be more profitable to pay a considerable premium for scrap of low sulphur and phosphorus content suitable for acid melting than to use a basic hearth. The reason for this is the extreme difficulty of preventing small particles of the very fluid basic slag from entering the mold with the steel. These particles are sure to flow to the sand surface and often cause a reaction resulting in blowholes or other imperfections.

EDWIN L. WILLSON,
Consulting Engineer and Metallurgist.
Farmington, Conn.

"Effective Oil-Testing Apparatus" Criticised

To the Editors of the ELECTRICAL WORLD:

Referring to the ELECTRICAL WORLD of July 28, page 186, I want to call your readers' attention to the fact that when the transformers are connected up as shown there will be a difference of voltage between the high-voltage and the low-voltage winding that may run up to 25,000 volts maximum (peak). As it is common practice in high-voltage tests to ground one side of the high as well as one side of the low-voltage winding, this maximum of 25,000 volts will be reached between the non-grounded pole of the high-voltage winding and the low side of the last transformer.

Of course the insulation of these potential transformers is not built for this stress. Consequently the scheme is dangerous and will most likely result in the blow-up of one or more of the potential transformers.

Changing the position of the transformers to 6,600-2,200-2,200-6,600 and grounding the lead between the two 2,200's would produce the most favorable condition, namely, a maximum of 12,500 volts between windings. However, even this would be far from safe.

JAN A. VANDERPOLL.
Jackson Heights, N. Y.

To the Editors of the ELECTRICAL WORLD:

In regard to the arrangement of the transformers used in the oil-testing arrangement described in the July 28 issue of the ELECTRICAL WORLD I wish to say that no ground connection has been used in this arrangement and that while the voltage stress from the high-voltage side to the low side may be dangerous, the writer does not know what the maximum stress would be or at what point in the windings it would occur. However, the arrangement has been in actual use a number of times without damage to the transformers.

The scheme shown is simply intended as a means of testing for moisture in the oil when no other means is at hand, since most of the equipment is available around any medium-sized central station. In case it is not desired to use the 2,200-volt transformers as shown, a break-down test of approximately 19,000 volts may be made by using the 6,600-volt transformers only, with a ground connection on the lead between the two. This would certainly not be dangerous and, as a choice between this test or none at all, would, in the writer's opinion, be well worth while.

RALPH PITTMAN.
The Pine Bluff Company,
Pine Bluff, Ark.

Help the Railroads Against Congressional Assaults

To the Editors of the ELECTRICAL WORLD:

Business in general may well tremble to think of what a new Congress is likely to try to do in the way of regulating the transportation industry. If only a small part of the schemes discussed are carried out, it seems reasonably certain that serious injury will be done. If all of them are put through, the damage will be irreparable.

Those engaged in the electrical industry have a peculiar interest in wishing to see fair play toward the railroads. Not only are they, like other shippers, seriously inconvenienced by bad transportation conditions, but the gradual increase in the use of electrical apparatus on steam railroads and the electrical operation of many of the lines is making the roads of rapidly increasing value as customers for electrical apparatus and supplies of all kinds.

Perhaps the ELECTRICAL WORLD is doing its full share in bringing this subject before those engaged in the electrical industry, but, judging from my limited reading of its editorials, not a great deal has been printed about it. In view of the imminence of the new Congress, which threatens, vocally and otherwise, to lambast the railroads in every conceivable way, it appears to me that it would not be out of order for the ELECTRICAL WORLD and other business papers to keep this subject constantly before the attention of their readers.

GEORGE H. LYNE.
Belden Manufacturing Company,
Chicago, Ill.

Suggests "Tracer" as Needed Wiring Term

To the Editors of the ELECTRICAL WORLD:

In line with your editorial of July 28 upon the need for a term to distinguish between polarized wiring and identified wiring, I should like to propose the word "tracer" to apply to wiring in which the polarity of a certain wire and its branches must be "identified" throughout a given installation; for example, the grounded side of lighting circuits. The same term could also be applied to polarity receptacles, sockets, plugs, etc., without ambiguity, as "tracer receptacles," "tracer plugs," etc. This term has the advantage of present use as the wire of twisted pairs, which has a colored thread running through it, is by some called the tracer wire.

The word itself suggests continuity of search and identification, a "following through" from point to point, whose significance would be readily grasped and remembered. Moreover, it has no other electrical significance, as has "selective" or "polarized," both of which are pre-empted for very different applications.

H. A. CALDERWOOD.
Ochiltree Electric Company,
Pittsburgh, Pa.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Why Use Weatherproof Line Wire?

By S. C. Lindsay

Electrical Engineer Puget Sound Power & Light Company, Seattle, Wash.

EXTENSIVE tests to determine the protection afforded by weatherproof line wire, the extent to which workmen rely upon it to protect themselves and the relative amounts of protection given by double-braid and triple-braid insulation have been carried out by the Puget Sound Power & Light Company. The investigation also covered the qualities of weatherproof insulation that have been in use on this system during the past twenty years, the qualities of insulation of new wire now in stock and the number of years that first-class weatherproof insulation can be relied upon to give any protection at all on 2,300-volt circuits.

The general information obtained from line foremen and workmen who have been employed for a long term of years was that a large number of crosses between 2,300-volt primaries and 220-volt secondaries had occurred and that the weatherproof insulation had in many cases prevented short circuits; also that it had prevented a large number of grounds and that it frequently prevented damage to the circuits of foreign companies when crossed with ours. Workmen rely upon the insulation to a very large extent when working on heavy leads carrying live wires, and their tendency is to place too much confidence in it.

To obtain some idea of its resistance to potential stresses after a number of years of service, samples were taken from various points on our system and subjected to the tests described below:

A porcelain testing cup was arranged, having a metal plate in its bottom, to which was connected one terminal of the testing transformer. The testing solution was a saturated solution of sodium chloride. The other terminal of the testing transformer was connected to the conductor of the specimen to be tested. Approximately one foot of each sample was immersed in the solution. After the puncture test a careful examination was made of the braid of each specimen, the nature of the puncture and the condition of impregnation of the braid noted.

The potential was obtained from two 200/2,500-volt transformers arranged to be quickly connected in series or in parallel. A water rheostat was placed in series with the primary or 2,200-volt side to vary the impressed voltage. The maximum potential that could be obtained with this testing set was 4,900 volts. Dry tests were made of another specimen of each kind of wire given the wet test. Contact was made to the outside of the insulation by wrapping tinfoil around a section 1 ft. in length and binding it on tightly with a small wire.

These tests were conducted to determine (a) the break-down potential of samples of new double-braid and triple-braid wires obtained from the stocks of the various divisions; (b) the breakdown potential on the double-braid and triple-braid wires that have been in service for varied periods of time; (c) the relative insulating values of weatherproof wires installed more than ten years ago as compared with wires installed within the last eight or nine years, information having been furnished by the manufacturing companies that very material changes had been made in their method of braiding and impregnating weatherproof wires within recent years, and (d) the upper limit of distribution volt-

SUMMARY OF TESTS ON FORTY-TWO SAMPLES OF WEATHERPROOF LINE WIRE

Specimen No.	Diam., (In.)	Approx. Size, B.&S. Gage	Braid	Length of Time in Service (Years)	Puncture Voltage Wet	Puncture Voltage Dry	Tensile Strength (Lb. per Sq.In.)	Remarks
11 & 12	0.202	4	Triple	New	3,700	3,900	41,500	Impregnation very good.
13 & 14	0.163	6	Triple	New	4,040	3,400	47,100	Thorough impregnation.
17 & 18	0.123	8	Triple	New	1,700	2,800	56,700	Outer braid impregnated, second braid partially so, third braid slightly stained.
23 & 24	0.128	8	Triple	New	2,500	3,160	54,600	Fair impregnation.
25 & 26	0.167	6	Triple	New	.....	4,900	51,100	Excellent impregnation, but thick layer of compound adhering to outer braid; cracks when wire is bent to much larger radius than permitted by standard specifications.
27 & 28	0.124	8	Double	New	2,300	4,800	53,700	Very good impregnation.
29 & 30	0.202	4	Triple	New	3,400	3,100	39,300	Two outer braids well impregnated, but not inner one.
31 & 32	0.159	6	Double	New	2,500	2,200	45,400	Fair impregnation.
15 & 16	0.101	10	Triple	Unknown	2,540	2,800	60,000	Very good.
33 & 34	0.203	4	Double	9	2,000	3,200	40,200	Outer braid showed more weathering than to be expected.
35 & 36	0.161	6	Double	9	2,100	2,800	45,300	Outer surface in splendid condition, but impregnation not as good as might be. Unusual performance due to closely woven braid.
21 & 22	0.203	4	Double	14	1,600	1,780	46,700	Original impregnation poor and compound weakly resistant to weather.
19 & 20	0.202	4	Double	14	1,150	2,500	40,300	Outer braid slightly abraded; impregnation fair.
1 & 2	0.204	4	Double	15	2,300	3,400	40,100	Portions having best insulation tested; parts bare.
3 & 4	0.160	6	Double	16	1,270	3,300	43,700	Portions having best insulation tested; parts bare.
41 & 42	0.202	4	Double	20	0–200	1,700	41,200	Interbraid much abraded by pulling over cross-arms.
39 & 40	0.162	6	Double	20	1,750	2,500	45,100	Outer braid worn in places.
37 & 38	0.201	4	Triple	20	2,600	4,400	40,300	Outer braid well worn by weather, but excellent when new.
5 & 6	0.204	4	Triple	20	3,940	4,800	44,100	Impregnation excellent; specimen typical of average sample.
7 & 8	0.165	6	Double	20	500	1,550	36,900	Braid cut through and abraded by pulling or restringing sections where braid was entirely gone; original impregnation poor.
9 & 10	0.161	6	Double	20	2,500	3,100	45,300	Outer surface almost like new; impregnation excellent.

age on which it is advisable to use weatherproof wire. The results of these tests are given in the accompanying table on page 608.

The following conclusions were drawn as a result of this investigation. The author does not wish to convey the impression that weatherproof wire should be used in all cases. It is his opinion that bare wire should be used in all situations where its use can be justified.

1. The weatherproofing on line wire used on our system during the past twenty years should be classed as "very good," "indifferent" and "very bad." Some of the latter kind is still being sold at the present time.

2. There are many situations in city work and on heavy leads where insulated wire must be used and double-braid insulation is inadequate to give the proper amount of protection.

3. Weatherproof wire has been made which will stand the Puget Sound climate for twenty years and still afford a fair degree of protection.

4. The best weatherproof insulation is frequently very badly damaged by careless handling when being strung, and this damage can be prevented by ordinary care on the part of the workmen.

5. Weatherproof insulation of even better quality than any of the specimens covered by this report can be obtained at the present time and at practically the same cost as wire having inferior grades.

6. Triple-braid weatherproofing should be used on all circuits from 2,300 volts to 4,900 volts where it is considered necessary to use weatherproofing of any kind.

7. Triple-braid weatherproofing affords practically no protection above 4,900 volts.

8. All weatherproofed wire should be purchased under specifications, and the purchaser should have tests made of each lot to see that his specifications are complied with.

Extracts from an Operating Code*

Low-Tension Testing Equipment

EVERY station and substation should be equipped with a standard testing set or testing panel to be used for low-tension tests. There are three usual types—110-volt direct or alternating current, 250-volt direct current and 600-volt direct current.

The 110-volt direct or alternating current set consists of a small panel upon which is mounted a 50-watt, 110-volt incandescent lamp and a double-throw, single-pole knife switch. One clip of the switch is connected to a grounded source of alternating current or direct current and the other clip to ground. A test lead terminating in a metallic rod with a wooden handle is connected to the middle point of the switch.

On any cable, when testing with alternating current, it is possible to get an indication on the test lamps to show when the cable is free from fault. A 10-watt or 15-watt "Mazda" lamp will give full light, a 50-watt lamp dim light and a 100-watt lamp no light. Care should always be observed in making tests on cables that erroneous reports of cable conditions do not arise.

The 250-volt set consists of a motor-generator for supplying current, a test panel and test leads. The generator voltage may be varied from 60 volts to 380 volts, although 250 volts is generally used for testing. The generator leads are brought to a double-pole, single-throw switch on the test panel. Two test leads are also connected to the switch, one of which may be grounded through a single-pole switch on the test panel, the other having in series with it a 250-volt incandescent lamp. Both leads terminate in metallic rods with wooden handles. This set is used for testing purposes only.

The 600-volt set differs from the 110-volt set mainly in that the same set cannot be used for both sending and receiving in a test. A bank of five lamps is connected from the upper clip of a double-throw disconnecting switch to a source of 600-volt trolley current for the sending set and to ground for the receiving set. The lower clip is connected direct to ground. The middle point of the switch is connected through an expulsion fuse to a test bus which runs through the line disconnecting-switch compartments. By means of a connector attached to the end of a stick this test bus may be connected to any one of the conductors.

In making any low-tension tests care must be taken not to touch any bare equipment until after the test for foreign voltage has been made. This is because all of the low-tension tests require direct handling or close approach to high-tension apparatus or conductors, and because the low-tension testing apparatus is not insulated for high voltage.

The foremost requirement for personal safety and protection of apparatus is a test for foreign voltage. The metal hook of the switch stick, or any other insulated conductor, if placed in contact with a source of alternating voltage, will be alternately charged and discharged, because of its electrostatic capacity. If the voltage is high enough, this charging current will be maintained while the hook is being withdrawn a short distance and will be visible as a spark. The absence of a spark, however, is not a sufficient test that no foreign voltage is present, as a voltage too low to produce a noticeable spark might still be dangerous. Therefore the second test.

For most tests (low and high tension) it is necessary to remove the potential-transformer fuses from the equipment to be tested; otherwise the potential transformer primary winding would form a connection between phases which would produce false test results.

*Abstracted from the operating code of the Philadelphia Electric Company.

Operating Centrifugal-Type Wet Pumps

TO EQUALIZE the vacuum between the condenser and the wet-pump casing the vacuum equalizing line should be opened. This always allows the water in the condenser to fall by gravity to the pump; otherwise the pump would have to operate against a high vacuum head. Following are detailed instructions for starting and shutting down wet pumps:

Starting

1. Admit water to the seals.
2. Open suction valve.
3. Start the pump slowly.
4. See that the oil rings in the bearings are revolving and carrying oil.
5. Open the discharge valve.
6. Open the vacuum equalizing line.
7. See that the water level is maintained in the hot wells to which the pump operating is connected. (Note.—If the water level rises and one pump does not meet the demand, a second pump must be put into operation.)

Shutting Down

1. Stop the pump.
2. Close the discharge valve.
3. Close the suction valve.
4. Close the vacuum equalizing line.
5. Shut off the water from the seals.

TABULATED COST DATA ON 6,600-VOLT LINE

Material	Size	Number	Actual Cost
Western red cedar poles	30 ft.—7-in. top	332	$5,303.00
	35 ft.—7-in. top	15	
	25 ft.—6-in. top	30	
Cross-arms	3½-in. x 4½-in. x 5-ft. 7-in.	475	648.66
Cross-arms (galvanized iron)	¼-in. x 1¼-in. x 24-in.	950	156.47
Cross-arm pins (galvanized iron)	Spring top	1,450	511.53
Guy anchors—Mathews		60	78.00
Bolts—space	½-in. x 14-in.	72	8.58
Bolts—through	⅝-in. x 14-in.	42	41.49
Bolts—through	⅝-in. x 12-in.	403	
Bolts—carriage	⅜-in. x 4-in.	950	24.04
Lag screws	½-in. x 4-in.	475	15.01
Washers—square galvanized ½-in. bolt	2-in. x 2-in. x 3/16-in.	250	3.68
Washers—square galvanized ⅝-in. bolt	2-in. x 2-in. x 3/16-in.	866	12.73
Rod	⅝-in.	926	
Insulators—porcelain	11,000-volt	1,450	620.00
Insulators—porcelain strain		60	5.28
Wire—copper	No. 6 H.D.	14,285 lb.	3,243.46
Tie wire	No. 6	230.55 lb.	
Guy wire	5/16-in.	3,550 ft.	27.60
Guy-wire clamps	3-bolt type	120	21.75
Items not listed above			68.75
Sundries and contingencies			1,449.65
Labor			2,704.87
Total cost			$14,944.55
Cost 1½ miles on high-tension poles			1,006.15
Cost 10 miles new construction			13,938.40
Cost per mile new line			1,393.84

Rural 6,600-Volt Line Costs $1,393 per Mile

BY D. G. WALLACE
Operating Engineer Illinois Power & Light Corporation, Bloomington, Ill.

IN ORDER to supply a 60-kw. load in Flanagan, Ill., 11½ miles north of the Gridley substation, the Bloomington & Normal division of the Illinois Power & Light Corporation built in 1921 a 6,600-volt rural transmission line at an average cost per mile for new construction of $1,393.84. No lightning arresters were installed by the company since there were numerous customers along the line who were already equipped. The itemized cost data are listed in table. Line conductors of No. 6 hard-drawn copper wire were strung on 11,000-volt insulators and the pole spacing was chosen at 150 ft. This line gave a voltage regulation at 80 per cent power factor of 5 per cent and a line loss of only 4 per cent.

Interconnection Forestalls Building New Plant

IN A STATEMENT to the Massachusetts Department of Public Utilities W. A. Whittlesey, president Pittsfield Electric Company, recently pointed out that interconnection with the Turners Falls Power & Electric Company by a line now under construction between the Connecticut and Housatonic River Valleys will obviate the necessity for further plant extensions at Silver Lake. During the early part of 1922 it became apparent that the generating capacity of the Silver Lake plant would be unequal to the demand for electricity in the Pittsfield territory in the near future. A study of the system load indicated that during the next six years it will increase at the rate of 10 per cent per year compounded. If this energy were to be produced by extensions to the company's present generating equipment, additional boilers to the amount of $600,000 and turbine units to the amount of $750,000 would be required by 1929.

After the last extension the Silver Lake steam plant would have a capacity of 15,000 kw. This is all the lake would be able to provide condensing water for, and in the future it would be necessary to build elsewhere. The company therefore contracted with the Turners Falls company to supply energy in excess of the present plant capacity at a price less than the cost of producing electricity by the Pittsfield company. The contract is for a period of ten years, and under its terms the Turners Falls company is building a double-circuit line from Turners Falls to Pittsfield, with a capacity sufficient to care for the Pittsfield company's requirements during that period. The Pittsfield company is building a 6,000-kw. outdoor substation at an estimated cost of $128,831 to receive energy for the initial delivery requirements.

Motor Drive and Control Requirements for Paper-Mill Beaters

BY O. C. CORDES
Paper Mill Section, General Engineering Department, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

IN MAKING motor applications to beaters in the paper-mill industry each case should be studied and handled as an individual problem, taking into consideration the conditions peculiar to the plant in which the beaters are installed. A fixed rule pertaining to horsepower requirements for beaters of certain sizes and operating on similar material cannot be laid down, as much depends on the design of the beater, the kind and character of the stock, its consistency and the individual ideas of the man who operates the beater.

The horsepower required to drive a beater varies considerably in the different paper mills and depends very materially upon the kind of paper being made. In this article only a 2,000-lb. beater will be considered, as in most cases the horsepower required will be very nearly proportional to the size and the capacity of the beater for the same method of operation and the same kind of stock. It will also be assumed that alternating current only is available since the majority of mills are so equipped.

Where the beaters are used only for mixing the stock, water, color and size, and most of the work is done in Jordans, a 50-hp. motor of the wound-rotor type should be large enough. In mills where most of the work is done in the beaters a 75-hp. motor of the wound-rotor type will need to be used for such papers as news, book and "kraft." Rag paper and felt may require as much as 125 hp., and some special types of beaters as much as 150 hp. Where the beater is used as a broke engine the horsepower required will vary between 75 hp. and 125 hp., depending upon the kind of paper being made.

Motors of the wound-rotor type are generally recommended because of the high starting torque obtainable and the fact that the starting current is much less than that required by a squirrel-cage type of motor.

When the wound-rotor motor is used the control consists essentially of an oil circuit breaker for the primary side and a drum-type controller for cutting resistance in and out in the secondary circuit. The

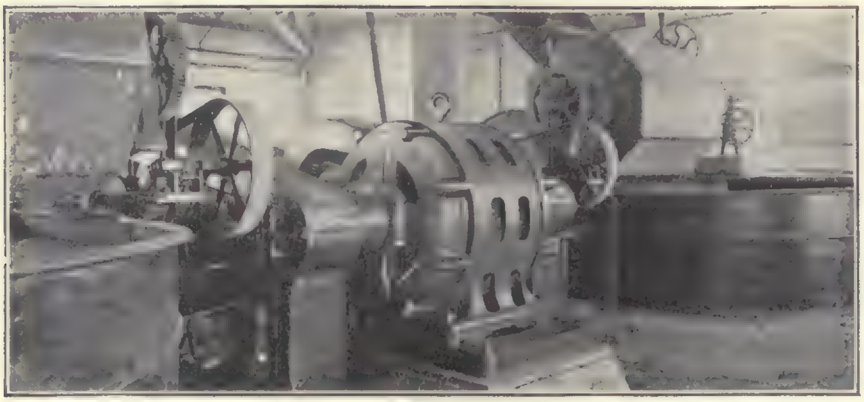


FIG. 1—A 150-HP., 575-R.P.M. SQUIRREL-CAGE MOTOR DRIVING TWO BEATERS THROUGH CHAIN DRIVE

secondary circuit of the motor may be interlocked with the primary oil breaker, so that, should the resistance be cut out of the secondary circuit, the motor cannot be started until the drum controller is returned to the full resistance in position. This feature makes it impossible to connect the motor to the lines unless the secondary resistance is all cut in. Since the beater is a constant-speed-drive machine, the control equipment is usually designed for starting duty only and consequently will not permit the motor to run at reduced speed, except during the starting period.

There are two principal approved methods in vogue today for individually driving beaters, i.e., belt and silent chain drives. Other drives, involving ropes and sprocket chains, are very few and are used mainly in old mills where line-shaft drive is still employed. Individual motor drive has many advantages over line-shaft drive. First, all line-shaft power losses are eliminated; second, should a motor fail or a drive give away, only one particular beater unit is shut down while the rest of the equipment continues to operate; third, the space saving is very considerable, and the beaters may be arranged and set in a way best suited to obtain the maximum efficiency and consequent increase in output of paper. Oftentimes where the beaters are close to each other one large motor with double-extended shaft is placed between each pair of beaters and drives them through belts from pulleys mounted on the shaft extensions.

Such an arrangement is entirely satisfactory and saves room and expense. Silent chain drives are coming more and more into the foreground as a medium for operating beaters, especially since some very successful installations have been made. Advantages of silent chain drive are that the motor can be brought up close to the beater-roll shaft, thereby saving a considerable amount of space, and that a higher-speed motor can often be used, which, of course, also means a less expensive motor. The saving in space, however, is of value only where the paper mill is crowded. An inherent characteristic of the silent chain drive is that it does not have the resiliency of a leather or rubber belt and consequently will not take up shocks caused by foreign materials, such as stone, tools and metal, getting caught between the beater roll and the bedplate. In the case of the silent chain type of drive this shock is transmitted directly to the motor bearing and may damage it or the motor shaft. This condition can be taken care of to a large extent by using special soft-metal pins between the chain links. The function of these pins is to shear in case of a heavy overload on the motor caused by the roll lifting because of foreign materials getting into the beater. This method helps materially to protect the motor, and the sheared pins can be replaced in a very few minutes. A geared drive is not feasible for this application as the beater roll is raised or lowered to obtain the proper refinement of the stock and, moreover, foreign material getting under the roll may cause it to jump.

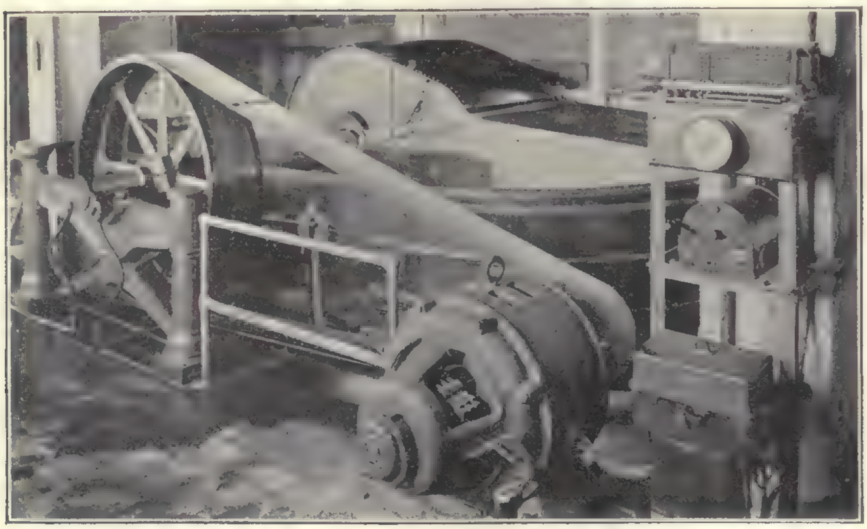


FIG. 2—BROKE BEATER BELT-DRIVEN BY 50-HP., 385-R.P.M. SLIP-RING MOTOR

Production Expenses of a 28,125-Kw. Plant

THE operating and maintenance expenses for a 28,125-kw. plant in New England for the year ended Dec. 31, 1922, are given below. The generating equipment of this plant includes six 750-hp. boilers, one 9,375-kw., two 7,812.5-kw. and one 3,125-kw. turbo-generators. During the year the coal consumption was 54,441 tons, costing $6.57 per ton and averaging 14,050 B.t.u. and 9.39 per cent ash. The total output was 63,907,555 kw.-hr., with a peak load of 19,800 kw. The annual load factor was 37 per cent while the annual plant factor (net output in kw.-hr. ÷ installed kw. × 8,760) was 26 per cent. The pounds of coal per kilowatt-hour was 1.68 and the B.t.u. per kilowatt-hour was 23,548.

Following are the unit production expenses in cents per kilowatt-hour delivered from the switchboard:

Operating expense:		
Fuel	0.56	
Wages and superintendence	0.12	
Water, lubricants and supplies	0.04	
Total		0.72
Maintenance expense:		
Building and structure	0.006	
Boiler plant, prime movers and auxiliaries	0.101	
Generators and electrical equipment	0.009	
Miscellaneous	0.017	
Total		0.13
Grand total		0.85

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Tell the Public and Tell It First*

Liberal Use of Advertising and Publicity Frankly Discussing the Central Station's Dealings with the Public Is Advocated by Utility Commissioner

By Samuel E. Hudson
Member Rhode Island Public Utilities Commission

OBSERVATIONS during nearly thirty years as a newspaper publisher and as a member of the Rhode Island Public Utilities Commission since its inception lead me to the firm conviction that public utilities should consistently, persistently and insistently develop the good will of the communities which they serve. Much improvement in this direction can be obtained and is being obtained through the proper use of the advertising and the news columns of the press. In recent years many of the larger public service corporations throughout the country in general, and in New England in particular, have adopted the policy of frankness and full publicity in their dealings with the public. Smaller companies, as a rule, have not yet done this.

It is primarily important that the public be kept fully, accurately and quickly informed. If there is an accident at the plant or out on the line; if you are reducing rates or raising them; if you, in fact, have anything that is a matter of public concern or regarding which the people are seeking information, tell them about it and tell them first. Get into the constant habit of presenting the various situations to the people whom you serve so that they will acquire familiarity with your utility, acquaintance with its officials and knowledge of its troubles and its triumphs.

The best manner in which to put your message across is through the columns of the newspapers. Advertise not only increases and decreases of rates and the sale of appliances, but also feature your service to industries, mercantile customers and homes. Do not forget that full and clear publicity on all matters connected with your concern, which is a public utility and as such is responsible to the public and the state as well as to your stockholders, will bring big dividends in good will and in the co-operation of your customers.

My experience has shown the foregoing to be true. Therefore every public utility should have one or more officials charged with the duty and the responsibility of supplying the press with information when it is sought. This man should always be available when information is desired by the press relative to accidents, interruptions in service, changes in rates, expansions of plant and other matters. The newspaper, and in this I speak advisedly, desires to obtain and correctly report the facts.

Authoritative Information Valued by the Press

If these are obtainable from officials of the company and inquiring editors and reporters are referred to a courteous, well-informed man, who cheerfully and clearly accords the information desired, the papers will not be forced to obtain their news from unauthorized sources which necessitate presenting to the public statements that are not authoritative and which are sometimes incorrect, when the true facts are in the possession of officers of the company.

Another suggestion is that when you file readjusted rates, either increases or decreases, with the public service commission of your state, you should be at the same time sure to send letters to the mayors, city councils, town councils and boards of selectmen of the communities which you serve, explaining the new move and offering to appear before these official bodies to give any additional information desired. Also, promptly furnish the news to the press in all communities affected by the rate change.

Some far-seeing utility corporations have adopted the policy of having trained executives and employees enter actively into the civic life of the communities served. I have especially in mind one utility whose officials and department heads are prominent in the Chamber of Commerce, active in the Kiwanis and Rotary Clubs, leading spirits in such moves as community chest campaigns and hospital drives. In these activities they form associations that mean much in the comfortable and orderly operation of the utility's business. With these formed associations, if a complaint arises at home, in the factory or at the office, it is very easy to say: "I'll call up my friend Jim Brown at the electric light office, and he'll fix it." And Jim does. Thus the liaison has been established.

When a man or a woman is a security holder in a utility he or she becomes its champion. From these centers of loyalty radiate areas of increased good will and confidence.

Keep your house in order. Have no conditions, methods or regulations concerning which you are ashamed to have the public fully informed at all times. In conclusion, let me again remind you to seek the bright light of publicity. Your business is to furnish light. Why keep the public in the dark?

*From an address made before the New England Division of the N. E. L. A. at Swampscott, Mass., Sept. 5, 1923.

How Advance Planning Helps a Campaign

Buffalo General Electric Company Sells 1,500 Electric Irons Through Well-Thought-Out Plan

WHEN the Buffalo General Electric Company set for itself a selling quota of 1,200 electric flatirons in a two months campaign starting on June 11 and then went out and sold the entire quota and more in seventeen days, it proved, more than anything else, the value of a complete and systematic plan to put over large sales of appliances to users of electrical current.

The plan worked out by A. B.

Jones, manager of the company's appliance division, left no detail to chance. The psychology of the campaign was carefully studied in advance and the work of the salesmen, as well as the advertising, was designed to make it easy to convince the housewife that she should buy a "Bee Gee Eee" electric iron even though she already owned another iron. The work was so plotted that the efforts of the salesmen and the mail advertising were correlated in every detail and intensively and simultaneously applied in the various districts worked.

As a matter of record, 1,500 irons were sold in the seventeen days elapsing before it was necessary to call off the campaign temporarily because the stock had run out and it was impossible to get a fresh supply in time to keep the drive going.

The iron used in the sale was specially constructed for the Buffalo General Electric Company, with its name and a five years guarantee plated on the heel of the appliance. The price advertised was $7.50. To introduce the "Be Gee Eee," the company offered a $4 "Rid-Jid" ironing table free with each sale of an electric iron. A time proposition of $1 down and $1 a month was made. Thirty-day charge accounts to customers of the Buffalo General Electric were permitted, but in all cases the company required a down payment of $1 or more.

At the beginning of the campaign large space was used in four Buffalo newspapers every day for a week. The same newspaper campaign was repeated the third week. In each newspaper advertisement a coupon appeared which would complete the sale to a customer when $1 was inclosed with the order.

A cardboard, triple-fold mailing folder, with one fold scored so that it could be detached and mailed back to the company, was used. The newspaper advertisement describing the table and iron and giving the terms of the offer was reproduced on this folder and the detachable card was a coupon addressed on the reverse side to the company. The total number mailed was 25,000.

The comparison given here for sixteen days of the campaign shows the proportion of replies received from the newspaper advertisements compared with replies from the mail advertising.

Of course, these figures, showing that 187 orders came in from a mailing of 25,000, or approximately seven orders for each thousand cards, do not do full justice to the direct mail work, as there was no means of knowing how many of the more than 900 direct sales made by the salesmen were influenced by these folders, and similarly by the newspaper advertising.

The complete plan as carried out comprehended broadly the following features:

1. Newspaper advertising preceding and during the campaign.
2. Direct mail work immediately preceding the visit of the salesman.

FOLDER USED IN DIRECT-BY-MAIL BROADSIDES

3. Zoning of the city into districts so that the salesmen would work systematically, and to govern mailing of the broadsides so that not more than a day would elapse after receipt of the card by the prospect and the visit by the company's representative.
4. Division of the sales crew into teams, each under a team captain, the captain to report to headquarters each night.
5. Instructions to salesmen giving complete details of the campaign and outlining for the salesman the kind of selling talk he was expected to use, including objections to be overcome and salient selling points of the iron and table.
6. Distribution of irons by trucks carrying banners and cutouts advertising the campaign.
7. Daily inventory of distribution cars to check with reports of the team captains.

The results of this quick selling campaign seem all the more remarkable when it is considered that the 1,500 electric irons were sold in but three out of the city's twenty-five wards and that the work was done by two teams of five men and a

REPLIES RECEIVED FROM ADVERTISING BY DAYS

	Newspaper Advertisements	Mailing Folder
First day	7	11
Second day	3	13
Third day	16	11
Fourth day	17	11
Fifth day	7	9
Sixth day	2	7
Seventh day	62	8
Eighth day	5	8
Ninth day	13	8
Tenth day	62	5
Eleventh day	55	13
Twelfth day	36	22
Thirteenth day	1	16
Fourteenth day	4	11
Fifteenth day	3	7
Sixteenth day	104*	27*
Total	397	187

* Last day and orders subsequently received.

team captain each, besides the drivers of the two delivery trucks. It is safe to assume these results could not have been approached had it not been for the careful study and planning of every detail of the campaign in advance of its execution, and the working out of it according to a predetermined schedule.

Raising Power Factor to Increase System Capacity

By R. L. Hall

Assistant Electrical Engineer British Columbia Electric Railway, Vancouver, B. C.

THE British Columbia Electric Railway about three years ago began a comprehensive survey of its transmission and distribution system with a view to adopting such remedial measures to raise power-factor conditions as the situation warranted. While this investigation is yet incomplete, the lines along which the company has been working and the measures proposed are of interest.

The initial step was to ascertain the load in kilowatts and the power factor of the feeders in twelve of the most important substations. A list of customers with a load of 50 hp. and more was obtained and each customer allocated to his particular feeder. Tests were made at each customer's main-line service switch to determine power factor, maximum demand and load in kilowatts during a normal day's operation. These results were analyzed as to the reactive component and total load and put into the form of a chart, together with full data as to length of feeders, size and spacing of wires and total weight and cost of copper in the feeder.

Voltage drop and regulation of each feeder were calculated, and the economies that would be effected in copper outlay should the power fac-

tor be raised to 90 per cent were shown. The amount of correction required to raise the power factor of the various feeders to 90 per cent, either with static condensers or with synchronous motors or by substituting smaller motors for large underloaded induction motors, was also ascertained. The customers' kilowatt-hour monthly consumption, net rate and discount were obtained, and the amount lost to the company by not enforcing an 85 per cent power-factor clause in its contracts was shown on a chart.

From these tests and data it was found that 97.3 per cent power factor was the economical limit for correction on the peak load. Beyond this point it was found that the cost of the corrective apparatus more than offset the saving in generator and line capacity, assuming that the company would install in its substations all apparatus necessary. It was realized, however, that true engineering economies called for power-factor correction at the customer's premises—i.e., the motor terminals—or at the real source of the trouble.

IMMEDIATE RELIEF NECESSARY

Since, however, individual customer correction will take several years to accomplish, and as the estimated peak load for 1923 will require every kilovolt-ampere of generator capacity available, it was expedient to provide relief in some other way. It was found that 9,750 kva. of synchronous-condenser capacity (6,000 kva. in one substation and 3,750 kva. in another) would relieve the generators on the system of 4,500 kva. of wattless, which would give a sufficient margin on the peak and raise the system power factor from 87 per cent to approximately 90.5 per cent. Two such machines have been ordered and will be installed by November of this year.

In the original tests on the substation feeders, as an experiment, a 500-kva. and a 250-kva. static condenser were installed on two of the most heavily loaded feeders. These condensers are being tried out, but as yet sufficient time has not elapsed for a full report on their operation. It is believed, however, that static condensers have a large field of application for correction of low power factor at the motor terminals which is not fully appreciated by power-company engineers.

As soon as the necessary graphic power-factor meters are delivered it is the intention of the company to measure the power factor of all of its customers using 50 hp. and over and to enforce the 85 per cent minimum-power-factor clause in its contracts. It is anticipated that by the elimination of customers with very low power factors—in some cases as low as 45 per cent on 150-kw. loads—and with the aid of the synchronous condensers soon to be installed and the improved condition generally of customers' power factor, a resultant system peak-load power factor of 95 per cent or higher will be obtained.

Electricity Roasts Beef for 5,000 People

A NEW and unusual application of electric heating was made recently when electrically barbecued beef was served to five thousand people at the annual round-up and celebration at Ephrata, Wash. Four steers weighing about two thousand pounds each were dressed and prepared for the barbecue and roasted in a large electrically heated pit built especially for the occasion. The improvised oven was 32 ft. long, 4 ft. wide and 6 ft. deep. Twelve heating elements each of 3 kw. capacity and consisting of about 150 ft. of No. 14 iron wire were placed one foot above the bottom of the pit. Sheet-iron heat deflectors were placed one foot above the heating elements, and a foot and a half above the deflectors were placed iron bars to hold the beef. Thermostatic control was provided to maintain an even heat in the pit.

FOUR TONS OF BEEF IS ROASTED IN IMPROVISED ELECTRIC OVEN

The meat was first roasted at a temperature of 550 deg. for two hours. The heat was then reduced to 350 deg. and maintained at this point for four hours. For the next six hours the temperature ranged from 250 deg. to 300 deg. At midnight the meat had been roasting for twelve hours, and the temperature was then reduced to 200 deg. and held there for twelve hours until the time of the barbecue.

The success of the undertaking was due to H. I. Kelhm, district manager of the Washington Water Power Company at Ephrata, Wash., who originated the idea and supervised the electrical installation.

What Other Companies Are Doing

Worcester, Mass.— Sales in the appliance department of the Worcester Electric Light Company, O. R. Underhill superintendent, indicate that 1923 will be the best year in the company's history. Total sales are at present 35 per cent ahead of last year, the weekly average sales being respectively $2,619 and $1,956. To Aug. 11 inclusive sales this year were $83,806, appliance repairs amounting to $3,785. The estimated added revenue from the appliances sold this year totals $17,252 per annum.

Davenport, Iowa.—An information and adjustment department recently established by the People's Light Company has proved very popular with the company's customers, who have taken advantage of the service in rectifying misunderstandings and settling complaints. The department was established in the interest of customers, and the company is striving to eliminate all possible causes of friction.

Illinois.—The Public Service Company of Northern Illinois in conducting a kitchen-lighting campaign is sending out a folder offering a choice of two fixtures on a thirty-day trial offer. To help in closing the sale a postal card is attached stating that the fixture will be removed at the end of thirty days without cost to the purchaser if it has not come up to his expectations.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Generation, Control, Switching and Protection

Large Low-Voltage Circuit Breaker.—A 525-volt, three-phase, 50-cycle circuit breaker with a current-carrying capacity of 10,000 amp. is described. The moving element weighs more than half a ton, which has necessitated a special design for the operating mechanism to insure quick breaking.—*Engineer (England)*, Aug. 24, 1923.

Voltage Taps on Power Transformers.—P. BUNET.—In ordering transformers customers usually desire to have, besides the normal voltage of the winding, several additional ratios for voltages of a few per cent above and below that normal voltage. To provide for this taps are required in the winding, and by connecting the lines to these the number of active turns in the winding can be varied. The methods usually employed to locate these taps are shown in this paper. Placing them at the line end of the winding not only unbalances the symmetry between the primary and secondary, which introduces dangerous mechanical forces, but at the same time puts the weakest part of the winding toward the line, where it is liable to be exposed to electrical surges. A better practice from the electrical standpoint is to locate the taps next to the specially insulated end turns, where they cannot be reached easily by line disturbances. Probably their best location is in the middle of the stack, where they have the best electrical protection and may be arranged so as to cause the least mechanical unbalance. To place the taps on Y-connected three-phase transformers next to the Y point is mechanically just as undesirable as to place them at the line ends, because it gives the worst unbalance. A decidedly wrong, and in high-voltage machines very dangerous, practice is to leave parts of the winding entirely idle or floating, with no connection with the rest of the winding, because these parts of the winding will become highly charged with static electricity, which may under certain possible circumstances exceed several times the operating voltage and cause dangerous corona discharges or even breakdown. Some European manufacturers consider taps in a transformer winding as causing such a dangerous weakening of the machine that they refuse to equip their transformers with them. They suggest, in case the customer wants taps of, say, a total of 10 per cent, that a second transformer be built, of a capacity of 10 per cent of the main transformer, and that this auxiliary machine be equipped with the desired taps, the two machines to operate in series. The author shows by several practical examples the mechanical forces which may be expected on an unbalanced winding, and also the overvoltage resulting from an open-end tap winding. — *Revue Générale de l'Electricité*, July 7, 1923.

Behavior of Aluminum-Cell Lightning Arrester Under Radio-Frequency Electromotive Forces.—H. YAGI and J. OKOCHI. — The most remarkable features of the aluminum-cell arrester under radio-frequency voltages ranging from 100,000 cycles to 200,000 cycles per second are that the condenser action of the film becomes considerable and that the dynamic characteristic has no falling part and consequently the discharge does not go disruptively, but passes like a simple leakage. These qualities are peculiar to the aluminum cell and indicate that the arrester may possibly be so arranged as to act as a wave filter or a high-frequency absorber and the like, which is not to be expected from any other type of arrester. — *Technology Reports of Tohoku Imperial University, Sendai, Japan*, Vol. III, No. 2.

Hydro-Electric Development and Steam Equipment

Heat Transmission in Surface Condensers Between Steam and Water.—C. H. NAYLOR.—The subject is treated mathematically with the addition of experimental data, and as a final check on the mathematical results a comparison is made with what obtains in practice. The problem is considered from the point of view of four heat resistances, the sum of which is the reciprocal of the heat transmission. The four heat resistances are: between water and tube, between steam and tube, that due to air, and the resistance through the metal of the tube. An expression is derived for the differential coefficient of increase of steam condensed with respect to the increase of surface traveled over, involving the four heat resistances and the instantaneous value of the temperature difference between water and steam. Formulas are also included for obtaining the value of each heat resistance in terms of the steam condensed and other constants depending upon the general data of the condenser. Various examples are worked out giving results consistent with present-day practice.—*Beama (England)*, April, May and July, 1923.

Testing Jet Condensers.—L. LONG.—Means of locating faults in jet condensing equipment, as described in this article, may eliminate unnecessary work and delay in restoring normal conditions. Eroded or plugged injection nozzles, high temperature of incoming water, corrections for vacuum and barometer reading and other points that come up in jet condenser testing are described.—*Power*, Aug. 21, 1923.

Electric Steam Boilers. — P. H. FALTER.—The author discusses the conditions under which electric steam boilers can be used economically and gives data regarding the electric boilers installed and results obtained in several plants. In one instance one man per shift does all the work in connection with the two 2,500 b.hp. electric boilers for the Laurentide Company, Grand Mère, Quebec, where formerly thirty-seven men were required to get the same amount of steam from fourteen coal-fired boilers. In addition, the handling of 50,000 tons of coal per year is eliminated. — *Industrial Engineer*, August, 1923.

Burning Boiler Oil. — A series of three articles describing types of burners, steam atomizers and mechanical oil burners.—*Power*, Aug. 7, Aug. 21 and Sept. 4, 1923.

Transmission, Substations and Distribution

Power Transmission with High-Voltage Direct Current Versus Alternating Current.—A. SCHERBIUS.—The author opposes the assumption that transmission with high-voltage direct-current would have advantages over equivalent alternating-current transmission only if the former had a much higher voltage. It is shown that even for lower voltages the direct-current transmission is considerably superior to an alternating-current system. Very material savings could be realized with high voltage direct-current lines by the reduction of the number of insulators and towers, particularly those with ground return. A number of well-known electrical advantages of the direct-current system are enumerated, especially the possibility to use underground cables for voltages considerably above those for which cables are being used today for alternating-current systems. The author realizes, however, that the Thury system, with a large number of 5,000-volt direct-current machines connected in series, has no promising future and that a new method with stationary windings will have to be developed. He foresees a great future for a 15,000-volt direct-current railway electrification, with much lighter locomotives and no telephone interferences such as the present-day single-phase traction entails. The hope is expressed that extensive research work will be carried on along these as yet very little known branches of applied electricity.—*Elektrotechnische Zeitschrift*, July 12, 1923.

Current Loading of Cables.—S. W. MELSOM. — The author considers the various formulas for the heat losses in a cable and from them the heating of the conductor of the cable itself. He deals with the limiting and ambient

temperatures adopted in various countries and under differing conditions, emissivity constants, the thermal properties of various kinds of ground, and the grouping of cables as it affects their temperature rise. He concludes with a discussion of the rating of cables for extra-high voltages where dielectric losses have also to be considered, with comments upon the time constant of cables operating under intermittent loads.—*Beama (England)*, July, 1923.

Units, Measurements and Instruments

Switchboard Instruments for Electric Ship Propulsion.—A twelve-page discussion of the various types of meters that are used aboard ship, of the various errors in reading that are encountered, reasons for these errors and remedies. Typical connections for several types of meters are shown to give an idea of present practice.—*Electric Journal*, August, 1923.

Temperature Rise of Electrical Machinery.—J. T. TAKEUCHI.—The author makes an analysis of the temperature rise in electrical machines and compares the double and single ratings and the distribution of losses. The copper and iron losses have different effects on the temperature rise of the machine because the copper loss is produced in the windings while the iron loss is produced in the core, which is exposed directly to the air. The author solved the problem of these losses by a simultaneous differential equation which takes into consideration the relation between the losses and cooling effects and also heat communication between windings and core. He discusses the relation between efficiency and temperature rise and gives a method by which the relation between temperature rise and capacity may be calculated. He illustrates the theoretical discussion by actual experimental results.—*Journal of Institute of Electrical Engineers of Japan*, July, 1923.

Precise Method of Calculation of Skin Effect in Isolated Tubes.—H. B. DWIGHT.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. summer convention, July 7, 1923, on page 18.—*Journal of A. I. E. E.*, August, 1923.

Illumination

The Carbon Arc as a Standard of Light.—N. A. ALLEN.—One of the most promising methods of maintaining a uniform incandescent surface at low cost is by means of the carbon arc, in which the positive crater may under certain conditions be made to give a perfectly uniform illumination whose candlepower is easily calculable. The best form for the electrodes, conditions of running the arc and the relations between various factors encountered are discussed. — *Electrical Review (England)*, Aug. 17, 1923.

History of the Incandescent Lamp.—HENRY SCHROEDER.—In a thirty-two-page article the author reviews the history of electricity since the invention of the battery, with particular reference to the incandescent lamp. Early incandescent lamp investigators, arc lighting, Edison's experimental work and study, the drawn tungsten wire and recent developments of leading-in wires and "getters" are among the subjects discussed.—*Bulletin L.D. 118A of Edison Lamp Works.*

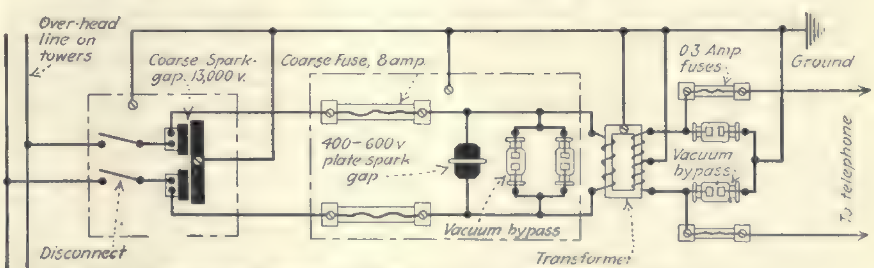
Motors and Control

Electricity in the Portland Cement Industry.—The special conditions which have to be taken into account in motorizing the cement industry are the presence of gritty dust or moisture in some portions of the plant. Most of the machines employed are of a heavy nature requiring gear, chain or belt drive, and in many of them very large masses of material have to be accelerated, so that considerable starting torque is required. At the same time the normal load is usually a steady one and the speed variations required are within small limits. For this reason the alternating-current motors of the induction type are well suited to meet these requirements. Two cement plants which have been equipped electrically, one in England and the other in India, are described. — *English Electric Journal*, July, 1923.

Heat Applications and Material Handling

Welding of Non-Ferrous Metals.—C. J. HOLSLAG.—It is pointed out that the best chance of success in brass welding or brazing lies in getting the metal to be welded impregnated with the filler rod before filling in; in other words, tinning the edges the same as when soldering. Another precaution is not to play the flame on the layer when it is partly filled up until it is spongy-looking, but to add enough filler and go on with the welding. The welding of bronze, monel metal, aluminum and other non-ferrous alloys is also considered.—*Journal of American Welding Society*, July, 1923.

Methods of Handling Materials.—M. W. POTTS.—Automatic and semi-automatic machines have done their part in eliminating waste motion and needless labor in the actual operations of manufacture. But the journey of manufactured goods, from raw materials to finished products in the hands of the consumer, is still an intermittent one, slowed up between the highly efficient processes by woefully inefficient handling. How to reduce the interstage delays and minimize the necessary handling forms the subject of this article, which covers the use of platforms and skids for various types of lift trucks. — *Industrial Management*, August, 1923.



PROTECTIVE SYSTEM FOR COMMUNICATION LINE ON TOWER WITH HIGH-VOLTAGE SYSTEM

Traction

Regeneration Tests of Locomotives.—C. E. FAIRBURN.—Results of various regeneration tests on locomotives supplied to the Chemins de fer du Midi. The system of regeneration used on this railroad was described in the April and July, 1922, issues of this journal.—*English Electrical Journal*, July, 1923.

Decade of the Norfolk & Western Electrification. — Many changes have taken place since the Norfolk & Western Railway made its decision ten years ago to electrify the section over the divide in the Blue Ridge Mountains between Virginia and West Virginia. Operating experience has led to minor changes in the original designs, electrified miles have been doubled since the first project was completed, and changes have been made in overhead construction. Methods of the transportation and other operating departments are described.—*Electric Railway Journal*, Aug. 11, 1923.

Telegraphy, Telephony, Radio and Signals

Protection of Telephone Circuits.—E. FISCHER. — The safe and reliable operation of telephonic communication between a power house and its substations is of vital importance to the system. If the telephone wires are installed on the main high-tension towers, the electromagnetic and static influence between the power and telephone lines make special arrangements necessary to safeguard the operator and to insure an intelligible transmission of speech. The paper describes the latest models of protective devices conforming to the above requirements. The complete apparatus is diagrammatically shown herewith. The coarse spark gap will flash over at 3,500 volts, the vacuum passes will function at 300 volts, and the transformer will not permit more than 200 volts on the receiver in the worst case. These sets have been installed on systems rated up to 60 kv. Similar sets are described for outdoor use, to be fastened to the towers, operating in conjunction with a portable receiving instrument.—*Siemens Zeitschrift*, July, 1923.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Decision Soon on "Romex"

Code Committee Will Meet Oct. 1 to Decide Whether Trial Installations Will Be Permitted

"ROMEX," a flexible, non-armored duplex cable developed by the Rome Wire Company to minimize the cost of providing concealed electric service, will be taken up for final consideration by the new developments sub-committee of the National Fire Protection Association on Oct. 1 to determine whether it will be allowed for trial installations under supervision. This permission is sought by the manufacturer because concealed installations of this or any cable without a grounded metallic sheath in the form of armor or conduit are contrary to the rulings of the National Electrical Code. The new product has been submitted to various tests at the Electrical Testing Laboratory at Chicago. The results, according to manufacturers, have been very satisfactory. However, the data are not available for publication at this time. The question of permitting trial installations of "Romex" was first thrown open for public discussion before the electrical committee of the National Fire Protection Association on July 17 last, as recorded in the ELECTRICAL WORLD of July 28.

CONTRACTORS OPPOSE MATERIAL

Copies of several briefs submitted to the Underwriters' sub-committee have been made available to the ELECTRICAL WORLD. One is a resolution passed by the Electrical Contractors' Association of New York and also by the Electrical Contractors' Association of Brooklyn and Queens to the effect that installation of "Romex" wire without a grounded metallic covering would not be in the interest of good electrical construction work and that the Underwriters' committee should not approve it for trial installation. This is urged, the resolution points out, for the following reasons: Liability to mechanical injury, absence of metallic covering that can be grounded, necessity of developing new standards to cover protection of conductors, the questionable saving involved, and the fact that allowance of a field trial is practically equivalent to full approval.

Similar action has been taken in three other cities, among them Cincinnati, where the Electric Club went on record as follows: That any changes in the code should be in the direction of greater safety. Any other proposed changes should be submitted to the entire industry for a sufficient length of time for opinions to be submitted to the code committee before action is taken. Objection was also raised to the non-compliance of "Romex" with rules 26, 26d and 26s of the code and because no evidence has been produced that proves sufficient economy in the new construction to justify lowering existing standards.

A little more than one week remains in which advocates and opponents of allowing trial installations of this new product can submit briefs to the National Fire Protection Association committee on new developments. Dana Pierce is chairman of the committee.

Quick Restoration of Service in Wake of Berkeley Fire

The disastrous fire which swept over Berkeley, Cal., on the evening of Sept. 17, completely destroying forty blocks in the residence district and causing property damage amounting to $10,000,000, caused the Pacific Gas & Electric Company to sustain a loss of about $30,000 to its distribution system, which was completely wiped out within the area burned. The plant of the Pacific Telephone & Telegraph Company was damaged to the extent of about $60,000. Lighting and telephone service were restored to all buildings left standing within twenty-four hours after the fire started. It was confidently expected that street-lighting service would be restored within forty-eight hours.

Boston Edison Seeks 20 per Cent Stock Increase

Permission to issue 64,881 shares of additional stock has been sought by the Edison Electric Illuminating Company of Boston from the Massachusetts Department of Public Utilities, following a stockholders' meeting at Boston, Sept. 10, the increased capital being required by the rapid development of the system and construction of the new tidewater steam generating plant at Weymouth. President C. L. Edgar said that about $11,000,000 will be expended on the Weymouth station in the near future. Mr. Edgar said that it is hoped to have the initial section of the plant in operation by the fall of 1924 and that it will cost about $3,000,000 to connect the plant with the rest of the system. The commission will hear the company Oct. 1, at which date the desired issue price will be announced.

Officials Not Backing Ford

No Truth in Report that They Favor Acceptance of Old Offer with Gorgas Plant Left Out

AN UNAUTHORITATIVE opinion sent out of Washington lately to the effect that if Henry Ford will renew his offer for the war-time nitrate plants and power projects at Muscle Shoals with the Gorgas steam plant eliminated the administration will assist him to obtain the remaining and major developments, including the water-power rights, may be disregarded. The Washington correspondent of the ELECTRICAL WORLD reports with authority that there is not one scintilla of truth in the idea that any such bargain is under discussion with the administration.

The Secretary of War is proceeding with negotiations for the sale of the government's Gorgas plant to the Alabama Power Company because since Congress adjourned he has received from the Judge Advocate General of the Army and the Attorney General of the United States opinions which declare that the contract entered into between the company and the government for the final disposition of the plant is a valid one and binding upon the government. The Alabama Power Company, under the terms of this contract, served notice on the government that it desired to see the agreement executed. Under its terms the government must either sell the Gorgas plant to the company at a fair value to be agreed upon or remove the plant from the lands of the company. If neither of these conditions is fulfilled by Oct. 24, the plant will automatically become the property of the company without the payment of a dollar. The company, as already reported, has extended the time in which the government must decide whether to accept its offer.

BELIEF FORD WILL DRAW OUT

Under the negotiations, if they come to a successful conclusion, as they are expected to do, the government would sell its Gorgas unit to the company for a sum between $3,000,000 and $3,500,000. The latter sum deducted from Mr. Ford's old bid of $5,000,000 would put him in the position of offering $1,500,000 for property representing an investment to the government of $106,000,000 and which, the War Department pointed out to the last Congress, could be sold as mere junk and scrap for $18,000,000. There is no one in Washington, says the correspondent of the ELECTRICAL WORLD, who believes that Congress would turn such enormous

values over to Mr. Ford for $1,500,000, and there is no one in Washington who believes that Mr. Ford will dare to come forward with any such offer. This leaves him in the position of being obliged to make a new offer for Muscle Shoals some time between now and next December. The opinion is gaining ground in official circles that Mr. Ford will not come forward with a new offer and that he really does not want Muscle Shoals at all.

Links Earnings and Service

Commissioner Tells Michigan Association Public Will Not Begrudge 10 per Cent if Earned

GIVE such efficient and cheap utility service that the public will not question a 7 or even a 10 per cent rate of return and that the Public Utilities Commission will gladly stand back of the companies and let them have an incentive to do their utmost—this was the opening message that W. W. Potter, chairman of the Michigan Public Utilities Commission, delivered before the annual convention of the Michigan Electric Light Association, held at Grand Rapids from Sept. 18 to Sept. 20. After tracing the rise of regulation, Mr. Potter expressed his opinion that in these days the greatest weakness of the utility companies was too much use of red tape, instead of allowing good management sense to dictate what should be done. He believed that when utilities showed real initiative, an ability to serve and a willingness to admit the rights of the people they should be encouraged in every way.

Reviewing the year's work of the Utility Information Bureau of Michigan, Director Alfred Fischer spoke of the 45,000 column-inches of newspaper space given to utility matters in 1922. For this year this space will reach more than 60,000 column-inches. He dealt with the four purposes for which this bureau is maintained, namely, furnishing information to newspapers about the utility companies, directing educational courses on utility matters in colleges, providing a speakers' bureau, and finally helping the utility companies in any particular problem that may arise. He especially urged that all executives interpret the engineering problems affecting service so that they can be understood by the every-day public.

On Wednesday morning George Opp, safety engineer Detroit Edison Company, told how accidents can be controlled, quoting examples from his own experience. He estimated the relative value of methods for preventing accidents as follows: Proper organization, 55 per cent; education, 30 per cent, and safeguarding, 15 per cent. Although only 6 per cent of the accidents at the plants of this company were due to contact with electricity, 62 per cent of the accidents from electric shock were fatal. This showed the need for developing a dynamic electrical sense among operators and workers.

Rural Service Problems

G. C. Neff, Madison, Wis., discussed the fundamentals of economic rural electric service. He said that since the farmer wanted the service he should be so instructed in the benefits of a wider use of electrical energy that the utility need not lose by supplying him. After laying stress on what had been done during the past year, Mr. Neff declared that it was right and proper for utility executives to see that their problems are presented to the farmers. The farmers, he remarked, are fair-minded once they know the facts.

The Thursday sessions of the convention were given over to a paper on overhead-line construction by B. L. Huff, Consumers' Power Company, Jackson; an account of the meter school at the University of Michigan by Prof. B. F. Bailey, a discussion of the Michigan commission Order No. 1,692 by M. K. Toeppen, chief engineer of the commission, and a paper on wiring standards by R. C. Loughead, chief engineer Michigan Inspection Bureau.

The First Mercury Turbine

ABOVE is a view of the mercury turbine, boiler and condenser which, as related last week, page 553, were put into service at the plant of the Hartford (Conn.) Electric Light Company on Sept. 7, this being the first application to commercial service ever made of power generated from heated mercury vapor.

Problems of Local Leagues Canvassed

Second Annual Conference on Association Island, N. Y., Discusses Organization and Functions of These Bodies and Listens to Many Instructive Experiences

CAMP CO-OPERATION III, the second annual conference of electric local leagues and clubs, was held on Association Island, Henderson Harbor, N. Y., Sept. 16-19. More than one hundred and fifty delegates from local leagues and representatives of all branches of the electrical industry, including a number of prominent executives of central-station and manufacturing companies, gathered at the invitation of the Society for Electrical Development to discuss league problems. The camp was opened with appropriate ceremonies on Sunday afternoon, addresses being given by J. Robert Crouse, who is called the "father of co-operation in the electrical industry"; W. E. Robertson of Buffalo, and W. W. Freeman of Cincinnati, president of the Society for Electrical Development. Mr. Freeman said that thirty local electrical leagues have been organized since the last league conference and thirty more are in process of formation as a result of the work of the society in seventy cities, entailing more than seven hundred thousand miles of travel. The society acted merely as the host at the conference, and the meeting was entirely in the hands of the league representatives.

W. E. Robertson was elected chairman of the conference, and five sessions were devoted to the discussion of league problems and the exchange of league experience. Monday morning's meeting was devoted to the purposes of league work and a detailed discussion of how to put national ideas to work locally. P. L. Thompson of New York, recently returned from a European trip, contrasted the conditions here and abroad. "No organized co-operation is in evidence in European countries, and the advantages which this idea has brought to the electrical industry in America stand as an inspiring proof," he said, "that electrical men here should carry forward the idea of co-ordination and co-operation, not only in national but in local work."

L. D. Gibbs, Boston, pointed to the need for a national "tie-in" for local leagues that would co-ordinate their activities and clear their experiences for general application.

J. H. Y. Kidd, Poughkeepsie, and P. B. Zimmerman, Cleveland, discussed the advisability of determining on a standard name for electric leagues to promote the spirit of unity among them.

Progress of Local Leagues

A. M. Little and W. Brewster Hall, Syracuse, described the organization and development of the Syracuse Electric League. F. D. Van Winkle and M. A. Curran told how the Cincinnati delegation had returned home from Camp Co-operation II last year and reorganized their league and described the success of the Cincinnati fall festival, just closed, which the electrical industry dominated. Harry Dawson, Providence, outlined the progress which

his league has made as an outgrowth of the inspiration received from the conference last year. L. R. Davis, the field man of the Association of Electragists, discussing the functions of the league, pointed out that the fundamental purpose must be the development and extension of the local market and warned leagues against becoming involved in inter-group controversies.

P. B. Zimmerman, acting as temporary chairman, conducted a presentation and discussion of the importance of residence lighting in league work. This was the first of a series of commodity programs in which was emphasized the opportunity for the league to engage directly in the development of specific commodity fields. J. F. Burns of Schenectady, D. P. Lockard of Pittsburgh, J. M. Fried of Pittsburgh, C. A. Collier of Atlanta, Helen Smith of Rochester, Carl Jackson, R. J. Canniff of Poughkeepsie, George E. Cullinan, N. T. Wilcox, F. M. Lille and President Gillinder of the Illuminating Glassware Guild contributed to the discussion.

Co-operation in California

An interesting story of the status of co-operation in California was related in the Monday evening meeting by E. A. Shreve, San Francisco, representing the California Co-operative Campaign. Mr. Shreve emphasized the principle of having all the electrical men of every community members of the league and stated his opinion that California electrical men are becoming more favorable to national co-ordination and his belief that the national organization of local league work will be of distinct benefit to the work in California. He described the newest plan of electrical demonstration which the California Co-operative League has instituted. This takes the form of a Pullman car electric home demonstration and an "electricity on the farm" display in a baggage car which is being transported about the state and exhibited in small communities. J. S. Trittle of New York, M. A. Curran of Cincinnati, L. Strauss of New York, W. T. Blackwell of Newark, Louis Kalisher of Brooklyn and W. L. Goodwin entered into the discussion.

Considerable time was devoted to experiences in putting on electrical home demonstrations. J. Caddingan of Boston, D. P. Lockard of Pittsburgh, J. S. Buchanan of Philadelphia, W. B. Hall of Syracuse and T. R. Huber of Rochester described in detail the operation and success of homes in their cities. Kenneth MacIntyre crystallized league experience by describing methods and practices which have been developed in a large number of electrical homes scattered through the country which he has visited in the service of the society. It was the sense of the meeting that it was fatal to commercialize an electrical home by endeavoring to make money either in the sale of appliances or by purchasing and endeavoring to resell furnishings or the property itself. Attempts at this have brought failure.

The vital importance of local field work was emphasized by L. R. Davis, New York, who has worked in intimate co-operation with most of the leagues of this country as a representative of the Association of Electragists.

He emphasized the particular need of relieving the league secretary from routine work and putting the burden of executive responsibility on the executive committee and officers of the league so that the secretary may remain free to engage in active field work. This point of view was heartily indorsed from many quarters. It was also the common experience that the social side of league activities must be clearly divorced from the work of market development, and that, concurrently, new timber must be developed within the organization and carefully schooled to carry on both the social and the market development work.

City League's Duty to Suburbs

H. A. Lane of the Joint Committee for Business Development pointed out the responsibility of the city league to ultimately extend its activities and influence to embrace surrounding towns and villages that the spirit of league work may be carried into the smaller communities. An interesting field activity which has been instituted in Toronto was described by G. W. Austen. A red seal was issued to builders to post on houses which have electrical installations up to the standard set by the local league. Similar seals are posted in the switch cabinets. This league indorsement is being advertised to the public and is having a material influence on raising the standard of electrical construction. In Denver, Cleveland, Winnipeg and Providence radio broadcasting has been inaugurated by the leagues in order to tell the electrical story more broadly. J. D. Israel, Philadelphia, and M. R. Griffeth, Boston, discussed field work which is being done by their local organizations.

"Electrical Housekeeping"

A most successful innovation was introduced on Tuesday afternoon in a series of talks by Miss Alice Carroll, Society for Electrical Development; Mrs. M. H. Norris, Westinghouse Electric & Manufacturing Company; Miss Helen Smith, Rochester Gas & Electric Corporation; Miss Edith Nichols, Western Electric Company; Miss A. B. Swan of the Public Service Company, Newark, N. J., and Mrs. J. F. Burns, Schenectady. The subject was "Electrical Housekeeping," and the speakers developed the feminine viewpoint on electricity in the home with delightful humor and with an appreciable degree of satire pointed out some of the fallacies of putting the work of electrifying the home into the hands of men. Definite experiences that have transformed electric home demonstrations from a house full of equipment into a natural home atmosphere were described in detail. E. L. Milliken, Woonsocket, made a strong plea for more attention to the training of high-school girls in electrical housekeeping methods. J. A. Brett of Cincinnati, R. J. Canniff of Poughkeepsie, Mr. Palmer of Malden, and O. F. Rost of Newark took part in the discussion.

Newspaper Publicity

Earl E. Whitehorne acted as chairman of the afternoon session on Tuesday, which was devoted to a general discussion of newspaper publicity from the league standpoint. J. E. North, Cleveland, gave in detail the extensive experience of the Cleveland league in developing co-operative electrical pages and other publicity measures. The general discussion that followed gave strong indorsement to the work which the Society for Electrical Development is doing in the promotion of newspaper publicity and magazine publicity and advocated the establishment of electrical pages wherever possible.

Thomas F. Logan, president Thos. F. Logan, Inc., New York, made an address on the subject of "Advertising in the Local Market." J. Y. Fletcher, director of the General Electric Company, Ltd., in London, expressed his astonishment at and admiration of the degree of co-operation which exists in the electrical industry in America. "Electrical men in Great Britain," he said, "have not yet discovered the value of co-ordination and harmony in market development, and the results of co-operation here have convinced me that the backwardness of electrical development abroad is largely attributable to the absence of this spirit of working together."

A very enjoyable banquet took place on Tuesday evening, with J. Robert Crouse as toastmaster. Among the speakers were Frank D. Van Winkle, J. Y. Fletcher of London, R. A. Lundquist of the Department of Commerce, H. A. Lane, representing M. R. Bump; Earl E. Whitehorne, L. R. Davis and O. F. Rost.

The Wednesday morning session was devoted almost entirely to the discussion of the need for a national direction for league activities. A resolution providing for a third annual conference at Association Island next year was passed.

First Steps in Massachusetts Superpower Project

Securities to the total of $600,000 par value have been authorized for issuance by the Montaup Electric Company in a decision of the Massachusetts Department of Public Utilities handed down last week in connection with the proposed development by Stone & Webster, Inc., and the Fall River Electric Light Company of a superpower steam plant on tidewater at Fall River, with interconnecting transmission lines to the systems of the Blackstone Valley Gas & Electric Company, Pawtucket and Woonsocket, R. I., and the Edison Electric Illuminating Company of Brockton, Mass. The New England Power Company opposed the project at a recent hearing before the commission.

Condemn Irregular Mining

Investigations for Coal Commission Show Effect of Intermittent Operation on Unit Cost

AMONG the chapters of the forthcoming report of the United States Coal Commission already made public is one on the "Effect of Irregular Operation on the Unit Cost of Production of Bituminous Coal," based on engineering studies made for the commission by C. E. Lesher, editor of *Coal Age*, and R. A. Walter. The conclusions to which these studies led are thus summarized by the investigators, a diagram aiding the reader in grasping their meaning:

"Cost of production is at the minimum when the mine is worked full time—that is, twenty-five days per month—and has no idle days. The loss of one day's operation increases the average cost 1 cent on each dollar of cost, or 1 per cent; the loss of two days in the month increases the cost 2 per cent.

"Thus, if the mine loses eight days out of twenty-five in the month, the average cost of production is increased 10 per cent, that is, 10 cents on each dollar of cost. If the mine is a 'low-cost operation,' with a full-time cost of say $2 per ton, when it is idle eight days the average cost amounts to $2.20. If a 'high-cost' mine, with an average of $3.50 per ton when working every day, the average cost per ton in a month when eight days were lost would be $3.85 per ton, or 10 per cent greater.

"When the time lost exceeds one-third of the month—that is, from nine days upward—the increase in average cost rapidly increases. If the mine is worked twelve days and loses thirteen days, costs are increased 25 per cent. If seventeen days are idle, the cost is nearly 50 per cent over the minimum.

"If but one day a week or four in the month is worked, the cost is more than doubled. Two days of operation per month raises the average cost per ton 263 per cent and each dollar of minimum cost becomes $3.63. If but one day is worked, the cost increases by the amount of 549 per cent."

This study was based on statistics from 266 mines in four states and covered operations in 1918. The costs at this group of mines, as was reported in the ELECTRICAL WORLD last week, ranged from $1.20 to $2.80. The study shows very clearly the great advantage that would ensue to coal-burning plants from steady operation of the mines as opposed to irregular and intermittent mining.

Losses in Mining Bituminous Coal in Eastern States

A thorough investigation of the "waste of coal" has been made by direction of the Coal Commission under the supervision of the Bureau of Mines. The commission will submit a report on the "Amount and Nature of Losses in Mining Bituminous Coal in the Eastern United States," which will include a full description of the fields visited in each state with the details of the field investigation. The official summary of this engineers' report says that the coal-producing states east of the Mississippi River were selected for the reason that their combined production is approximately 90 per cent of the total production of all of the states and for the further reason that the Bureau of Mines did not have sufficient mining engineers to assign to a similar study of the coal-producing states west of the Mississippi.

The facts were determined by calculations of the areas extracted, the areas remaining and the tonnage produced over a number of years. The ten states in which the investigations were made embrace seventy-one districts; underground examinations were made in 333 mines; authentic data were secured from an additional 1,049 mines, and the total time spent by the engineers amounted to 220 days in the field and a similar period in office work.

In classifying the data relating to losses it was recognized that in mining a coal deposit certain conditions determine some of the losses that may be called avoidable or unavoidable. The principal causes of losses were found to be coal left on the roof and bottom, coal lost in room entry and panel pillars, coal lost in oil and gas-well pillars, coal lost under buildings, railroads and boundaries, coal lost in handling and preparation, underground and surface, and coal lost by rolls, thin or dirty areas and streams.

The coal lost in mining, based upon the production of coal in 1921, reached a total of 196,168,000 tons, of which 109,605,000 tons is classified as avoidable loss. The percentage of coal lost ranges from 20 in Virginia to 49 in Illinois, the average for the ten states being 34.7 per cent, and the avoidable loss ranges from 5 per cent in Virginia to 29.7 per cent in Illinois, the average avoidable loss for the ten states being 19.4 per cent and the unavoidable loss averaging 15.3 per cent. The total avoidable loss of tonnage was equivalent to the production in 1921 of Illinois, Alabama, Indiana and Virginia.

The causes for this avoidable loss are listed under six divisions.

American Firms Ready for Reconstruction in Japan

Reconstruction orders are already being taken by the Westinghouse Electric & Manufacturing Company for work in Japan, where, President E. M. Herr says, the electric light and power plants in both Tokio and Yokohama are destroyed, though probably much machinery will be salvaged. The transmission lines are thought to be little damaged. By the destruction of the building in which it had its offices, the Westinghouse company, which has no factory in Japan, lost all its engineering records, sales data, drawings and so forth. It is possible that the offices will be re-established in Kobe rather than in Tokio.

Though, as reported in these columns last week, the International General Electric Company's laboratory building at Kawasaki, half way between Tokio and Yokohama, was completely destroyed with heavy loss, the remainder of its plant at that place escaped with comparatively small injury. One building was partly destroyed and others damaged. At this plant many hundred natives were employed.

Attendance Records Broken

Rocky Mountain Division Has Highly Successful Meeting—Quarterly Gatherings to Be Held

WITH a 50 per cent increase in attendance over the previous high mark, established last year, the annual joint convention of the Rocky Mountain Geographic Division of the National Electric Light Association and the Colorado Public Service Association at Glenwood Springs, Col., Sept. 17 to 19, broke all division records. Though marred by a period of heavy rains and cold weather, the sessions, from both the program and the social viewpoint, were highly successful. A large number of heads of utility companies were in attendance, as well as an unusually large number of ladies.

Better public relations, customer ownership and co-operative business development were the outstanding subjects of discussion. Nearly every paper and report presented dealt with one or more phases of these utility problems. Rate structures and municipal ownership also came in for their share of treatment, and electric cookery and commercial applications of various kinds were exhaustively discussed.

"Generating Good Will," by John W. De Maine of the Minneapolis General Electric Company, and a discussion of "Timely Topics" by Clare N. Stannard, vice-president and general manager of the new Public Service Company of Colorado, were two of the chief items on the program.

Mr. Stannard resigned as the incoming president of the Colorado Public Service Association and was later elected third vice-president of the Rocky Mountain Division, N. E. L. A. Ben S. Read, president of the Mountains Telephone & Telegraph Company, succeeded him as head of the Colorado utilities group, while all division N. E. L. A. officers were moved up one notch, though their new offices will not be assumed until July 1 next year. At that time Norman Read, manager of the Colorado Power Company, will succeed D. C. McClure as president. Mr. McClure presided jointly at the convention with Ernest Stenger, receiver of the Denver Tramway Company, the retiring president of the Colorado Public Service Association.

Three quarterly meetings, one each in Denver, a Wyoming city and a New Mexico city, in addition to the annual convention at Glenwood Springs, were approved, and the first of these gatherings will be held at Albuquerque, N. M., early in November.

Oppose Ferris Amendment

Strong Effort to Prevent Construction of Power Houses and Lines in New York Forest Preserve

DEFEAT of the Ferris amendment to the New York State Constitution permitting the use of not to exceed 3 per cent of the Forest Preserve for the building of transmission lines and power stations in connection with hydro-electric development is more than possible when it goes to the people for approval at the general election in November.

This amendment to the constitution is, it is claimed, of vital importance if St. Lawrence River power is to be developed and economically distributed in the territory of the capital district and the cities further south. As the constitution now stands, no timber can be cut on the Forest Preserve, which would mean that the only way power from the St. Lawrence could be transmitted to the central and southern part of the state would be to carry it around the Adirondacks instead of by a direct route from the river to its destination.

A well-planned attack has been made upon the proposed amendment by the self-styled "Committee to Prevent the Exploitation of the Adirondacks." The chairman of this committee is John G. Agar of New York, and its executive committee of nineteen numbers among its members men prominently identified with the Adirondacks and with conservation and forest and game protection. The committee has issued a booklet in which it condemns the proposed amendment as having been passed in the interests of the lumber and power men, as providing for fifty-year leases with no provision for compensation to the state, as permitting the destruction of millions of trees and as creating "highly artificial, unsightly and dangerous conditions." Though not opposed to necessary water storage, the committee condemns the manufacture of hydraulic power in the Forest Preserve and its transmission thence by high-tension lines.

In Defense of the Amendment

Advocates of the constitutional amendment, on the other hand, point out that as a matter of fact it passed two successive legislatures as a bipartisan measure and was drafted to coincide both with the Esch law of the United States and the Robinson law of New York State regulating the development and lease of state-owned water power. New York State has now reached a tentative working agreement with federal authorities over the question of state sovereignty of water power and when certain incongruities between the Esch law and the Robinson law are clarified will be in position to bring about speedy development of state-owned power either through state or private agencies.

The Ferris amendment fits into the general scheme of development of state-owned power, its friends say, and its passage is deemed absolutely essential if any consistent attempt is to be made to develop and distribute energy from the St. Lawrence. Its lack of approval will, they contend, mean setting back for from two to four years the fulfillment of a complete ultimate plan for the development and distribution of state-owned power. Constitutional amendments must be passed by two successive legislatures under two different administrations.

Although the State Senate, which, like the Assembly, passed the amendment in the closing hours of the last session, has a small Democratic majority, the Democratic party had declared against the amendment in its 1922 platform, and Governor Smith has issued a manifesto asking for its defeat by the voters.

How Drought Has Affected New York Hydro Plants

Hydro-electric plants of New York State report that the continuing drought this summer has produced the lowest water in twenty-five years, according to a statement issued by the New York State Committee on Public Utility Information. More electricity generated from water power is used in New York State than in any other except California, and the drought would have compelled hundreds of up-state factories to shut down if the electric companies had not been able to maintain their regular service. This they have done by reason of the extensive system of interconnection, which has permitted the exchange of power between generating stations according to the demand, and by utilization of steam generating stations only called on for standby service in emergencies.

Owing to the slight rainfall many streams in the state have almost dried up. The Upper Hudson, Raquette and Mohawk Rivers have been extremely low. Watertown and the Black River section of the Adirondacks report the lowest water since 1896.

Under normal conditions Albany gets its electrical energy from the hydro-electric plant of the Mohawk at Cohoes. The river flow has been so diminished that a steam generating plant at Albany, ordinarily held in reserve, has been making electricity for the capital city and has been sending power back into Cohoes and into the Adirondacks.

A group of utilities whose interconnected lines extend from the Central Adirondacks and along the Mohawk and Hudson valleys as far south as Newburgh depends in normal times almost entirely on water power. It has been able to maintain its service by running a steam generating plant at Amsterdam full time and pouring power from other steam plants at Mechanicsville and Poughkeepsie into the general power pool.

The Oswego and Salmon Rivers, which contribute power to the big system which supplies a large part of western New York, have been so low that a steam generating plant at Lyons has been called on to help.

For Federal Superpower

Creation by Government of a National Hydro System Favored by Public Ownership League

THE main resolution passed by the Public Ownership League of America at its meeting in Toronto, of which the opening sessions were reported in last week's ELECTRICAL WORLD, page 558, advocated government establishment and operation of a hydro-electric superpower system for the United States. The resolution was couched in these terms:

"Resolved by the Public Ownership League of America, that the executive officers of this organization be and they are hereby instructed to proceed at once, in co-operation with such members of Congress and other public officials and public-spirited citizens as may be found willing to help, to draft a suitable measure for introduction at the next session of Congress providing for a United States superpower commission either by the expansion of some existing federal government agency or by the creation of a new one that shall act in co-operation with other federal agencies concerned with the waterways and with irrigation, navigation and the conservation of the natural resources of the nation, and with the local municipal and state governments, in the development of a nation-wide hydro-electric superpower system, to be publicly owned and operated, for public service at cost upon the principles outlined above; and

"Be it further resolved, that an appeal be made to the governors of all the states, the state legislatures, and especially to the municipalities throughout the nation, for their support and co-operation in getting the superpower measure through Congress and the public superpower movement into actual operation throughout the nation at the earliest possible date; and

"Be it further resolved, that we pledge our support and co-operation to individuals and organizations both political and non-political, commercial, civic and all others, that consistently favor, vote and work for the public superpower system."

Side Lights of the Meeting

There were several interesting side lights at the meeting. R. Husselman of Cleveland linked customer ownership with advocacy of taxation of government securities and with publicity work as "propaganda schemes of the private power companies." Margaret Haley of Chicago, head of the schoolteachers' organization in that city, declared that the teachers were prepared to move directly against all private utilities and were against private operation as well as private ownership. Although, as Miss Haley admitted, the schools are supposed to be secure against propaganda, yet she told how the teachers had used schoolchildren to get signatures to petitions.

O. T. Erickson of Seattle said that city had made some stupid blunders.

The Skagit River project was one of them—first $5,000,000 had been spent, then another $5,000,000, then another $5,000,000, and no one knew exactly where it would end. He said private utility men and engineers knew what they were doing when they let Seattle have Skagit because it was a "lemon." The Seattle street-car system was also a blunder. The city paid more than it should have done for a worn-out system, according to Mr. Erickson, which in itself showed the frailty of public officials.

Carl D. Thompson, secretary of the league, made a plea for more funds. He asserted that last year he had a budget of $7,000 to assist communities in fighting private ownership and that aid was given to thirty-two separate communities. He said that he was opposed by the resources of the National Electric Light Association, Wall Street bankers and others with large funds at their disposal. After Mr. Thompson's report funds were pledged indicating a slightly larger sum for 1924.

The first definite move of the league is to be staged in Washington and Oregon, where it will work for state-owned and state-operated superpower systems.

How the S. E. D. Educates the Public

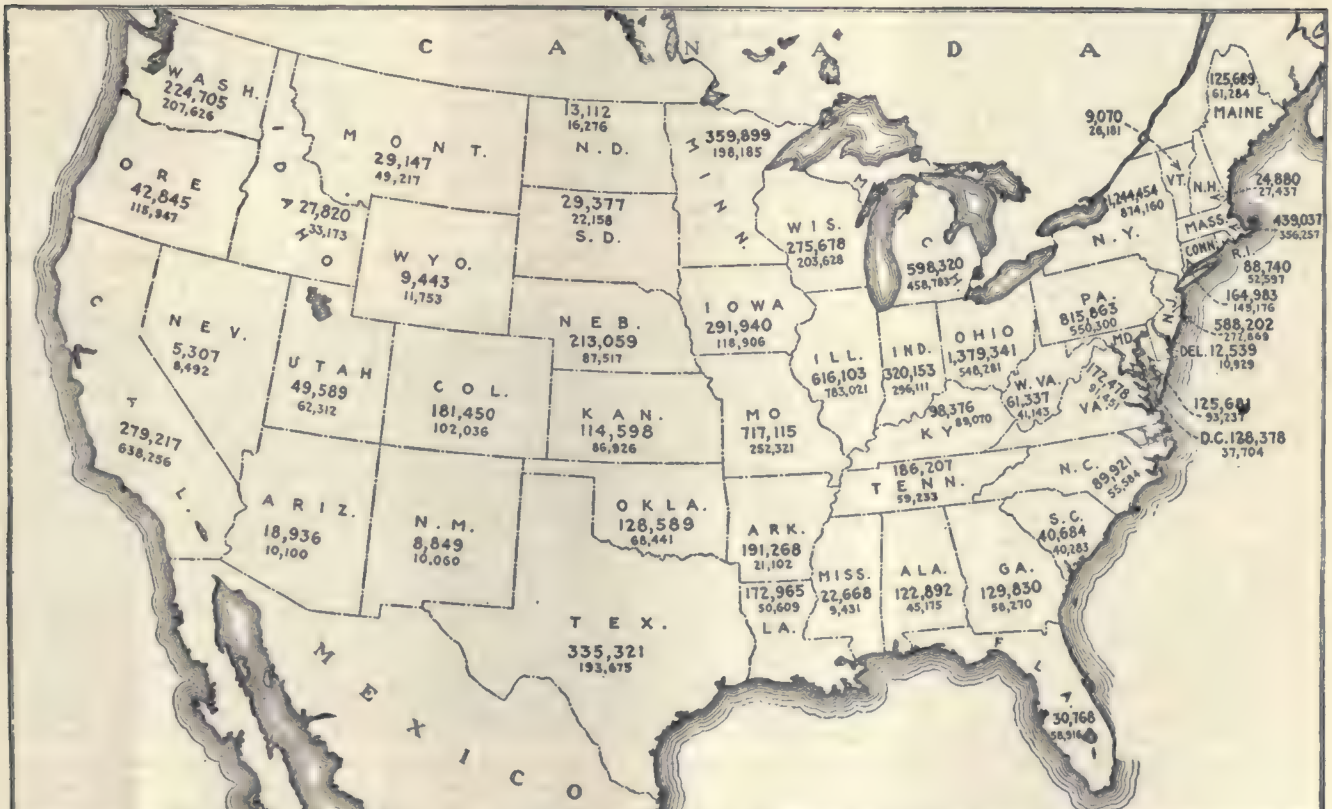
Annual Report of the Society Tells of Newspaper Service and Other Forms of Publicity—Varied Activities of the Organization—Two Intimate Functions Set Up

UNDER the headings "Educating the Public," "Trade Relations," "Promotion of Local Activities," "Commodity Sales Planning," "Guarding the Industry's Good Will," "Statistical Aids to Trade Promotion," "Co-operation with Other Organizations" and "Accomplishments of the Council," *Do It Electrically*, the monthly publication of the Society for Electrical Development, abstracts in its August number the annual report made to the board of directors by W. L. Goodwin, assistant to the president. The varied activities of the society and the results achieved in the past year are recounted, and the broad establishment of two intimate functions is recorded—one the task of being a center for the distribution of information to the public concerning the electrical industry, the other the setting up of a workshop for putting into action promotion programs which have been initiated by committees of various other organizations and which touch the merchandising or selling work of the electrical industry as a whole.

Several striking charts reduce to a form quickly grasped the statistics contained in the report. An outline map of the United States, for instance, shows the circulation in every state of the daily newspapers using the society's news service and the number of wired homes in the state. The society does not "use" the newspapers or indulge in "hit-or-miss" propaganda. On the contrary, when its service is supplied this is done at the request of editors. The newspaper-reading population reached daily by the service is more than eleven million persons, or 34.2 per cent of the estimated total newspaper-reading population, which is figured at between sixty-nine and seventy millions. Twenty-three per cent of the newspaper-reading population of Canada is reached.

How Budget Is Divided

A chart showing proportionate appropriations by the society for next year in its budget of $200,000 gives these figures: Lighting, $40,000; cooking, $30,000; storage-battery transportation, $25,000; industrial heating and power, $25,000; electrical homes, leagues and other local activities $20,000; table and socket appliances, $12,000; washing machines, $10,000; electric cleaners, $10,000; better wiring and convenience outlets, $10,000; domestic refrigeration, $2,000; fire investigation, $2,000; small-motor applications, $2,000; dishwashers, $1,000; fans, $1,000; all other activities, $10,000. Member companies may designate just how their contribution shall be applied.



NEWSPAPER READERS REACHED BY THE SOCIETY IN EVERY STATE

The heavy figures show the circulation of daily newspapers using the society's news service, and the light-faced figures the number of wired homes in the state. The total newspaper circulation that is served is 11,356,877, or with Canada 12,103,828.

Move for Public Ownership

In State of Washington a Measure for Forming Public Utility Districts Is Prepared

A TENTATIVE draft of an initiative measure providing for the formation of public utility districts in the State of Washington, giving these districts sweeping powers, has been prepared and is being sent to interested bodies throughout the state. The bill is sponsored by the Public Ownership League of Seattle and embraces a public ownership program of far-reaching character. The movement was started by Oliver T. Erickson, Seattle Councilman and one of the leaders of the public ownership group of that city.

Through the creation of public utility districts machinery is provided for the public ownership and operation of light, power, irrigation, water supply and drainage projects, and in addition telephone systems. The bill was originally drafted by Thomas J. L. Kennedy, Corporation Counsel, and was revised by a group of Seattle lawyers. The bill follows the plan under which the Province of Ontario is operating its publicly owned systems, but instead of a commission with supervisory powers covering the entire state, the proposal is to give complete authority to local improvement district commissions.

Broad Powers for Utility Districts

Under the proposed bill broad powers are granted to the utility districts, which are authorized to construct, condemn or purchase and operate light, power, irrigation, water-supply, drainage and telephone projects, purchase or sell light, water or power, borrow money or issue general or utility bonds, levy a general tax not exceeding 2 mills and institute municipal operation of steam or other plants. The size of the public utility districts is not limited, and the governing body is to be an elected commission holding office for a term of six years. This commission is to be headed by a president, who is to be assisted by four commissioners.

The utility districts can be formed on the initiative of a certain number of voters, varying from 500 to 100, depending on the size of the county. If the majority of the voters approve of the forming of the district, the proposition carries and the district becomes "a municipal corporation of the State of Washington, within the powers prescribed in the act."

The Public Ownership League has mapped out a course to follow in the placing of the bill before the people of Washington. The tentative draft will first be sent to labor councils, farmers' leagues, civic and commercial bodies and other organizations to secure their approval if possible. Petitions for the submission of the bill to popular vote will be circulated early next year. As only 40,000 signatures are needed to secure a place for the bill on the 1924 ballot, the matter will probably come before the voters a year from this November. A majority vote in favor of the initiative measure would automatically make the bill a law of the State of Washington.

Hetch Hetchy's Total Future Cost Put at $173,000,000

At the meeting of the San Francisco Board of Supervisors held Sept. 11, when, as reported last week (page 558), a resolution was passed declaring for municipal distribution of Hetch Hetchy energy and the purchase of a distribution system, City Engineer O'Shaughnessy submitted a report in which he recommended that condemnation proceedings be started by the city to acquire the distributing systems of both the Pacific Gas & Electric Company and the Great Western Power Company within the city limits. Owing to the delay in taking over these systems he recommended that the city accept the offer of one of the power companies to market the power temporarily at an estimated annual revenue to the city of approximately $2,000,000. In recommending that the city attorney be instructed to file condemnation suits immediately, to be followed by a bond election, Mr. O'Shaughnessy advised that the city buy from the power companies whatever energy would be necessary in excess of the Moccasin Creek plant output. This plant will supply only approximately 45 per cent of the city's requirements.

The city engineer's report put the initial capacity of the Moccasin Creek plant at 70,000 kw. and that of additions to the plant at 35,000 kw., estimating the ultimate capacity of the Hetch Hetchy project at 173,000 kw. To complete the Hetch Hetchy project, he said, $32,000,000 would be required; to buy the Spring Valley water system $38,000,000; to build the Early Intake and North Mountain power units $18,000,000. Adding to these sums the probable cost of a distribution system, $45,000,000, and the annual cost of extensions and additions at $2,000,000 a year for twenty years, $40,000,000, an ultimate financial requirement totaling $173,000,000 is arrived at.

The report said that neither the Pacific Gas & Electric Company nor the Great Western Power Company is willing to sell its distribution system on the pay-as-you-go plan. Both companies indicated their willingness to act as the city's agent in marketing the power at such a figure as will return to the city from $2,000,000 to $2,150,000 yearly, or more than 5 per cent on a capital investment of $40,000,000.

Owing to the present limit of bonded indebtedness of the city of San Francisco it would probably be necessary to revise the city charter before the people could be asked to vote bonds for the building of a distribution system within the city. By the terms of the resolution an advisory committee of five citizens will be appointed by the Mayor to report recommendations within thirty days.

Santee River Project

Charleston (S. C.) Company Asks for License and Sees Great Future for Proposed Development

AN APPLICATION from the Columbia Railway & Navigation Company of Charleston, S. C., has been made to the Federal Power Commission for a license for its proposed project contemplating diversion of the Santee River at Ferguson, S. C., into the Cooper River at a point near Monck's Corner. The application for a license follows a preliminary permit which was granted the company by the commission Sept. 14, 1921. The plans call for the initial diversion of 500 cu.ft. per second through a canal 14 miles long to a large basin at the headwaters of the Cooper at Monck's Corner, which is to be converted into a reservoir for daily and weekly storage by the construction of a long, low dam. The power house is to be built in the dam and a tailrace 3 miles long cut through Biggin Swamp to the Cooper River.

The first development would provide 42,800 hp. When the market develops it is proposed to raise the dam in the Santee 18 ft. and to enlarge the canal so as to provide for a total development of 121,000 hp.

The feasibility of this project will depend to a considerable extent on the requirements which the War Department may insist upon as to the amount of water to be discharged past the diversion dam so as to maintain a navigable depth in the lower reaches of the Santee. There is not at present any navigation on the 75 miles between Ferguson and the sea, although this river formerly was navigated to a considerable extent. This project will provide a navigable channel between Columbia and Charleston about 60 miles shorter than the old route. The city of Charleston is very enthusiastic about the project.

I. E. S. in Readiness for Its Lake George Convention

Everything is in readiness for the annual convention of the Illuminating Engineering Society at Lake George, N. Y., on Monday to Friday of next week. The tentative program printed in the ELECTRICAL WORLD for Aug. 18, page 352, holds good except that there has been some shifting of papers and reports from one day to another, as is inevitable when final arrangements come to be made, and that the phrasing of the titles of a number of papers has been altered in accordance with the authors' ideas. One paper, "Some Experiments on the Speed of Vision," by Percy W. Cobb, has been added. The special illumination features described in the issue for July 28, page 200, have been completed, and Tuesday evening has been set aside as a "night of light and color." Entertainment features include, besides the customary dancing, sporting and musical events, a picnic in the woods, a steamer trip on Lake George and mountain drives.

Great Lakes N.E.L.A. Program Well Balanced

Many subjects, including the trend of steam-power-plant design, rural service, public relations, electrical heating and the relation of college work to public utilities, are scheduled to be presented before the third annual meeting of the Great Lakes Geographic Division of the N. E. L. A. from Sept. 27 to 29 at French Lick Springs, Ind. A joint meeting with the Indiana Electric Light Association will be held on Sept. 26. Ample entertainment has been provided. The program is as follows:

WEDNESDAY, SEPT. 26

Morning.—Address, Harry Reid; reports; "Power-Factor Correction and Benefit Derived by Both Central Station and Consumer," C. W. Drake, Westinghouse company; address, "Public Relations," Martin J. Insull; general discussion.

THURSDAY, SEPT. 27

Morning.—President's address; report, women's public information committee, Mrs. P. W. Evans; address, Frank R. Coates, vice-chairman Public Relations National Section; "Practical Methods of Improving Contacts with the Public," W. S. Vivian, Middle West Utilities Company; short talks by Sherman T. Handy, member Michigan Public Utilities Commission; Lewis E. Gettle, chairman Railroad Commission of Wisconsin; John McCardle, chairman Indiana commission, and Frank L. Smith, chairman Illinois commission; reports from public utility information committees by B. J. Mullaney of the Illinois committee, John Mellett of Indiana, Alfred Fischer of Michigan and Franz Herwig of Wisconsin.

Evening.—Banquet. C. W. Tippy, president Great Lakes Division, toastmaster; speakers, Walter Johnson, president N. E. L. A., and M. H. Aylesworth, executive manager.

FRIDAY, SEPT. 28

Morning.—Address, W. A. Jones, chairman Accounting National Section; "Benefits to be Derived from the N. E. L. A. Accounting Course," C. B. Boulet, Wisconsin Public Service Corporation; report, power survey committee, R. F. Schuchardt; address, N. F. Wilcox, chairman National Commercial Section; report Electric Vehicle Bureau, Secor Cunningham, Jr.; report, Power Sales Bureau, B. H. Gardner; "Experiences with Electric Heating," J. D. Noyes, Detroit Edison Company; "Use of Central Station Power in Coal Mines in Illinois and Indiana," C. O. Dunten, Central Illinois Public Service Company; "Electrical Refrigeration," A. D. McLay, Detroit Edison Company; "Trend of Legislation and Commission and Court Decisions," Carl Jackson, general counsel N. E. L. A.

Accounting Section.—"Bookkeeping Machines in Connection with Light and Power Customers' Accounts," J. B. Mahan, Terre Haute; general discussion.

SATURDAY, SEPT. 29

Morning.—Report, educational committee, J. H. Mitchell; address, H. P. Liversidge, chairman Technical National Section; "Trend of Steam-Power-Plant Design," C. H. Berry, Detroit Edison Company; "Commercial Service and Relations with Customers," R. T. Duncan, Detroit Edison Company; "Relations of College Work to Public Utilities," Charles M. Thompson, University of Illinois; "Supplying Rural Districts with Electricity," J. W. Coverdale, American Farm Bureau Federation; "Business Research in Public Utilities," Stanley P. Farwell, Bureau of Commercial Economics, Chicago.

New York Men Plan Advertising Campaign on Big Scale

A campaign designed to cover a period of eight months and to cost $268,000, of which $160,000 has already been pledged, is about to be launched by the Electrical Board of Trade of New York, of whose board of governors Charles L. Eidlitz is chairman. This campaign will center in a co-operative advertising movement having for its three objects (1) to "sell" the board of trade to the public, (2) to "sell" the general uses of electricity in a broad, educational way, and (3) to sell electrical merchandise specifically without mentioning brands or trade names.

The methods, briefly summarized, by which it is hoped to accomplish the three fundamental bases of the campaign are: For the first phase, by public contest for both an emblem and a slogan, with cash and electrical appliance prizes; for the second phase, by the use of striking advertisements in local newspapers, with outdoor advertising in prominent locations, and, for the third phase, by intensive and continuous advertising of a less conspicuous sort in local newspapers, coupled with outdoor and car displays.

Boston Edison Attains 500,000-Kw. Connected Load

FOUR THOUSAND employees and guests of the Edison Electric Illuminating Company of Boston, including various city and town officials from eastern Massachusetts, attended an evening celebration on Sept. 12 at the General Service Building of the company in recognition of the attainment of 500,000 kw. connected load on Aug. 29. The property was illuminated by flood and colored lamps with an aggregate beam candlepower of 43,000,000.

Brief News Notes

Westby, Wis., Discontinues Municipal Plant.—The city of Westby, Wis., has signed a ten-year contract with the Wisconsin-Minnesota Light & Power Company for obtaining electrical energy at wholesale power rates. This city will discontinue the use of its own steam plant.

"What Engineering Is and What It Is Not." — This will be the topic of E. J. Mehren, editor *Engineering News-Record*, who on Wednesday evening next, Sept. 26, will conclude the four radio talks given this month by editors of the McGraw-Hill Company publications.

New Cable to Alaska to Be Laid.—The cable between Seattle and Alaska, which has been in service twenty years, is to be replaced by a new cable to be laid by the Signal Corps of the army. This cable will be made in England, and it will be at least a year before it is in place, according to Col. G. S. Gibbs, U. S. A.

Will Build New 60,000-Hp. Plant at Bryson, Quebec, to Serve Ottawa.—At a meeting of the board of directors of the Ottawa & Hull Power Company held at Ottawa, Canada, on Sept. 11 President A. J. Nesbitt announced that the Ottawa River Power Company, a subsidiary concern, will construct a power plant at Bryson, Que., capable of developing 60,000 hp., which will be used to supply communities along the Ottawa River and also the cities of Hull and Ottawa.

Washington's Street Lighting Inadequate.—Warren B. Hadley, electrical engineer of the District of Columbia, declares in his annual report that the lighting of the nation's capital is not keeping pace with the rapid growth of the city. Although the last year saw material development in the outlying sections of the city, the increase in total candlepower of street lighting was only 5.2 per cent, Mr. Hadley said, in urging the need for improved street lighting.

Public Tribute to the Late John A. Britton.—A public memorial meeting for the late John A. Britton, who at the time of his death was vice-president and general manager of the Pacific Gas & Electric Company, was held in the San Francisco Civic Auditorium on Sept. 6. The meeting was initiated by the Lincoln Grammar School Association and was participated in by the San Francisco Electrical Development League, the officials and membership of many San Francisco clubs, the San Francisco Red Cross and Boy Scouts' organizations.

Merger Planned in Southern New York.—The Southern New York Power Company of Cooperstown, N. Y., is seeking permission to transfer its franchises and plants to the New York State Gas & Electric Corporation of Ithaca. The Southern New York Power Company operates in a considerable number of towns and villages in Otsego and Delaware Counties as well as in Cooperstown. Its acquisition by the New York State Gas & Electric Corporation would connect up a number of existing hydro-electric plants.

Commonwealth Edison's Big Construction Gang.—More than 1,100 men are now engaged in construction work for the Commonwealth Edison Company of Chicago. Four hundred of these men, representing fifteen trades, are working on the new Crawford Avenue 400,000-hp. plant, and at the Calumet station 450 men are busy. The building of six transformer vaults, five semi-substations, two substations and an extension to a substation is responsible for the employment of the remaining 250 men.

Three Tenney Central-Station Companies Petition for Stock Par Reduction. — The Malden (Mass.) Electric Company, the Eastern Massachusetts Electric Company, Salem, and the Suburban Gas & Electric Company, Revere, have petitioned the Massachusetts Department of Public Utilities for authority to reduce the par value of their capital stock issues from $100 to $25 per share in order to facilitate the wider distribution of such securities among the public. The outstanding stock of the Malden company is now $1,602,000, of the Eastern Massachusetts company $250,000, and of the Suburban company $1,251,700. A similar petition has been filed for the gas company at Malden.

Securities of Indiana Holding Companies Come Under "Blue Sky" Law.—Securities of holding companies for public utilities are under the supervision of the Indiana State Securities Commission, according to an opinion just given by the State Attorney-General. The issuance of securities by public utilities is, under the law, subject to the control of the Public Service Commission and not the Securities Commission, but the holding companies are not under the jurisdiction of the former body, which therefore cannot pass upon their issues. Securities of holding companies listed on a recognized exchange are exempt from the scrutiny of the state "blue sky" officials.

New Orleans Council Takes No Action on New Franchises.—R. S. Hecht, president of the Public Service, Inc., appeared before the Commission Council of New Orleans last week to oppose favorable action on the application for franchises for two competing electric light and power companies. Opponents and supporters of the proposed franchises were present in large numbers. It was the consensus of opinion among the opponents that the movement was inaugurated simply for the purpose of embarrassing the operations of the Public Service, Inc., and to retard the improvements and extensions contemplated and that no enduring advantage could be gained by the creation of competitive companies not adequately equipped. No action was taken by the Commission Council.

Airplane Crashes Through Transmission Lines.—An unusual accident occurred on the system of the Tennessee Electric Power Company recently, when an airplane flying from Chattanooga to Nashville crashed through the 44,000-volt lines between Chattanooga and Hale's Bar at Hooker, Ga. The plane was flying very low, and in an attempt to clear the wires the bottom section became entangled in the top phase of the south line, breaking it and causing it to encircle all three phases of the north line. The plane itself was overturned and wrecked in a field 350 ft. away. The damage to the lines, resulting in an outage of power for industrial and street-railway uses in Chattanooga for three hours, was all the more difficult to repair because the particular span into which the plane crashed extended between towers on two hills 1,700 ft. apart. The impact was so great that insulators and one wire were also torn loose from twelve other towers, so that one phase of the south line was grounded for a distance of half a mile. The north line was cleared up and placed in service within three hours, but it was not until 6 o'clock the next day that the south line was repaired by the trouble department.

Radio and the Japanese Disaster.—It was radio that flashed across the Pacific the first news of the Japanese disaster. The great concrete mast rising to 660 ft. at the Japanese station weathered the test, perhaps owing to its construction, which combines steel and concrete. Telegraphic facilities to and from Tokio and Yokohama were completely wiped out, but service to other points inland remained intact. The largest radio station in Japan which communicates with the United States consists of a receiving unit at Tomioka and a transmitting set at Haranomachi. The distance from Tokio to Tomioka and Haranomachi is 155 and 178 miles respectively. The equipment used at the Japanese receiving station is essentially the same as that used at Riverhead, Long Island, by the Radio Corporation of America and was supplied by that company to the Japanese government last year. A "wave" antenna 9 miles in length is employed for reception on 16,300 meters. The transmitting station utilizes a 500-kw. arc set for communication on 14,350 meters. It was erected in 1921 and surpasses in power all other radio stations on the island. This transmitter is controlled from the receiving station at Tomioka by a system of land wires which were not severed by the earthquake.

Associations and Societies

American Management Association.—This association will meet in convention at New York on Oct. 29-31, with sessions for plant executives, sales executives and office executives. Owen D. Young, chairman of the board of the General Electric Company, has accepted the chairmanship of the general convention committee.

Washington League Plans for "Electragist" Convention.—Members of the Electric League of Washington, of which George P. Mangan is president, have perfected plans for the entertainment of delegates to the convention of the Association of Electragists International, which will be held in the capital city the week of Oct. 7. Among the entertainment features planned are trips to Mount Vernon, Arlington Cemetery and other points of interest by automobile, to be taken as opportunity presents between business sessions. A play entitled "Do It Electrically" will be presented one evening, probably that of Oct. 11, and on another evening there will be a dinner and dance.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

Illuminating Engineering Society—Lake George, N. Y., Sept. 24-28. S. G. Hibben, 29 West 39th St., New York.

Association of Iron and Steel Electrical Engineers—Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

International Association of Municipal Electricians—Reading, Pa., Sept. 25-28. C. R. George, Houston, Tex.

Indiana Electric Light Association—French Lick Springs, Sept. 26. T. Donahue, Northern Indiana Gas & Electric Co., Lafayette, Ind.

Great Lakes Division, N. E. L. A.—French Lick Springs, Sept. 27-29. R. V. Prather, 305 Illinois Mine Workers' Bldg., Springfield, Ill.

American Electrochemical Society—Dayton, Ohio, Sept. 27-29. Colin G. Fink, Columbia University, New York.

National Safety Council—Buffalo, Oct. 1-5.

American Institute of Electrical Engineers—Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

Empire State Gas and Electric Association—Lake Placid, N. Y., Oct. 8-9. C. H. B. Chapin, Grand Central Terminal, New York.

Association of Electragists International—Washington, Oct. 8-13. Farquson Johnson, 15 West 37th St., New York.

American Electric Railway Association—Atlantic City, N. J., Oct. 8-13. J. W. Welsh, 8 West 40th St., New York.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Oct. 19-20. Herbert Smith, Robson-Prichard Bldg., Huntington.

Telephone Pioneers of America—Atlantic City, N. J., Oct. 19-20.

Electric Power Club—French Lick Springs Ind., Nov. 19-22. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Southeastern Division, N. E. L. A.—Tampa, Fla., Nov. 20-22. Charles A. Collier, Georgia Railway & Power Company, Atlanta, Ga.

Recent Court Decisions

Safety Device Proved Reasonably Necessary Must Be Used.—In Brendel vs. Union Electric Light & Power Company damages were sought for injuries from explosion in a heating plant of defendant company. A finding for the company was reversed by the Supreme Court of Missouri, which held that a safety device proved reasonably necessary must be used by an employer and that recovery of damages could not be refused because of the injured employee's failure to report defect in equipment where evidence tended to show that the safety device had been removed without his knowledge and against his warning and that he had no knowledge of its removal before the explosion. (252 S.W. 635.)*

Efficient Management a Factor to Be Considered in Rate Making.—In affirming telephone rates fixed by the Public Utilities Commission of Ohio for the city of Lima, suit having been brought by the city against the commission to upset them, the Ohio Supreme Court observed: "Were it true that the Public Utilities Commission had based the increase in quesion solely upon the efficient management of the company by its officers, we would not hesitate to declare that such a basis of rate making alone would be unlawful within the purview of our statute. Certainly 'economical and efficient administration' is one of the factors to be considered in the fixing of rates and is an element generally recognized by state commissions. Otherwise a utility might rest upon the assumption that an increase should be awarded even though the commission should find that by elimination of waste and efficient management lesser rates would be justified."

Street Along Which Electric Wires Are Strung Not Part of Employer's Plant.—In Burns vs. Johns the plaintiff sued for injuries from being struck by an automobile while stringing wires on a street in Tacoma, of which city he was an employee. The defendant claimed that suit should have been brought against the city under the provisions of the workmen's compensation act. The Supreme Court of the State of Washington has affirmed judgment for the plaintiff, holding that he was not working in his employer's "plant" when injured and therefore had the right under the law to elect to sue those responsible for his injury. Even if the poles and wires of an electric line placed alongside a street are held to be part of the employer's plant, the court said, the extent of the plant must be limited to the space surrounding and beneath them which is necessary and convenient for their care and upkeep and does not extend to any portion of the paved part of the street alongside of which they are placed. (216 Pac. 2.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Boys Climbing Trees Entitled to Protection from Electric Wires.—Although finding a verdict for $20,000 for injury to a twelve-year-old boy from an uninsulated wire in a tree excessive and reducing it to $15,000, the Supreme Court of Missouri maintained (in Godfrey vs. Kansas City Light & Power Company) the legality of the jury's finding. The court said: "Electric companies must take notice of the natural instinct of boys to climb trees, especially trees which bear nuts or fruit, and if they string wires through such trees under circumstances which may reasonably charge them with notice of the probability of boys climbing such trees, and a boy who has climbed a tree to get the nuts or fruit, or even to satisfy his childish instinct to climb trees, is injured by an uninsulated or dangerous wire, without contributory negligence, the company must respond in damages." (253 S. W. 233.)

Commission Fixing Rate Basis Must Consider Cost of Reproduction New.—Reversing an order of the Indiana Public Service Commission at the suit of the Columbus Gaslight Company, the Supreme Court of Indiana made several pronouncements with a general bearing, as follows: "(1) The value of the property of a public utility to be considered by the commission in fixing a rate base is not the mere original cost less depreciation, but increased reproduction cost at time of rate fixing must be considered. (2) The going value, the element in an assembled and established plant doing business and earning money over one not thus advanced, is to be considered. (3) The commission should consider and amortize a deficit of the utility for the years immediately preceding under a rate fixed by the commission. (4) The commission cannot ignore items charged by the utility as operating expenses unless an abuse of discretion in that regard by the utility's officers appears." (140 N. E. 538.)

Unreasonable Operating Expenses of Utility Construed.—A utility's operating expenses must be reasonable to be allowable in a rate decision, according to the United States District Court of Nevada, in Reno Power, Light & Water Company vs. Public Service Commission. "The utility should be permitted to earn the cost of operation and a fair return," the court decreed, "but in addition to a fair return it is not entitled to earn whatever it may choose to spend. Its expense account is limited to the reasonable cost of efficient ordinary operation, to the exclusion of expenditures too large or otherwise improper, unjust or unfair to its patrons, who must pay them if provided for by higher rates." An item for bad debts was disallowed where it was shown that the company had a custom of requiring a deposit equal to the estimated two months' bill of a consumer. Charges for picnics, photographs of employees, radio stock, charitable organizations, magazines and newspapers, floral pieces and music were also disallowed, it being held that, while these expenditures might be commendable, they were not to be imposed on ratepayers unless in some way it was shown that they were incurred in the service of and for the benefit of the patrons of the company.

Commission Rulings

Avowal of Public-Spirited Motives Does Not Deprive Utility Promoters of Right to Reasonable Rates.—The New Hampshire Public Service Commission, in fixing rates for the Francestown Electric & Water Company, observed: "Whether or not the time has come when money will be invested in public utilities upon less than an 8 per cent rate of return need not be decided in this case for the reason that the proposed rates will not yield even a 5 per cent return, which every one will admit is not too high. It is true that those who put their money into the enterprise did so out of a desire to benefit the public rather than to make money. But this attitude of mind does not deprive them of their legal right to make the business pay them a reasonable amount, if it can be done without charging for the service rendered more than it is worth."

Difficulties of Divided Jurisdiction.—A discussion of the disadvantages of the division between a commission and municipal councils of jurisdiction over a public utility operating in several municipalities was contained in the findings of the Michigan Public Utilities Commission in establishing gas rates for the city of Pontiac. "In order that the commission might intelligently dispose of the Pontiac matter," the report said, "it was absolutely necessary that it should make a complete study of the whole utility, including not only the plant serving Pontiac but that serving the other municipalities. It is unfortunate that the same regulating body does not have charge of the rates and service in all of the municipalities. The commission has now before it pretty complete information with reference to the Pontiac, Birmingham and Royal Oak gas utility, but has nothing to say as to rates or rules or conditions of service as far as Birmingham and Royal Oak are concerned." The absurdity of such a situation, with the inherent possibility of three different standards of service being set up for the same company in three neighboring places, was dwelt on by the commission.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

E. M. Walker Leaves Terre Haute

E. M. Walker, general manager of the Terre Haute division of the Terre Haute, Indianapolis & Eastern Traction Company since 1917, has been made general manager of the Schenectady (N. Y.) Railway. As general manager of the Terre Haute property Mr. Walker had charge of the electric lighting and power work in the city of Terre Haute and a number of surrounding suburban towns as well as the street-railway system. He began his public utility career immediately after he was graduated from Williams College in 1897 and has served successively with the Lockport (N. Y.) Gas & Electric Company, the Hyde Park (Mass.) Gas Company, the Bristol (Tenn.) Gas & Electric Company, the Muscatine (Iowa) City Railway & Light Company and the Union Electric Company of Dubuque, Iowa, now known as the Dubuque Electric Company, where he was general manager before going to Terre Haute. For a number of years he has been a leading figure in public utility circles in the Middle West both as an executive of electric properties in that section and as an active participator in association work, having served as president of the Iowa Electric Light Association, the Indiana Electric Light Association and the Illinois Electric Railways Association.

Oscar Rippley has been made chief engineer of the Boonville (Mo.) Light, Heat & Power Company, succeeding A. J. Tuttle.

F. L. Fox has been made manager of the Southern Public Utilities Company at Hickory, N. C., succeeding E. B. Templeton.

E. D. Spicer has resigned his position as works manager of the Kerr Turbine Company, Wellsville, N. Y., to become general manager of the Standard Turbine Corporation of that city.

D. P. Robinson, for several years sales manager of the New Haven division of the United Illuminating Company, has resigned to enter private business at Meriden, Conn.

James Masek has severed his connecnection with the Cutler-Hammer Manufacturing Company of Milwaukee and is now associated with the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

A. G. Crocker, formerly special power representative, has been appointed manager of the industrial division of the Detroit office of the Westinghouse Electric & Manufacturing Company, succeeding E. A. Wooten, who has been assigned to other work.

F. H. Buswell is now engineer of power station of the Tower City (N. D.) Light & Power Company, succeeding M. C. Tonges.

John O. Strand is now superintendent of the municipal electric light plant at Madison, Minn., succeeding F. B. Leasman.

C. W. Bell, formerly assistant to the superintendent of operation of the Pennsylvania Power & Light Company, is now assistant to the superintendent of generation of the company.

Wallace S. Heald, electrical engineer, past-president Duluth Engineers' Club, has severed his connection as commercial manager of the Duluth-Edison Electric Company to accept a position with the Phoenix Utility Company, Duluth.

W. M. Stearns and **N. R. Birge** have been appointed assistant managers of the supply department of the General Electric Company. The appointments were made by D. R. Bullen, manager of that department.

John Ryan, resident manager of the Adirondack Power & Light Corporation at Ballston Spa, N. Y., has been relieved of the duties of that office to undertake sales work in Schenectady. James A. Quinlan has been assigned to take charge of the Ballston district as acting resident manager.

C. D. Woodward, chief electrical engineer of the Anaconda Copper Mining Company, Butte, Mont., will sail from New York on Oct. 13 for Antofagasta and Santiago, Chile, in connection with engineering work on company property near these points.

Henry L. Doherty, president of the Doherty Operating Company, the Cities Service Company and other corporations, has been elected a director and member of the executive committee of the American Light & Traction Company, New York.

Philip L. Thomson, publicity director of the Western Electric Company, has been elected president of the Association of National Advertisers. His election follows successful service as director and since 1921 as vice-president of the association.

William C. L. Eglin, vice-president in charge of the engineering department of the Philadelphia Electric Company, has just returned to Philadelphia after spending a few months in Europe. During his stay abroad Mr. Eglin visited the power plants of several of the larger central stations on the Continent.

Samuel J. Burris, Jr., has been appointed railroad and hydraulic engineer for the Colorado Public Utilities Commission, relieving C. D. Vail. Mr. Vail was filling temporarily the place of Judge Tully Scott, who through ill health had been unable to perform his duties as a member of the commission.

Ralf R. Woolley, hydraulic engineer of the United States Geological Survey, will represent the Federal Power Commission in the development of the Flaming Gorge site on the Green River. Mr. Woolley, who is considered one of the best informed men on the water-power possibilities of Utah, surveyed the Flaming Gorge district for the Geological Survey last year. Because of his intimate acquaintance with the problems presented the Federal Power Commission has borrowed his services.

Louis A. Ferguson, vice-president of the Commonwealth Edison Company in charge of construction and operation, was the guest of honor at a dinner given on Sept. 12 at the Drake Hotel, Chicago, by three hundred of his associates. The occasion was the thirty-fifth anniversary of Mr. Ferguson's service with the Commonwealth Edison Company and its predecessor, the Chicago Edison Company. He was presented with a thirty-five-year service badge of the Commonwealth Edison Company set with two rubies, a silver tea service and a richly bound morocco-covered book containing an illuminated address to Mr. Ferguson signed by about a thousand friends and associates.

Obituary

Welles E. Holmes, treasurer and general manager of the Cambridge (Mass.) Electric Light Company, died at his home in Newton, Mass., Sept. 17. Mr. Holmes was formerly manager of the electrical department of the Newton & Watertown Gas Light Company, which was purchased some years ago by the Edison Electric Illuminating Company of Boston. He was widely known among New England central-station executives and possessed unusually sound financial judgment and a broad knowledge of the central-station business. Mr. Holmes had been active in the New England Division of the N. E. L. A. from its inception.

William Henry Merrill, founder-president of the Underwriters' Laboratories, Inc., died Monday, Sept. 17, at the Presbyterian Hospital in Chicago. Mr. Merrill was graduated from the Massachusetts Institute of Technology in 1889 and shortly after engaged in fire protection and prevention work, to which his career was entirely devoted. In 1898 he organized the Underwriters' Laboratories and had since served as its principal executive. Mr. Merrill was a principal factor in bringing together the various interests which adopted and sponsored the first edition of the National Electrical Code and worked indefatigably for its recognition and enforcement in Chicago and other cities of the Central West. He served as secretary-treasurer and president of the National Fire Protection Association and was later elected to honorary membership.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Simplification in the Lamp Industry

How the 55,000 Types of Lighting Units in Existence in 1900 Have Been Reduced to 342—Standardization of Lamp Bases and Voltages

By M. D. Cooper

Engineering Department, National Lamp Works of General Electric Company

THE average person in buying an electrical article of any kind—a receptacle, a lamp or the like—has little conception of the meaning to him of the simplification work which is embodied in that device. This simplification work may favorably affect any or all of the following attributes of the thing purchased: (1) The quality; (2) the price; (3) the adaptation to the function to be performed; (4) the ready availability of the device in quantities as desired.

To get a realistic picture of the advantages of simplification, consider for a moment some of the steps toward simplification which have been taken in the incandescent lamp industry and then visualize what the conditions in the electrical trade would be today if these simplifications had not been accomplished.

Fifty-five Thousand Varieties

In the '90s there were in common use in this country fourteen different kinds of bases, with their corresponding sockets, for incandescent lamps. This number does not include the large bases used on series-burning lamps for street lighting. Incandescent lamps for general lighting service were also supplied for each individual voltage between 100 and 130. There was some demand for lamps of 200 volts and above, but for purposes of comparison with present conditions these may be neglected. Without regard to such differences in design of the lamp as shape of bulb, mounting of the filament or finish of the bulb (such as clear or frosted), there were therefore for each individual size of lamp thirty times fourteen, or 420, possible variations which had to be taken into account in manufacturing that one size of lamp.

In the year 1900 the only kind of lamp available was the carbon-filament lamp, of which there were five standard sizes—the 2, 4, 8, 16 and 32 cp. Different manufacturers used different forms of filament construction and also different sizes and shapes of bulb. For purposes of illustration, let us say that there were only four of these variations in bulb size and shape. As to bulb finish there were three variations—clear, bowl-frosted and all-frosted. Variations of bulb color can be neglected, since lamps with colored bulbs had a limited application. At the beginning of this century there were, then, four times three, or twelve, possible variations of bulb shape and finish, or twelve times 420, or 5,040, variations in each size of lamp. At least three of the five regular sizes of lamps were each made for three different efficiencies. In respect to size and efficiency there were then eleven variations, and the total number of types of lamps was eleven times 5,040, or about 55,000—all used in the ordinary course of incandescent lighting.

The first efforts toward simplification had for their object the standardization of the lamp base. In spite of the general opinion to the contrary, this simplification was not difficult to accomplish. The Edison screw type of base, or the medium screw as it is now called, was chosen as the type for future standardization, and by means of adapters the use of the medium-screw base in the sockets of the other principal types was made possible. The lamp manufacturers contributed very largely to the speed with which the movement was accomplished by offering a lamp with the standard base together with an adapter at the same price which was charged for the lamp

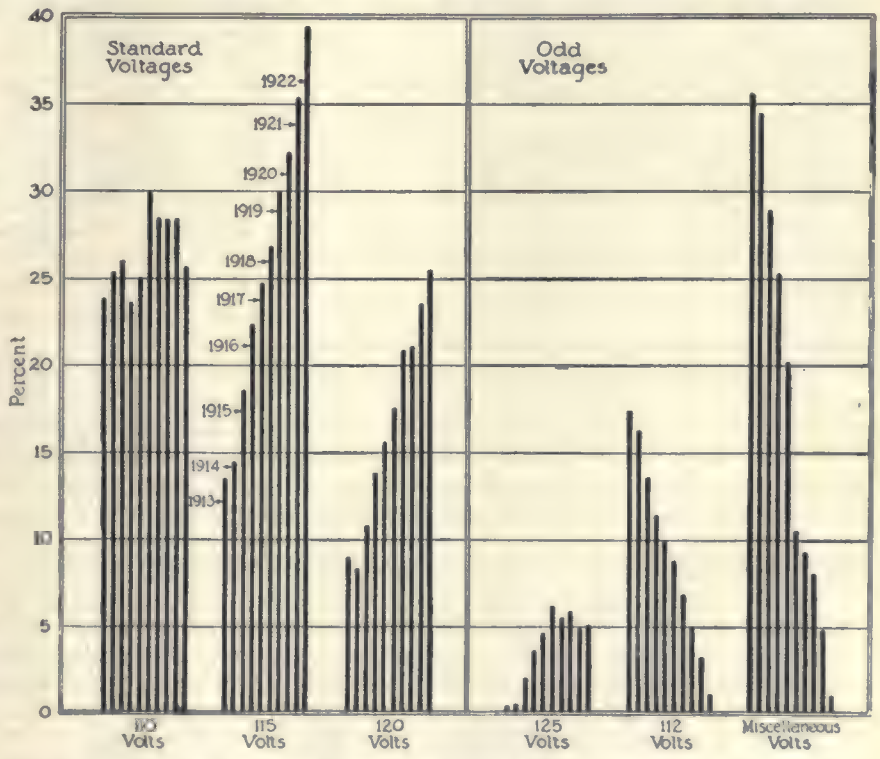


CHART SHOWING RATE OF PROGRESS OF STANDARDIZATION

This chart taken from the report of the N.E.L.A. lamp committee, 1923, clearly shows the progress toward voltage standardization at 110, 115 and 120 volts and indicates the tendency toward 115 volts as the ultimate single standard.

carrying the base which it was desired to eliminate. Simultaneously, steps were taken which led to the standardization of the mogul-screw base for series lamps. It was but a few years until the demand for lamps with any except the standardized bases had decreased to an infinitesimal percentage of the total demand, and at the present time, twenty years after, one of the superseded types of bases or sockets is a museum exhibit rather than an article of every-day commerce. This standardization of bases decreased the number of types of lamps in common use for multiple lighting from 55,000 to one-fourteenth of that number, or 3,900.

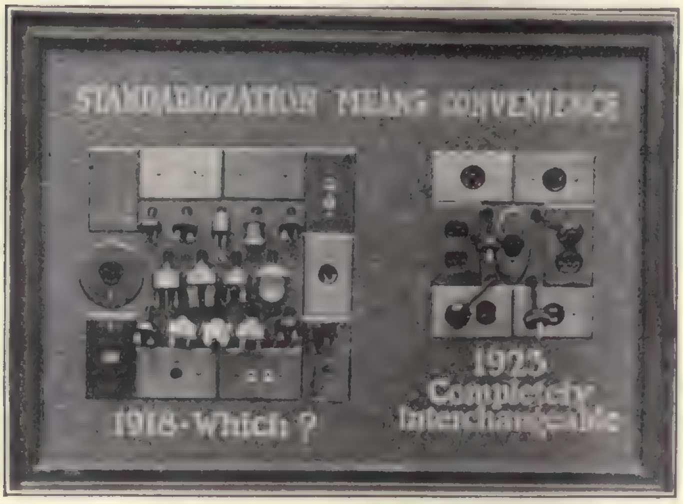
There is an interesting story connected with the voltage or range of voltages at which electric lighting is done in this country. Edison's first practical lamps were designed to operate at 110 volts. Other lamps were manufactured for different voltages, generally lower, such as 40, 55, 80, etc. Since the Edison organization had developed a complete system of electrical supply, as well as the lamp, the 110-volt system gained precedence over low-voltage systems, with the result that ultimately 110 was practically the only lighting voltage. In the early days of lamp manufacturing, however, it was impossible to predetermine the exact voltage of a lamp, and consequently a considerable portion of the production ran off-voltage. In order to utilize this product effectively, the central stations supplying electricity adopted various voltages on both sides of 110. The use of lamps five in series on street-railway circuits was probably the leading factor in creating demand for lamps of 120 volts and higher. Up to 1910 there was no effort to restrain this spread of voltages within the 100-130-volt range.

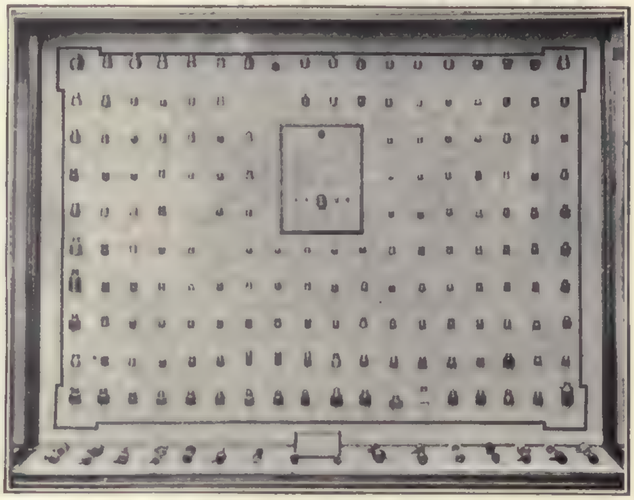
By the year 1913 it had become possible to manufacture lamps accurately to any desired voltage. It was noticed that there was a gradually increasing concentration of lamp demand at 110, 115 and 120 volts, whereupon these three voltages were selected as logical focal points for voltage standardization. In the period from 1913 to the present date a continuous agitation has been made for the standardization of the pressure of electric lighting circuits so as to make use of lamps of one of these three voltages. During the early part of this period these three centers gained in percentage of total demand at the expense of the intermediate and extraneous odd voltages.

At the present time the demand for lamps of voltages other than the three mentioned has practically ceased, with the possible exception of lamps for 125 volts, which find some use in manufacturing plants using 250-volt direct current and on some of the Pacific Coast transmission systems. As the demand became concentrated at these three voltages, it was noted that 115 volts gained in percentage of total much more rapidly than either 110 volts or 120 volts. The final stage in the progress of this standardization—the concentration of all demand at one of the three voltages—is now under way. The central stations of the country, through the National Electric Light Association, are making the recommendation that all new construction be designed for 115 volts, to the end that at some future date this may become the single standard voltage.

These examples of standardization—of lamp bases and of lighting voltages—are typical of the normal course of development and perfection of an industry. First there is the simple device or the simple conditions constituting the nucleus of the idea. As the use of this idea spreads various means of utilization are incorporated, each differing in some detail from all the others and all leading to a condition of nonstandardization. As the idea grows in commercial significance with increasing demand, the extra costs, poorer quality and lack of ready availability of the particular product needed give rise to a general demand for standardization.

It is interesting to compare the large number of different types of lamps—namely, 55,000—which were in common demand in the days of the carbon lamp and before lamp bases and lighting voltages were standardized with the number of types of "Mazda" lamps in common demand today. The range of size in carbon lamps was from 2 cp. to 32 cp., or a range of sixteen to one. The range of size of "Mazda" lamps for general lighting is from 10 watts to 1,000 watts, or a ratio of a hundred to one. The great bulk of the demand for multiple incandescent lamps for general lighting service is





STANDARDIZATION OF INCANDESCENT LAMP BASES

The 175 different lamp bases shown in this case have been eliminated by standardization. A special socket was necessary for each type of base and a few of those in use before the adoption of a standard base are shown. The medium screw base has superseded all of these old bases and, with the five bases shown on the card, takes care of all incandescent lamp requirements. At the left is a striking example of what standardization has accomplished in the plug and receptacle field—allied to lighting. Any plug fits any receptacle today and the variety of equipment manufactured in 1918 is shown as a contrast.

now covered by lamps of 110, 115 and 120 volts and of size types as follows:

	Wattage	No. of Different Sizes
Regular lamps	10 to 1,000	15
Round-bulb lamps	15 to 40	5
Sign lighting	10 to 50	3
Tubular bulbs	25 and 40	2
Mill-type lamps	25 and 50	2
Daylight lamps	50 to 500	7
Street-railway service	23 to 94	4
Total		38

Each size type is available with three different bulb finishes, that is, clear, coated all over and coated only on the lower part. With the three voltages this makes nine variations for each size type, or a total of only 342 types in common demand today to cover a size range of a hundred to one, as compared with the former number of 55,000 types covering a size range of only sixteen to one.

It is difficult to realize today the conditions of lamp supply and of lamp cost which would be prevalent if the standardizations above discussed had not taken place. If it were necessary to supply 55,000 types instead of 342, there would not exist the benefit of the great refinements which have been made in the manufacturing processes, all contributing to quality, cheapness and the speedy production which makes possible prompt deliveries. With only 342 principal types to supply, the lamp manufacturers of this country conduct their business with a factory stock of perhaps 30,000,000 lamps. This is roughly one-seventh of the total annual consumption.

HOW IT BENEFITS

A brief mention of the conditions in European countries will give some idea of the working significance of these standardizations of lamp base and lighting voltage. Lighting voltages in Europe go by 5-volt steps, and there is a demand at practically each 5-volt step from somewhat below 100 volts up to nearly 300 volts (10-volt steps at the higher voltages). There are also in common use a large number of different types of lamp sockets, necessitating the use of different types of lamp bases. One European lamp manufacturer told the writer that in his customary factory stock of about 3,000,000 lamps the maximum number of any one type was 3,000.

An inventory of an approximately equal factory stock in the United States showed about 200,000 lamps of the following description — 40-watt, 115-volt, medium-screw base, clear. With the degree of standardization now existing, this amount of stock enabled the American manufacturer to give one day's service in filling practically all orders for lamps. If the standardization of the industry stood at the point where it did in 1900, or if we had the same lack of standardization that there is in Europe, this manufacturer would need to increase his total stock in about the proportion of 200,000 to 3,000, or approximately in the ratio of seventy to one, in order to give the same degree of service that he is now able to give with the smaller stock and with conditions standardized. This tremendous stock of two billion lamps would be equivalent to ten years' supply for the country, and if it were necessary to maintain such an enormous stock, the following disadvantages would result:

1. Any improvements in lamps or any new development would be very greatly delayed in reaching the public, since any such development could not be made effective until the stock of all of these lamps had been exhausted.

2. The investment and overhead costs of this enormous stock of lamps would necessarily result in higher prices for lamps.

If the manufacturers of this country had to operate under the lack of standardization which existed in 1900 and chose to meet these conditions without material increase of lamp stock, the result would be very poor service and very slow service to the users of lamps. It would be difficult to make an accurate estimate of the differences in service, but it is plainly evident from the figures above given that the chaos resulting would nowadays be considered intolerable.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

WITH the increasing demand throughout the United States for most of the electrical commodities, a more healthy situation has come to the surface—one of steady prices and well balanced stocks on the jobbers' shelves. The heavier business recorded in the Eastern territory two weeks ago is moving to the Southern territory, where a sharp pick-up is reported for all lines. Although conditions in Chicago and other centers of the Middle West are not satisfactory at present, manufacturers believe large business will be placed within the next two weeks. Improvement is reported along the West Coast, where prices have become steadier.

Opportunities for Sign Business Are Great in Cities of All Sizes

THE rate of increase in the use of electrical advertising through more and larger displays and the substitution of higher-wattage lamps in already existing sockets was, previous to last year, about 15 per cent annually. A much faster growth has evidenced itself during 1922. This has been due to two major influences—first, publicity managers are appreciating more fully the many advantages and the comparative efficiency of this medium and are appropriating a constantly growing part of their advertising budget to it; second, central-station commercial managers are realizing more generally the desirable and profitable nature of the electrical advertising load and are joining in organized stimulation of the field.

The opportunity for promoting electrical advertising is clearly brought out by surveys conducted through the co-operation chiefly of the Lighting Sales Bureau of the National Electric Light Association. One hundred and twelve central stations assisted by furnishing detailed information from their cities, and sign manufacturers from thirty other cities did likewise. These surveys reveal the facts regarding electrical advertising development in 143 cities in the United States, with an aggregate population of 6,300,000. In addition to showing the relative popularity of different forms of displays, the distribution of the load by lamp sizes and the demand by various classes of consumers, these surveys bring out the following fundamental facts:

1. The opportunity for development is relatively the same in cities of all sizes. In large cities and small cities organized sales effort has succeeded equally well in promoting a high per capita use of electrical advertising, and it is also true that lack of stimulation has everywhere resulted in a lower use of this medium.

2. The opportunity exists in all sections of the country. Again it is found that North, East, South and West respond enthusiastically wherever organized effort is made.

3. In industrial and commercial cities, trading centers or agricultural districts, summer and winter resorts, in cities of all types, this medium is effective and has been used extensively whenever vigorously offered.

4. The actual development in specific cities of all sizes, types and districts, however, does vary enormously, depending upon the promotional effort put forth. The average development is equivalent to 3½ watts

per inhabitant, corresponding to about 5 kw.-hr. annually. Some cities report only 0.1 watt per inhabitant while others show 10 watts per inhabitant, or more. If the development of all cities is brought up to that already obtaining in the best 10 per cent the central-station revenues from electrical advertising will be increased from its present figure of $15,000,000 annually to $35,000,000.

The 250,000 electrical displays in the United States consist of:

Exposed lamp signs	112,000
Inclosed lamp signs	81,000
Bulletin and poster boards	50,000
Building outline and marquis lighting	7,000
Total	250,000

The 15,000,000 sockets have the following lamps:

Lamp Size, Watts	Per Cent of Total Lamps	No. of Lamps	Kw. Connected	Per Cent of Total Wattage
5	39.2	5,860,000	29,300	14.8
10	43.8	6,680,000	66,800	33.2
15	3.0	448,000	6,700	3.4
25	7.4	1,108,000	27,600	14.0
40	0.5	81,000	3,240	1.6
50	3.2	471,000	23,500	11.9
60	0.3	38,000	2,280	1.1
75	0.6	89,000	6,700	3.4
100	1.5	160,000	16,000	8.0
150	0.2	34,000	5,100	2.6
200	0.3	52,000	10,400	5.2
250 and larger	0.2	24,000	1,200	3.0
Total	....	15,005,000	198,820	....

The largest display has a connected load of 300 kw. and has 20,000 sockets, the average display has a connected load of 800 watts and has 60 sockets, and the smallest display has a connected load of 25 watts and has 1 socket.

The chief users of electrical advertising in the country as measured in number of sockets connected are thus classified:

	No. of Lamps
1. Theaters (motion-picture and legitimate)	2,680,000
2. Automotive (sales offices, garages, oil stations)	1,500,000
3. Restaurants (cafes, lunch rooms, etc.)	1,290,000
4. Clothing (stores, tailors, cleaners, etc.)	1,280,000
5. Hotels (rooming houses, etc.)	1,260,000
6. Banks (investment houses, etc.)	780,000
7. Drugs	700,000
8. Shoes (stores, repair, etc.)	385,000
All others	5,000,000

Quality Signal Systems Gain Control

PRESENT sales of signaling systems show a large increase over those of six months ago, according to reports just received from seven leading manufacturers. Influences contributing to this healthier business are increased confidence in the continuance of general prosperity and the greater appreciation of the value of "quality" signaling systems for improving the management of many kinds of business. A large element of this increased appreciation lies in the acceptance of reliable systems by office organizations of all kinds, whereas in the past the principal consumption of equipment for such service has been by industrial organizations.

Large manufacturers of signaling systems also attribute the increased volume of sales to the fact that they have held strictly to their policy of putting out merchandise of high quality, maintaining standard prices and as far as possible protecting the dealers against price cutting. Some of these makers are not hesitant in saying that they have turned down a lot of orders from people who they knew would cut their prices. In order to keep on firm ground, they need to stand on a standard policy, protect customers and sell guaranteed products.

Deliveries of steel are easier than they were three months ago and a little better than normal. Brass is longer than in normal times, but it is believed this condition will improve. Steel prices possibly will change if labor conditions do not improve in the steel mills. Brass prices, of course, are fluctuating from week to week, but it is believed that they are at or near their high point now.

Prices generally are firm, and these makers of systems for wide extension do not contemplate changes during the next five months; however, the price of one leading manufacturer's unit will soon be increased from $100 to $125 in order to restore the proper price, cut a year or so ago without warrant in the idea of this being a necessary concession to competitive conditions.

Deliveries of the products are somewhat behind sales, but manufacturers expect to have normal shipping schedules by Oct. 1.

Producers of bells, buzzers, small telephones and the more simple signaling systems say their sales have shown a consistent increase during the last six months but not to the extent they had anticipated. These makers are in a position to make prompt deliveries and have no difficulty in getting quick deliveries on raw materials. They anticipate a good business during the coming season and feel that the better class of dealers are about through with handling merchandise which is being continually cut in price because of its refusal by the consumer. In the opinion of these makers, this business is gradually becoming stabilized and the more worth-while trade is settling down to those standard lines which it feels to be thoroughly reliable.

As to the outlook for the general market for both signaling systems for wide extension and small systems for offices, factories and residences, no radical changes for the better are anticipated until the labor situation in this country shall have improved. The manufacturers feel that building is being retarded through the building trades which are demanding excessive wages, and consequently only such buildings are going up as are absolutely necessary or those which will produce very large rates to the owners, who can therefore afford to pay excessive wages. On this account they feel that existing building conditions are just normal, whereas in order to catch up with the country's delayed building program considerably more construction should be under way. As soon as the labor situation is straightened up the business in signaling apparatus should increase at least 100 per cent, the manufacturers believe, and until that situation is improved, they do not look for much change from present orders.

Tape Market Reflects Sharp Competition

SALES of adhesive tape display considerable price irregularity as the fall opens, and recent business has been marked by acute competition among some of the late comers into the manufacturing field. A good deal of tape has moved during the past few months on price levels which some authorities regard as inadequate to yield a profit on total costs of production and selling. Some material of what might be called sub-standard quality has gone into the hands of buyers on a price basis which won the business without much regard to other considerations, but it is very significant that week before last two formerly long-established customers of a representative producer of high-grade tape returned to the "fold" upon the "quality" appeal. Slowly the fallacy of the idea that "tape is tape" is penetrating the buying public.

Deliveries are satisfactory and considerable production for factory stocks is in progress. Raw materials are in good supply, and in some quarters the opinion is held that firmer prices for cotton and rubber may be expected this fall. Other producers anticipate little change before the year ends, but reports of the cotton-crop status incline toward the probability of this material being quoted at higher levels before long. Wages are still high, and one large manufacturer has recently put a 10 per cent advance into effect. First-class help is rather hard to obtain in sufficient numbers. On the whole, the total volume of business has

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.0337	$0.0337	$0.0285
Cold finished shafting, per lb.	0.0433	0.0428	0.0373
Brass rods, per lb.	0.17	0.1741	0.1666
Solder (half and half), per lb.	0.276	0.276	0.2283
Cotton waste, per lb.	0.1225	0.1231	0.1458
Washers, cast iron (½-in.), per 100 lb.	4.66	4.66	4.00
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.08	3.08	2.96
Machine oil, per gal.	0.575	0.349	0.36
Belting, leather, medium, off list	37%	37%	44½%
Machine bolts, up to 1-in. x 30-in., off list	49½%	44¼%	53½%

been considerably below the productive capacity of representative manufacturers for some months, but the opinion is expressed in several offices that an increased volume of sales is to be looked for this fall, and in one instance at least it was declared that perceptible improvement has lately set in.

Eastern Business Is Increasing from Week to Week

BASED on general conditions, the outlook for the fall trade in Eastern electrical circles continues excellent and the present volume of business tends to increase from week to week. Jobbers have been buying from hand to mouth all summer, and considerable pressure is now being felt by appliance manufacturers to meet late fall requirements. Central-station outputs are gaining fast, and extensive investments in plant expansion are under way or slated for the near future.

Low water has prevailed for many weeks in the hydro-electric plant districts, so that unusual demands are being made upon the steam stations of the interconnected systems. Prices are unsteady, especially in the wire and wiring-device markets. The demand for textile motors is fair, and the sale of toasters has boomed during the past fortnight. The metal-working industry, woolen manufacturers, general building and the paper trades report vigorous activity. An enormous amount of new residential business is being added by electric utilities this fall.

Middle West Business Continues Sluggish

ELECTRICAL business still remains rather sluggish and spotted in Middle Western territory. Jobbers have not begun to buy their fall merchandise as yet, and with the exception of socket appliances, radio and cable no unusual sales have been reported. The unusually cold weather has stimulated the sale of electrical heaters. Radio sales are increasing and jobbers are laying in their fall supplies. Interest is growing for this type of equipment now that long-distance reception is increasing. One large utility placed some very large cable orders this week. The demand for construction materials, such as pole-line hardware, poles and insulators, is fair. Building activity has slackened somewhat.

Pacific Coast Prices Steadier; Conduit Stocks Are Heavy

A BETTER week is reported, with greater buying from all classes of customers. Prices are steadier, even copper showing less wavering. It looks as though the period of cautious buying will be followed by a period of necessary replenishment of stocks. Some heavy schedule-material orders are reported.

Lead-covered cable in small and medium sizes is moving nicely, probably because of increased activity among lumber camps and mines. Local conduit stocks are high because of decreased building of the larger type following the buying flurry of the spring. The Japanese catastrophe is reflected both for good and evil in California. Lumber companies are overwhelmed with orders. All rice stocks and crops of the Sacramento Valley are sold out, but, on the other hand, the forty-five-day steamer embargo in favor of the shipment of relief material will seriously affect regular export business.

Southern Jobbers Report Sharp Pick-Up in All Lines

JOBBERS report a sharp pick-up in all electrical lines. Heating appliance sales are showing up well, especially flatirons, and one of the largest jobbers states that his stocks of the 3-lb. type have been almost depleted. This latter fact is attributed to the increase in travel and to the fall opening of women's colleges. The more prominent electrical dealers have announced their intention of discontinuing the boudoir and inexpensive floor-lamp lines, though they will continue to carry conservative stocks of the more expensive type of portables. The discontinuance also applies to electrical toys and specialties, no orders having been placed to take care of the holiday demand. This is due to the keen competition and price cutting by department and furniture stores.

Building permits in Atlanta for August totaled $1,361,460, this being considerably under the total for the prior month, but it is accounted for by the fact that this amount is almost entirely for residential construction—no large apartment houses being included. Building permits for the Southern States, however, show an increase of more than $1,000,000 over July. Contractor-dealers report that house-wiring activities are 20 per cent in excess of this period last year. This is somewhat the reflection of the activities of manufacturers' representatives, which have resulted in the large majority of the more prominent architects adopting a more liberal attitude toward the specification of convenience outlets in all new houses. A consequent further increase in the demand for house-wiring materials should come and should pave the way for larger appliance sales in the near future.

The Metal Market

COPPER sales are moderate, and a further reduction to 13.62½ cents is reported. Foreign business is still quiet, and producers are watching European developments as the prosperity of their industry is involved in the demand for the metal abroad. The lead market is stronger than it was last week. Sales of zinc are fair at practically unchanged prices.

NEW YORK METAL MARKET PRICES

	Sept. 12, 1923 Cents per Pound	Sept. 19, 1923 Cents per Pound
Copper, electrolytic...	13.75	13.62½
Lead, Am. S. & R. price	6.75	6.75
Antimony............	7.50	7.50
Nickel, ingot.........	27.00 to 32.00	27.00 to 32.00
Zinc, spot........	6.50	6.50
Tin, Straits..........	41.75	42.00
Aluminum, 98 to 99 per cent...........	25.00 to 26.00	26.00 to 27.00

Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Post-Glover Company Appointed General Electric Distributor

Frank D. Van Winkle, president of the Post-Glover Electric Company, Cincinnati, announces the firm's appointment as a distributor of the General Electric Company. This new connection will not affect the ownership or management of the company's business, and there will be no changes except those which come with increased facilities. On Sept. 12 the firm completed its thirty-first year.

Award $1,000,000 in Equipment Orders for Kearny Factory

Contracts aggregating $1,000,000 have been placed for manufacturing machinery and equipment to be used in the cable and telephone switchboard works that the Western Electric Company is erecting on its Kearny (N. J.) property, it was announced by the company this week. Ten piledrivers are at work on the construction of the new 1,600-ft. bulkhead. Present plans call for the employment of 600 men on the sixty-acre tract next fall. This will be the first contingent of the 30,000 employees who will work in the first group of buildings in the Kearny works.

Large Automatic Motor-Generator Set Ordered from Westinghouse

The Westinghouse Electric & Manufacturing Company has received an order from the Union Electric Light & Power Company of St. Louis for a three-unit 3,750-kw. automatic motor-generator set, said to be the largest set of its type yet built. All the parts of the machine are standard and have been built for manual operation, but complete automatic operation has heretofore been used only with smaller machines. The set will be used to supply current to the Edison system of the company in the downtown districts.

The set consists of a synchronous motor and two 1,875-kw. generators, one mounted on each side of the motor and all mounted on the same bedplate.

The alternating-current supply is at 13,200 volts, three-phase, 60 cycles, and the motor is wound for this voltage. The generators are for two-wire operation at 250 volts direct-current excitation for the motor, and the two generators will be supplied from a direct-connected exciter. The two generators will be connected in parallel and will be operated as a single unit.

Walter Roycraft Now in Kelly Construction Company

Walter Roycraft has purchased the interests of Harry Johnson in the Kelly Construction Company, Chippewa Falls, Wis., which is engaged in electrical construction and ornamental street-lighting system installation work. He has also been chosen to succeed Mr. Johnson as vice-president of the company. Mr. Roycraft in the past seventeen years has been connected with the Chippewa Falls Water Works & Lighting Company and its successors, the Chippewa Valley Electric Railway Company and the Kelly Construction Company.

Electrical Equipment for Ventilation of South Hills Tunnel

The contract for electrical equipment to be used for ventilating the new Liberty Tunnel under Mount Washington, Pittsburgh, has been awarded to the Westinghouse Electric & Manufacturing Company by the Booth & Flinn Company, Ltd., contractors for the tube.

Work on the equipment will be started immediately at the main works of the Westinghouse company at East Pittsburgh. The equipment contracted for includes two 200-kw. synchronous converters, transformers, two 300-kw. synchronous converters, eight 40-hp. direct-current motors to drive fans, eight 85-hp motors, direct-current-drive fans, one 10-kw. motor-generator set, distributing transformers, street-lighting fixtures, complete separate parts of motors, rotors and switchboard.

Merger of Vehicle Equipment Firms Under Consideration

Proposals are under consideration by directors of the American Bosch Magneto Company for the merger of Gray & Davis, Inc., Cambridge, Mass., with the Bosch organization. Both concerns manufacture starting and lighting equipment for motor-vehicle service, and at present the Bosch company is acting as selling agent for the output of the Cambridge company.

Business is increasing rapidly with each company, both the Springfield and Cambridge plants being actively engaged in production. Recent large gains in Gray & Davis orders have raised the problem of increasing production facilities, and it is believed that if the two concerns unite, more effective distribution of manufacturing orders can be accomplished.

Repeat Orders Are Feature of Demand for Fault-Locaters

J. F. Beedle, engineer of the Lundin Electric & Machine Company, Boston, in commenting last week upon market conditions stated that recent purchases of electric fault-locating equipment of the interrupter type exhibit a marked tendency toward repeat ordering. The larger systems are finding it helpful in the work of rapidly locating and removing distribution system troubles to assign fault-locating apparatus units on a divisional basis in order to secure greater mobility of service during emergencies. The Edison Electric Illuminating Company of Boston has about two dozen of these sets. The Malden (Mass.) Electric Company, the Philadelphia Electric Company and the Commonwealth Edison Company, Chicago, have lately added to their original equipment, and during the past year or thereabouts a number of foreign shipments have been made, including some to Belgium and Japan. The Orient has figured in recent inquiries.

Mr. Beedle stated that no price changes have taken place during the past year, and that while this class of equipment is not sold on a staple "over-the counter" basis, the market appears stable and interest in the problems of fault location is growing. Recent developments in this field include the design and manufacture of a new amplifier and sector coil for increased efficiency of trouble detection.

No American Manufacturers Bid for Alaska Cable Order

Acting Secretary of War Davis announced on Sept. 17 that the department has purchased a complete Alaska cable outfit in England, paying $1,244,000 for 1,806½ miles of cable. Secretary Davis said it was necessary to make the purchase in England because there were no bidders from this country when the cable was advertised for.

The War Department will use its mine layer, the *Delwood*, for transporting the cable to this country, thereby saving $300,000. Delivery will be made in seven months.

B. Joseph Joins Alt-Le Firm

Announcement is made that B. Joseph, formerly purchasing agent for the Peerless Light Company, New York branch, has joined the Alt-Le Lighting Fixture Company, 262 Bowery, New York City, in a general executive capacity.

Vye-Smith Company Adds to Line

The Vye-Smith Company, Boston, has been appointed New England distributor for the "Marion" line of electrical heating appliances manufactured by the Rutenber Electric Company, Marion, Ind., and for the "Union" renewable-fuse line manufactured by the Chicago Fuse & Manufacturing Company.

The Acme Wire Company, New Haven, Conn., has closed its Cleveland office and has opened its Detroit office at Room 808 Kresge Building, in charge of J. T. Crippen.

The Logan Cut-Out Switch Manufacturing Company, Logan, W. Va., recently formed with a capital of $100,000 to manufacture electric switches, has preliminary plans under consideration for the erection of a new local plant. Pending its establishment production will be carried on at the works of the West Virginia Grinding & Machine Shops, Huntington, W. Va. William Abraham is president.

Fairbanks, Morse & Company, Chicago, manufacturers of motors, electrical and mechanical equipment, etc., have acquired a large tract of land at Indianapolis heretofore used by the county workhouse and will utilize the property for proposed additions to their local plant, for which plans were projected initially a number of months ago. The complete expansion, to be carried out over a period of time, will cost in excess of $10,000,000.

The Aladdin Lamp Company, Muncie, Ind., manufacturer of electric lamps, has tentative plans for the rebuilding of the portion of its plant destroyed by fire Sept. 5, with loss estimated at $18,000. George Spencer is president.

The Champion Switch Company, Toledo, Ohio, has filed a copy of its certificate of incorporation in the office of the Secretary of State at Albany and will enter New York State, with its office and principal place of business at 550 Abbott Road, Buffalo. W. L. Stinson is agent for the corporation, which will engage in the manufacture of switches and electrical appliances. It is capitalized at 1,000 shares of preferred stock of $100 par value and 2,000 shares of common, no par value.

The Electric Boiler Corporation, Cambridge, Mass., manufacturer of electric household water meters, A. F. Graham sales manager, announces the appointment of M. C. Brown, Framingham, Mass., and A. R. MacLeod, Taunton, Mass., as agents.

The General Electric Company is perfecting plans for expansion at its plant at Bridgeport, Conn., to include a number of new lines of production. A department will be established for the manufacture of rubber-covered wire, while armored cable, armored hose, flexible steel conduit and steel outlet boxes and covers will also be produced at the local works, transferring the departments from the plant at Masheth. Additions will be made in the working force to accommodate the expansion.

The Electric Appliance Company, Dallas, Tex., has been organized with a capital of $90,000 to take over and merge a local company of the same name and the Electric Specialty Company. The new organization will manufacture and deal in electrical supplies and equipment. M. E. Martin is president and Charles L. Martin secretary and general manager.

Foreign Trade Notes

ELECTRIFICATION OF THE LEOPOLDVILLE-MATADI RAILROAD.—Conditions under which the Leopoldville-Matadi Railroad, in the Belgian Congo, will be electrified, according to the Belgian Minister of Colonies, *Commerce Reports* states, are as follows: It will be the first important railroad in Central Africa to be electrified. Investigations made by the railroad company have shown that 100,000 hp. can easily be developed and that there are unlimited reserves for extensions. For the electrification of the railroad it is estimated that 30,000 hp. will be sufficient, at least in the beginning. The gage of the railroad is at present 75 cm., consequently the widening of the track will have to be undertaken before any other work is begun. The cost of the electrification is estimated at 150,000,000 francs. The government will make the necessary advances to the company for rebuilding the line and also for the electrification. The Belgian government and the colony together hold the majority of the capital stock of the company.

JAPANESE PROMOTING USE OF DOMESTIC APPLIANCES.—The use of electric household appliances in Japan is increasing rapidly among the well-to-do classes, according to *Commerce Reports*. In Nagoya an American lady was recently engaged by the local power company to demonstrate to invited classes of Japanese women the use of the electric iron and the electrically driven sewing machine.

NEW HYDRO-ELECTRIC PROJECT IN INDIA.—British construction and electrical manufacturing interests have applied for license for the sole right to develop the water-power possibilities of the Pykara River, in the Nilgiris, and to utilize it for supplying electric energy to industries in the surrounding territory, according to the Calcutta *Press*. The necessary surveys have been made, and it is understood that plans contemplate transmission of the bulk of the power to the port of Calicut.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Porto Alegre, Brazil (No. 7683), for wiring supplies and fixtures.

Purchase and agency is desired in Dublin, Ireland (No. 7746), for advertising signs.

Purchase and agency is desired in Dublin, Ireland (No. 7686), for cables and insulators.

Agency is desired in Amsterdam, Netherlands (No. 7730), for electrical appliances, installation material, insulation material and novelties.

Agency is desired in Amsterdam, Netherlands (No. 7730), for radio materials.

Purchase and agency is desired in Dublin, Ireland (No. 7686), for farm-lighting plants.

WATER-POWER DEVELOPMENT IN BAVARIA.—Plans are being carried out for the utilization of Bavaria's water power in order to restrict to a minimum the use of coal for power production. The work is being done through a company organized for the purpose, known as the Bayernwerke Aktiengesellschaft. A 110,000-volt distribution system is under construction, and a Bavarian superpower zone will be established to enable co-operation to be had with existing steam and water-power plants, together with a more economical use of the surplus power.

DUTCH ELECTRICAL TRADE AWAKENING.—Improvement in the Dutch electrical machinery trade is reported by Consul-General G. E. Anderson, stationed at Rotterdam. Substantial increases in the imports of generating apparatus and miscellaneous electrical materials occurred during 1922. Telephone and telegraph apparatus imports also exceeded those of the previous year.

EXTENSION OF INDO-CHINA LIGHTING SERVICE PLANNED.—Plans for the extension of lighting service into new districts of Indo-China have been made by the Energie Electrique Indochinoise, according to Consul Leland L. Smith, at Saigon, French Indo-China. This company, which has a monopoly for the furnishing of electrical energy in Indo-China, has asked permission of the government to increase its capital from 4,000,000 francs to 10,000,000 francs.

RURAL ELECTRIFICATION FUNDS MADE AVAILABLE IN FRANCE.—It is announced that a maximum of 600,000,000 francs to be employed in the extension of electric service in the rural districts of France has been placed to the credit of the National Office of Agricultural Credit.

New Apparatus and Publications

SOCKET AND ATTACHMENT PLUG.—The Magnus Electric Company, 451 Greenwich Street, New York City, has recently developed the "Plugall" attachment plug. The company has also brought out a weatherproof socket, No. 54, especially adapted for outdoor advertising-sign work and outdoor lighting in general.

ELECTRIC WASHING MACHINE.—The Auto Parts Manufacturing Company, 1915 West Fort Street, Detroit, has placed on the market the "Abso-Clean" washer. It operates on the vacuum-percolating principle and has a gas heater underneath the tub to heat the water.

ELECTRIC IRONER.—The Utensils Company, 305 East Columbia Street, Fort Wayne, Ind., has brought out a new model ironing machine with a push-button control.

SCREWDRIVER ATTACHMENT FOR ELECTRIC DRILL.—The Independent Pneumatic Tool Company, 600 West Jackson Boulevard, Chicago, has developed the "Thor" screwdriver attachment for electric drill.

OIL-BURNING HEATING PLANT.—A new type of burner, known as the "Oil-O-Matic," driven by an electric motor, has been brought out by C. U. Williams & Son, Bloomington, Ill.

AUTOMATIC STARTERS FOR SYNCHRONOUS MOTORS.—Bulletin No. 798 issued by the Electric Machinery Manufacturing Company, Minneapolis, gives engineering specifications, including wiring diagrams and oscillographs, of its new automatic starters for synchronous motors.

AIR FILTER.—The William Reed Engineering Company, 50 Church Street, New York City, is distributing bulletins Nos. 106 and 107 describing the "Reed" air filter, a device for filtering air used in ventilating machinery, such as turbo-generators, transformers, etc.

WAFFLE IRON.—A waffle iron with an expansion hinge has been placed on the market by Landers, Frary & Clark, New Britain, Conn.

AUTOMATIC COMPENSATOR.—The Electric Controller & Manufacturing Company, Seventy-ninth and Woodlawn Avenues, Cleveland, has developed a manual automatic compensator.

THERMAL RELAY.—The Automatic Reclosing Circuit Breaker Company, Columbus, Ohio, has brought out a thermal relay to be used on control circuits not exceeding 6 amp. at 125 volts or 3 amp. at 250 volts.

ELECTRIC SOLDERING SET.—A soldering iron with a removable tip for radio and general home repair work has been placed on the market by J. Thomas Rhamstine, 2152 East Larned Street, Detroit.

REFLECTOR SCREEN.—A reflector screen for colored lighting in store windows has been developed by J. B. Timberlake & Sons, Jackson, Mich.

STORAGE BATTERY.—A heavy-duty storage battery with Planté type positive plates has been placed on the market by the Lincoln Light Corporation, Grafton, Wis.

BENCH DRILL PRESS.—The Burke Machine Tool Company, Conneaut, Ohio, has placed on the market a heavy-duty bench drill press of 12 in. size with a capacity up to $\frac{5}{16}$ in.

THERMOSTAT.—A thermostat "Mercoid" for refrigeration and oil burning equipment has been brought out by the Federal Gauge Company, 564 West Adams Company, Chicago.

New Incorporations

THE KICKAPOO RIVER POWER COMPANY, Crawford County, Wis., has been incorporated by E. E. Dillon and L. C. Fleck, Madison, Wis., and H. L. Seely and E. F. Woodard, La Farge, Wis., with capital stock of $25,000.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

PATTEN, ME.—The Katahdin Electric Company, recently formed, contemplates the installation of a plant and system for service in this section. Raymond D. Gardner is president.

PORTLAND, ME.—The Cumberland County Power & Light Company has tentative plans for the construction of a substation on Congress Street, estimated to cost $50,000.

BELCHERTOWN, MASS.—Plans are being arranged for the installation of electrically operated pumping machinery in connection with a new waterworks system, estimated to cost $70,000. Brainerd & Brainerd, Palmer, Mass., are engineers.

UXBRIDGE, MASS.—Plans are under consideration for the installation of electrically operated pumping machinery in connection with an addition to the waterworks.

Middle Atlantic States

BUFFALO, N. Y.—Plans have been approved for the installation of an underground conduit system for electric service in Eastwood Place; also for the installation of a luminous-arc lighting system on Kensington Avenue.

BUFFALO, N. Y.—The New York Central Railroad Company will build a one-story transformer station on Deshler Street, near Bailey Avenue.

BUFFALO, N. Y.—Bids will be received by the Superintendent of Light Houses until Sept. 24 for one oil-engine-driven electric generator and one motor-driven air compressor unit, as per specifications on file.

BUFFALO, N. Y.—Plans are being perfected by the Commissioner of Public Works for the extension of the lighting system, using underground conduits, on Franklin Street from Chippewa Street to North Street.

BUFFALO, N. Y.—Bids will be received by Arthur W. Kreinheder, Commissioner of Public Works, until Oct. 23 for electrically operated centrifugal pumping machinery, with ten switchboard panels, instruments and auxiliary electrical equipment. The pumping units are to be: two, each with capacity of 75,000,000 gal. per day; one, 45,000,000 gal.; one, 30,000,000 gal.; one, 15,000,000 gal.; one, 8,500,000 gal., and one, 3,500,000 gal. per day. Fuller & McClintock, 170 Broadway, New York, are consulting engineers.

DERRINGER, PA.—The Pennsylvania Power & Light Company will construct an addition to its transmission system from Black Creek Township for service at local coal properties.

LE ROY, N. Y.—Plans for the installation of an electric fire alarm system will be held in abeyance until the first of the year, when it is expected to ask for bids. Arrangements are being perfected for rebuilding the local electric lines.

NEW YORK, N. Y.—Bids will be called at once by the United States Navy Purchasing Office, South and Whitehall Streets, for 100 ammeters. (N. S. A. Req. 826).

ORCHARD PARK, N. Y.—Plans are under consideration for the installation of electrically operated pumping machinery at the proposed municipal waterworks, estimated to cost $215,000.

PORT JERVIS, N. Y.—The Orange County Public Service Company has issued notes for $550,000, the proceeds to be used for the purchase of the Orange County Public Service Corporation and the Orange County Hydro-Electric Corporation, including proposed extensions in transmission system.

ALLENTOWN, PA.—The Pennsylvania Power & Light Company has secured permission to take over and consolidate the Excelsior Electric Light Company, Lock Haven Electric Light & Power Company, Lycoming Edison Company and the Wilkes-Barre Company. The purchase will involve $4,865,700. Extensions will be made in plants and systems, including the construction of additional transmission lines.

LEWISTOWN, PA.—The Penn Central Light & Power Company has tentative plans under advisement for extensions and improvements in its local plant and system.

MIDDLETOWN, PA.—The Metropolitan Power Company, a subsidiary of the Metropolitan Edison Company, Reading, Pa., will install a 37,500-kva. turbo-generator and auxiliary electrical equipment for the initial unit of its new steam-operated generating plant on the Susquehanna River, for which superstructure work is under way. At an early date another generating unit of this same size will be installed, with an ultimate installation of 200,000 kw. Steel-tower transmission lines will be constructed for connection with affiliated companies. The project will involve more than $750,000.

MOSCOW, PA.—The Moscow & Roaring Brook Electric Company, recently organized, contemplates the construction of a transmission line. F. J. Doherty is treasurer.

PHILADELPHIA, PA.—Electric power equipment will be installed in the nine-story plant addition now being erected by Stephen F. Whitman & Son, Inc., Fourth and Race Streets, manufacturers of confectionery, estimated to cost $750,000. Walter S. Sharp is president.

PHILADELPHIA, PA.—Bids will be received by the Department of Public Works, City Hall, until Sept. 25 for an electrically operated pumping plant on Germantown Avenue for booster service.

PHILADELPHIA, PA.—Work will commence on construction of a transmission line by the Philadelphia Electric Company to furnish service from its Somerset Street power plant to the West Jersey & Seashore Railroad Company. The last-noted company purposes to discontinue operations at its private power plant at Westville, N. J.

YORK, PA.—The Yorkana, Crossroads, Winterstown, and North and East Hopewell Township Light, Heat & Power companies have been organized to construct and operate transmission lines in the respective districts for which the companies are named. Charles E. Stees, York, is treasurer and representative for the organizations.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company has completed plans for the construction of an addition to its station on Hopkins Place, estimated to cost $65,000.

FREDERICKSBURG, MD.—The Spottsylvania Power Company has closed negotiations for the purchase of the Rappahannock Electric Light & Power Company and will merge the property. Plans are under consideration for expansion, including the construction of transmission lines.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies & Accounts, Navy Department, until Oct. 2, for one apron feeder and motor, for use at the Annapolis Naval Station (Schedule 1301); also, until Oct. 9, for 1,660 lb. of magnet wire for the Mare Island Navy Yard (Schedule 1303), and, until Oct. 2, for radio-frequency transformers for the Washington Navy Yard (Schedule 1307).

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Sept. 29, for telephone equipment, including thirty-four rectifier bulbs, twenty switchboard relays, 125 telephone condensers, 20 operators' transmitters, 100 cable terminals and 50 cord terminals (Proposal PR 15663-2 CP); also, until Oct. 20, for a quantity of vacuum tubes, 50 watt, in lots of 2,000 and 3,000. (Circular PR 15482-1 CP).

WASHINGTON, D. C.—Bids will be asked at once by the Supply Officer, Washington Navy Yard, for three three-phase motors and three automatic starting compensators; also for four 60-cycle transformers (N. S. A. F. Req. 83).

North Central States

GRAND RAPIDS, MICH.—The United Light & Railways Company has issued bonds for $1,000,000, a portion of the proceeds to be used for extensions and improvements.

MARYSVILLE, MICH.—A transmission line will be constructed here by the Ohio Edison Company, which recently took over the Springfield (Ohio) Light & Power Company. Lines also will be built to Milford Center and Urbana.

PONTIAC, MICH.—Electric power equipment will be installed in the proposed local plant of the Fisher Body Company, General Motors Building, Detroit, estimated to cost $500,000. The company is a subsidiary of the General Motors Corporation.

AKRON, OHIO—The International Lead Company will install substation and other electric power equipment in its proposed new plant unit, estimated to cost $500,000. The company is a subsidiary of the Anaconda Copper Mining Company, 25 Broadway, New York.

CONNEAUT, OHIO.—Electric power equipment will be installed in the proposed plant to be constructed by the Graham Clay Products Company, 518 Guardian Building, Cleveland, estimated to cost $100,000. B. J. Graham is president and treasurer.

TIFFIN, OHIO.—Plans have been authorized for the construction of a power plant at the local National Orphans' Home, Junion Order United American Mechanics, estimated to cost $50,000.

JASONVILLE, IND.—Plans are under consideration for the installation of electrically operated pumping machinery for a new waterworks system, estimated to cost $150,000. A Simms is engineer for the city.

ODANAH, WIS.—The local electric lighting and water systems, it is reported, have been purchased by the Ashland Iron & Milling Company. Improvements, it is understood, are contemplated.

WAUSAU, WIS.—The Wisconsin Valley Electric Company is planning to extend its transmission line to Stevens Point, Marshfield and Stratford.

PORTAGE, WIS.—Bonds for $90,000 have been voted for extensions in the waterworks, including the installation of electrically operated pumping equipment. Service will be furnished by the Wisconsin Power, Light & Heat Company.

LE SUEUR, MINN.—Preliminary plans are under consideration for the construction of a municipal electric plant.

WASHINGTON, IOWA.—Plans are being arranged for the installation of electrically operated pumping machinery in connection with a new waterworks station, estimated to cost $80,000. Arthur L. Mullergren, 555 Gates Building, Kansas City, Mo., is consulting engineer.

AVA, MO.—Plans are under consideration for the installation of electric power equipment in connection with a proposed waterworks system. Elston, Axon & Russell, Springfield, Mo., are engineers.

CAPE GIRARDEAU, MO.—The Union Sash & Door Company contemplates the rebuilding of its plant and power house, recently destroyed by fire with loss estimated at $250,000.

HOLDEN, MO.—Plans are under consideration for the installation of electrically operated pumping machinery at the municipal waterworks, in connection with improvements, estimated to cost $65,000.

MEXICO, MO.—The Illinois Power & Light Corporation has acquired the Missouri Utilities Company, operating at Mexico, Vandalia, Montgomery City and vicinity, and plans for extensions in the transmission system and plant improvements.

MILLER, MO.—Plans are being prepared for the construction of a municipal electric plant, to be operated in conjunction with a waterworks system. The Alexander Engineering Company, Woodruff Building, Springfield, Mo., is engineer.

NEW LONDON, MO.—Plans are being considered for the installation of electrically operated pumping machinery in connection with a new waterworks system. W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., are engineers.

REPUBLIC, MO.—Plans will soon be prepared for the construction of a municipal electric power plant, for which bonds for $35,000 have been voted. W. M. Barron is mayor.

CHADRON, NEB.—The Western Public Service Company has commenced the enlargement of its local power plant and will soon install additional equipment. The work will cost about $25,000.

GRAND ISLAND, NEB.—Work is under way on a new electric generating plant on the Platte River by the Central Power Company, to cost about $750,000, and arrangements for equipment installation will be perfected at an early date.

GREELEY, NEB.—Bonds have been authorized to erect a transmission line from Cedar Rapids to Greeley.

STANTON, NEB.—The Nebraska Gas & Electric Company will build a transmission line from its power plant at Norfolk, Neb. The local municipal electric power plant will be closed down.

GOFF, KAN.—Plans are being considered for the installation of electrically operated pumping machinery at the proposed municipal waterworks. The Shockley Engineering Company, Graphic Arts Building, Kansas City, Mo., is engineer.

KANSAS CITY, KAN.—A special election has been called Oct. 23, to vote bonds for $2,000,000 for extensions and improvements in the municipal light and power system. R. L. McAlpine is engineer.

WINFIELD, KAN.—Electrically operated pumping machinery will be installed in connection with proposed extensions and improvements in the municipal water plant, to cost about $112,000. H. P. Haynes, Winfield, is engineer.

Southern States

BETHEL, N. C.—Work will soon commence on a transmission line from Greenville, N. C., and the installation of a local light and power system. Edward E. Williams, Greenville, is engineer.

CAMP LOOKOUT, N. C.—Bids will soon be called by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of radio stations at the local naval property. (Specification 4906.)

WAYNESVILLE, N. C.—The Pigeon River Power Company has authorized plans for the construction of a hydro-electric power plant on the Pigeon River, vicinity of Waterville, with initial output of 50,000 hp., to be increased with two additional units, each of the same capacity, at a later date, making an ultimate rating of 150,000 hp. A steel-tower transmission line will be constructed to Asheville, N. C., and vicinity. Application has been made to the Federal Power Commission. Francis R. Weller, Mills Buildng, Washington, D. C., is engineer.

WINSTON-SALEM, N. C.—The Blue Ridge Mica Company contemplates the construction of a power house in connection with a local plant, estimated to cost $250,000.

GREAT FALLS, S. C.—Work will be commenced on the construction of a transmission line from the plant of the Republic Cotton Mills, Inc., to the local hydro-electric station of the Southern Power Company. Electric power equipment will be installed in different departments of the mill.

UNION, S. C.—The Consolidated Ice & Fuel Company will install electric power equipment to replace present steam-operated machinery. Plans are being completed. R. L. McNally is treasurer.

PERRY, GA.—The Clinchfield Portland Cement Company, Kingsport, Tenn., will soon complete plans for its proposed cement-manufacturing plant and power house in this section, to cost in excess of $1,500,000.

SAVANNAH, GA.—The Savannah River Lumber Company contemplates the construction of a power house in connection with a local mill. I. H. Fetty is president and general manager.

TUSCALOOSA, ALA.—A committee has been appointed by the Chamber of Commerce to make investigations relative to the installation of ornamental lighting in the business section of the city.

MONTGOMERY, ALA.—Electric power equipment will be installed in the proposed local plant to be erected by the Gulf States Chemical & Refining Company, American Trust Building, Birmingham, Ala., estimated to cost $200,000. J. M. Gallalee is in charge.

JACKSONVILLE, FLA.—Plans are under advisement for a bond issue of $350,000, a portion of the proceeds to be used for extensions and improvements in the municipal lighting system.

LAKE WORTH, FLA.—Work will be commenced on the installation of a municipal electric lighting plant, estimated to cost about $30,000.

CHATTANOOGA, TENN.—The Kelleys Ferry Coal Company, 322 First National Bank Building, plans for the installation of electric power equipment and mining machinery at its properties. W. J. Nixon is president.

COOKEVILLE, TENN.—Plans are under consideration for the installation of electrically operated pumping machinery in connection with extensions and improvements at the municipal waterworks and

BIRDELL, ARK.—The Central Power & Light Company, St. Louis, Mo., contemplates the construction of a hydro-electric power plant on the Spring River, with transmission system, estmated to cost about $500,000, including improvements in existing system.

MURFREESBORO, ARK. — A power house will be constructed at a proposed stone quarry and crushing plant, for which plans are being prepared by the Henrici-Lowry Engineering Company, 1222 Commerce Building, Kansas City, Mo. The owner's name is temporarily withheld and will be announced later. The plant will cost in excess of $80,000, with equipment.

WELSH, LA.—Plans are being perfected for the construction of an addition to the municipal electric plant, cost about $20,000.

OKLAHOMA CITY, OKLA.—The Lawton-Duncan Electric Company has arranged for a change of name to the Southwestern Light & Power Company. Extensions and improvements are planned.

WELCH, OKLA.—The proposal to grant a franchise to the Empire Electric Company, Joplin, Mo., has been approved by the voters. The County Commissioners have granted the company permission to erect a high-tension transmission line from the Ottawa County line to Welch, and thence to Hudson.

STRAWN, TEX.—Electric pumping machinery will be installed in connection with the installation of a waterworks system, estimated to cost $150,000.

WYLIE, TEX.—Plans are being considered for the installaton of electrically operated pumping machinery in connection with a waterworks system, estimated to cost $50,000. The Municipal Engineering Company, Praetorian Building, Dallas, Tex., is engineer.

Pacific and Mountain States

CARLISLE, WASH.—The Carlisle-Pannell Lumber Company, Okalaska, Wash., plans for the construction of a local mill and power house to replace its plant recently destroyed by fire.

OLYMPIA, WASH.—The Fir Tree Lumber Company plans for the rebuilding of its mill and power house, recently destroyed by fire with loss estimated at $250,000, including equipment.

SPOKANE, WASH.—Plans are under consideration for the installation of electrically operated pumping machinery in connection with extensions in the municipal waterworks, estimated to cost $139,000.

CHINO, CAL.—Steps are being taken for the construction of an ornamental lighting system on D Street, between Fifth and Ninth Streets; on Riverside Drive, between Fifth and Ninth Streets, and on Sixth Street, between Riverside Drive and Chino Avenue, with underground conduits. M. L. Birnie is city clerk.

MONTEREY, CAL.—The Coast Valley Gas & Electric Company has issued bonds for $250,000, a portion of the proceeds to be used for extensions and improvements.

LONG BEACH, CAL.—The Pacific Coke & Coal Company, recently organized as a subsidiary of the Pacific Steel Company, San Francisco, plans for the construction of a power plant in connection with its proposed local steel works, estimated to cost in excess of $1,500,000.

LEWISTON, IDA.—Bids will be received by the City Controller until Oct. 10 for five motor-driven horizontal centrifugal pumps, with switchboard panels, starters and miscellaneous electrical equipment, to be used in connection with a new waterworks system, for which bids will be received at the same time. The Bruns & McDonnell Engineering Company, 402 Interstate Building, Kansas City, Mo., is engineer.

BUTTE, MONT.—Electric power equipment will be installed in the proposed addition to be constructed to the wire mill at the plant of the Anaconda Copper Mining Company, estimated to cost close to $100,000.

RENO, NEV.—Plans are being perfected for the construction of a hydro-electric power plant in the vicinity of Indian Springs, with irrigation system, estimated to cost $500,000. Ira McFarland, former Deputy State Engineer, is in charge of the project.

DENVER, COL.—The Midwest Refining Company is arranging an appropriation of about $5,000,000, for the electrification of its properties in the Salt Creek oil fields, including an electric generating plant at Shannon, about 6 miles distant.

DENVER, COL.—The Colorado Public Service Company has issued bonds for $5,000,000, a portion of the proceeds to be used for extensions and improvements.

Canada

DUNCANS, B. C.—The Yellow Fir Lumber Company plans for the installation of electric power equipment in connection with the rebuilding of the portion of its local mill, recently destroyed by fire with loss estimated at about $85,000.

OTTAWA, QUE.—The Ottawa & Hull Power Company has issued bonds for $2,500,000, a portion of the proceeds to be used for extensions and improvements.

Electrical Patents

Announced by U. S. Patent Office

(Issued Aug. 28, 1923)

1,466,361. Box Connector; B. E. Getchell, Plainville, Conn. App. filed Dec. 5, 1921. Tubular trough for inclosing wires between meter cabinet and switch box.

1,466,364. Self-Cooled Electric Motor; R. A. Ilg, Chicago, Ill. App. filed Aug. 4, 1921. Cooling air passes through field on to armature.

1,466,375. Trolley Safety Clutch; W. B. Haskins, Independence, Mo. App. filed Aug. 13, 1921. For trolley pole rope.

1,466,389. Heater or Vaporizer; I. E. Aske, Duluth, Minn. App. filed May 17, 1921. For automobile manifold.

1,466,406. Preheater and Mixer; J. B. MacDonald, Oakland, Cal. App. filed Jan. 23, 1922. For internal-combustion engines.

1,466,419. Means for Maintaining the Focus of Arc Projectors; P. R. Bassett, Brooklyn, N. Y. App. filed Oct. 15, 1918. Flame automatically kept in focus.

1,466,441. High-Frequency Self-Induction Coil; Edouard Binard, Brussels, Belgium. App. filed Aug. 27, 1921. Method of winding coils.

1,466,448. Annunciator or Indicator System; S. Katz, New York, N. Y. App. filed July 22, 1921. Electromechanical mechanism.

1,466,471. Time-Control Signal System; D. W. Driscoll, Villanova, Pa. App. filed April 27, 1923. Bell-ringing system for hotels, schools, etc.

1,466,479. Indicating Device; E. F. Potter, Chicago, Ill. App. filed Oct. 2, 1922. Lamp on radiator temperature indicator goes out if any other light on automobile does.

1,466,497. Indirect-Lighting Fixture; A. Wood, Dearborn, Mich. App. filed Sept. 25, 1920.

1,466,503. Electrode Handler; A. W. Gregg, Chicago, Ill. App. filed July 16, 1921. Control apparatus for electrodes.

1,466,529. Ignition System; John H. Hunt, Dayton, Ohio. App. filed April 2, 1921. Shower ignition for engine starting.

1,466,537. Lock; C. M. McCarthy, Norfolk, Va. App. filed Feb. 18, 1922. Electrically operated lock for automobiles.

1,466,541. Rectifier for Electric Currents; Montford Morrison, New York, N. Y. App. filed April 12, 1921. Mechanical rectifier.

1,466,582. Plating Machine; William Dietzel, Merrick, N. Y. App. filed Feb. 18, 1920. Spiral trough for tumbling articles during plating.

1,466,584. Power Transmission and Electric Braking; Peter W. Forsberg, Schenectady, N. Y. App. filed Nov. 11, 1922. For electric locomotives.

1,466,587. Welding Process and Means; C. H. Hollup, Milwaukee, Wis. App. filed Dec. 29, 1917. Welding various types of steel together.

1,466,603. Electric Furnace Apparatus and Method of Operating the Same; John A. Seede, Schenectady, N. Y. App. filed May 8, 1916. Method of overcoming high reactance between electrodes.

1,466,627. Process of Making Cyanids; Karl P. McElroy, Washington, D. C. App. filed Jan. 25, 1922. In electric induction furnace.

1,466,635. System and Apparatus for Generating and Distributing Electric Currents; C. H. Tower, Cleveland, Ohio. App. filed Dec. 12, 1918. Automobile generator for battery charging.

1,466,654. Dynamo-Electric Machine; F. H. Clough, Hillmorton, near Rugby, England. App. filed Feb. 19, 1920. Automobile generator and starter.

(Issued Sept. 4, 1923)

1,466,656. Electric Toaster; C. E. Barr and T. E. Jackson, Detroit, Mich. App. filed April 17, 1922. Toasts two slices at once and is provided with heat plate on top.

1,466,674. Storage Battery; V. C. Stanley, Brookline, Mass. App. filed April 15, 1922. For supplying individual signaling circuits of fire and police alarm systems.

1,466,701. Method of and Means for Controlling Electric Currents by and in Accordance with Light Variation; L. de Forest, New York, N. Y. App. filed Sept. 18, 1919.

1,466,707. Method of and Apparatus for Limiting the Transmission of Electrical Energy; L. Espenschied, Hollis, N. Y. App. filed March 16, 1916. By thermionic device.

1,466,708. Transmission System; L. Espenschied, Hollis, N. Y. App. filed Sept. 26 1919. Multiplex system employing carrier currents.

1,466,716. Electric Weld Forging Method; I. W. Henry, New York, N. Y. App. filed Aug. 4, 1921. Substitute for riveting and bolting beams, plates, etc.

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1,466,809. Automatic Traffic Signal; L. Strong, Long Beach, Cal. App. filed Nov. 16, 1920. Automatic intermittently revolving sign.

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1,466,856. Telephone System; M. B. Stazak, Chicago, Ill. App. filed July 15, 1920. Magneto or local battery systems.

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1,466,874. Automobile Signal Light; B. W. Elliott, Cleveland, Ohio. App. filed March 13, 1922. Rear direction signal.

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1,466,893. Electrically Driven Grinding Machine; H. W. Dunbar, Worcester, Mass. App. filed Oct. 21, 1920. System of supplying power to motor on Norton type grinder.

1,466,902. Motor Controller; A. J. Horton, White Plains, N. Y. App. filed Oct. 15, 1920. Controlling speed of cutting out resistance.

1,466,912. Current Relaying and Production; D. G. McCaa, Palo Alto, Cal. App. filed May 18, 1921. Radio transmitting apparatus.

1,466,925. Electric Circuit Support; E. R. Biggs and C. R. Biggs, Clinton, Ind. App. filed Jan. 22, 1923. Means for supporting trolley wires from beams in carhouses.

1,466,940. Ignition System; W. W. Hawkins, Brooklyn, N. Y. App. filed Feb. 20, 1922. Induction-coil type.

1,466,994. Apparatus for the Electrolysis of Metals; A. Cremer, Verviers, Belgium. App. filed Oct. 7, 1922. Method of replenishing electrotype.

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1,467,003. Electrical Dehydrator; R. E. Land, Houston, Tex. App. filed Sept. 2, 1922. Construction for bringing live conductor through wall of tank.

1,467,028. Welding Electrode Holder; J. J. Dooley, Bootle, Liverpool, England. App. filed Nov. 12, 1921. Permits expeditious insertion and removal of electrode.

1,467,033. Engine-Starting Device; W. R. Goodman, Worthing, and K. I. Goodman, Richmond, England. App. filed Aug. 9, 1921. For automobiles.

1,467,044. Electric Furnace; E. F. Kiefer, Cleveland, Ohio. App. filed June 11, 1920. Crucible type.

1,467,054. Distributor; A. C. Menges, Memphis, Tenn. App. filed May 21, 1920. For internal-combustion engines.

1,467,060. Anode; A. P. Munning, Brooklyn, N. Y. App. filed Dec. 5, 1921. Spiral-shape metal anode for electrolytic apparatus.

1,467,080. Electrical Apparatus for Producing and Collecting Gases; J. M. Allen, St. Louis, Mo. App. filed Feb. 27, 1922. Collecting gases from liquids by electrolysis.

1,467,083. Electroplating Anode; B. Bart, East Orange, N. J. App. filed May 24, 1922. Prevents uneven consumption of material.

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The Increasing Importance of Light in Industry

ELECTRICITY has been a boon to mankind in many ways. It has served to produce light when and where it was wanted; it has come to perform the tasks of industry and of the household; it is used directly in manufacturing processes of various kinds; it provides warmth; it provides flexibility, and the electrical industry has been constantly at work devising new ways in which it can serve. But it was only recently that there came a realization that light, the earliest form of service by electricity, had much latent ability to be of far greater service than had previously been thought possible.

All early work by illuminating engineers in their attempt to provide adequate light in factories and other industrial establishments was directed toward the proper distribution of light to give a virtually uniform illumination of an intensity recognized as sufficient for "good vision." Light in its relation to production was considered solely from the standpoint of a substitute for waning daylight. But it is characteristic of engineering development that study and analysis continued until it was definitely shown that the intensity or degree of illumination was a vital factor in increasing production in all kinds of work. No longer was it a question of determining whether the light satisfied the average investigator or the average workman as being enough to enable him "to see his work well." Rather, were definite data gathered to show that as intensity increased so did production. The engineer does not yet know to what intensity it is desirable to go. It is known that on changing from 3 or 4 foot-candles to 15 or 20 or 30 foot-candles there is a definite increase in productivity. Some experiments indicate that 50 foot-candles is not too high, and some able and experienced engineers talk in hundreds.

Enough, however, is now known on the subject to cause many manufacturing executives to realize that illumination does play a real part in the productive effectiveness of their plants. They can see that by increasing the expenditure for light by three or four or six times they have to increase only one of the very small elements of their manufacturing costs and that the returns on this expenditure are manyfold.

From the standpoint of the illuminating engineer the problem of lighting in industry thus presents many new aspects. He is no longer merely a calculator of illumination intensities. He has to consider his contribution to the producing ability of the plant, and the actual illumination studies he makes are complicated by the intrusion of glare and similar problems on account of the intensities used. Requirement and opportunity exist for a great deal of illuminating engineering ability in the successful application of this newly developed philosophy of industrial illumination. Only a small part of industry has so far reaped the benefits, but from now on surely no engineer charged with the layout of a factory and no illuminating engineer charged with the problem of lighting it can fail to consider fully the relation of the illumination to that factory's production.

Charles Henry Roth

An untiring, consistent worker in the interest of high quality and of industry standards in manufacture.

WHEN associations are active, and when they accomplish things of real significance and value, investigation into their workings shows in each case some moving spirit, some individual who keeps the machinery going and who, consistently keeping the real goal in sight, helps guide action aright.

To Charles H. Roth the organization now known as the Power Club owes much, and to Charles H. Roth the industry which benefits from the work of the Power Club also owes much. Himself a manufacturer of electrical equipment, principally motors and generators, he was one of the members of the original board of what used to be the American Association of Electric Motor Manufacturers, organized in 1908, and when that was changed into the Electric Power Club, three years later, he was elected secretary and served in that capacity until June of the present year. He has been the one continuous official, the one who bore much of the brunt of "carrying on" in Power Club work. Its many accomplishments in standards of quality and specifications are some of the things which Charles H. Roth has helped make possible.

But his contribution to the industry has been not alone in association work. He has always tried to set an example of high standards of quality in the product of his own company. His training in mechanical lines was principally through practical experience. Born in the South in 1870 and a pupil at schools in Cincinnati until he was about fourteen, he then learned the trade of making bank locks and spent some years as an expert on time locks and other such devices. This, Mr. Roth says, gave him an excellent background for "quality" equipment.

In 1894 the firm of (A. G.) Roth & (C. A.) Eck was formed in Chicago. In 1895 C. H. Roth bought out Mr. Eck, and later G. A. Roth purchased an interest. The business was incorporated and the name was changed to Roth Brothers & Company in 1902. After A. G. Roth's death in 1903, C. H. Roth was made president of the company, the position he now holds. The firm's business was at first desk fans, later generators and motors, and with the increase in independent telephone business, motor-generator sets for batteries and ringing outfits became a large part of it. From this the business has developed principally into a general one of motors and generators of standard type and also to meet special requirements.

Mr. Roth is still a valued member of several of the Power Club committees. He is a member of the A. I. E. E. and of the Electric Club of Chicago.

Editorial Comment

Electrical World, September 29, 1923
Volume 82 Number 13

Make the Engineering School Part of Industry

THE purchaser of engineering equipment is almost always careful to examine what he buys. He wants to know all about the product. He is zealous in specifying what it shall be, and not infrequently he insists on giving it occasional or continuous inspection as it passes through the factory. But in connection with one of the most important purchases he makes—whether he be himself a manufacturer or an operator—he is all too negligent in helping to shape the product he needs. In spite of this negligence, as an employer of technically trained men he is prone to be critical of the recent graduates he employs and also of the schools and teachers that train them.

As Andrew Carnegie among others forcefully pointed out, the greatest thing of value an executive has is his organization. To build an organization good raw material is needed, and in the electrical industry above all others good technically trained men are needed. The schools which train and produce these men are thus as much a part of the industry itself as are the manufacturers of material and equipment. They are, in fact, more important. In general, they are trying to get close to industry. But the power to make the amalgamation complete lies with industry itself.

Those men charged with the executive responsibility for technical industries can make no more valuable effort than to see to it that steps more aggressive than ever are taken to make the union of industry and schools complete, so that when the engineering graduate product is absorbed into practical work it will be a product that is most useful and valuable to the industry. Equal benefit will inure to the graduates themselves. In other words, make the engineering school a part of industry and not apart from industry.

Do Your Commercial Men Have Time to Grow?

UNDERMANNED commercial departments cannot grow for the simple reason that overworked employees cannot do constructive thinking. It is a matter worth the serious consideration of utility executives.

It is not an uncommon thing to hear the general manager of a public utility say that he cannot obtain good men for his commercial department, that he has difficulty in getting salesmen of the right type and finds it hard to develop out of these salesmen men of executive capacity for promotion to be district agents and sales managers. There are probably two reasons that have something to do with it. In the first place, it has not been traditional in the central-station industry to pay the kind of salaries to commercial men and to delegate to them the scope of authority that attract the kind of personnel that their executives actually desire, considering the competition both in pay and power offered by other industries that are constantly bidding in the open market for more and better men. Then, after this, is the fact that sales departments of utilities are rarely staffed as generously as sales departments of the ordinary manufacturing concern, and there is the additional hindrance that the men in these departments are likely to be heavily burdened with detail and therefore have insufficient leisure to think forward and to grow.

It is commonly conceived that the sales function of the public utility is of steadily increasing importance. Market development undoubtedly will play a greater part in years to come than it has in years gone by or than it does today; yet the sales department of a central station cannot hope to meet this opportunity beyond the measure of its personnel. There are both quantitative and qualitative elements in an analysis of any sales department, and it is not enough to select good men if they are not in sufficient number to enable them to think and grow as well as work.

"The Frailty of Public Officials"

IN HIS remarks at the recent Toronto meeting of the Public Ownership League of America Oliver T. Erickson of Seattle called attention in an emphatic way to what he termed "the frailty of public officials." For examples he pointed to extravagance of expenditure in the Skagit River project of the city of Seattle and also to the "humbug of the five-cent fare" of the same city's municipal street railway.

There has been a great deal of discussion about municipal, state and national operation, but Mr. Erickson has coined a phrase which points clearly and somewhat dramatically to its weakest point. A public official as an individual is no worse and no more fallible than the rest of us. He is not a separate kind of an individual; as a matter of fact, he is merely any one of us elected or appointed to office. But he is surrounded with restrictions and influenced by ideas for which we, the public, are responsible, and the point which Mr. Erickson brings out is that, with the present civic development of our cities and states, there is no incentive for public officials charged with responsibility for the operation of public utilities to conduct them according to sound business policies. The public clamor for low rates, the public pride in grand and stupendous undertakings and similar public influences all call for an extravagance of expenditure and for the overmanning of these works to a degree not consistent with good business and never to be countenanced in an official responsible to a board of directors. Parenthetically, the recent situation on the municipal railway system of Berlin, Germany, where the overmanning was carried to such an extreme as to weaken the enterprise, may be instanced as a case in point. In strictly technical or engineering work a government can employ men as able as those who can be employed by a private company,

but when it comes to management and policy the circumstances are different.

Mr. Erickson, to be sure, in making the point that public officials are frail, does not oppose public ownership, but seeks to analyze its weakness with a view to strengthening it. But, like other similarly minded enthusiasts, he fails to recognize the difference between the functions of government and the functions of business and thus to understand why any given official may be a successful political officer and at the same time a "frail" operator of publicly owned utilities.

It cannot be emphasized too often or in too strong terms that this country was builded on the basis of reward for individual initiative. This is one principal differentiation between America and the older European countries. This basic principle must not be disturbed. The incentive for skillful utility operation is always before the private manager, but it is seldom before the public official so noticeably as is his principal duty in carrying on the government. Those who profess to see opportunity for better utility service through government operation will do well to study "the frailty of public officials" in this line of work, as portrayed by Mr. Erickson, and also to study carefully the reverse of the picture to see why it is that private operation and private initiative have produced in America a development of electric service which is far superior to that existing in any other country on earth.

Active Work for N. E. L. A. Geographic Commercial Bureaus

AT THE recent meeting of the executive committee of the Commercial National Section, N. E. L. A., a long step forward was taken in the decision to issue this year a single commercial progress report and relieve the various section bureaus of the traditional responsibility to write annually a series of histories covering progress and experience in each branch of central-station market development. The result in the past has been the simultaneous release at the height of the convention season of masses of printed matter that could not hope to win any large amount of serious attention.

The most appealing feature of this new plan, however, lies in the fact that this combined commercial progress report is now to be developed in the field through the geographic sections and that thus the facts will spring from their source. They can be presented in full before geographic section conventions in different parts of the country, and the Commercial National Section bureaus can compile and condense them into one progress report for the year that will be far more readable and usable, and that even in its brevity should be far more comprehensive and authentic, than the usual historical paper written not from the field but from the desk of the bureau chairman. It will leave the bureaus free for the study of definite problems that affect their branches of the work, and under the present plan this is to be the chief purpose of the year.

It is of particular interest that the geographic section bureaus thus have something definite to do. By its very nature the work of central-station market development must be local. Therefore the contact of the geographic section with its field cannot but be more intimate than local contact with the national bureau. These groups of able men throughout the country have stood by ready to work, but it has seemed to be difficult to bring them actively into the national picture. The response to this appeal for co-operation will undoubtedly be hearty and much good should come of it.

Business Development Is One Problem in Determining Rates for Rural Lines

THE rural-lines committee of the Empire State Gas and Electric Association has been doing some very constructive work toward a solution of the rural service problem. A part of its report was published in a recent issue of the ELECTRICAL WORLD (July 21, page 136), and in this issue is given a formula for the computation of the excess charge for rural customers which the committee has developed. An examination of this formula reveals the fact that the committee has apparently ignored one of the two basic factors that affect the accurate formulation of any rate and which should, it seems, be taken into consideration, at least in the present state of rural-line development. The committee considers the average cost per mile of rural line, number of customers, average cost of urban distribution systems per customer and the annual charges on the rural line of retirement, taxes, maintenance and return. But the item of revenue, which forms one of the two basic factors in any rural rate schedule, the item of cost being the other, is eliminated entirely. Under the formula two lines into rural territory that cost the same amount of money to construct and operate and served the same number of consumers, one of which returned a revenue of 20 per cent annually and the other one of 10 per cent, would carry the same excess charge per customer. Neither extension would be classed as an urban extension that could, under the rules, be handled like other urban extensions, unless the company arbitrarily undertook to handle the one with the larger revenue as urban and accepted a loss due to insufficient revenue. Handling such an extension in either way would prove a discrimination, in the one case against the consumers on the line, who would be paying the same excess charge as a similar group paying less for energy used, and in the other against the real urban consumers because the rural customers so classified would be receiving service at a rate less than cost and the others would be making up the losses. A similar error has been made in the case of the Indiana rules for electric service.

Apparently what has been attempted in such cases is to avoid the clerical labor of carefully analyzing each extension until a more solid basis of knowledge shall be developed and the problem of a uniform rural service rate for a given territory can be successfully handled. Use of electrical energy on the farm is still in an active stage of development—there is nothing final about it, and rate problems as well as other problems are best approached with the idea of present and future development rather than in an attempt to find a semi-permanent solution. One encouragement to development is to assure each customer of no discrimination, and any extra temporary calculations are worth while from that standpoint. As revenues increase excess cost conditions also vary. In the case of the Wisconsin rules, which are criticised frequently because of their complication in the fixing of the rates, or, more correctly, the excess charge, the men responsible for their formation recognized the possibility of change, the need of a means of handling the present situation without blocking future development, while at the same time avoiding discrimi-

nation between consumers of the same or different classes. The rules produced are admittedly temporary in their form. A series of adjustments, taking into consideration costs and revenue, is provided which will permit the farmer, as a customer, finally to get the same rate schedule as his urban neighbor if he can develop his use of energy sufficiently. In any event, he can progress toward the goal as far as his use of energy at any time permits. When the business development is more clearly defined it is probable that an entirely different method of handling the question will be followed in Wisconsin. The present rules are serving the purpose of helping that development.

It is not suggested that the form of the Wisconsin rules will fit all parts of the country. The Northwest Electric Light and Power Association, for example, has developed a set of rules that fits the particular situation in the Northwest. But a careful analysis of the two sets shows that the Northwest rules, as well as the Wisconsin ones, are adjustable to meet changing conditions and to avoid discrimination. They reach substantially the same answer by a different road because different conditions must be met. The basic rate-making principles are identical.

State association committees and others working on the subject of rural rates can well afford to consider the relation of rates to business development. There will be plenty of time when more is known about rates to try to develop short cuts and permanent rates in a situation of which the best informed are unwilling now to predict even the approximate result.

Aside from the one situation described above, the Empire State committee has taken a broad view of the situation and of utility obligations to serve the territory covered by franchises. Its report merits study.

Analyzing Washington's Frequency Problem

A THOROUGHGOING engineering investigation of the trend of urban load development in relation to growth of business and central-station plant and distribution facilities affords splendid material for analysis. The economic aspects of such a study of the District of Columbia's future electrical requirements are outlined by W. R. McCann elsewhere in this issue. Space prevents the presentation of the detailed computations by which the conclusion was reached that on the basis of anticipated load trends the 60-cycle system is by far the more economical line of development, but even the rather summarized treatment of the subject will be found highly suggestive.

Past, present and future costs must be weighed in deciding the logical moves to be made in bringing about a degree of standardization like that indicated as essential for Washington. Exhaustive studies of loads at different periods, including estimates of future business in different classes of service, must be combined with a keen analysis of the fixed and operating costs of different types of equipment such as frequency changers, rotary converters, power transformers, cable transmission and generating units of each frequency. All this has been done with skill in the Washington case, and it is interesting to note that in ten or twelve years the adoption of 60-cycle service bids fair to save well over $1,500,000. While the problem at Washington was to some degree simplified by the absence of any substantial industrial load, either in existence or anticipated, the existence of an important electric railway load had to be carefully considered in relation to future as well as present requirements, and the operation of Edison three-wire direct-current service in the downtown areas had a real bearing upon the investigation. It would be difficult to cite a better example of the wisdom of determining development plans by exhaustive engineering analysis, leading to a decision to make larger immediate capital outlays for the sake of ultimately increased savings.

National Organization for Local Electrical Leagues

LAST week saw the expression of a very interesting bit of evolution in the organization structure of the electrical industry. Representatives of local leagues and clubs throughout the country gathered on Association Island. There are about eighty leagues in operation today, and about thirty more are in process of formation. They decided to establish some sort of national direction for league work, that their activities may be co-ordinated and their influence strengthened.

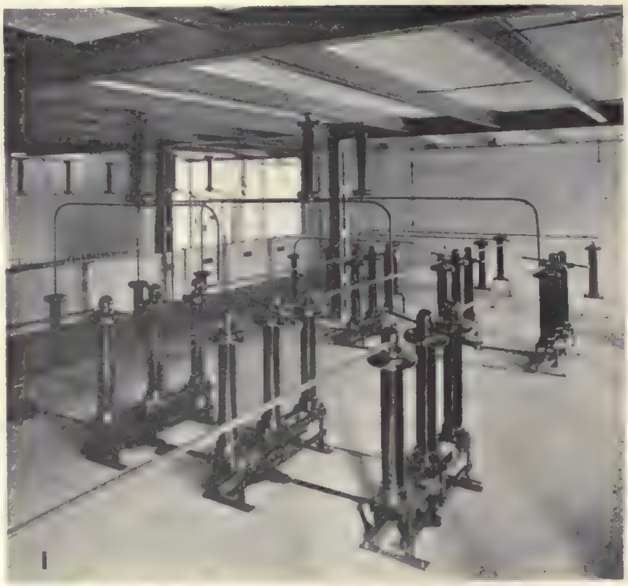
Some men have been inclined to doubt the necessity for local electrical leagues and question their practicability. But, after all, it is a natural development. It would have come years ago had not the electrical industry been—in a sense—built backward.

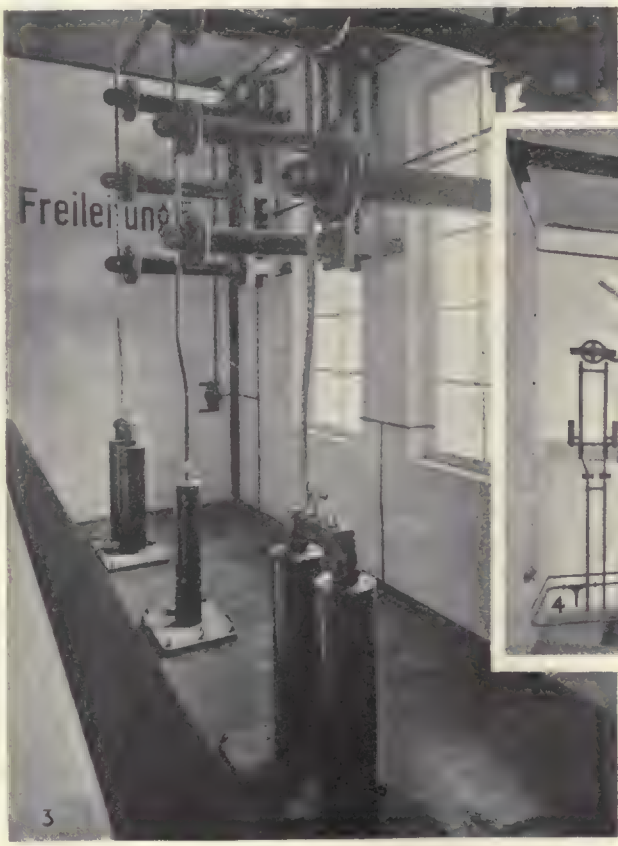
Think about it, and one of the very fundamental institutions in American civil and social life has been the so-called "stove committee" of the village store. Here through generations gathered the head men of the village to talk politics—local and national—and to argue the problems of the day. Washington, Jefferson, Hamilton, national leaders, did not spring from the nation as a whole. They were the product of localities, and behind them sat these fathers of ten thousand villages in small groups around the wood-burning stoves in the general stores. It was they who made public opinion. They *were* the public.

The organization of the electrical industry is in itself a similar structure—a community of electrical men in every city, with national leaders sprung from groups and from localities. But because it started with great power stations and great manufactories feeding down to the communities, instead of growing up from village barter and trade as most other industries have done, electrical men have never set up these village "stove committees"; they have never until recently organized local opinion and local strength in each community to put united force behind the common purposes—despite the fact that in any national development civic or industrial community opinion is basic and vital.

Last autumn the Society for Electrical Development took the initiative and called the league to gather for the benefits of contact and conference. The spirit of that meeting has carried far, and sixty leagues have either been established or are forming. At their second conference spontaneous demand for a national "tie-in" and direction for league work resulted in the appointment of a committee to devise a plan. Meanwhile the S. E. D. has been requested to promote league development and to arrange for another conference next fall.

The electrical industry has long waited for the coming of local organization. It has needed "stove committees" that could guide opinion and get things done. The announcement of the national plan will be awaited with keen interest.





Switching Equipment in Germany

IT HAS been stated on good authority that German stations have a cheaper and simpler electrical design than American stations. The accompanying photographs are illustrative of practices used in Berlin, and American engineers will note several radical deviations from standard practice in this country.

No. 1—Method of mounting 100-kv. "disconnects" and buses in Moabit station (Berlin).

No. 2—Entrance of 100-kv. line to Moabit station.

No. 3—Another view of "disconnects" and floor-mounted current transformers in a substation.

No. 4—"Disconnects" and floor-mounted current transformers in a 60-kv. substation in Berlin.

No. 5—Interesting installation of "disconnects" on girders. At lower left, oil-breaker control pedestals are shown. (Dresden South substation.)

Calibration of Test Meters

Laboratory Facilities Used—Testing Methods and Accuracy Limits—Test Forms and Certificates—Thirty-five Public Utility Companies Take Advantage of the Means Placed at Their Disposal

By A. E. KNOWLTON
Electrical Engineer Public Utilities Commission, State of Connecticut

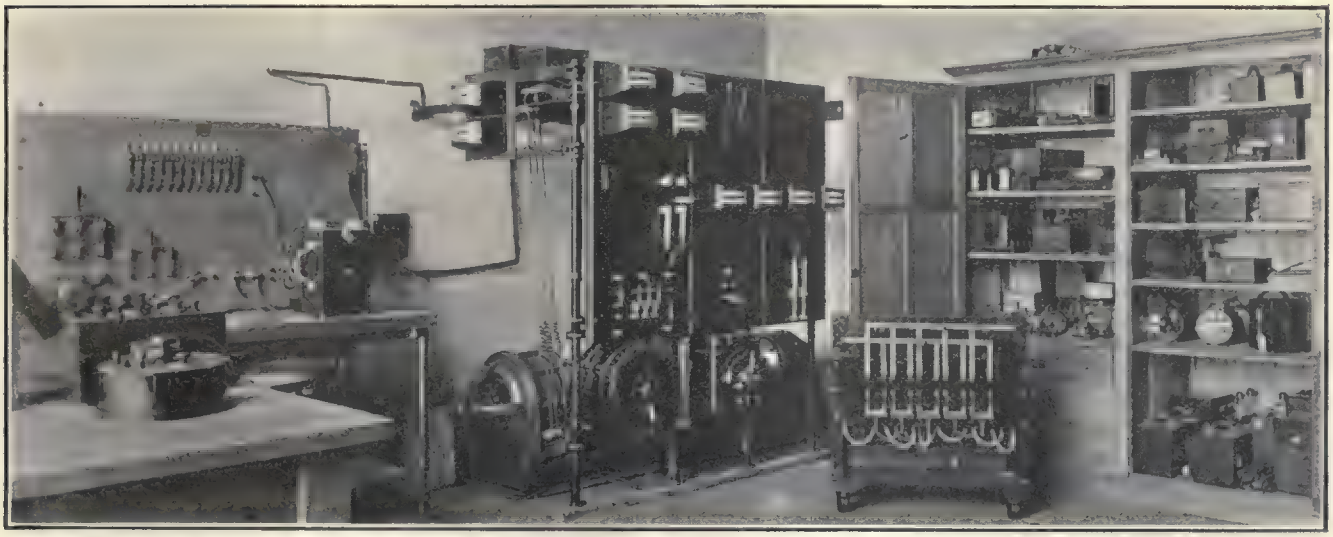


FIG. 1—VIEW OF COMMISSION METER-TESTING LABORATORY IN ELECTRICAL DEPARTMENT OF SHEFFIELD SCIENTIFIC SCHOOL

THERE was a period when one heard much of the prospect of selling electric service by other methods than by meter. That time does not seem to be arriving very rapidly—in fact, metering seems now to be receiving more attention than ever. This is undoubtedly due to the fuller recognition of the various factors entering into the cost of rendering electric service and their reflection in more complicated rate schedules. Naturally, the application of the complicated rate schedules frequently results in complication of metering methods.

Many electric companies are said to be considering the installation of facilities for maintaining their own standards of electrical measurement. To such companies it may be of interest to learn of the equipment and methods employed in a laboratory which verifies the standards of about thirty-five utilities. It should, of course, be understood that no claim is laid to superiority or universality for the particular instruments, accessories or methods employed. The intention is merely to describe one way of meeting the requirements.

The laboratory to be described is that maintained by the Public Utilities Commission of the State of Connecticut for the purpose of maintaining the accuracy of electrical energy measurement by the electrical utilities in the state. It is housed in the Dunham Laboratory of Electrical Engineering, Yale University, New Haven, an arrangement which appears to be advantageous to both the university and the state, the precision instruments of the latter being available to the university in exchange for the former's space and supply of energy of uniform characteristics.

The first matter to be decided in the establishment of such a laboratory was the provision of an appropriate space for the permanent installation of the standard instruments and the motor-generator set and proper housing of accessory equipment. The space is inclosed and accessible only to those responsible for the equipment; it is kept free of irrelevant material; it has a fairly uniform temperature; it is free from moisture, dust, drafts and vibration; it is reasonably close to the source of power. It is, of course, imperative to have available an unfluctuating source of both current and voltage, continuous and alternating. In the laboratory in question continuous current is obtained from Edison cells and potential from the university's lead battery. As for the supply of alternating current, special consideration was given to two factors—first, the wave form; second, control of load power factor. In the case of an individual company having modern alternators of satisfactory wave form and a single continuously connected system, it is an open question whether the prevailing wave form should not be employed for the alternating-current tests in preference to any standardized wave form. In this laboratory, however, inasmuch as standards are calibrated for so many different companies, it was felt desirable to employ a sine-wave source of supply and for that reason a special sine-wave alternator is used for all alternating-current tests.

PHASE SHIFTING USED

Rotating standards used to calibrate service meters operating on loads of other than unity power factor should, of course, themselves be checked at various power factors. This necessitates provision of a ready means of getting load currents to lag or lead the impressed voltages. In this laboratory the displacement in phase is accomplished by means of a potential phase

shifter of commercial form, and this incidentally provides in addition the means of getting the nominal voltages of 110, 220, 440 and 550 from the 220-volt alternator by an auto-transformer method. Heavy current loads would involve an inordinately large alternator, and this is avoided by the use of a States phantom load of 220-volt primary and 8-volt secondary. Some fear has been expressed to the writer of the departure from sine-wave form which may be introduced by the use of these two devices, phase shifter and phantom load, but oscillographic examination under working conditions has proved the absence of such distortions in the case of the specific apparatus installed. It is well, however, not to lose sight of the distortions which may creep in when accessories of poor or inappropriate design are resorted to in order to economize in kilovolt-ampere capacity or in energy consumption.

The "organization chart" (Fig. 2) shows not only the instrument equipment but also the sequence of comparison from the ultimate to the working standards. The range of some of the instruments is also shown. Full lines apply to direct current and dashed lines to alternating current. In the first place three standard cells are employed so that any irregularity in the working standard can be detected by comparison with two others used only for that purpose. The cells are checked regularly by the national Bureau of Standards. D'Arsonval type laboratory standard voltmeter and ammeter are calibrated by means of the potentiometer, standard cells and standard resistances. The dynamometer-type wattmeter is then calibrated by averaging reversed readings of D'Arsonval type ammeter and voltmeter with continuous-current load. An alternative procedure would be to calibrate the wattmeter on alternating current by means of dynamometer or Kelvin type instruments, but this procedure has been found less satisfactory. This wattmeter then serves to calibrate the primary rotating standard through the medium of time measurement and a standardized current transformer for the higher values of current.

At the beginning a stop watch was used for timing the revolutions of the standard watt-hour meter, but always in a way completely to avoid the starting and stopping errors of the watch. The fly hand was allowed to run continuously, and when this hand passed over some hour point on the dial the meter was started, and when the fly hand passed over this same point two minutes later the meter was stopped. Starting and stopping of the meter was effected by closing and opening the three-pole switch which energized both the phase shifter and the primary of the phantom-load transformer. By this means the meter was removed completely from the circuit. The accuracy of this procedure may be inferred from the experience—it was found easy to get three consecutive readings to agree with no more than 0.1 per cent difference in watt-hour-meter revolutions. Convenience and the reduction of eye strain have dicated the adoption of a mechanical timing device.

Six or seven loads ranging from 10 per cent of normal current rating of the principal coil (say 5 amp.) to 140 per cent of that value are in general sufficient to establish the characteristic curve of the primary standard. For every other current coil, every other potential coil and for 50 per cent lagging power factor four or five additional checks are needed to determine the ratios between coils and the accuracy of lagging of the meter. The readings are recorded in the form shown in

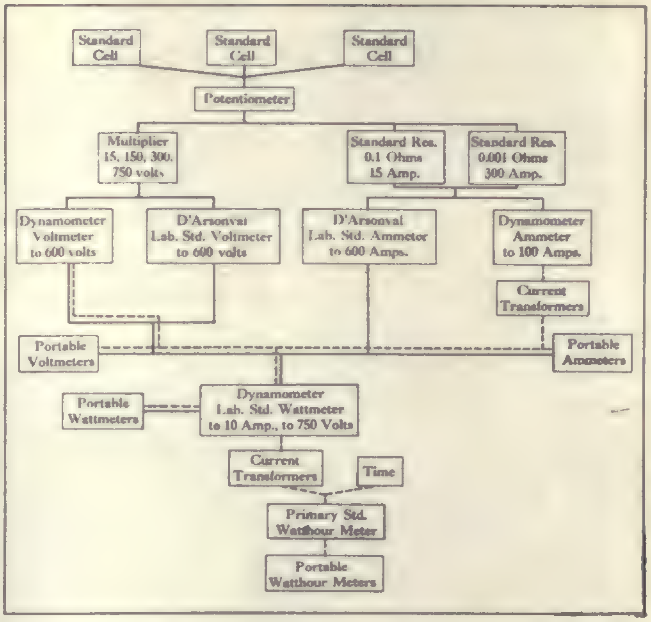


FIG. 2—INSTRUMENT EQUIPMENT AND SEQUENCE OF TESTING

ROTATING STANDARD No. Date
(Two minute runs for all readings) Sheet No.

W.M. No.	Volts	Amps	W.M. Rdg.	Cor.	Inst. Watts	Cur. Trans Amps.	Cur. Trans Ratio	True Watts	Watt-hours	Rev. of RS	RPM of RS	Why Rev

FIG. 3—RECORD FORM FOR CHECKING ROTATING STANDARDS

STATE OF CONNECTICUT

PUBLIC UTILITIES COMMISSION

Electrical Laboratory

CERTIFICATE OF STANDARDIZATION

OF

WATTHOUR METER

Make and Type Mowbray Maker's No. 611 Owner's No

Rating 1.5/15/150 Amps. 110/220 Volts. 60 Cycles. single Phase.

Submitted by

UNITED ILLUMINATING COMPANY BRIDGEPORT.

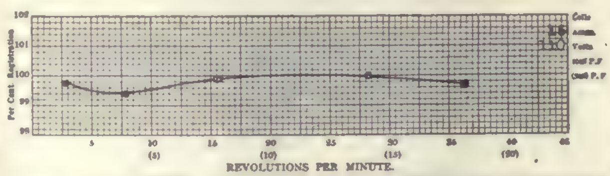
This meter has been compared with the standards maintained by this Commission and its use, in conjunction with the attached curve and corrections, is hereby approved for the period of six months from date hereof, unless sooner revoked.

Calibration was made using alternating current of practically sine-wave form and of 60 cycle frequency, at unity and 50% lagging power factor and with voltages of 112 and 224

Seal as found P.U.C. Seal as left P.U.C.

Adjustments, None Full load X Light load X Lagging

Remarks



For other coil combinations, add the adjacent corrections to the per cent. registration read from the curve for the given disk speed.

Volt Rating	Power Factor	Current Coils 1.5	15	150			
110	1.0	0	0	0			
	0.5 lagging		0	0			
220	1.0	0	0	0			
	0.5 lagging		0	0			

Calibration by X New Haven, Conn., Dec. 27 1922

Curve by X Approved S. E. Knowlton

Electrical Engineer.

FIG. 4—CERTIFICATE FORM ISSUED AFTER TESTING METERS

Fig. 3 and the results plotted in terms of watt-hours per revolution and revolutions per minute rather than as per cent registration and revolutions per minute, as will be seen to be the case for the standards submitted by the utilities (Fig. 4). It might be said in passing that by means of a simple preliminary study the relatively large number of appropriately spaced loads on the separate coils of the rotating standard can be obtained from a relatively small number of cardinal-point calibrations of the indicating wattmeter.

So much for the calibration of the polyphase watt-hour meter (current coils of 1.5, 5, 15, 50 and 150 amp. rating, potential coils for 110, 220, 440 and 550 volts) which serves as the primary standard.

At six-month intervals the electric companies of the state are notified to deliver at the commission's laboratory (preferably by messenger) specified rotating standards. If a company has several portables, one is selected which most nearly covers the range of the others. The company specifies the prevailing average secondary voltage, and the rotating standard is calibrated at that voltage and multiples of it.

Sheet No. 1... Date 12/27/22

...United Illuminating Company's vs. Pub. Util. Comm. (Calib 12/20/22
......Watt-hour Meter # 611 Rot. Std. #..727...... (dated

Coil S	Coil X	A	V	PP	Revolutions Std.	Revolutions X	Sec	Rev. per min. Std.	Rev. per min. X	K_S	K_X	% Reg_X	Dev.	Av. Dev.
As found.			P.U.C. Seal.											
15	15	[illegible]	112	100			[illegible]	27.60	27.47	1.0025	1.0075	99.3		
				50				14.29	14.21	1.000	1.005	99.5	+.2	
1.5		1.5		100				27.45	2.78	.1005	.993	100.7		
Made full load and light load adjustments.														
1.5	15	1.5	112	100			60	27.91	2.80	.1005	1.0025	99.7		
5		3.8	112	100				23.42	7.79	.3343	1.006	99.4		
			112	50				11.89	3.94	.3333	1.006	99.4	0	
15		7.5	[illegible]	100				[illegible]	15.44	.9995	1.001	99.9		
			112	50				8.16	8.14	.998	1.000	100.0	+.1	0
		15	112	100				28.18	28.23	1.0025	1.000	100.0		
			112	50				14.34	14.36	1.003	1.002	99.8	−.2	
50		[illegible]	112	100				10.87	[illegible]	3.357	1.003	99.7		
1.5	1.5	1/4	112	100				5.31	5.31	.1007	.1007	99.3	−.1	
		1/2	112					9.61	9.65	.1005	.1001	99.9	+.1	0
		3/4	112					13.43	13.45	.1003	.1001	99.9	0	
		1.5	112					23.79	23.89	.10035	.0999	100.1	+.1	
50	150	37.5	112	100				20.99	6.96	3.331	10.05	99.5	+.1	
150		[illegible]	112					14.21	14.18	9.98	10.00	100.0	+.1	0
		150	112					26.42	26.39	10.00	10.01	99.9	−.1	
5	15	3.8	224	100				22.45	7.47	.6686	2.010	99.5	+.1	
15		7.5	224					14.41	14.39	2.000	2.002	99.9	0	0
		15						27.92	28.00	2.005	1.999	100.0	0	

FIG. 5.—RECORD FORM FOR POLYPHASE WATT-HOUR METER

Upon receipt the instrument is first examined for external physical condition and the condition of the last official seal is also noted. The meter is then loaded to rated value on the 5-amp. or 10-amp. coil at the specified voltage and allowed to run for ten to fifteen minutes to bring the coils and disk to a steady temperature. Three "as found" readings are then taken, each of which gives significant information as to the exactness of the three available adjustments—full load, light load and lagging. Polyphase standards are also checked for balance. Inasmuch as the meters are approved for use only in conjunction with the calibration curve supplied, adjustments are made only when the deviation from normal amounts to several-tenths of 1 per cent. The meter is, of course, examined for loose parts or connections, dust, filings, inadequate clearances, etc., before adjustments are made.

The calibration run is then made. The number of readings taken, their distribution and the form in which they are preserved are indicated in the sample shown in Fig. 5. The primary standard is designated by S and the meter under test by X. The time of each run is made an even minute, so that "revolutions" and "revolutions per minute" are numerically identical. The quantity K_s is the value in watt-hours per revolution for the given current and voltage coils of the primary standard running at the speed observed, and K_x is the corresponding computed value for the meter under test. The column headed "Dev." contains the fractions of a per cent deviation of a given per cent registration from the corresponding value for the principal combination of current and potential coils and with non-inductive load. These deviations are averaged in the last column, and the averages serve to indicate the exactness of ratio of the different coils and also of the lagging of the potential coil.

The results are then plotted in curve and tabular form as shown in Fig. 4. A blueprint copy is supplied to the utility for use in conjunction with the sealed and certified instrument.

Basis for Unit Sizes of Steam Turbo-Generators

THE unit size of steam-turbine generators selected for generating stations is determined very largely by the prevailing size of central stations and by the character of the system load. Most operating engineers have believed, for example, that the single unit should be roughly 10 per cent or 12 per cent of the ultimate station capacity. Since the largest stations in this country, and for that matter in the world, have been rated at 200,000 kw. to 300,000 kw. until recently the majority of large units have consequently been rated at 25,000 kw. and 30,000 kw. Even today the 30,000-kw. unit is the most "popular" size. However, some stations having an ultimate capacity of 400,000 kw. or more are now under construction (Hudson Avenue in Brooklyn, Kearny in New Jersey and Crawford Avenue in Chicago), so that single generator sets of 50,000 kw. (62,500 kva.) at 1,200 r.p.m. are now being built and installed in several plants.

Another factor in American practice that has influenced the maximum size of turbo-generators has been the preference by some operating companies for the cross-compound type of turbine. Thus the Interborough Rapid Transit Company has had a 70,000-kw. cross-compound unit (with three separate generators) in operation since 1918, and the Duquesne Light Company of Pittsburgh has had two 60,000-kw. units (each consisting of three 20,000-kw. units) in its Colfax station for several years.

The recent development and introduction of high steam pressures (say above 500 lb.) has considerably increased the favor with which the cross-compound design is considered. The Commonwealth Edison Company has under construction a 60,000-kw. cross-compound unit by the General Electric Company and a 50,000-kw. cross-compound unit by the Westinghouse Electric & Manufacturing Company for its new Crawford Avenue Station.

A Correction

IN THE article entitled "Points in Modern Power-Plant Design," appearing in the Sept. 1 issue of the ELECTRICAL WORLD, the labels on curves B and C of Fig. 3 should be interchanged.

Michigan Industries Highly Electrified

Electrical Energy Consumed by Manufacturing Plants and Mines of Wolverene State During 1920 Is Estimated at 1,489,151,000 Kw.-Hr., 53.7 per Cent of Which Was Purchased from Central Generating Systems

THE growing industrial importance of Michigan is indicated by the fact that in value of manufactured products it advanced from ninth place among the states in 1889 to seventh place in 1921. Electric production has played a large part in this steady industrial growth. In 1919 the total rating of prime movers in manufacturing plants and mines of Michigan was given as 1,550,407 hp. and the rating of installed electric motors totaled 1,000,218 hp. These figures do not truly represent the electrification of Michigan industry, however, as a large proportion of the prime-mover rating was used in the production of electrical energy in private plants.

During the past four years the ELECTRICAL WORLD has conducted a country-wide survey to ascertain the extent to which electrical energy is being used by the various industries. The survey has been undertaken by states, and Michigan is the eighteenth state in the series. Detail data on the industrial load in the other seventeen states canvassed were published in prior issues of the ELECTRICAL WORLD.

The total consumption of electrical energy by the mills, factories and mines of Michigan during 1920 is estimated as 1,489,151,000 kw.-hr., of which 690,992,000 kw.-hr., or 46.3 per cent, was generated in private stations of factories and mines. It is estimated that 1,670 generators were installed in the private generating plants, with a total rating of 366,003 kva., of which machines rated at 143,793 kw. were direct-current generators. By far the largest users of electrical energy in Michigan are the stone and clay industry, paper and pulp industry, mining industry, iron and steel industry and the automobile industry. These five industries consumed a total of 984,331,000 kw.-hr. during 1920, and the extent to which operations in these industries were curtailed during the industrial depression is indicated by the fact that only 827,000,000 kw.-hr. was consumed during 1921. This curtailment in the consumption of electricity in Michigan is considerably less, however, than that reported by other industrial states.

It is estimated that there are 78,954 electric motors

Table II—Direct-Current Motor-Operating Voltages of Industrial Plants of Michigan

Industry	Total Number of Companies Reporting on Direct-Current Motor Voltages	Number of Companies Reporting Various Motor-Operating Voltages: 110	115	220	230	240	250	440	460	500
Chemicals and allied products	5	1	..	1	..	..	2	1	..	..
Electrical equipment and machinery	0	..	..	..	..	..	..	..	..	..
Food and kindred products	6	..	..	4	1	..	..	1	..	..
Iron and steel and their products	31	3	..	20	..	1	2	5	..	..
Leather and its products	5	..	..	2	..	2	..	1	..	..
Lumber and its products	3	2	..	1	..	..	..	..	..	..
Metals and metal products other than iron or steel	8	1	..	2	..	1	..	4	..	..
Mining, miscellaneous	21	..	..	3	1	..	15	..	..	2
Paper and printing	16	..	1	8	1	2	..	4	..	..
Railroad-shop construction and repairs	0	..	..	..	..	..	..	..	..	..
Rubber and its products	0	..	..	..	..	..	..	..	..	..
Stone, clay and glass	2	1	..	..	..	..	..	1	..	..
Textiles	8	..	..	3	1	..	..	3	..	1
Vehicles for land transportation	2	..	..	..	..	..	..	1	1	..
Miscellaneous	9	1	..	3	2	2	..	..	..	1
Totals for all industries of Michigan	116	9	1	47	6	8	19	21	1	4

Table I—"Electrical World" Estimate of the Use of Electrical Energy by the Industrial Plants of Michigan in 1920 and 1921

Industry	Electric Generators (In Private Plants): Direct-Current No.	Direct-Current Total Rating, Kw.	Alternating-Current No.	Alternating-Current Total Rating, Kva.	Electrical Energy Consumed: Purchased from Public Utilities 1920, Kw.-Hr.	Generated in Private Plants 1920, Kw.-Hr.	Total Energy Consumed 1920, Kw.-Hr.	Total Energy Consumed 1921, Kw.-Hr.
Agricultural implements	5	1,050	2	1,300	5,175,000	545,000	5,720,000	2,600,000
Chemicals and allied products (total)	31	5,200	67	27,710	71,129,000	93,300,000	164,429,000	118,054,000
Rubber and rubber products	4	570	4	3,260	3,905,000	11,300,000	15,205,000	11,130,000
Glass and glass products	0	0	0	0	384,000	0	384,000	254,000
Chemicals	15	3,360	58	21,900	60,800,000	71,000,000	131,800,000	91,800,000
Artificial-gas manufacture	11	1,220	4	2,440	2,700,000	10,540,000	13,240,000	13,240,000
Miscellaneous chemical industries	1	50	1	110	3,340,000	460,000	3,800,000	1,630,000
Electrical equipment and machinery	1	20	1	10	11,280,000	179,000	11,459,000	5,980,000
Food and kindred products	211	22,300	55	13,450	116,400,000	40,800,000	157,200,000	182,800,000
Iron and steel and their products	22	6,743	73	31,290	159,300,000	33,276,000	192,576,000	160,000,000
Leather and its products	41	3,700	15	13,800	4,950,000	9,600,000	14,550,000	8,360,000
Lumber and its products	30	7,630	49	12,700	12,800,000	8,600,000	21,400,000	16,200,000
Metals and metal products other than iron or steel	12	1,260	23	3,920	21,400,000	3,390,000	24,790,000	22,800,000
Mining (total)	193	30,960	30	23,030	73,490,000	120,985,000	194,475,000	130,100,000
Bituminous coal mines	12	1,870	2	1,390	960,000	7,290,000	8,250,000	6,400,000
Copper mines	96	15,400	15	11,430	8,830,000	60,100,000	68,930,000	29,800,000
Iron-ore mines	73	11,760	11	8,730	51,600,000	45,850,000	97,450,000	81,000,000
Miscellaneous mines	12	1,930	2	1,480	12,100,000	7,745,000	19,845,000	12,900,000
Paper and pulp	56	15,200	87	43,400	28,500,000	166,200,000	194,700,000	198,700,000
Printing	9	950	3	450	43,250,000	2,840,000	46,590,000	34,300,000
Railroad-shop construction and repairs	1	90	1	300	8,090,000	965,000	9,055,000	6,950,000
Stone and clay and their products	28	4,700	73	26,110	89,000,000	127,400,000	216,400,000	163,000,000
Textiles	16	1,550	8	770	3,495,000	1,324,000	4,819,000	4,050,000
Tobacco	2	280	1	140	800,000	638,000	1,438,000	1,400,000
Vehicles for land transportation	49	7,560	32	16,800	127,000,000	59,150,000	186,150,000	175,200,000
Miscellaneous	352	35,600	109	7,040	21,600,000	21,800,000	43,400,000	32,700,000
Totals for all manufacturing industries and mines in Michigan	1,059	143,793	629	222,210	798,159,000	690,992,000	1,489,151,000	1,263,194,000

Table III—"Electrical World" Estimate of Motors Installed in the Industrial Plants of Michigan

Industry	Motors Run by Purchased Energy: Number	Motors Run by Purchased Energy: Total Rating, Hp.	Motors Run by Energy Generated in Private Plants: Number	Motors Run by Energy Generated in Private Plants: Total Rating, Hp.	Total Motors in All Plants: Number	Total Motors in All Plants: Total Rating, Hp.	Distribution of Drives: Motors Under 5 Hp.	Distribution of Drives: Belt, Number	Distribution of Drives: Chain, Number	Distribution of Drives: Directly Connected, Number
Agricultural implements	252	3,154	26	332	278	3,486	70	126	9	143
Chemicals and allied products (total)	1,381	24,341	2,143	33,232	3,524	57,573	935	1,627	647	1,250
Rubber and rubber products	107	2,227	308	6,435	415	8,662	126	244	25	146
Glass and glass products	16	176	0	0	16	176	5	9	1	6
Chemicals	1,152	20,135	1,643	23,511	2,795	43,646	714	1,184	608	1,003
Artificial-gas manufacture	47	805	184	3,149	231	3,954	70	151	9	71
Miscellaneous chemical industries	59	998	8	137	67	1,135	20	39	4	24
Electrical equipment and machinery	828	5,357	16	85	844	5,442	523	566	6	272
Food and kindred products	3,920	48,044	1,680	16,860	5,600	64,904	1,730	3,231	805	1,564
Iron and steel and their products	16,700	157,685	3,210	30,322	19,910	188,007	7,450	11,080	390	8,440
Leather and its products	262	3,418	509	6,619	771	10,037	215	678	35	58
Lumber and its products	2,083	22,088	1,400	14,859	3,483	36,947	1,058	2,593	29	861
Metals and metal products other than iron or steel	2,605	32,932	410	5,214	3,015	38,146	726	2,970	357	586
Mining (total)	1,022	66,159	1,739	109,960	2,761	176,119	952	757	102	1,902
Bituminous coal mines	10	695	179	5,285	189	5,980	66	40	2	147
Copper mines	261	8,236	888	56,088	1,149	64,324	398	305	44	800
Iron-ore mines	523	48,162	580	42,782	1,103	90,944	378	329	44	730
Miscellaneous mines	228	9,066	92	5,805	320	14,871	110	83	12	225
Paper and pulp	393	5,854	2,300	34,202	2,693	40,056	1,134	1,670	75	948
Printing	1,813	12,473	71	491	1,884	12,964	1,396	1,610	54	220
Railroad-shop construction and repairs	442	8,000	53	955	495	8,955	56	157	33	305
Stone, clay and their products	848	14,425	1,213	20,635	2,061	35,060	665	1,672	102	291
Textiles	1,074	4,711	301	1,783	1,375	6,494	825	758	270	347
Tobacco	111	593	89	473	200	1,066	165	174	2	24
Vehicles for land transportation	15,780	180,960	7,350	84,302	23,130	265,262	12,250	13,400	1,800	7,930
Miscellaneous	3,450	24,760	3,480	24,940	6,930	49,700	4,515	3,400	210	3,320
Totals for all manufacturing industries and mines in Michigan	52,964	614,954	25,990	385,264	78,954	1,000,218	34,665	46,469	4,926	28,461

Table IV—Prime-Mover and Boiler Equipment of Industrial Plants and Mines of Michigan

(Prime-mover ratings from U. S. Census reports; Boiler data estimated by "Electrical World")

Industry	No. of Plants in State	Total Hp. of Prime-Movers in Industrial Plants	Steam Engines No.	Steam Engines Hp.	Steam Turbines No.	Steam Turbines Hp.	Internal-Combustion Engines No.	Internal-Combustion Engines Hp.	Waterwheels No.	Waterwheels Hp.	"Electrical World" Estimate of Boilers in Industrial Plants No.	"Electrical World" Estimate of Boilers in Industrial Plants Hp.
Agricultural implements	23	3,043	17	2,993	0	0	2	50	0	0	10	2,260
Chemicals and allied products (total)	358	92,558	379	47,117	64	43,419	32	1,922	1	100	282	80,980
Rubber and rubber products	7	6,525	8	2,025	3	4,500	0	0	0	0	24	6,350
Glass and glass products	25	125	1	125	0	0	0	0	0	0	1	110
Chemicals	197	67,628	139	29,516	45	37,387	6	625	1	100	173	55,000
Smelting and refining of metals	8	3.400	11	3,400	0	0	0	0	0	0	11	2,580
Artificial-gas manufacture	59	12,788	202	10,484	14	1,032	25	1,272	0	0	62	14,400
Miscellaneous chemical industries	62	2,092	18	1,567	2	500	1	25	0	0	11	2,540
Electrical equipment and machinery	54	302	1	265	0	0	1	37	0	0	1	150
Food and kindred products	2,251	72,900	440	54,074	24	6,184	14	2,873	248	9,769	206	61,600
Iron and steel and their products	848	48,639	160	33,054	28	12,311	9	1,690	2	1,584	179	49,000
Leather and its products	114	10,412	75	8,740	2	520	32	1,152	0	0	36	7,420
Lumber and its products	888	124,221	407	112,726	13	7,761	7	1,309	55	2,425	660	142,000
Metals and metal products other than iron or steel	462	19,683	92	17,497	2	1,415	20	546	4	225	64	14,680
Mining (total)	171	275,064	1,086	209,447	30	57,100	15	417	16	8,100	1,482	317,440
Bituminous coal mines	14	6,189	49	6,114	1	75	0	0	0	0	34	7,350
Copper mines	28	161,353	326	127,961	11	33,230	4	162	0	0	893	191,200
Iron-ore mines	100	94,778	655	69,497	13	17,132	4	49	16	8,100	485	104,000
Miscellaneous mines	29	12,744	56	5,875	5	6,663	7	206	0	0	70	14,890
Paper and pulp	60	90,706	168	57,637	13	10,050	0	0	66	23,019	222	64,000
Printing	1,315	5,052	25	4,472	1	46	10	519	1	15	17	4,860
Railroad-shop construction and repairs	51	3,926	25	3,633	1	260	1	33	0	0	16	3,430
Stone and clay and their products	391	45,251	268	26,734	26	15,600	38	917	14	2,000	97	25,800
Textiles	235	5,762	41	5,342	3	260	2	49	1	111	68	10,600
Tobacco	363	591	5	575	0	0	1	16	0	0	13	1,600
Vehicles for land transportation	586	106,272	298	38,266	57	59,177	214	8,784	1	45	487	129,200
Miscellaneous	517	31,071	.....	26,505	...	3,287	...	226	...	1,053	171	35,400
Totals for all manufacturing industries and mines in Michigan	8,687	935,453	3,487	649,077	264	217,390	398	20,540	409	48,446	4,011	950,420

Table V—Alternating-Current Motor-Operating Voltages of Industrial Plants in Michigan

Industry	Total Number of Companies Reporting on Alternating-Current Motor Voltages	110	115	120	125	220	230	240	250	430	440	480	550	2,200	2,300	2,400
		Number of Companies Reporting Various Motor-Operating Voltages														
Chemicals and allied products	16	1	...	1	...	4	1	...	2	...	5	...	1	.....	.....	1
Electrical equipment and machinery	8	1	...	...	...	6	...	...	...	...	1	...	...	.....	.....	.....
Food and kindred products	16	3	...	...	...	6	...	...	...	...	7	...	...	.....	.....	.....
Iron and steel and their products	91	5	2	...	1	43	1	2	3	1	27	1	...	3	2	.....
Leather and its products	2	...	...	...	...	1	...	...	...	...	...	1	...	.....	.....	.....
Lumber and its products	34	3	...	...	...	12	...	1	...	...	17	...	...	1	.....	.....
Metals and metal products other than iron or steel	15	...	...	1	...	8	...	...	...	...	6	...	...	.....	.....	.....
Mining, miscellaneous	20	...	...	...	...	7	...	...	...	...	9	...	...	3	1	.....
Paper and printing	15	2	...	...	...	5	1	1	...	...	6	...	...	.....	.....	.....
Railroad-shop construction and repairs	5	...	...	...	...	1	...	...	...	...	4	...	...	.....	.....	.....
Stone, clay and glass	11	...	...	...	...	2	...	...	1	...	7	1	...	.....	.....	.....
Textiles	18	2	1	...	...	10	1	...	...	...	3	1	...	.....	.....	.....
Vehicles for land transportation	12	3	...	...	...	5	...	...	...	...	3	1	...	.....	.....	.....
Miscellaneous	7	1	...	...	1	4	...	...	...	...	1	...	...	.....	.....	.....
Totals for all industries of Michigan	270	21	3	2	2	114	4	4	6	1	96	5	1	7	3	1

installed in the factories and mines of Michigan, with a total rating of 1,000,218 hp. Of these motors, 34,665, or 43.9 per cent, are under 5 hp. About 57.0 per cent of the machines are belt-driven, 36.1 per cent are directly connected, and only 6.9 per cent are chain-driven. The returns indicate that nine voltages are in use in Michigan by mines and factories for the operation of direct-current motors and that fifteen voltages are used in the operation of alternating-current motors. It appears that about 40.5 per cent of the direct-current motors are operated at 220 volts, but a large percentage are also operated at 330 volts and 440 volts. The mining industry particularly reports a high percentage of direct-current motors operated at other than 220 volts. About 42 per cent of the alternating-current motors are operated at 220 volts and about 36 per cent are operated at 440 volts.

About 84 per cent of the companies reporting on types of motor control use knife or safety switches exclusively or in conjunction with other types of motor control. About 53 per cent of the companies reported installation of automatic starters, and about 40 per cent reported

Table VI—Frequencies Used in Plants and Mines of Michigan

Industry	Total Number of Companies Reporting on Frequency	Number of Companies Reporting Various Frequencies Used (The first figure gives number of phases; the second figure the number of cycles)					
		1–25	3–25	3–30	1–60	2–60	3–60
Chemicals and allied products	17	..	..	..		1	16
Electrical equipment and machinery	7	..	..	.	1	.	[illegible]
Food and kindred products	18	..	..	1	2		15
Iron and steel and their products	90	..	..	5	1	4	80
Leather and its products	3	1	..	.	..		2
Lumber and its products	35	..	..	7	.	..	28
Metals and metal products other than iron or steel	17	..	..	5	..		12
Mining, miscellaneous	14	..	2	1	.	1	10
Paper and printing	13	..	..	1		.	12
Railroad-shop construction and repairs	5	..	..	.	.	1	4
Stone, clay and glass	11	..	1	2	.	.	8
Textiles	18	..	.	3			15
Vehicles for land transportation	10	..	..	1	1		8
Miscellaneous	8	..	..	..	3	.	5
Totals for all industries of Michigan	266	1	3	26	8	7	221

Table VII—Types of Motor Control Used in Industrial Plants and Mines of Michigan

Industry	Number of Companies Reporting Various Types of Motor Control						
	No. of Companies Reporting on Motor Control	Snap Switches	Knife or Safety Switches	Auto-Starters	Magnetic Switches	Remote Control	Circuit Breakers
Chemicals and allied products	19	4	17	8	6	5	12
Electrical equipment and machinery	7	4	6	3	1	0	3
Food and kindred products	18	4	16	9	6	2	7
Iron and steel and their products	95	17	79	53	19	21	33
Leather and its products	6	0	5	4	3	1	4
Lumber and its products	32	6	24	19	7	4	11
Metals and metal products other than iron or steel	16	4	16	7	7	2	4
Mining, miscellaneous	21	4	16	13	8	4	17
Paper and printing	22	8	18	7	6	7	6
Railroad-shop construction and repairs	6	1	6	5	0	1	3
Stone, clay and glass	11	1	9	8	3	2	4
Textiles	21	6	17	11	5	4	4
Vehicles for land transportation	10	2	8	6	6	4	3
Miscellaneous	17	7	17	7	4	5	9
Totals for all industries of Michigan	301	68	254	160	81	62	120

Table VIII—Size of Largest and Smallest Motors Installed in the Industrial Plants and Mines in Michigan

Industry	Total Number of Companies Reporting on Size of Motors	Largest Motor Installed (Number of Companies Reporting)								Smallest Motor Installed (Number of Companies Reporting)						
		Under 10 Hp.	From 10 to 25 Hp.	From 26 to 50 Hp.	From 51 to 100 Hp.	From 101 to 200 Hp.	From 201 to 300 Hp.	From 301 to 1,000 Hp.	Over 1,000 Hp.	Under ¼ Hp.	From ¼ to ½ Hp.	From ½ to ¾ Hp.	From ¾ to 1 Hp.	From 1 to 2 Hp.	From 2 to 3 Hp.	Over 3 Hp.
Chemicals and allied products	22	2	3	10	3	4	[illegible]	0	[illegible]	0	9	1	6	1	[illegible]	2
Electrical equipment and machinery	7	4	1	1	0	0	1	[illegible]	[illegible]	[illegible]	1	1	1	2	0	1
Food and kindred products	23	2	9	4	[illegible]	2	3	1	0	3	5	3	6	3	0	4
Iron and steel and their products	72	1	21	22	20	4	1	3	0	7	27	15	27	12	[illegible]	15
Leather and its products	8	2	2	2	1	1	0	0	0	0	2	1	3	0	1	1
Lumber and its products	39	2	13	9	7	[illegible]	2	0	[illegible]	0	5	7	10	3	5	9
Metal and metal products other than iron or steel	2	9	[illegible]	3	0	2	1	0	0	2	6	2	3	3	[illegible]	3
Mining, miscellaneous	51	3	12	7	5	1	0	1	0	0	7	4	3	8	9	18
Paper and printing	24	3	8	3	1	7	2	[illegible]	[illegible]	0	12	4	[illegible]	2	1	2
Railroad-shop construction and repairs	5	0	0	1	4	[illegible]	0	0	0	0	0	1	3	0	0	1
Stone, clay and glass	11	1	0	1	1	6	0	2	0	1	0	2	3	1	2	1
Textiles	23	4	14	5	0	[illegible]	0	0	0	4	[illegible]	3	[illegible]	2	3	1
Vehicles for land transportation	12	0	[illegible]	4	1	1	1	0	1	3	[illegible]	0	1	1	2	1
Miscellaneous	18	3	8	5	2	0	[illegible]	0	0	1	6	[illegible]	3	1	1	3
Totals for all industries of Michigan	317	36	99	77	47	34	11	7	1	23	92	46	73	39	36	62

Table IX—Michigan Far Outranks Other States in the Manufacture of Automobiles

States	Number of Establishments Using Power	Value of Products	Power: Primary Horsepower						Average Electrical Horsepower Generated in Private Plants
			Total	Steam Engines	Steam Turbines	Internal-Combustion Engines	Water Power	Average Purchased Electrical Power	
United States	2,830	$3,080,073,979	542,242	78,343	67,869	12,927	566	384,537	111,172
Michigan	271	1,621,383,356	284,127	37,539	59,177	8,567	18	178,826	84,259
Ohio	281	371,436,478	79,039	8,555	440	877	0	69,167	3,723
New York	344	211,137,153	42,474	8,212	332	493	540	32,897	6,326
Indiana	172	179,064,863	39,481	7,026	3,375	230	0	28,850	5,450
Pennsylvania	202	113,820,134	23,363	3,540	150	729	5	18,939	1,323
Wisconsin	95	119,380,641	22,892	5,710	0	559	0	16,623	4,198
Illinois	229	104,883,442	15,098	1,065	670	248	0	13,115	455
New Jersey	116	54,671,352	9,185	960	3,500	565	0	4,160	2,720
Massachusetts	96	27,031,604	4,441	840	225	32	0	3,344	310
Missouri	86	71,939,496	3,506	993	0	40	0	2,473	554

circuit breakers in use in their plants, mines or quarries. Only one company in Michigan reported a motor of more than 1,000 hp. rating. About 43 per cent of the companies in the state reported their largest motor as rated under 25 hp. Almost 30 per cent of the companies reported that the smallest motor installed ranged from ⅛ hp. to ¼ hp., although a large proportion also reported the smallest motors to range between ½ hp. and 1 hp.

Only six frequencies are used in the industrial plants and mines of Michigan. More than 83 per cent of the mines and plants used three-phase, 60-cycle service in the operation of their motors, and almost 10 per cent reported the use of three-phase, 30-cycle service.

It is estimated that there is a total of 4,011 boilers installed in the industrial plants, mines and quarries of Michigan. The total estimated rating of these boilers is placed at 950,420 hp., or an average rating of 240 hp.

Relative Cost of 25 and 60-Cycle Generation at Washington

Probable Saving in Ten Years by 60-Cycle Development Will Reach $1,500,000—Comprehensive Program Under Way to Eliminate Less Efficient Equipment

By W. R. McCANN
Stone & Webster, Inc., Boston

FOR the primary steam generation of electrical energy to supply the requirements of the District of Columbia during the next decade or more there is no available site superior to or more economical than a further development of the existing Bennings power station of the Potomac Electric Power Company.

Washington's electric load is composed principally of residential and business lighting (three-wire direct current and 60-cycle alternating current), street railways (600-volt direct current), street lighting and a small amount of industrial power (chiefly 25-cycle service). Growth in these types of loads is largely proportional to the population, augmented by the public's increasing per capita use of electricity. There is not now, nor is there likely to be, the industrial demand for electricity which in other cities is largely responsible for marked increases in central-station capacity.

The Bennings station, situated on the Anacostia River, in the northeast section of Washington, now generates all electrical energy for supplying the power systems of the Potomac company and the Washington Railway & Electric Company. This plant is at present equipped with eight steam turbo-generators ranging in capacity from 7,500 kw. to 20,000 kw., and aggregating 98,000 kw. There are thirty boilers ranging in capacity from 525 to 1,000 rated boiler horsepower and aggregating 20,100 boiler-hp., together with the necessary auxiliary and electrical apparatus, all housed in a substantial cement-stone building subdivided into the usual boiler room, turbine room and electrical galleries.

The Potomac company has recently placed in service at this station a 12,500-kw., 60-cycle turbo-generator. This is the second generating unit to be installed in Washington directly on the 60-cycle system. The first 60-cycle unit went into service in October, 1922, and a third unit of 20,000-kw. rating is to be installed in 1924.

The probable growth of electric loads in Washington during the next ten years has been a subject of much study. Several projects for further power development have been examined; the importance of the electric power supply in the nation's capital has been weighed and the special problem of continued generation at 25 cycles or the adoption of 60-cycle generation has been considered.

A decision to change to 60-cycle generation has been made in accordance with a well-studied plan for developing additional power supply during the next ten years. The total peak load in Washington will probably grow to 110,000 kw. in 1932, compared with the 1922 peak of 70,000 kw., of which 18,000 kw. was 60-cycle lighting load. This 60-cycle load at present is the most rapidly growing one in Washington and has been supplied heretofore through twelve frequency changers in five substations.

Twenty-five-cycle energy has been and will continue to be generated to supply the synchronous converters

TABLE I—SAVINGS IN OPERATING COSTS BY ELIMINATION OF FREQUENCY CHANGERS IN 60-CYCLE SUBSTATIONS

The second column shows the estimated year-by-year growth of natural 60-cycle load (monthly residential) as distinguished from 60-cycle generation that may be converted to direct current and upon which no saving may be accumulated. The third column represents the annual savings in kilowatt-hours obtained by non-operation of frequency changers in substations and the substitution of 60-cycle transformers therefore. The percentage of 11½ has been obtained by separate computation of the relative all-day efficiencies of frequency changers and transformers carrying the loads upon which they are to operate. The fourth column is an assumed production cost at the generating station, and the fifth column is the annual saving, i.e., the product of column 3 and column 4. In column 6 there is set forth the estimated savings in substation operation, which combined with the saving in production costs in column 5 will give the total annual savings tabulated in column 7. This total saving is expected to aggregate $70,000 annually within ten years and will continue to grow with the load.

Year	Estimated 60-Cycle Load, Kw.-Hr.	11½ Per Cent Saving by Elimination of Frequency Changers, Kw.-Hr.	Assumed Production Cost, Mills	Annual Saving in Cost of 60-Cycle Energy	Estimated Saving in Substation Operation of Frequency Changers	Total Savings
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1922	39,000,000	1,150,000*	7.7	$8,900	.....	$8,900
1923	42,000,000	4,830,000	7.4	35,700	.....	35,700
1924	45,000,000	5,175,000	7.2	37,200	$1,000	38,200
1925	48,000,000	5,520,000	7.1	39,200	2,000	41,200
1926	52,000,000	5,980,000	7.0	41,800	3,000	44,800
1927	56,000,000	6,440,000	6.9	44,300	4,000	48,300
1928	60,000,000	6,900,000	6.9	47,500	5,000	52,500
1929	64,000,000	7,360,000	6.8	50,000	6,000	56,000
1930	68,000,000	7,820,000	6.8	53,200	7,000	60,200
1931	73,000,000	8,395,000	6.8	57,100	8,000	65,100
1932	78,000,000	8,970,000	6.8	61,000	9,000	70,000

*Last two months' operation only—estimated load carried 10,000,000 kw.-hr.

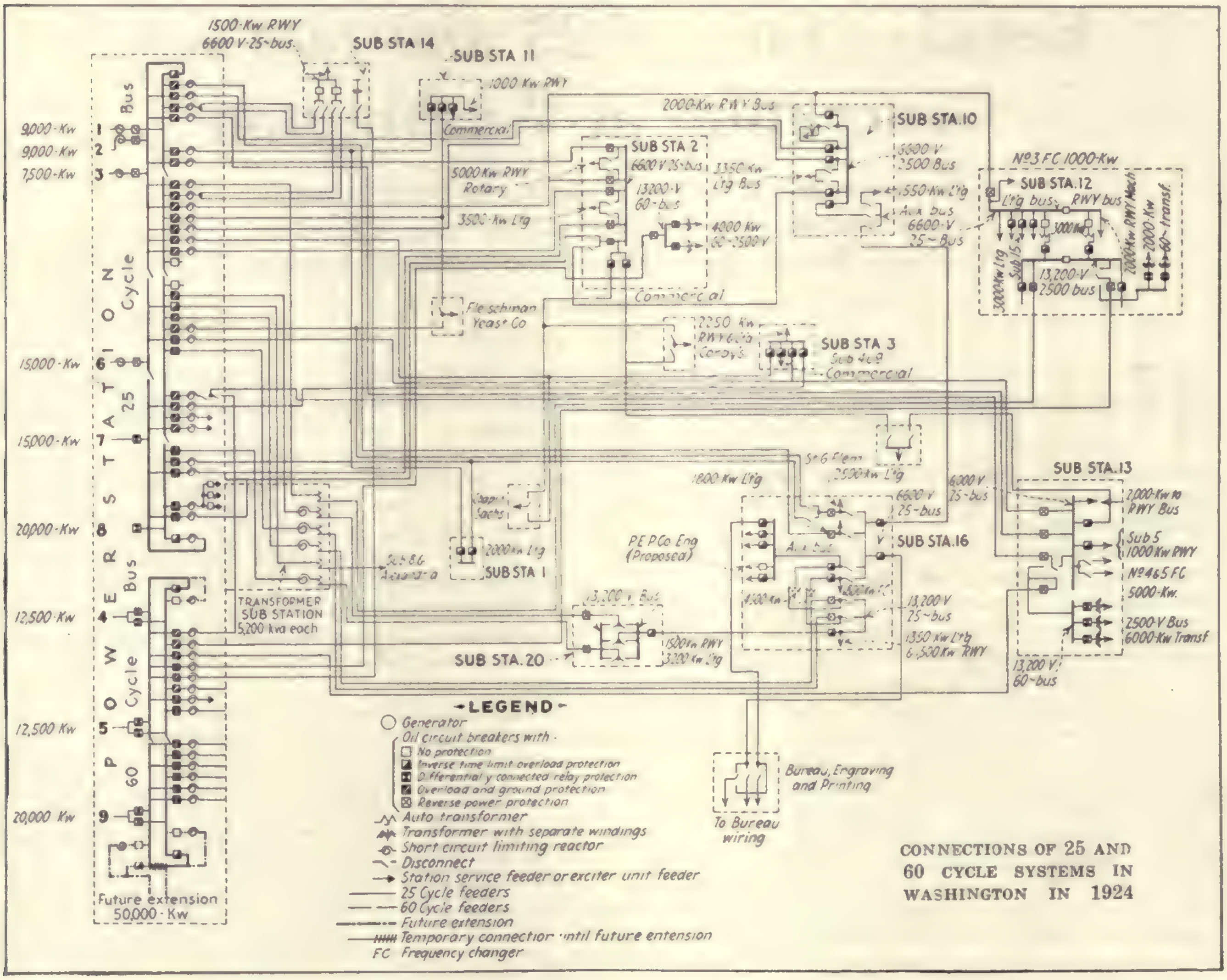
in substations of the Edison three-wire direct-current system of the downtown district, as well as the rotary converters now being utilized on the 600-volt railway system.

Growth of load in Washington is expected to develop for the most part in the 60-cycle system, or else through 60-cycle converters installed in substations to supply the smaller increments of growth in the Edison and railway systems. In other cities large and rapidly growing industrial loads have been weighty factors in determining the time for changing from 25-cycle generation

4. Lower cost of 60-cycle synchronous converters, as system grows, due to higher operating speeds and to transformers containing less iron.

5. Lower operating expense in frequency-changer substations, or savings equivalent thereto made possible by installing automatic substations in lieu of existing combined substations whenever present frequency changers are supplanted by 60-cycle transformers.

6. Augmented savings in both investment and operating costs during years subsequent to the ten-year period under consideration.



CONNECTIONS OF 25 AND 60 CYCLE SYSTEMS IN WASHINGTON IN 1924

to 60-cycle generation, but in Washington the scanty industrial load of itself could not possibly justify the change.

Advantages and Disadvantages

Briefly, the general advantages of generation at 60 cycles compared with 25 cycles are outlined as follows:

1. Generators serving the 60-cycle system will carry 10 per cent more revenue-producing load, owing to elimination of frequency-changer losses. Cables from the generating station likewise will carry 10 per cent more revenue-producing load.

2. No investment or losses are entailed in frequency-changer sets for converting 25-cycle energy as generated into 60-cycle energy for distribution.

3. Lower cost of standard 60-cycle prime mover, with same efficiency.

7. Sixty-cycle generation admits restriction of the present Edison direct-current district, limiting such service strictly to the more important business and commercial centers of Washington.

8. In general, a frequency of 60 cycles is more adaptable than 25 cycles and places the utility in a better position to handle increases in load.

9. Possibility of developing and extending single transformation of generated pressure to customers' voltage, especially for large consumers.

10. Sixty cycles is the probable frequency of Superpower Zone.

11. It is also the probable frequency of any hydraulic development at Great Falls on the Potomac.

12. The general practice of electrical industry tends toward standardization at 60 cycles.

13. There is increasing difficulty in residential dis-

tricts in securing locations for 25-cycle substations that are not objectionable to the community on account of the noisy operation of frequency changers, as compared with the transformer operation on the 60-cycle system.

The disadvantages of generation at 60 cycles, compared with 25 cycles, are outlined briefly as follows:

1. Somewhat greater capital expenditures are required during first few years.

2. Another high-tension system is initiated at the generating station and in some substations.

3. It adds complications during change-over and until the 60-cycle system is reasonably well developed.

4. It requires substation transformers between the 13,200-volt and 2,400-volt systems; but these transformers cost only one-quarter as much as equivalent frequency changers and are 11½ per cent more efficient.

5. Slightly greater transmission losses—negligible in underground cables of Washington.

6. Diversity factor in high-tension lines is lowered until such time as the 60-cycle system is more heavily loaded.

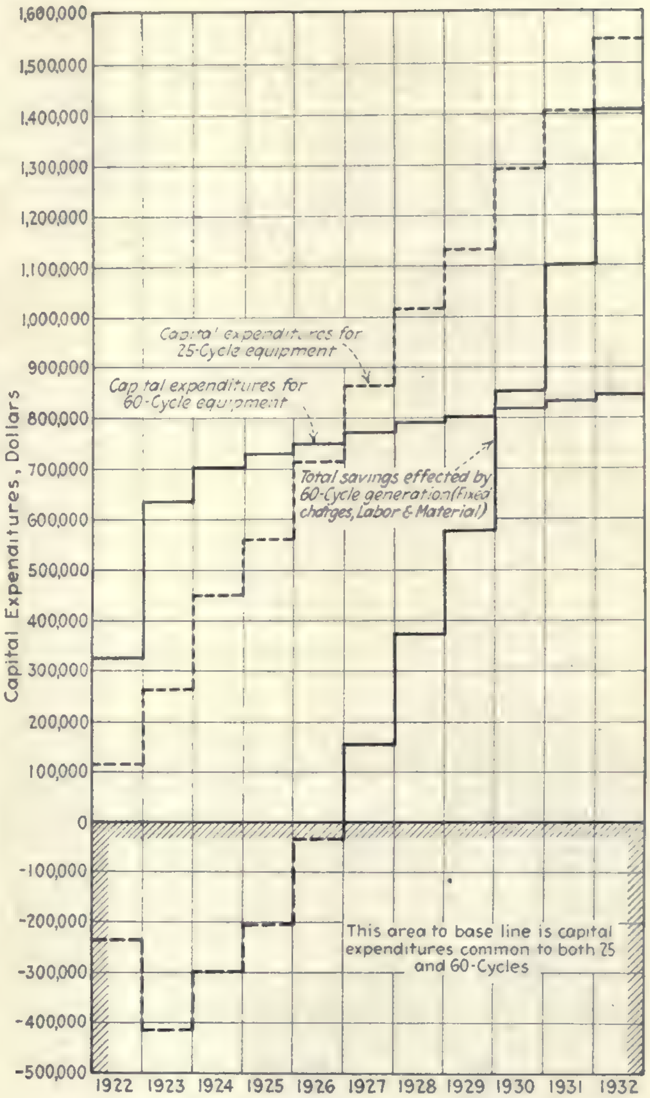
7. Sixty-cycle generators operate at somewhat lower power factor than 25-cycle units, owing to load characteristics.

ESTIMATED SAVINGS ON INVESTMENT

Some of the foregoing advantages and disadvantages are more or less intangible; others are capable of concrete analysis and of conversion into tangible savings. Table III gives approximate estimated savings (March, 1921, prices), both in capital expenditures and operating costs, which are to be effected over a period of about ten years by generation at 60 cycles. The computation indicates that an average saving in operating expenses of more than $50,000 annually is made possible by the elimination of further frequency-changer installations in substations.

OVER-ALL ECONOMIES OF 60-CYCLE SCHEME

Although the estimates of capital expenditures and operating expenses indicate that considerable savings are to be realized by generation at 60 cycles instead of at 25 cycles the former frequency is not justified unless it can be shown that the accrued fixed charges on the earlier initial investment required to change over to 60 cycles are more than offset by reduction in operating costs and by savings of fixed charges on later capital



COMPARISON OF CAPITAL EXPENDITURES AND ANNUAL SAVINGS FOR 25 CYCLE AND 60 CYCLE GENERATION

expenditures that would be required for continuing 25-cycle generation. Table II shows that the year-by-year accumulations of savings in operating expenses and fixed charges, including taxes, will offset in the course of

TABLE II—COMPARISON OF 25-CYCLE AND 60-CYCLE OPERATION IN CAPITAL COSTS, FIXED CHARGES, OPERATING ECONOMIES AND CUMULATIVE TOTAL SAVINGS

The higher capital expenditures in column 2 during the first three or four years are due mostly to the initial cost of 60-cycle generating equipment and cable to replace former 25-cycle turbo-generators and feeders. In later years this column is augmented only by the addition of 60-cycle transformers. In column 3 the capital expenditures concern for the most part the recurring costs involved in each yearly purchase of frequency-changer equipment that is required at substations for converting 25-cycle generation into 60 cycles.

Year	Capital Expenditures		Annual Fixed Charges at 15 Per Cent			Savings in Fuel and Labor	Surplus Due to 60-Cycle Generation				Capital Expenditures, 60-Cycle, Plus Deficits	Cumulative Total Saving (3) Minus (12)
	60 Cycles	25 Cycles	60 Cycles	25 Cycles	Difference		For Year (6) Plus (7)	Previous Years	Interest at 8 Per Cent on (9)	Cumulative With Interest		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1922	$327,000	$111,000	$49,050	$16,650	$32,400*	$8,900	$23,500*	....	....	$23,500*	$350,500	$239,500*
1923	634,000	262,000	95,100	39,300	55,800*	35,700	20,100*	$23,500*	$1,900*	45,500*	679,500	417,500*
1924	701,000	450,000	105,150	67,500	37,650*	38,200	550	45,500*	3,650*	48,600*	749,600	299,600*
1925	729,000	561,000	109,350	84,150	25,200*	41,200	16,000	48,600*	3,900*	36,500*	765,500	204,500*
1926	750,000	715,000	112,500	107,250	5,250*	44,800	39,550	36,500*	2,900*	150	749,850	34,850*
1927	771,000	864,000	115,650	129,600	13,950	48,300	62,250	150	....	62,400	708,600	155,400
1928	792,000	1,018,000	118,800	152,700	33,900	52,500	86,400	62,400	....	148,800	643,200	374,800
1929	806,000	1,133,000	120,900	169,950	49,050	56,000	105,050	148,800	....	253,850	552,150	580,850
1930	820,000	1,291,000	123,000	193,650	70,650	60,200	130,850	253,850	....	384,700	435,300	855,700
1931	834,000	1,402,000	125,100	210,300	85,200	65,100	150,300	384,700	....	535,000	299,000	1,103,000
1932	848,000	1,547,000	127,200	232,050	104,850	70,000	174,850	535,000	....	709,850	138,150	1,408,850

Notes.—* Indicates deficits. Capital expenditures (columns 2 and 3) mean total investment to the year stated and do not include expenditures which are common to both 25 cycles and 60 cycles.

Savings in fuel and labor (column 7) due to 60-cycle generation are taken from Table I (column 7).

In column 12 the cumulative deficit of column 11 is added (or subtracted if a surplus) to the investment in 60 cycle equipment (column 2) to indicate the total dollars which 60-cycle generation is ahead or behind.

In column 13 the total saving (or loss) of 60-cycle generation over 25-cycle generation is shown.

TABLE III—COMPARATIVE COSTS FOR 25-CYCLE AND 60-CYCLE SYSTEMS

CAPITAL EXPENDITURES	25 Cycles	60 Cycles
Three turbo-generators—first cost	$1,120,000	$960,000
Four 2,000-kw. frequency changers, installed	340,000	....
Building space for same	48,000	..
Six 1,000-kw. frequency changers, installed	330,000	....
Building space for same	48,000	..
3,000-kva. increased capacity of generating station due to elimination of frequency-changer losses, at $100 per kva., installed	300,000	.. . .
Cable required to carry frequency-changer losses, 4 miles, at $10,500, installed	42,000	....
Sixteen transformers, 2,000 kva., 13,200/2,400 volt, 60-cycle, at $7 per kva., installed	....	224,000
Two 12,500-kw., 60-cycle turbo-generators to replace existing 25-cycle generators, installed	....	470,000
Three cables, one required to offset lower power factor on 60-cycle system and two required on account lowered diversity, installed	....	126,000
Six lighting synchronous converters—total 12,000 kw., installed	300,000	240,000
Four railway synchronous converters—total 8,000 kw., installed	160,000	128,000
Total	$2,688,000	$2,148,000
Saving in capital expenditures, 60 cycles over 25 cycles, ten years	....	540,000
Saving in capital expenditure, estimated for second ten years	....	1,000,000

OPERATING COSTS	Per Cent
All-day efficiency of 13,200/2,300-volt, 60-cycle transformers, distributed in present frequency-changer substations, connected to system day and night	97.5
All-day efficiency of frequency changers, connected as demanded by load conditions	87.5
Difference in efficiencies, applicable to total annual kilowatt-hours sold on the 60-cycle system	10.0
Percentage of annual kilowatt-hours sold	11.5
	Kw.-hr.
Average annual 60-cycle sales estimated during ten-year period following initial installation	56,000,000
Average annual saving of energy	6,450,000
Value of energy saved annually—average during next ten-year period at assumed production cost of 7 mills per kw.-hr	$44,000
Estimated average annual saving in reduced operating expenses effected by elimination of frequency changers	8,000
Average annual saving in operating costs	$52,000

ten years or so an early maximum deficit amounting to $417,500 and will ultimately produce a most excellent return on the early capital expenditures that are required to finance the initial change.

Conclusions

It is to be concluded from Table II that the total cost of changing to 60 cycles, aggregating $701,000 by 1924, will be returned completely by a saving of $709,850 in operating expenses and fixed charges alone within ten years. These savings will continue to accumulate thereafter and at an increasing rate. Furthermore, in this ten-year period there will be an accumulated saving of $699,000, due to the lesser cost of 60-cycle generating and converting equipment—a total probable saving in the ten years of nearly a million and a half. The relative capital expenditures for 25-cycle and 60-cycle generation, and the accumulated savings produced by the latter, as computed in Table II, are illustrated graphically by the curves on page 653.

Smithsonian Institution Issues History of Electric Light

A pamphlet entitled "History of Electric Light," just issued by the Smithsonian Institution at Washington, traces electrical progress in this direction from Otto von Guesicke's electric machine of 1650 to the perfection of the gas-filled tungsten lamp in recent years. At the present time, the pamphlet says, there are about three hundred and fifty million incandescent and about two hundred thousand magnetic arc lamps in use in the United States alone and about an equal number of incandescent lamps in foreign countries.

Water-Power Situation in the State of North Carolina

EARLY in 1922 the North Carolina Geological and Economic Survey issued Circular No. 2, entitled "The Water Power Situation in North Carolina." The demand for this publication has exhausted the supply, and a new publication has just been issued bringing up to date the information presented in paper No. 2. Out of a total production of 450,000 hp. this report indicates that 80,000 hp., or 18 per cent, is transmitted for use outside of the state, and that 113,000 hp. produced at Badin, or 25 per cent, is used chiefly in the reduction of aluminum. The remaining 257,000 hp. available for general and industrial and public use amounts to 57 per cent of the total development in the state. Of this approximately 45,000 hp. is developed and used by private manufacturing establishments in relatively small units. So far as power development in the state is concerned, there is available for general use only the power developed by the public utility companies and municipalities, amounting to about 212,000 hp. Of the latter the Southern Power Company and the North Carolina Power & Light Company will during 1923 develop 178,500 hp., or 84 per cent, which is 40 per cent of the total developed power in the state. Some portion of the 45,000 hp. developed by manufacturers is also controlled by these companies.

Since early in 1922 the amount of power available for general use has increased from 167,000 hp. to 257,000 hp., and this is also a greater proportion of the total water-power development, having risen from 46 per cent to 57 per cent. The amount of power developed by the two principal public utility companies has increased from 98,500 hp. to 178,500 hp. This is 40 per cent of the total power, an increase of 18 per cent over the former figure. It is also 84 per cent of the power available for the general public use, an increase of 11 per cent over the figures at the opening of 1922. The report, which is issued under the supervision of Thorndike Saville, hydraulic engineer of the North Carolina Geological and Economic Survey, contains a large number of valuable tables on water-power development and power in use in the manufacturing plants of North Carolina.

WATER-POWER DEVELOPMENTS IN NORTH CAROLINA

Company	Plant	Installed Horsepower	Total Horsepower
Southern Power Co.	Bridgewater	33,000	....
	Lookout Shoals	30,000	....
	Mountain Island*	80,000	
			143,000
Carolina Power & Light Co.	Blewett Falls	32,500	....
	Buckhorn Falls	3,350	
			35,850
Tallassee Power Company	Badin	93,000	....
	Narrows of Yadkin	20,000	....
	Cheoah	72,000	
			185,000
Blue Ridge Power Company	Tuxedo	8,000	8,000
N. C. Electric Power Company	Ivy	536	....
	Marshall	4,000	....
	Weaver	3,350	
			7,886
Sandhill Power Company	Carbonton	1,350	....
	Other plants	2,100	
			3,450
Roanoke Rapids Power Company	Roanoke Rapids	4,000	4,000
Other public utility plants	....	......	15,000
Manufacturing plants, census of 1919	....	....	44,700
Manufacturing developments since 1919	....	.....	3,464
Total developed horsepower	....	....	450,000

* Under construction.

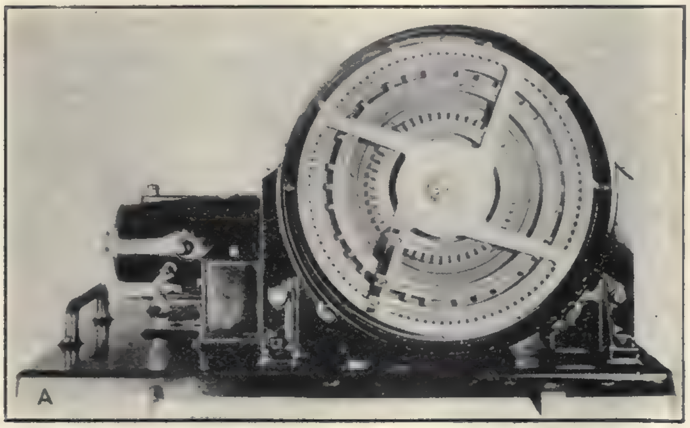
Supervisory Systems for Remote Control

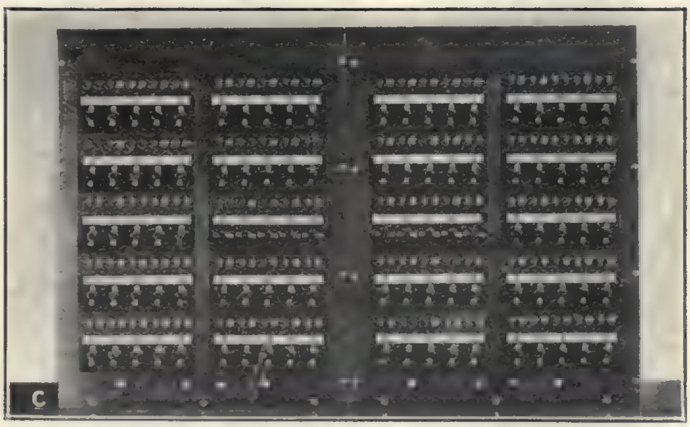
Conditions Which Have Forced the Development of the Apparatus—Its Economic Place—Basic Requirements and How These Have Been Met by Three Distinct Systems

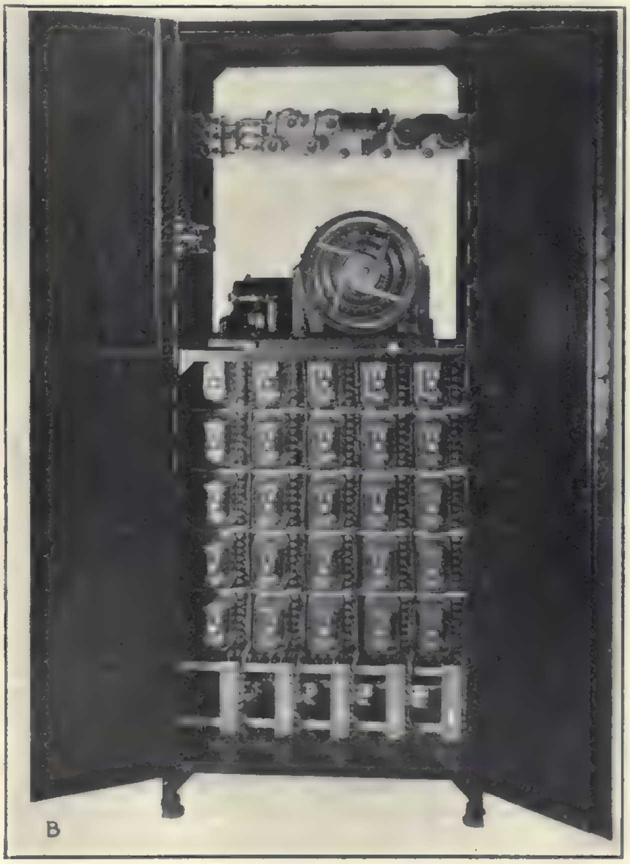
By C. E. STEWART* and J. C. FIELD†

WITH the extensive development and rapid growth of power networks there has come a need for some reliable and economical means to indicate continuously at a central point the condition of the operating units in outlying stations and for some system by which these units can be controlled from the same point. This demand has resulted chiefly from the advent of the automatic station, the practice of interconnecting power systems, the development of the outdoor switching station and the natural desire to justify expenditures for new apparatus by material reduction in operating costs. Because of these conditions it has become increasingly important that the load dispatcher shall have direct control over the rotating or switching equipment of a power network, where this will not too greatly complicate his duties, and in addition have a continuous visual indication of the operating position of such equipment. Advantages are also seen in making it possible for the load dispatcher to start and stop automatic stations, open and close oil or air-break circuit breakers at remote points and raise or lower load on hydro-electric generators in isolated stations, and in providing for the load dispatcher red and green lamps which will indicate at all times the stopped, running, open or

*General Electric Company. †Western Electric Company.







DISTRIBUTOR, APPARATUS CABINET AND DISPATCHER'S CONTROL BOARD FOR SUPERVISORY SYSTEM

Fig. 1A—Distributor Used to Send and Receive Control and Signaling Impulses

Since this distributor contains a large number of segments and is designed for handling considerable traffic, a synchronizing circuit was found necessary, thereby adding a third wire to the system. The line circuits include one control circuit, one indicating circuit and one synchronizing circuit, with one common return for each pair of distributors.

Fig. 1B—Typical Distributor Apparatus Cabinet Used in Both the Dispatcher's Office and the Outlying Station

The cabinet is made of sheet steel with doors opening at the front and rear of the cabinet. In the upper section is mounted the distributor, while the lower section contains polarized relays, one for each supervised unit. The entire equipment is completely wired and ready for installation when shipped from the factory.

Fig. 1C—One Control Key and Two Indicating Lamps for Each Supervised Power Unit with Distributor System

The key and lamp circuits are controlled through a system of polarized relays and the distributor, so that the operation of any one of the fifty keys on the dispatcher's cabinet will operate the corresponding controlling unit in the distant station through similar relays and a distributor controlled by impulses over the connecting lines. In a like manner the operation of any power equipment at the distant station will be indicated over the same connecting lines to the dispatcher. The arrangement of the control keys and indicating lamps resembles as nearly as possible, but in a miniature form, a standard power switchboard. The indicating lamps are arranged in pairs, one pair being associated with each key, and one of the lamps of each pair is lighted at all times. Similarly other pairs of lamps are arranged to show a number of other operations taking place at the distant station without the manual aid of the operator or dispatcher.

closed position of the equipment controlled. Some companies desire to have remote control without the indication or remote indication without control, but a complete supervisory system combines both. Such a system must be highly reliable, contain as few parts and contacts as necessary, be rugged in construction and require as few connecting lines between stations as possible. The supervisory systems discussed in this article have been designed to meet these requirements, and so far as years of experience in train dispatching has demonstrated and the last few years in the electric service field have shown, the results have come fully up to expectations.

Application of a supervisory system makes possible the unit operation of any or all individual units of the power network. For example, it places under the control and supervision of a load dispatcher all desired

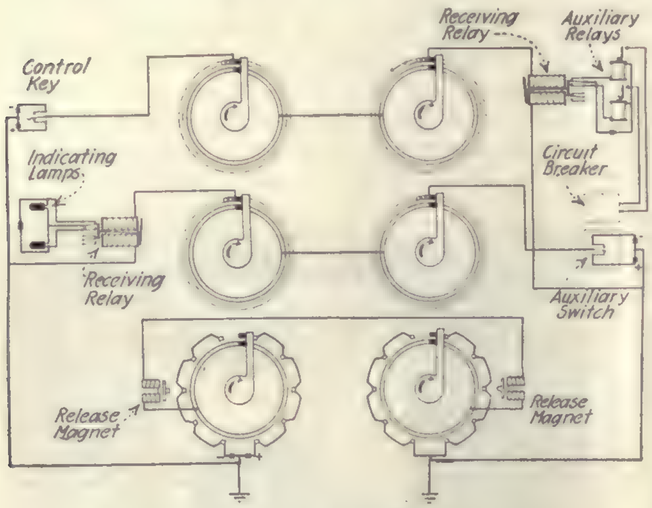


FIG. 2—SCHEMATIC DIAGRAMS SHOWING PRINCIPLE OF OPERATION OF DISTRIBUTOR SYSTEM

The upper diagram is the controlling circuit from the dispatcher's station to the distant station. The center diagram is the indication circuit from the substation to the dispatcher's station. The lower diagram is the control circuit used entirely for synchronizing the rotation of the brush arm of the distributors. Keeping in mind that the three circuits are contained in one pair of distributors, it will be understood that the three brush arms shown are in reality carried by one arm of each distributor, rotating at a given speed.

operations in either automatic or manually operated substations and generating stations, centralizes the control of isolating switches in power networks, switching stations and feeder points, and keeps the system operator fully acquainted with all conditions about which he should know in order to maintain reliable and economical operation. Furthermore, it saves time and possibility of error in transmitting instructions from the system load dispatcher's office to individual stations where the same operations might be done manually.

Another advantage of the supervisory system is that better service can be rendered to the public since the load dispatcher will be continuously informed of the exact conditions existing at all points in the system under his supervision. Should trouble occur on a particular feeder, it is indicated immediately, and an operator can advise customers obliged to make complaints that the trouble already is under investigation. This saves considerable delay to the customer and is a much better practice than waiting for a complaint as the initial source of information. In an emergency, such as a fire, it is possible for the operator immediately to cut out the feeder supplying the affected section.

Three distinct types of supervisory control equipment have been developed, each having its application to a particular condition and each giving equivalent results so far as control and indication are concerned.

These systems were designed to cover the following conditions:

1. Where the power system contains a large number of power units installed in an outlying station at a considerable distance from the central point. This condition is met by a system using motor-driven distributors and associated apparatus with four connecting line wires from the central station to each of the outlying stations.

2. Where the power system contains several outlying stations spread over long distances with a small number of power units in each. This condition is met by a system using selectors, selector keys and motor-driven selector keys with three continuous connecting line wires from the central station to all of the outlying stations.

3. Where the outlying stations are within such a short distance of the central point that it is preferable to install standard telephone cable using one or two wires per switch between the stations rather than employ the distributor or selector system for transmitting the signals between stations.

Conforms with Past Practice

In the development of these systems it was essential that the design of both the circuits and apparatus should conform in a general way to the practices already well established in the field of power generation and transmission. In order to make the system of practical use the indications to the load dispatcher are continuous and visual and are shown by the standard method of red and green indicating lamps. All indications show the position of the power apparatus, whether its operation is due to the automatic functioning of the outlying station equipment or is the result of control from the central station. To open or close an oil circuit breaker the dispatcher merely turns one of two keys provided for each breaker. A green or red lamp associated with that key lights up when the operation has been completed.

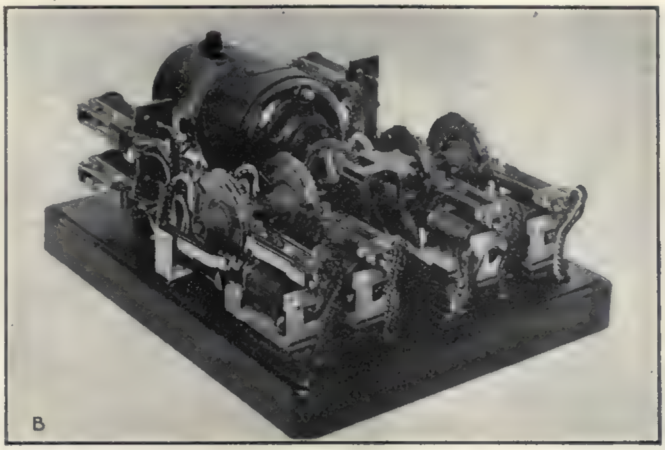
Supplementing these indications is a short bell signal which attracts attention to the fact that some of the power apparatus has changed in position.

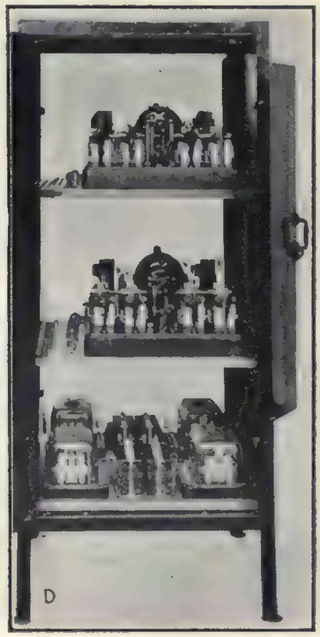
Modified Printing Telegraph Equipment Used

Distributor System.—To meet the conditions outlined in paragraph 1 a supervisory system using modified printing telegraph equipment was developed. The standard equipment had some limitations so that a number of modifications in the apparatus and circuits were necessary, although a great many of the mechanical features have been retained. The first distributor system used standard printing telegraph distributors and a combination of coding relays, but it developed that so many series contacts were necessary that the relay scheme was found to be unreliable. The next step resulted in an arrangement of distributors without the coding relays and with two connecting lines only, but this system was limited directly to the number of segments on each distributor. As the distributor faces were too small for the addition of the required number of segments, it became necessary to develop the present distributor shown in Fig. 1A.

To assure synchronous operation of the distributor brush arms, control segments and collector rings are

provided to send a series of positive and negative impulses over the line wire and through the windings of the release magnets on the distributors at the opposite ends of the line. Thus the two release magnets, being in series, will operate and release the brush arm of each distributor simultaneously. Since the teeth on the brush arm are in alignment with the control segments, the release magnet will be energized before the brush-carrier teeth engage with the latches, provided that the distributors are operating in synchronism. If, however, the two distributors are not running in synchronism and if one brush arm should lag behind the other, the arms will be brought into step each time the teeth on the brush arm engage with the release magnet latch. In other words, the brush arm which is running the faster will be stopped at the latch and held until the slower arm reaches the corresponding position.





TYPICAL APPARATUS INVOLVED IN THE REMOTE CONTROL OF POWER NETWORKS

Fig. 3A—Selector Apparatus Cabinet Used at Dispatcher's Station

This cabinet is made of steel with front and rear hinged doors and is arranged with slides to take the apparatus shelves as shown. On the top shelf is mounted the common control apparatus, while on the next two shelves are mounted the selectors for receiving indications from the outlying stations.

Fig. 3B—Automatic Motor-Driven Four-Unit Selector

Fig. 3C—Key and Lamp Cabinet Used with Selector System

Fig. 3D—Selector Apparatus Cabinet Used at Distance Station

This cabinet is similar to that used at the dispatcher's station. In it are mounted the motor-driven selector keys for originating the indication impulses and the selectors for receiving the control impulses sent from the dispatcher's station. Both apparatus layouts are arranged in units of four and are completely wired and ready for installation when leaving the factory.

Assuming that the pair of distributors is operating as described, positive or negative current originating at the dispatcher's key will be transmitted to the sending segment and over the connecting line wires to the receiving relay at the distant station. The receiving relays, being polarized, will take a position corresponding to the impulses received from the sending keys at the dispatcher's station as the distributor brushes pass over the corresponding segments of the distributors. Each supervised unit at the distant station is provided with an auxiliary switch operated in either one of two positions by the functioning of the equipment to which it is attached. In this way positive or negative current from a local battery is placed on the sending segments of the distributor at the distant station in the same manner as that described for the operation of the keys at the dispatcher's station. A similar series of impulses will be sent back over a separate line wire to the dispatcher's station for the operation of the receiving relays at that point. The operation of these receiving relays will change the indication given by the red or green light.

Cable System.—Where the central station and the outlying stations are within a short distance of each other it was considered advisable to develop a system using multiple-conductor, lead-covered telephone cable in place of the two distributors. This requires one wire per switch for control and one wire per switch for indication. The terminal apparatus at both stations is the same as that used with the distributor system, with the exception, of course, that no distributors are necessary.

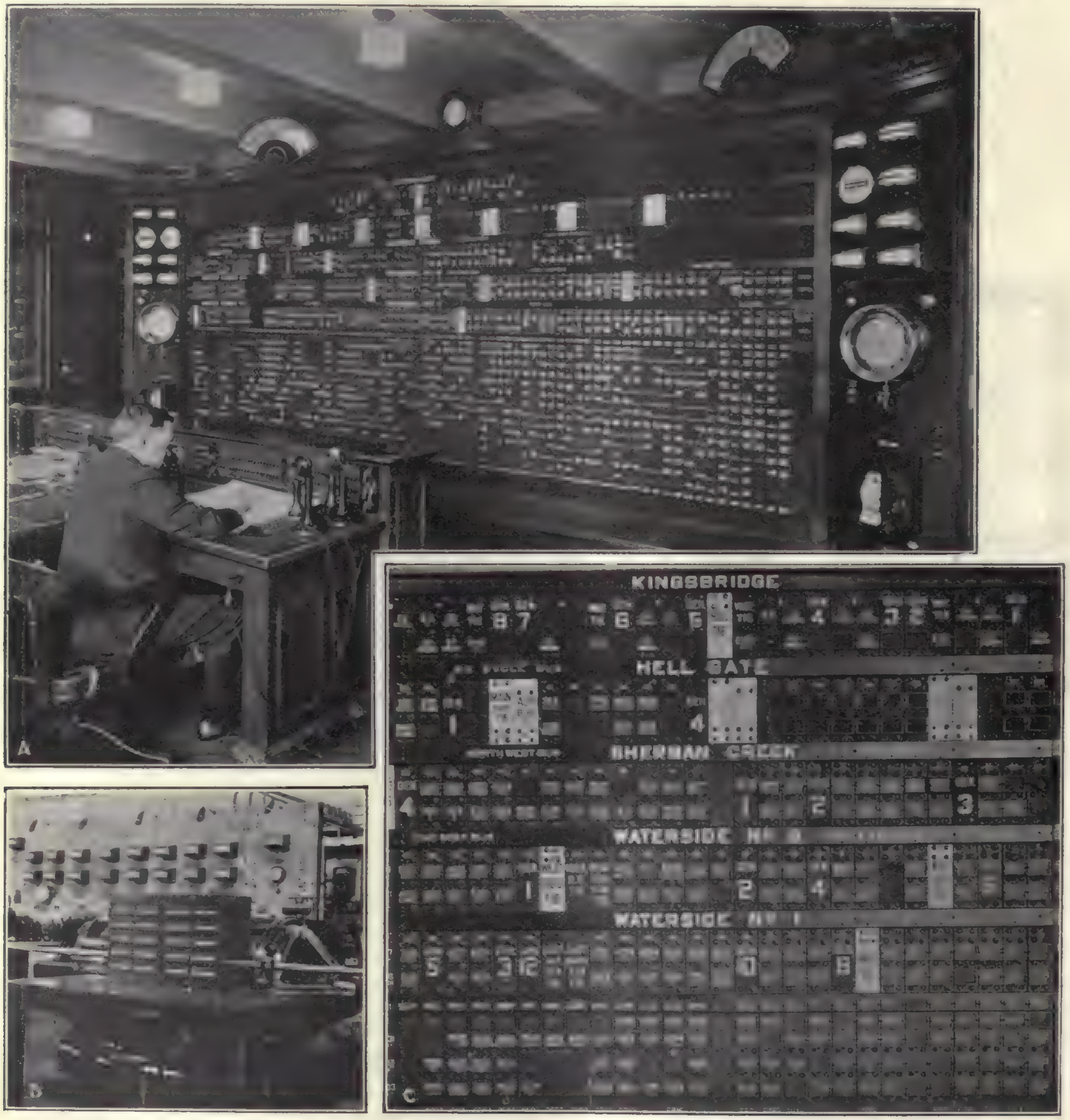
Batteries Used for Reliability

Originally it was intended to operate the majority of the equipment in both the distributor and selector supervisory systems by alternating current supplied directly from the buses of the various stations. However, it was decided that since the supervisory systems are most valuable when trouble is occurring on the power networks, a separate battery source for the

operation of the supervisory system would be more reliable. Hence the potentials required for the operation of the distributor system are derived from 120-volt motor-generators or batteries installed at both ends of the system.

A center tap is connected to either set of batteries to furnish 60 volts positive and 60 volts negative. The batteries required for the operation of the selector system are one 144-volt battery at the dispatcher's station and one 72-volt battery divided into three equal parts at each of the outlying stations. The constant battery drain in no case exceeds 1 amp. In the cable system a 120-volt battery with a center tap is required at either the dispatcher's station or the outlying station. In this case the current drain will be 0.008 amp. for each indication and for each control of power units. A 24-volt source, either alternating-current or direct-current, is required for lighting the indicating lamps in each of the systems. The maximum current drain is 0.040 amp. for each pair of lamps connected in this manner to the systems.

Selector System.—When a power network contains a dispatcher's station and a number of distant stations scattered over a vast territory, the selector system is



ACTUAL INSTALLATIONS OF SUPERVISORY SYSTEMS HAVE PROVED SUCCESSFUL

Figs. 4A and 4C—Load Dispatcher's or System Operator's Pilot Board at the Waterside Station, New York Edison Company

The section of the board marked "Hell Gate" is an application of the cable system and indicates the open and closed position of approximately two hundred circuit breakers at the Hell Gate power station.

Fig. 4B—Supervisory Control Cabinet as Applied to the Control and Indication of Switches in Two Outlying Stations

The equipment shown is that of the Malden Electric Company at Malden, Mass., and is installed in the Malden power station. The two outlying stations are Medford, now in operation, and Everett, in the course of construction.

applicable and the three line wires may be run continuously throughout the system.

By the use of standard train-dispatching selector equipment the control feature for operating the power units was comparatively simple. It meant only an adaptation of the standard calling circuit used in train-dispatching systems. However, to produce the visual indication by the standard practice of lighting a red or green indicating lamp an automatic sending device at the outlying station was necessary. The device finally developed was an automatic motor-driven four-unit selector key (Fig. 3B). The original automatic sending device for the indication circuit was designed as a single-unit automatic motor-driven key, one key being required for the two indications of each power unit.

In order to utilize one motor and one reduction-gear combination and to apply a local lock-out circuit together with a clutch and latch arrangement for preventing the overthrow of the impulse wheels, the present four-unit automatic motor-driven key was developed. This device has a capacity of sending in eight indications for the "open" or "closed," "start" or "stop" positions of four power units. The mechanism is driven by a 24-volt direct-current motor, which is operated whenever there is an indication to be sent in to the dispatcher's office. It would be possible to develop a system requiring two rather than three connecting lines if the positive lock-out feature had been waived. However, it was the opinion that a positive lock-out circuit was necessary, so that if two or more power units, either in the same station or different ones, operated simultaneously, the indication signals would be transmitted to the central station in sequence.

APPARATUS IN ANY STATION CONTROLLED AT WILL

In this system the dispatcher will have before him a lamp and key cabinet (Fig. 3C) similar to the one described and shown in Fig. 1C except that in this case there are two keys for each supervised unit. Associated with each pair of keys are two indicating lamps, one red and one green. The keys on the left-hand side are associated with the red lamps, and the keys on the right-hand side with the green lamps. This arrangement enables the operator to control at will any of the apparatus in the outlying stations and gives him a visual indication at all times not only of the operation of the apparatus but of the unit's final position.

When the dispatcher operates a control key to open or close a designated power unit a train of impulses will be sent out over the connecting lines to the outlying station, and the selector which has the same code setting as the sending key will move to the operating point and close a contact which in turn energizes the auxiliary relay governing the operation of the power unit. The operation of this power unit through its auxiliary contact will start up one of the automatic motor-driven keys and release a corresponding code wheel. The operation of this code wheel will send a series of impulses to the dispatcher's station. The selector at the dispatcher's station, set for the same code as that being sent by the impulse wheel, will step to the operating point, energize a local relay and give the indication in the usual manner.

The operation is the same for each supervised unit, but the equipment is so interlocked that no incoming signals can occur while the dispatcher is operating his keys and but one indication can be sent in at a time. Should several breakers either in the same station or different stations open simultaneously, indications will be stored and sent in to the dispatcher's office in a definite order.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Progress in Engineering Practices the Economic Salvation of Mines

To the Editors of the ELECTRICAL WORLD:

I have read the article entitled "Electrified Copper Mine" in the Sept. 26 issue of the ELECTRICAL WORLD and feel sure that it will be of considerable interest to other engineers engaged in metal-mine work.

In general, however, a great many of the methods which were used a few years ago, and likewise the equipment, have become obsolete. Today the older metal-vein mines are deeper. Hoisting and pumping have become more difficult. Ventilating and tramming is necessary for great areas and is therefore more complicated. Consequently these factors, coupled with higher labor costs, make it necessary for such mines to adopt the most improved processes and appliances, thereby reducing the cost per ton of ore mined per man. If this is not done, then deep-metal-vein mines cannot compete with the large low-grade mining properties.

With a view to lowering the costs both in mining and likewise in the reduction of the ores, the mine operators are always on the watch to find new methods and machinery which is more economical. It follows naturally, then, that electricity has played an important part in solving a large number of the new mining problems. Thus, with the greater use of electric power in the mines, the transmission of large blocks of electrical energy underground has confronted the electrical engineer with a great number of new questions to solve. The fire hazard and risk to life have increased proportionately.

In the past the only material and appliances that could be used for underground mining have been apparatus built for industrial purposes. Instead of making equipment and using machines for the mining conditions, it has been the practice to change the mining conditions to a certain extent to suit the equipment. Therefore new methods had to be found and new equipment designed for a condition which before had never existed. Again the electrical industry has entered into the spirit of solving these new problems, and in the past few years marked improvements have been made in the manufacture of cables, motors and switchgear for use in the mines. In addition, striking improvements have been made in the installation of this apparatus. All of these features have contributed to safer and more economical operation of mines, but we still believe there are greater possibilities. By the exchange of thought through the technical press the mining industry should benefit greatly, as the men therein are now engaged in trying to make mines safer and more economical to operate.

C. D. WOODWARD,
Chief Electrical Engineer.

Anaconda Copper Mining Company,
Butte, Mont.

Central Station and Industrial Practice

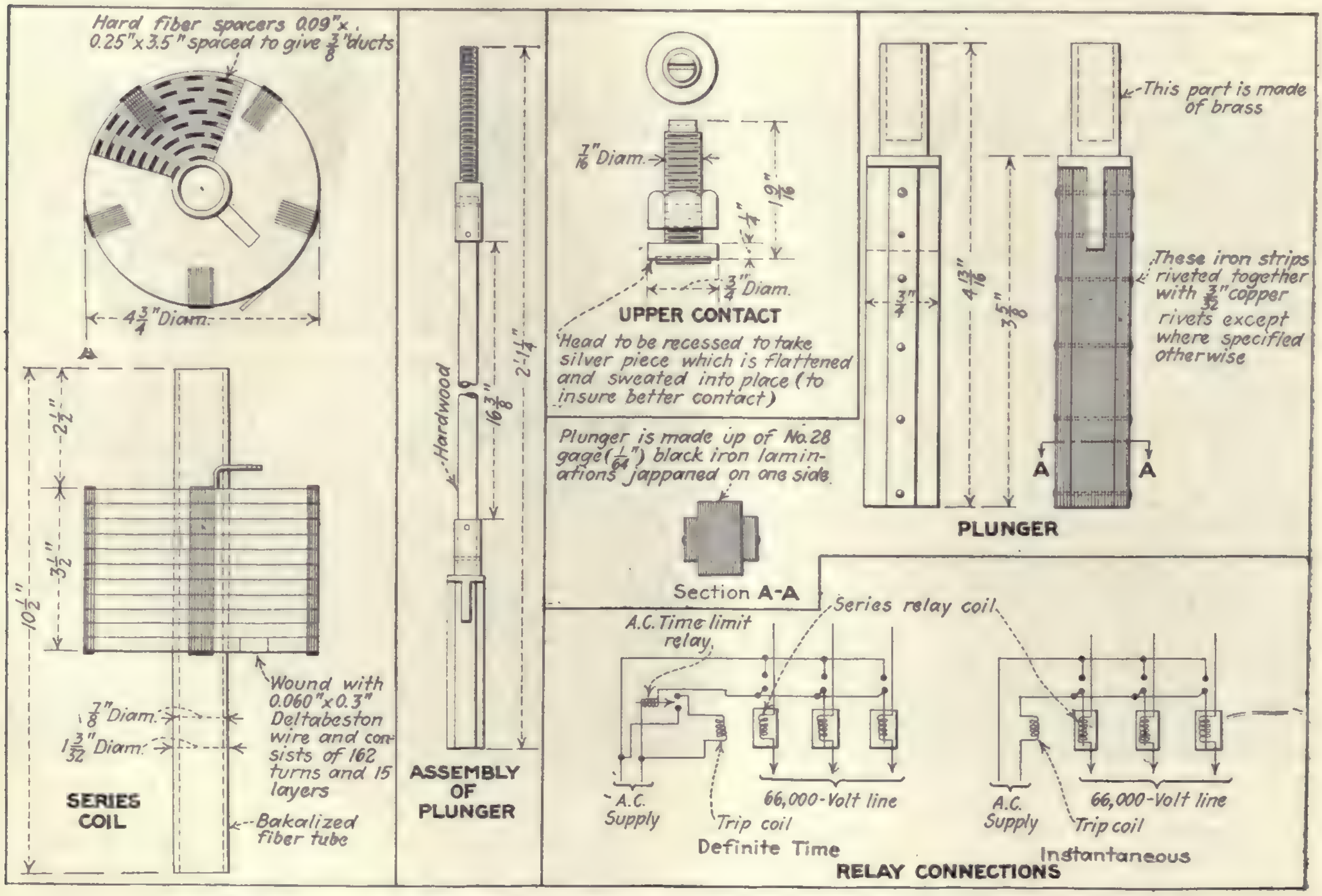
Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Incorporating Series Trip Coil Inside Circuit Breakers

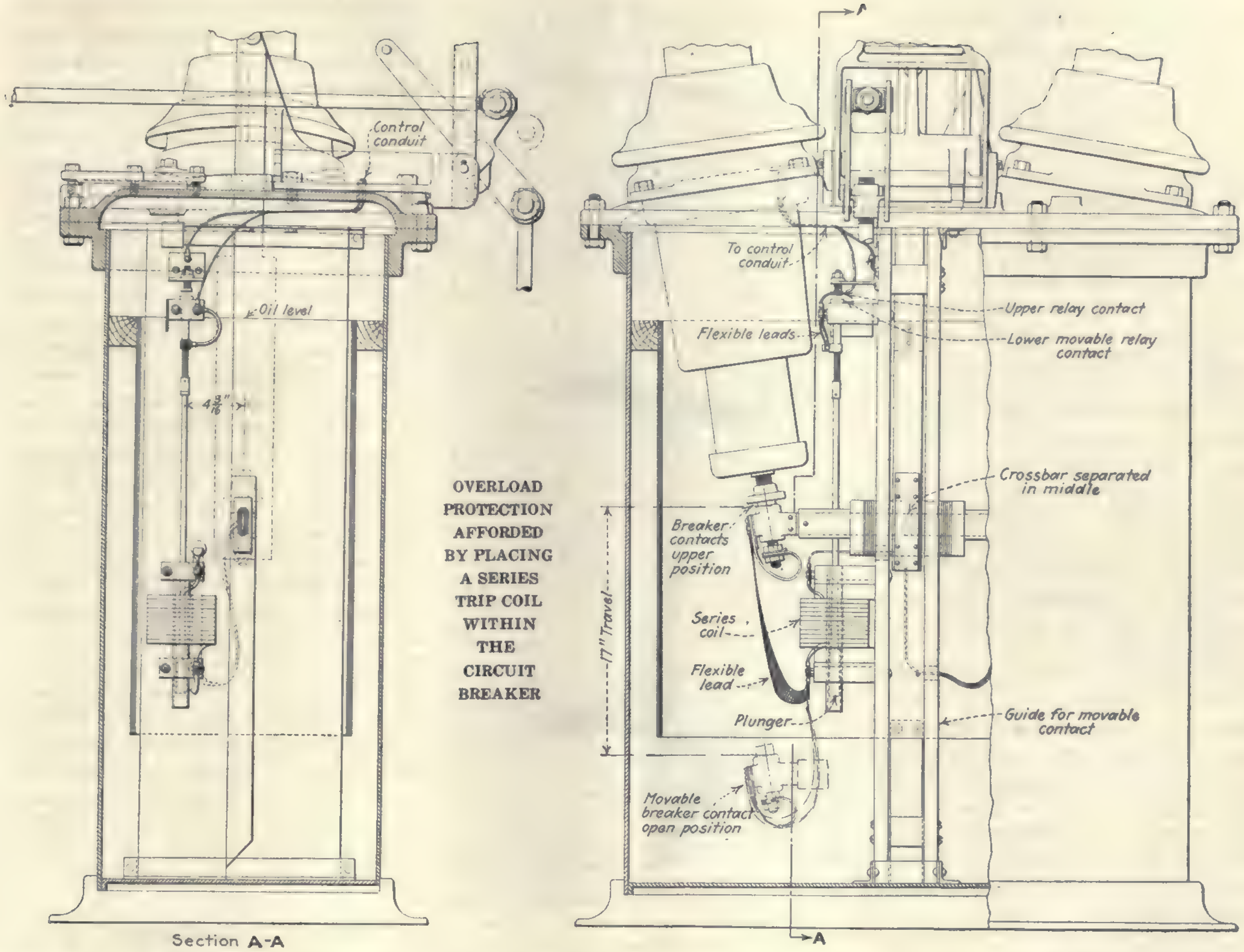
HAVING a number of 66,000-volt Westinghouse type G.A. oil circuit breakers which could not be equipped with bushing-type current transformers without extensive modification, the Tennessee Electric Power Company has undertaken the installation of series relays within the switch tanks to trip the breakers on overload. These coils are inclosed in the switch tanks to avoid the difficulties of constructing separate series relays and installing control wiring for tripping the breakers. The changes have been developed in co-operation with the E. W. Clark & Company Management Corporation and the Westinghouse Electric & Manufacturing Company.

As shown by the accompanying illustrations, the brass bar connecting the main moving contacts of the breaker is cut apart at the middle and the two halves clamped together physically but not electrically. The series coil, which is mounted at one side of the tank but within the tank lining, is connected by flexible copper braid to the two movable contacts so that all current passing through the breaker flows through the series coil. Supported so it will slide vertically through the cènter of the series coil is a laminated plunger. Attached to its upper end by a hardwood rod $16\frac{3}{8}$ in. long is a movable contact the upper surface of which is just above the oil level in the switch tank. Above this is a stationary contact. The current at which the breaker will trip is set by adjusting the length of the rod carrying the laminated plunger, in that way changing the relation of the plunger with respect to the series coil. The connections with the control circuit are shown in the accompanying illustrations. Action of any one of the series coil to close its respective contact will trip all three phases. Definite and instantaneous time action is secured by the arrangements shown in the wiring diagram, while the details of construction are shown in the remaining illustrations.

The modified breakers have not been in service long enough to state how satisfactorily they will perform the function for which they were intended. Tests and experience will tell whether any trouble may be expected from placing the series coil in the proximity of the line of travel



DETAIL ARRANGEMENT OF TRIP COIL, MOVING AND STATIONARY CONTACTS AND FLEXIBLE CONDUCTOR



OVERLOAD PROTECTION AFFORDED BY PLACING A SERIES TRIP COIL WITHIN THE CIRCUIT BREAKER

of the moving contacts. In this regard an engineer of the E. W. Clark & Company Management Corporation says:

"The location of the series coil in these breakers is a compromise, taking into account a number of considerations. In the first place, we wanted to get as far away from the main contacts as possible and still allow reasonably short connections to the coils. In the second place, the location had to be such that these flexible connections would not become grounded by touching the tank or other parts of the switch when the contact started to open.

"Moreover, while the coil is not very far from the contacts, I do not believe that any arc started by opening the contacts would jump to the coil, considering that this arc would be in oil under a considerable head, which would tend to keep the arc confined to the shortest possible path. Of course, the foregoing is all more or less surmise, and the only check we have on it is the fact that several of these switches have been in service for a number of months without any indication of trouble from this source.

"The object of using the series coils in this manner was to make these switches automatic without the expense and very undesirable features of separate current transformers. The space limitations imposed by the switch tanks and bushings made it impossible to use bushing transformers, except of unusual and extremely expensive design; therefore about the only thing left was a series trip arrangement such as we have worked out."

Energy Costs 0.9972 Cent in 7,000-Kw. Plant

DATA available from an Eastern 7,000-kw. power plant show that for the twelve months ended July 1, 1922, energy was generated for 0.9972 cent per kilowatt-hour. The plant factor (net output in kw-hr. ÷ installed kw. × 8760) was 23.8 per cent, while the load factor was 47.6 per cent. The total net output for the year was 14,601,040 kw.-hr. with a peak load of 3,500 kw. The coal consumption was 18,471 tons, costing $5.89 per ton and averaging (over a period of six months) 13,724 B.t.u. and 10.26 per cent ash. The fuel economy was 2.66 lb. of coal, or 36,500 B.t.u.

The generating equipment of this plant consists of four 500-hp. boilers and two 3,500-kw. horizontal turbines. The net unit production expenses in cents per kilowatt-hour delivered from the switchboard were:

	Cent	
Operating expense:		
Fuel	0.7440	
Wages and superintendence	0.1233	
Water, lubricants and supplies	0.0177	
		0.885
Maintenance expense:		
Building and structure	0.0068	
Boiler plant	0.0781	
Prime movers and auxiliaries	0.0092	
Generators and electrical equipment	0.0132	
Miscellaneous	0.0049	
		0.1122
Total		0.9972

Tests on an English 33,000-Volt Cable

IN THE article with the above heading, published in ELECTRICAL WORLD for Sept. 8, 1923, on page 492, the cross-sectional area of the cable conductor was given as 25,464 circ.-mil. This should have been 254,640 circ.mil.

Secondary Racks Reduce Line Troubles

By D. J. White
Superintendent Electrical Department, Illinois Power & Light Corporation Decatur, Ill.

By installing secondary distribution racks in place of cross-arms the Illinois Power & Light Corporation, Decatur Division, has been able during the past three years to lower its primary and secondary troubles from a total of 3,606 in 1921 to 1,241 in 1922. This system was adopted when the distribution circuits were changed from two-wire to three-wire because of the increasing demand for energy.

Several reasons dictated going into this type of construction, the most prominent one being to get away from troubles arising from the primary circuits falling down on or swinging into the secondaries and creating short circuits. Another reason was that a complete uniform system of distribution was desired since in some localities no secondary cross-arms had ever been installed, making it necessary to place the secondary circuits on the same arm as the primary. Naturally this created much trouble whenever storms or swinging wires short-circuited the circuits and burned them down.

However, the new method requires a standard six-pin cross-arm for the primaries and uses a three-spool rack for the secondaries, which are placed on the side of the pole with 4½-in. x ½-in. fetter-drive lag bolts (Fig. 1). The dead-end rack is then attached to face of pole with 10-in. through-bolts. All secondary distribution is being cut three-wire. The neutral wire is placed on the top spool of the rack. This spool is white-glazed so that no mistake can be made by linemen when connecting services. The two other spools are the regular brown-glazed type. The neutral wire is placed on the top spool for the reason that if primaries should fall across the secondaries they will come in contact with the grounded wire first. This also makes much neater-looking construction and relieves the pole from the added burden of another cross-arm.

FIG. 1—SECONDARY RACKS HAVE LOWERED DISTRIBUTION TROUBLES 65 PER CENT WITHIN TWO YEARS

For controlling the position of transformers as to load centers a secondary map (Fig. 2) was commenced when this change-over first went into effect. It shows the transformer location number, which is indexed and filed; the distance of secondaries from transformers and the number of services on each side of the three-wire distribution system. The sketch of the secondary winding illustrates the three types of service available, namely, two-wire, 110-volt lighting; three-wire, 110-220-volt lighting and power, and two-wire, 220-volt power. This map has been very beneficial in many ways. These are, first, making voltage surveys; second, relocating transformers to get to the load center, or dividing secondaries when they run too great a distance from one transformer; third, assisting the routing of new business orders, whereupon it can be ascertained which orders require an extension of secondaries, poles and drops without the necessity of going to the street; fourth, advising the applicant which kind of service can be furnished without delay in looking over the lines; fifth, determining the number of consumers affected and the trouble caused when fuses are blown.

Relative costs as between this system and the use of cross-arms remain about the same, but the advantages of the racks in eliminating distribution troubles have more than offset the change-over costs.

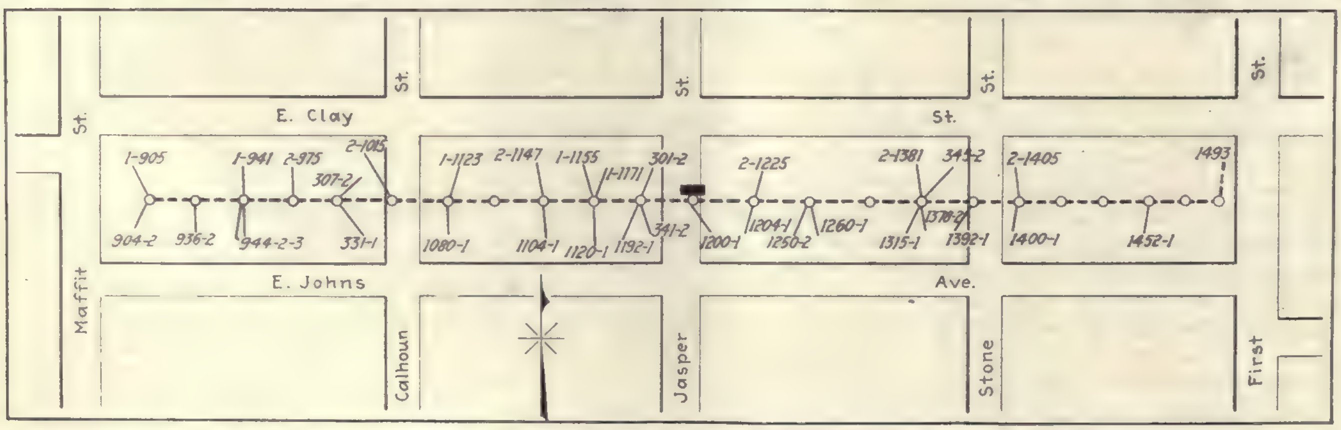


FIG. 2—DISTRIBUTION MAP VALUABLE IN PLACING TRANSFORMERS NEAR LOAD CENTERS

Unified Standards for Hydro Plants

By Frederick Krug
Superintendent of Hydro-Electric Plants Porto Rico Railway, Light & Power Company, Bayamon, Porto Rico.

The advantages of definiteness and accuracy that may be obtained by putting a description of functions, organization, duties and routines into writing are generally realized. Putting these things into the form of comprehensive system standards is not so generally practiced. The accompanying plan, covering engineering standards and

instructions for operation, maintenance and construction, pertains to hydro-electric plants only, but it is part of the complete standards being developed by a public utility to cover all of its operations.

From the standards that have been completed for the hydro-electric plants each employee receives detailed written instructions on his duties and place in the organization. An operating code covering the electrical and hydraulic operation under both normal and abnormal conditions is also abstracted from the standards for the information of all employees concerned. The maintenance crew is furnished with detailed inspection schedules and outlines, and all men engaged on construction work receive clear and concise instructions on the best methods of handling the work.

By centralizing all of these matters in one set of system standards, a definite depository for such data exists which can be drawn upon as required by different divisions or departments of the company. Such standards must of necessity be flexible and in a continuous state of development, in order that changed conditions may be met and better methods incorporated into them as developed.

PLAN OF STANDARDS FOR HYDRO-ELECTRIC PLANTS

Binder		
29		**Hydraulic Plants—General**
	1.	Organization.
	2.	Duties of Employees.
	3.	General Plant Rules.
	4.	Safety Rules.
	5.	Inspection and Maintenance Schedules and Methods.
	6.	Employee Housing and Welfare.
	7.	Educational.
	8.	Office Routine and Files.
	9.	Requisitions and Stores.
	10.	Records and Statistics.
	11.	Reports.
30		**Plant No. 1**
	1.	Electrical Operation. Normal. Abnormal.
	2.	Hydraulic Operation. Normal. Abnormal.
	3.	Electrical Inspection and Maintenance.
	4.	Hydraulic Inspection and Maintenance.
	5.	Records and Statistics.
	6.	Reports.
31		**Plant No. 2**
	1.	Electrical Operation. Normal. Abnormal.
	2.	Hydraulic Operation. Normal. Abnormal.
	3.	Electrical Inspection and Maintenance.
	4.	Hydraulic Inspection and Maintenance.
	5.	Records and Statistics.
	6.	Reports.
32		**Dams and Pipe Lines**
	1.	Operation.
	2.	Inspection and Maintenance.
	3.	Records and Statistics.
	4.	Reports.

Extracts from an Operating Code*

Low-Tension Testing

THE foremost requirement for personal safety and protection of apparatus is a test for foreign voltage. In no case should any equipment be touched until after this test has been made. Detailed instructions for foreign voltage tests and also the phase tests follow (the testing equipment referred to was described in the ELECTRICAL WORLD for Sept. 22 on page 610):

Test for Foreign Voltage

110-Volt and 250-Volt Sets.—1. Touch the bare equipment with the metal end of a switch hook and slowly pull it away. If a small spark is observed, the equipment is alive.

2. If no spark is observed, touch each phase of the equipment in succession with a grounded wire. If no spark is observed, the equipment is free from foreign voltage.

(Note.—Where a bus-grounding device is supplied, see below.)

600-Volt Set.—With the test switch closed to ground, connect each of the conductors of the line to the test bus. If the line is still alive, the expulsion fuse will blow.

Bus-Grounding Device.—1. Close the switch supplying current to the indicating lamps of the bus-grounding device. If these lamps all light, close the grounding fuses in succession, beginning with the A phase.

2. If the lamps do not light, examine the lamps, lamp circuit and fuses for open circuit. When this has been corrected proceed as in Rule 1.

3. Open all the fuses and return them to their initial position, when the lamps should again light.

4. If all the lamps light, the circuit is clear of foreign voltage.

5. If any one of the lamps does not light, it is an indication that there is foreign voltage on this phase.

6. Examine the fuse of the phase that does not show a pilot light. If this fuse wire is blown, replace it and test this phase again. If the fuse again blows, as indicated by the lamp's not lighting, there is foreign voltage on this conductor.

Phase Test

110-Volt and 250-Volt Sets.—1. Remove the fuses from the potential transformers connected to the section of the line under test.

2. Make the test for foreign voltage.

3. If foreign voltage is indicated, report it to the load dispatcher and proceed no further until directed by the load dispatcher; then repeat the test for foreign voltage.

4. If no foreign voltage is indicated, the sender will throw the switch of the 110-volt sending set to the supply side or close the grounding switch of the 250-volt set.

5. Firmly hold the test lead at the sending station on the A conductor.

6. The receiver will ground one terminal of his test lamp (50-watt, 125-volt) and touch the other terminal to each of the conductors in succession, noting that his lamp lights on only one of the conductors. He will then hold the lead on this conductor. The sending and receiving lamps should then burn at half brilliancy.

7. As soon as the sender's lamp lights he will signal three times at intervals of three seconds, each signal lasting for a period of three seconds. At the termination of the last signal he will hold the lead on the conductor.

8. The receiver, after waiting three seconds, will return the signal three times in the same manner.

9. When the last signal is made the receiver will continue to hold his lead on the A conductor until the sender moves his lead to the B conductor. This will be indicated to the receiver by his lamp going out.

10. Test the B and C conductors in the same manner.

600-Volt Set.—1. Remove the fuses from the potential transformers connected to the section of line under test.

2. Make the test for foreign voltage.

3. If foreign voltage is indicated, report it to the load dispatcher and proceed no further until directed by him; then repeat the test for foreign voltage.

4. If no foreign voltage is indicated, the sender will throw the switch of the sending set to the lamp-bank position.

5. Connect the A conductor at the sending station to the test bus.

6. The receiver will ground one terminal of his test lamp (50-watt, 125-volt) and touch the other terminal to each of the conductors in succession, noting that his lamp lights on only one of the conductors. He will then hold the lead on this conductor. The sending and receiving lamps should then burn at nearly full brilliance.

7. As soon as the sender's lamp bank lights he will signal three times at intervals of three seconds, each signal lasting for a period of three seconds. At the termination of the last signal he will hold the lead on the conductor.

8. The receiver, after waiting three seconds, will return the signal three times in the same manner.

9. When the last signal is made the receiver will continue to hold his lead on the A conductor until the sender moves his lead to the B conductor. This will be indicated to the receiver by his lamp going out.

10. Test the B and C conductors in the same manner.

*Abstracted from the operating code of the Philadelphia Electric Company.

Weekly Test for Leakage on Surface Condensers

TO DETERMINE the amount of leakage, and by comparison with previous tests to find out whether it is increasing or decreasing, weekly leakage tests should be conducted on each surface condenser used. The procedure for making these tests is outlined below:

1. The test should be made while shutting down the turbines.

2. Maintain as high a vacuum as possible in the steam space of the condenser.

3. With the suction valve of the set pump closed, note the rise of water in the hot well and the length of time necessary for this rise. (Note.—A rise of water in the hot well under these con-

ditions indicates a leakage of circulating water into the steam space.)

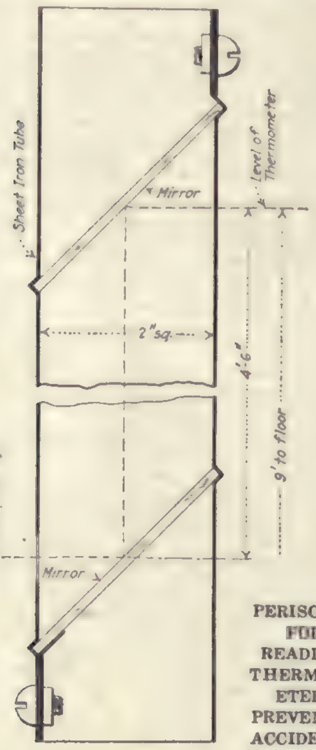
4. Record on the daily log sheet the rise of water, the length of time necessary for the rise and the vacuum.

5. When an additional chemical test is required take a 1-gal. to 2-gal. sample of circulating water from the hot well immediately at the end of the test and forward the samples to the proper laboratory for analysis.

Elevated Thermometer Read by Periscope

By R. A. Horton
Pacific Power & Light Company, Walla Walla, Wash.

To facilitate the reading of thermometers mounted 9 ft. above the floor level on the 66,000-volt transformers at the Walla Walla substation, a periscope was con-



PERISCOPE FOR READING THERMOMETERS PREVENTS ACCIDENTS

structed from sheet iron at a very small expense, which device was described in a recent issue of the company's bulletin. The former practice was to have the station operator climb a stepladder, but now these thermometers can be read from the main floor with perfect safety. For building the periscopes sheet iron 2½ in. square and 4½ ft. long and two plate-glass mirrors, 2 in. x ⅜ in., were used. The illustration shows the arrangement of the mirrors in the tube.

In front of the upper mirror a 2-in. square hole was cut in the side of the tube and in front of the lower mirror there is a 1-in. hole. Slots were cut into the sides of the tube and the metal was formed into hooks to hold one end of the mirror in place, while the other ends were held in place by metal hooks bolted into the main periscope. The tube is hung on the thermometer by a bracket made of strap iron which is looped around the thermometer and then clamped to the tube by a couple of small stove bolts. This allows the periscope to be moved up or turned to one side to give the proper position for the reading. The upper mirror and opening, also the upper end of the tube, must be as large as the field of view desired, but the lower opening need not be more than ½ in. in diameter.

Centrifugal Oil Purifier Proves Satisfactory

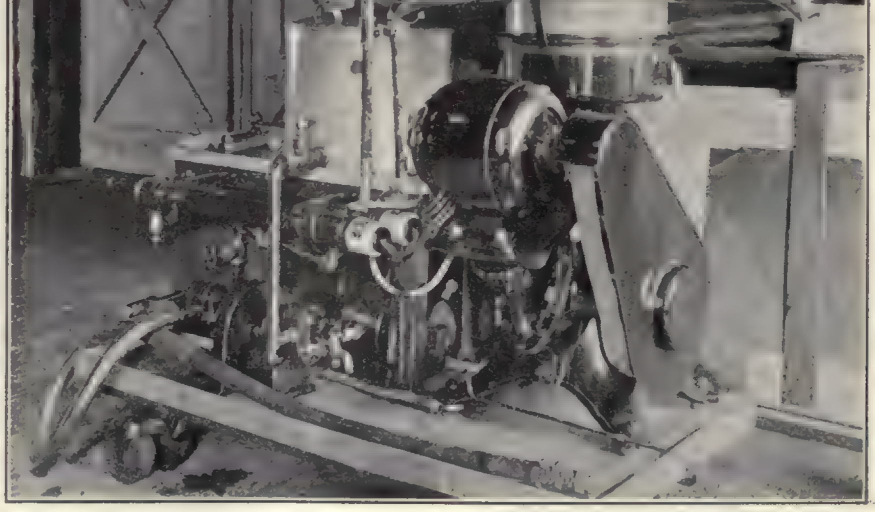
By S. F. Jones
Repair Shop, City Lighting Department, Seattle, Wash.

Experience with a centrifugal oil purifier and dehydrator by the lighting department of the city of Seattle is of interest in view of the discussion on this subject in the Electrical World for Aug. 18, on page 338.

Contrary to the experience of some operating companies, this machine has given very satisfactory results during the past year. It is not only lighter and more portable but cleans and dries the oil more thoroughly and with greater speed than any other type of oil purifier. In addition, it has been found that by adding one-tenth part water to the oil any sulphuric acid contained in the oil is readily removed. Water and sulphuric acid have a natural affinity, and when the water is removed by centrifugal force the acid is taken out with it.

The manufacturer recommends that the oil be run through the machine at a temperature of 40 deg. C., but the most satisfactory results in drying oil have been obtained by passing it through the purifier at a temperature of about 70 deg. C. The oil is first preheated in a large storage tank to about 50 deg. C. and then passed through the two 6-kw. heaters on the purifier, where it is brought up to the higher temperature. To avoid any possibility of explosion and fire due to the flow of the oil ceasing for any reason, it has been found necessary to equip the machine with a contact-making thermometer which makes contact at 80 deg. C. and rings an alarm bell.

This De Laval machine is used in the field as well as in the shop by rolling it on an auto-truck and transporting it to the point where it is to be used. By passing the oil through the machine more than one cycle it is not necessary to drain the transformer or take it out of service. Under normal operations about 100 gal. of oil can be cleaned per hour.



WATER, SULPHURIC ACID AND DIRT ARE REMOVED FROM OIL WITH THIS PURIFIER

Central Station Business

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Formula for Determining Rural Charge*

Empire State Gas and Electric Association Rural Line Committee Develops One—Declares Utilities Must Accept Responsibility for Serving Farms

THE rural lines committee of the Empire State Gas and Electric Association, in its report of September, 1921, said: "A brief consideration shows that the limited amount of business possible to secure in any rural section necessitates the reduction of construction costs to the minimum, or, rather, that the annual charges on the investment necessary to serve rural customers should be reduced to the minimum and that the form of rate for such service and the method of determining the proper rate are features of greatest importance."

At that time the committee also made the following observations:

1. The development of rural territories should be fostered by the utility that is most logically situated to serve such territory because of:

(a) Franchise conditions, which, giving it the right to operate in that particular territory, necessarily carry with them the duty of serving the public therein.

(b) Revenue possibilities.

(c) Protection of territory against competition through extension of neighboring utilities and the organization of local systems to fill demands not met by the established utilities.

2. Rural development should be carried out through instrumentalities constructed and maintained by the utilities because of:

(a) The natural objection of rural residents to participating in organization and burdening themselves with expenses and the compilation of comparatively unimportant but locally necessary reports and the responsibility for the proper conduct of the project.

(b) The experience of the telephone companies throughout the entire country, which has shown that rural customers cannot be depended upon properly to construct and maintain the instrumentalities requisite for the desired standard of service.

(c) Control of the facilities, by reason of the necessity of increasing capacity of lines and the construction of extensions made necessary by new business as well as to facilitate changes.

The rural extensions should be developed upon a self-supporting basis so as not to impose an undue burden upon urban customers. Each single project may be considered by itself, or the several projects necessarily radiating from a similar service of supply covering the entire rural territory surrounding such points of supply may be considered as a unit. The choice will in general be determined by the character of the territory and density of the rural population.

> IN STUDYING the formula proposed in the report of the rural lines committee of the Empire State Gas and Electric Association, the reader should note that the item of revenue received from an extension is not taken into consideration in the calculation of the rural or excess charge. A question might well be raised as to whether such a method of calculation would produce a non-discriminatory rate and also whether it would help or hinder the development of the business.

The most equitable form of rate for rural service is one that takes into consideration the excess cost of furnishing this service over the cost of furnishing urban service. It seems to be generally conceded that such a rate should contain an element dependent upon this excess cost in addition to the energy charge, such excess being known as a "service" or "line" charge and being apportioned equitably among the customers served by the particular line.

The committee feels that it is possible to develop a rate plan which will be suitable for general use in the determination of rural rates in any particular locality and trusts this subject will have the further study which it deserves.

The committee said further:

The limited number of customers possible to secure on rural extensions and the limitation of their requirements, thereby producing a low ratio between the revenue, if figured at urban rates, and investment, requires that annual charges on the investments necessary to serve rural customers be reduced to the minimum. This can best be accomplished by departure from the construction standards generally adopted for urban lines or by taking advantage of the possibilities of joint construction with telephone companies. In general the economic limit of joint construction with telephone companies will be found confined to exchange lines or at least one or limited to two or three cross-arms.

A sub-committee made a study of low-cost rural lines and prepared a specification which was printed and distributed by the association.

The study given to the proposal by the committee during the past two years confirms the views previously expressed, and, as pointed out in 1921, the committee still feels that the matters of investment necessary to render the service desired now and formulating a rate for such service are of the greatest present importance. Methods of financing and of developing a greater use of the service appear to be of secondary import. The main thing in the opinion of the committee is to be able to furnish service at the lowest annual cost and to establish a form of rate flexible enough to meet the needs of any condition. The first requisite has been partly met by the preparation of the specifications for low-cost construction to which reference has been made. The present tendency of many companies to make an excessive investment in rural lines can well be overcome by following these specifications. The second matter of importance has been studied with the following conclusions:

"Rural extensions should be developed upon a self-supporting basis, so as not to impose an undue burden upon urban customers. The most equitable form of rate for rural service is one which takes into consideration the excess cost of furnishing this service over the cost of furnishing like urban service. Such a rate should contain an element dependent upon this excess cost in addition to the urban rate, such an element being known as 'rural charge' and apportioned equitably among rural customers."

Definitions

The committee, in order to clarify the use of terms, gives the following definitions:

1. The term *"rural service"* is taken to refer to matters relevant to the furnishing of electric service throughout the country districts, outside of the corporate limits of cities or villages having established services or supply or being of such size as to warrant the establishment of independent services

*From a report of the rural lines committee of the Empire State Gas and Electric Association presented at the Commercial Section meeting at Briarcliff Manor, N. Y., June 28 and 29.

or supply, or to any other territory having similar character or density of population.

2. The term *"rural customers"* is taken to refer to customers for electrical energy who are not located within the corporate limits of cities or villages having established services or supply, or in any other territory having similar character or density of population, except those sections within the corporate limits of cities and villages which are essentially rural in character.

3. The term *"rural charge"* is taken to mean the annual charge to be made to rural customers in addition to the regular urban rate, based upon the additional cost of serving such customers over the average cost of serving urban customers receiving the same grade of service. This additional cost is in general composed of two items:

(a) The annual charges upon the physical plant provided to serve rural customers, including transformers and services, but not including meters or meter installations.

(b) The additional line and transformer losses incurred.

DETERMINATION OF CHARGE

The committee outlines the method of determination of the rural charge as follows:

Let C_m = average cost per mile of rural line including transformers and services.

(Secondary distribution should be omitted, owing to the scattered locations of rural customers and the difficulty of arriving at any average of such distribution which would be representative. In its place the installation of one 1½-kva. transformer should be assumed for each rural customer; then, if secondary distribution is provided, in order to be economical, it must produce total annual costs no greater than those produced by a 1½-kva. transformer installation per rural customer.)

N = number of rural customers per mile.

C_u = average cost of urban distribution system per urban customer.

A_c = annual charges on the rural line.

(In this case they are taken at 18 per cent: Retirement expense, 4 per cent; taxes, 2 per cent; maintenance, 4 per cent; return, 8 per cent.)

If financing of the line is done by the rural customer, the item of interest in the return should be eliminated to the extent that it is applicable to that portion of the financing done by the rural customer.

T_l = transformer losses.

(It is assumed that the total primary loss, transformer copper loss, in rural service is equivalent to the total losses in urban service. This leaves the transformer core loss as an excess loss in rural service. It is felt that no profit should be earned on this load. It is a steady load, can be readily calculated and should be charged for on the basis of production cost only. This core loss is to be taken as the core loss of the average transformer per rural customer, which on the basis of 1½-kva. amounts to 184 kw.-hr. per year. In the event of individual transformer installations of more than 1½-kva. per rural customer, the actual core losses should be considered and figured at production cost. The customer requiring the additional transformer capacity should be required to pay for this additional core loss plus the annual charges—18 per cent; the exact percentage to be used will depend upon the experience of the particular company involved—on the added cost of the transformer installation over the average transformer installation—1½-kva.)

P_c = production cost per kilowatt-hour.

R_c = rural charge.

Then $R_c = \dfrac{(C_m - N \times C_u)}{N} \times A_c + 184 \times P_c$.

Example

C_m (average cost per mile of rural line including transformers and services) = \$1,500.

N (number of rural customers per mile) = 4.

C_u (average cost of urban distribution system per urban customer) = \$75.

A_c (annual charges on the rural line) = 18 per cent.

R_c (rural charge) =

$$\frac{(\$1{,}500 - 4 \times \$75)}{N} \times 18 \text{ per cent} + 184 \times \$0.02 = \$54 + \$3.68 = \$57.68.$$

The proper annual charge to make each rural customer in addition to the regular urban rate is thus \$57.68. For convenience rural customers should be billed monthly for one-twelfth the annual rural charge.

The foregoing formula for the determination of the rural charge automatically gives the rural customer the benefit of population density, which results in an increased number of customers per mile of line. It is quite unlikely that the actual cost of serving rural customers will ever be reduced to that which obtains for urban customers, and it is not easy to imagine a condition where rural customers should, strictly speaking, be placed upon the same basis as urban customers. The extreme to which any utility wants to go in placing rural customers upon a self-sustaining basis is a matter of policy which cannot be covered by rule, but the opinion of the committee is that, so far as it is reasonably practicable to do so, rates for rural service should be formulated with the idea of making this class of business self-supporting.

CONSIDER SERVICE TO WHOLE TERRITORY

In the application of the foregoing formula for the determination of the rural charge a utility may find it advantageous to consider its rural territory as a whole and develop a rate applicable throughout this entire rural territory, or it may find it desirable to consider by itself the rural territory surrounding each of its several services of supply, so that a different rural charge will be developed for each such territory. The procedure will be determined by the character of the territory served by the utility and the rate at which it is desired to effect the development of the entire rural territory.

Much has been written and many discussions have taken place in regard to possible uses of electricity on the farm and the raising of the farmer to be a power customer of high consequence. There is no question about the usefulness of electricity on the farm for household services and the lighter applications of power and lighting the farm buildings. It is, however, out of the question for the farmer to consider the use of electric power in large blocks except in isolated cases. Much more good will be done by emphasizing the uses to which electricity may well be put, as above enumerated, and by discouraging the ideas so frequently expressed as to its value for purposes for which its use at this time is economically impossible. The committee feels that much good can be accomplished by studying the economic and sociological phases of the situation in connection with the state agricultural college and farm organizations, to the end that the findings may be distributed with the stamp of official approval from such institutions.

Interurban Electrical Expositions for Boston Territory

BEGINNING Oct. 1 at Walpole, Mass., the first of a series of ten exhibitions of electrical equipment and appliances will be opened by the Edison Electric Illuminating Company of Boston. These displays will be held in auditoriums rented by the company and assigned without charge to manufacturers, jobbers and contractor-dealers wishing to demonstrate to the public the latest advances in electrical applications to domestic mercantile and industrial pursuits. Free electrical energy will be furnished exhibitors, and each exposition will run for six days, with free admissions. Lectures and demonstrations will occupy the daily programs, and one night each week will be assigned to inventors, who will be invited to demonstrate their latest devices under electric operation.

In addition to featuring household appliances, improved store and factory lighting will be emphasized, together with automatic electrical machinery of interest to manufacturers and business men. House-wiring demonstrations will also be included. Provision will be made at these expositions for the complete labeling of exhibits and devices and sales on the spot to visitors desiring to take equipment home after purchase. In this way a good deal of potential buying power on the part of the public will be capitalized, instead, as is so

often the case at co-operative electric shows, of being lost through the failure of visitors to follow up the interest which had been awakened in unmarked exhibits.

After the Walpole exposition other shows will probably be given during the late fall and winter at Canton, Dedham, Framingham, Natick, Somerville, Arlington, Woburn, Waltham and Newton. The idea of these expositions was conceived by W. H. Atkins, general superintendent of the Edison company, and the committee in charge consists of Leavitt L. Edgar (chairman), L. D. Gibbs, L. R. Wallis, J. J. Buckley, E. S. Mansfield and J. J. Caddigan (who will manage the shows) of the Edison staff; Harry B. Gilmore, Western Electric Company, Inc., Boston; I. Matson, representing contractor-dealers, Boston, and a leading Boston jobber who will shortly be invited to share in the work. A comprehensive advertising appropriation has been approved by President Edgar of the Edison company to aid in the development of these exhibitions.

What Other Companies Are Doing

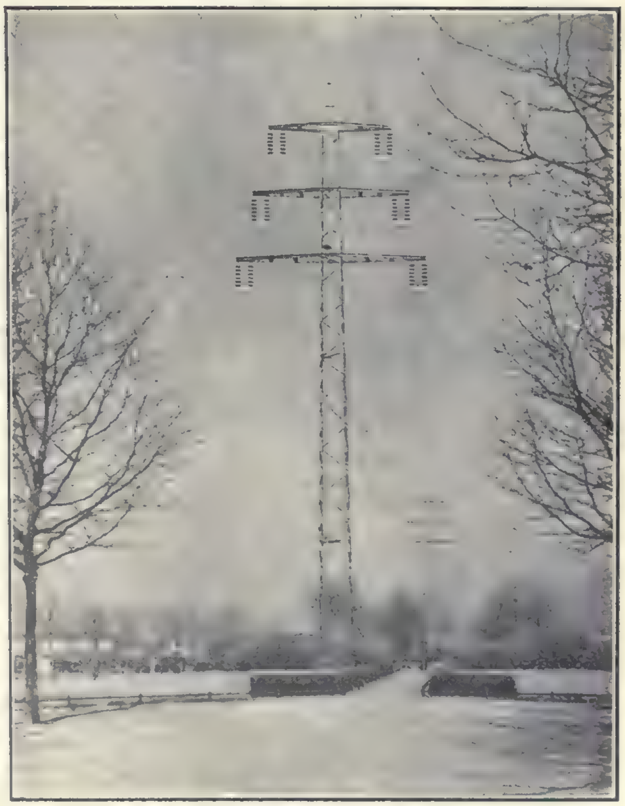
Colorado. — A special percolator campaign has been launched by E. B. Ball, commercial manager of the Western Light & Power Company, through all the offices of the company as the result of the success attained by F. S. Henderson, local manager of the company at Boulder during the month of August, when nearly three hundred pot-type percolators were sold on a special allowance and installment-payment plan. Aluminum percolators retailing at $7.50 were featured, a dollar being allowed on each old percolator or coffee pot taken in. A payment down of 50 cents was required, the balance to be paid with the light bill in similar amounts for twelve months.

Oklahoma City, Okla.—Under the auspices of the Oklahoma City Electric Club a fifty-thousand-dollar electric home was opened to the public on Sept. 9. During the first four hours more than two thousand persons passed through the house. A complete equipment of appliances was installed, including an electric elevator, electric refrigerator, temperature control of the sleeping-porch beds and an electric piano.

Boston, Mass.—During the first half of 1923, 6,503 new domestic electric meters were added to the lines of the various utilities operated by Charles H. Tenney & Company, or an increase of 24 per cent over the corresponding period of 1922. On July 1, 1923, 98,098 domestic meters were in service on Tenney company lines, compared with 81,575 a year ago.

Spokane, Wash.—A total of 407 household electrical appliances, representing approximately $20,000 in annual revenue, was sold by twenty-two district agents of the Washington Water Power Company during August. Every article was sold in country territory. Among the important items sold were 60 electric ranges, 18 electric washing machines, 55 water heaters and 169 flatirons. The company expects to double its appliance sales in country territory over last year.

A 100,000-Volt Line Along City Thoroughfare



ALTHOUGH the public has frowned upon the construction of high-voltage lines through city streets, economy and the demand for high standard of service are breaking down many such prejudices and restrictions. A striking example of bringing high-tension overhead wires into the heart of a city is the 100,000-volt line which has been carried through a number of the principal thoroughfares of Berlin. The transmission towers with their long spacing, as shown in the accompanying views, are not much more conspicuous than an ordinary street lighting standard, and as far as danger to life and property is concerned, voltages of 100,000 are not more deadly than 2,300 volts and 4,400 volts, which are accepted distribution voltages.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Hydro-Electric Development and Steam Equipment

St. Lawrence River and the Great Lakes.—HENRY HOLGATE.—The author deals at length with the drainage area of the Great Lakes, giving some interesting figures showing the remarkable regularity of the flow of the St. Lawrence River. He reviews the treaties which have been made with Great Britain and the United States, showing how they affect any scheme of power development that may be proposed for the St. Lawrence River. The origin of the International Joint Commission and the development of the canal systems are also dealt with. The second part of the article deals more particularly with the growth of canal navigation, economical size of ships, features of the St. Lawrence waterways project and possible water-power developments. — *Canadian Engineer*, Aug. 7 and Aug. 14, 1923.

Interesting Modern Condensing Plant.—An interesting condenser installation is described that was constructed to meet special conditions. It is arranged vertically and designed to deal with 220,000 lb. of steam per hour, while maintaining a vacuum of 28.5 in. with the barometer at 30 in. and cooling water at a temperature of about 65 deg. F. This condenser is installed on a 12,000-kw. turbine at the Leeds power plant in England. Details of the plant, air extraction, pipe work, valves and surface feed-water heater are considered. — *Electrician (England)*, Aug. 3, 1923.

Generation, Control, Switching and Protection

High-Tension Disconnecting Switches.—H. J. CRABBS.—The development of disconnecting switches and of air-break switches has taken an individual trend, although each has been influenced by the other. Forms of insulation and operating mechanism used are quite in common. Horn-gap switches are at the present time built only for outdoor application, as no satisfactory method of confining the arc has been found. This is of little consequence with a properly designed pole-top switch mounted out of doors, as the arc may have considerable latitude without danger of establishing itself between switch poles or to ground. The space between poles can be considerably reduced on plain "disconnects" since no arc results on opening them. Switches of this type for voltages below 88,000 volts are commonly mounted inside, although there is a growing tendency toward standardizing outdoor substations down to 4,500 volts. Indoor and outdoor switches of various types are described.—*Electric Journal*, August, 1923.

Some Fundamentals in Protecting Against Lightning.—E. E. BURGER.—To give adequate protection against lightning an arrester must have certain qualities. To design a set of tests which will determine in what degree a given type of arrester possesses these essential qualities has taken years of study. The author discusses the fundamentals which should be considered in the commercial testing of lightning arresters, and his conclusions are based on experiments made in the laboratory. An outline of the tests that should be made is given.—*General Electric Review*, September, 1923.

Operating Performance of a Petersen Earth Coil.—J. M. OLIVER and W. E. EBERHARDT.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. spring convention, May 5, 1923, on page 1020. —*Journal of A. I. E. E.*, September, 1923.

Transmission, Substations and Distribution

Theory of Heat-Dissipating Sheets on Dry-Type Transformers.—B. SCHWARZ. —In Europe, where air-insulated, self-cooled transformers are still being used to an appreciable extent, the use of copper sheets between the coils to carry away the heat losses is an old method to increase the heat radiation. It seems that the author has developed a new and accurate way to determine the exact amount of heat energy dissipated by such radiating fins. On an actual example, taken from Vidmar's book on transformers, the use of these fins is explained with concrete values.—*Elektrotechnik und Maschinenbau*, Aug. 12, 1923.

Standards for Electric Service. — Rules and regulations governing the standards and conditions of electric service to consumers as issued by the Michigan Public Utilities Commission are given in full. These standards include record forms and reports, requirements of service entrances, records, location and methods of testing meters, how transactions with consumers should be carried on, operation of utility covering standards of frequency and voltage, and requirements for extensions of land.—*Order No. 1692 of Michigan Public Utilities Commission.*

Practical Installation of Underground Cables. — PHILIP H. TORCHIO. — The author divides underground cable installations into three general classifications, viz., large cities where it is necessary to transmit and distribute large blocks of power; small cities, towns and country districts where the amount of power distributed is small and the cables few and of relatively small size, and large factories or industrial plants. He considers each system briefly, and then discusses the laying out of subway systems, subway and manhole construction, specifications for cables, cleaning the duct lines before installing cables, installing cables, splicing, bonding, grounding and cable identification. — *Proceedings of Association of Iron and Steel Engineers*, August, 1923.

Units, Measurements and Instruments

Standardization of Testing Methods for Line Insulators.—W. WEICKER.—The rain flashover of a line insulator is considered today as the criterion of its performance. However, the author points out, no uniform conditions have as yet been standardized under which these tests should be made. The flashover of an insulator under rain depends upon such a large number of details that without knowing these the given values are almost useless. It is of interest to tabulate all the different factors which have a more or less pronounced bearing upon the flashover voltage:

1.—*Rain Conditions.*—(a) Amount of rain per time unit; (b) direction of rain; (c) duration of rain; (d) conductivity of water; (e) shape of rain drops.
2.—*Atmospheric Conditions.*—(a) Barometric pressure; (b) temperature; (c) humidity.
3.—*Arrangement of Insulator.*—(a) Height and diameter of insulator support; (b) diameter of wire on insulator; (c) manner of fastening of wire; (d) configuration of cross-arm; (e) insulated or grounded support.
4.—*Electric Conditions.*—(a) Peak value of voltage wave; (b) output of generator and transformer. (c) frequency, impulse voltage, etc.

A large number of tests made independently by many investigators proved conclusively that all of the above factors have an influence upon the flashover of insulators of both the pin and the chain type. On several occasions attempts have been made to standardize testing conditions, so that characteristic figures given by different manufacturers could be compared intelligently, but no agreement has as yet been reached. — *Elektrotechnik und Maschinenbau*, July 29, 1923.

Proximity Effect in Wires and Thin Tubes.—H. B. DWIGHT.—An abstract of this article may be found in the ELECTRICAL WORLD report of the A. I. E. E. summer convention, July 7, 1923, page 18.—*Journal of A. I. E. E.*, September, 1923.

Illumination

Industrial Lighting Regulations.—G. H. STICKNEY.—A discussion of the requirements of various industrial lighting codes now in effect and the tendency likely to be followed in future legislation. Intensities of illumination as specified by the various industrial lighting codes, classification of tungsten lamps with globes and reflectors from the standpoint of glare and limiting grades of light source permissible for

various conditions and operations are covered in tabular form.—*Industrial Engineer*, September, 1923.

Stage Lighting.—A. L. POWELL.—Stage lighting in general exemplifies many of the principles of correct illumination; for instance, one never sees a brilliant, glaring light source on the stage. Footlights, border lights, floods, etc., are invisible to the audience. In planning the stage lighting one should keep in mind the general principles of the action of colored light on colored subjects. By the application of this principle one set can be used for two or more scenes by manipulation of light, avoiding the necessity of changing scenery. To accomplish these things it is necessary to have available light of various colors from many different directions and means of changing the direction of light as well as its quantity or intensity. Stage-lighting devices may be divided into two main groups, those for providing general illumination and those for providing localized lighting. In the first group fall the foot, strip, proscenium and border lights; in the second the bunch and spot lights and effect machine, or sciopticon. Each type of light is described.—*Bulletin L.D.* 146 *of Edison Lamp Works.*

Electrophysics, Electrochemistry and Batteries

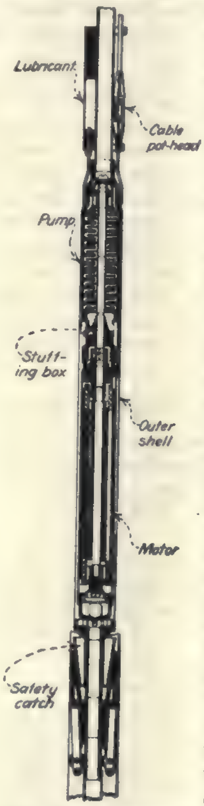
Magnetic Properties of Sheet Steel.—Y. NIWA and Y. ASAMI.—The authors have studied the properties of unsymmetrical hysteresis losses, superposing an alternating field upon a direct-current field in the sample. As one of the means of minimizing the eddy-current effects a sample of very thin sheet steel was used. It was found that the saturation curves, as well as the hysteresis loops, are considerably affected by the superposition. Taking these effects into consideration, the properties of unsymmetrical hysteresis losses traced by the superposed alternating current were studied. These results are shown by numerous loops and curves. Some general conclusions and an experimental formula are given.—*Researches of the Electrotechnical Laboratory, Tokyo, Japan, No.* 124.

Chemical Action and the Disappearance of Gas in the Electrical Discharge Tube.—F. H. NEWMAN.—Hydrogen and nitrogen are absorbed in the presence of different elements deposited on the cathode of a discharge tube when the discharge is passing. The elements which show this effect most markedly are phosphorus, sulphur, iodine, sodium, potassium and the alloy of sodium and potassium. The rate of disappearance is greatest with phosphorus, sulphur and iodine, and the final pressure attained is a minimum with phosphorus and sulphur. The disappearance of the gas is due to the production of chemical compounds. The formation in this manner of the nitrides of sodium, potassium, magnesium and tin and the hydrides of sodium, potassium and sulphur has been proved by chemical analysis. The gas under the ionizing effect becomes modified, assuming an active condition which consists probably of triatomic molecules.—*Paper presented before the American Electrochemical Society at Dayton, Ohio,* Sept. 27-29.

Motors and Control

Squirrel-Cage Induction Motors with High Starting Torque and Reduced Starting Current.—T. F. WALL.—The article shows how to predetermine the performance of this type of motor when the constants of the windings are known. The author's treatment permits the determination of the effect on the characteristics of the motor of altering one or more of the constants of the electric or magnetic circuit.—*Engineering (England)*, Aug. 10, 1923.

Electric Motor Pump for Oil Wells.—B. KAMENSKY.—This article describes an ingenious electric motor pump which is intended to be used in oil or water drills of small diameter. A section through such a machine is shown herewith which is rated at 40 hp., 2,000 volts, three-phase, 50-cycle current, for pumping water from a depth of more than 1,200 ft., the entire pump passing through a drill of only 12 in. in diameter. The squirrel-cage motor is built extremely narrow and very long, and a twelve-stage impeller centrifugal pump, likewise of very narrow design, is mounted directly above the motor. Hermetical inclosing of the motor protects it against water or dirt. The entire construction is a Russian patent which is now being exploited in Europe. A curve sheet of the electrical characteristics of such a pumping set shows a remarkably good performance.—*Elektrotechnische Zeitschrift*, July 26, 1923.



OIL-WELL PUMP RATED AT 40 HP. AT 2,000 VOLTS IS ONLY 12 IN. IN DIAMETER

Traction

Compound Characteristic in Regenerative Braking with Direct-Current Traction.—M. G. SAY and H. C. FRAMPTON.—This paper deals with a particular form of regenerative braking for direct-current trains effected by the application of a differential compound-field excitation to the traction motors. Speed-torque and speed-current curves are derived mathematically and experimentally and are compared. A peculiar property of the speed-torque characteristic is a pronounced maximum value, which is very important.—*Journal of Institution of Electrical Engineers (England)*, August, 1923.

Better Inspection of Railway Cars Reduce Maintenance Costs.—H. S. DAY.—Three systems used for inspection of railway cars are described. Good working conditions and surroundings lead to better work and attract a much higher grade of men. Another important factor is the selection of a capable foreman.—*Electric Railway Journal*, Aug. 18, 1923.

Telegraphy, Telephony, Radio and Signals

Pupin Cable Measurements with Valve Oscillator.—A. H. DE VOOGT.—The increasing demand for many and safe telephone circuits makes it necessary to replace the overhead telephone route lines by an underground cable system composed of a number of Pupin loaded cables, the quality of which does not depend upon weather conditions. The requirements of the telephone administration as regards values of the cable constants stimulate the production by the cable manufacturers of highly efficient circuits and very uniform and carefully made cables. Apparatus for testing the various characteristics of Pupin cables are described. — *Electrician (England)*, Aug. 17, 1923.

Standards of Capacity, Particularly for Radio-Frequency Currents.—J. B. DEMPSTER and E. O. HULBURT.—Standards of capacity for use with radio-frequency currents, made according to a suggestion of the former Lord Rayleigh, are described. A simple method of increasing the sensitivity of the thermocouple galvanometer system for indicating resonance is mentioned. Metallic disks and small spheres were found to be erratic standards, because of unavoidable effects to the connecting wires. The measured capacities of small parallel-plate condensers were in agreement with the capacities calculated from the dimensions.—*Proceedings of Institute of Radio Engineers*, August, 1923.

Miscellaneous

Electricity on Canadian Farms.—In Canada systematic efforts are being made to extend the use of electricity on the farms. Aside from the farmer, power-using industries in the rural districts are few. Most of them are such as are found to a greater or less extent in all country districts, consisting of brick and tile yards, cheese factories, gravel plants, quarries, chopping and flour mills. Where power is supplied to industries in any rural power district it materially assists in helping carry the annual charges on the distribution system, thereby resulting in a lower rate to all taking service. After discussing fields of development, the article takes up present factors affecting rural lines, considering overhead lines, conductors, pole lines, underground cables, etc. — *Electrical Times (England)*, Aug. 9, 1923.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Debate Colorado Treaty

Arizona Opponents and Upper-State Advocates Are Heard by Power Commission

A COMMITTEE headed by Governor Hunt of Arizona has informed the Federal Power Commission that Arizona opposes ratification of the Colorado River water-power agreement on the ground that it violates the doctrine of prior appropriation laid down by the Supreme Court in the Colorado-Wyoming case and allocates an unequitable share of the water in perpetuity to the upper basin. The committee disclosed the plan whereby Arizona proposes to develop the Colorado River within its borders as a state-owned, operated and controlled enterprise.

After listening on Sept. 25 to the arguments of the upper states of the Colorado River basin, the commission adjourned its hearing without rendering any decision other than to state that no cognizance of the Arizona state development proposal would be possible until full and definite details are furnished as to financial arrangements and as to every other step necessary to the bringing of the power into use. No meeting of the commission will be held until Oct. 10, so that the decision as to what will be done in the matter of the Girand license for the development of the Diamond Creek project will be delayed until that time at least.

Anti-Pact Men Shift Ground

While no encouragement was held out by the commission to the anti-compact faction in Arizona, it is quite apparent that its position was strengthened. The scheme of state development, while it is admittedly nebulous, nevertheless gives the anti-pact forces a talking point and an issue with which they can go before the people. Arizona's original contentions were almost lost sight of in a rally to the support of what is characterized as a better excuse for not ratifying the seven-state compact.

The states in the upper basin contend that no license should be granted until Arizona signs the treaty or until a substitute proposal is worked out. They argued before the commission that the compact is fair and is essential to the prosperity of the entire basin. They pointed out that the pact had been formulated with great deliberation and after full consultation with all those concerned. While apparently they have no objection to the Girand project *per se*, their contention is that to grant a license to it would upset the entire arrangement.

Regardless of all the pressure brought to bear on Governor Hunt of Arizona to call an extra session of the Arizona Legislature, the main issue to be the ratification of the Colorado River pact, he announces that there will be no special session. The treaty will, however, come up again at the session next year.

Gorgas Plant at Muscle Shoals Is Sold

Government Accepts Alabama Power Company's Offer of Nearly $3,500,000—Henry Ford Unlikely to Make New Bid—Farm Bureau Attacks Transaction

AS FORESHADOWED in the ELECTRICAL WORLD, the United States government has sold to the Alabama Power Company its war-time steam plant built on the company's land at Gorgas, near Muscle Shoals. As already stated, the government had no other option, except to remove the plant, which would have meant the loss of substantially all the investment. The sale includes the transmission line from that plant to Sheffield, and the price is $3,472,487.25 in cash.

Company Refuses Further Delay

The company, through its president, Thomas W. Martin, replied, under date of Sept. 24, to a request from the Secretary of War for a further extension of time as follows:

"In April last we served notice upon the government, under the terms of the contract, looking either to the removal of the facilities from our lands or the sale to this company. We have from time to time, at your suggestion, extended the period within which the government by the terms of the contract is required to make sale of the property to this company or remove the same. So recently as Sept. 14 we extended the time to Sept. 24, being this day.

"During this period we have had pending before you an offer to purchase the government's interest in these facilities at their fair value, which we understand to be approximately $3,450,000. This offer we are ready, willing and able to carry out. The time heretofore agreed upon in which the government may accept this offer expires this day. We feel we have given the utmost consideration to the government in this matter, and we feel under the necessity of informing you that, under the terms of the contract and notices, the company after today is relieved of the obligation to buy and will withdraw its offer heretofore made for the purchase of the government's facilities. Therefore the company most respectfully declines to make a further extension of the time which expires on this date."

The War Department, which had the advice of experts from the Federal Power Commission and the Ordnance Department in arriving at a fair value for the property, is declared to be well satisfied with the price obtained.

Notification under date of Sept. 11 to Henry Ford of the government's position brought answer from W. B. Mayo, a Detroit representative of the manufacturer, that the latter was away. Mr. Mayo said that an extension of time until Nov. 1 had been assumed as certain. It is now held by many to be improbable that Mr. Ford will renew his Muscle Shoals proposition in any form. At the White House, however, it was stated that the President is convinced that the success of Mr. Ford's proposed undertaking at Muscle Shoals is in no wise dependent on possession of the Gorgas plant. All of the auxiliary power needed can be provided for $1,000,000, it is believed. In an undertaking of the magnitude of that suggested by Mr. Ford this is a relatively small item. The Gorgas plant is no more essential to the development, said a White House spokesman, than is "the stem to an apple after the apple has fallen from the tree." Moreover, the life of the steam plant would be short in comparison with the hundred-year lease which Mr. Ford is seeking.

Attack from Farm Bureau

Grey Silver, speaking for the American Farm Bureau Federation, has come out with a statement attacking the sale of the Gorgas plant. He says: "To accommodate the special interest group an additional burden of $1,200 a day is placed upon the manufacturer of fertilizer, for this amount represents merely the transportation charges on coal from the mines by rail to the steam plant at Muscle Shoals instead of using coal directly at the mines to operate the Gorgas steam plant and carrying the current by wire. In spite of this fact this burden was willingly placed by the Secretary of War upon the farmers without further consideration." Mr.

Silver asserts that the Alabama Power Company took property under a contract which Congress was advised was not binding upon the government by both the acting Judge Advocate General of the army and the Attorney General. As stated last week, since Congress adjourned the Judge Advocate General of the army and the Attorney General have declared the contract binding.

Illuminating Engineers Hold Big Meeting

Definite Advance in Various Aspects of Illuminating Science and Application Shown in Papers and Discussions at Lake George Convention

ATTRACTED by a program full of interest and a meeting place set amid scenic attractions, members of the Illuminating Engineering Society flocked to one of the largest and most successful conventions which the society has ever held, with headquarters at the Fort William Henry Hotel, Lake George, N. Y., on Monday to Friday of this week. Registration ran well over 300 and the meetings were all well attended and discussion active.

In his presidential address Ward Harrison first dwelt on the greatest technical need of illuminating engineers today, which he said was a better working knowledge of brightness and glare in a quantitative as well as a qualitative manner. There has been an extension of knowledge of the relation between flux and lumens and the quantity of illumination in the room. In other words, lighting men think in lumens fairly well, but when it comes to brightness the same cannot be said. This is shown by prescriptions for twice as much lighting to illuminate dark articles as light ones, whereas ten or fifteen times as much light is really needed. Two things are requisite to facilitate an extension of brightness knowledge—one is an instrument to read brightness directly and the other is a simple term to express the unit of brightness. Another point strongly stressed by Mr. Harrison was the need for greater dissemination of knowledge of illumination. This, he pointed out, should be the principal duty of I. E. S. chapters—they should have meetings to interest engineers, architects and others concerned. A chapter on lighting will soon be ready for physics books, and local chapters can do much to urge its adoption.

ADVANCES RECORDED

F. E. Cady's report for the committee on progress indicated that 1923 has already seen a great, concrete advance in illuminating engineering science and practice. The report covers ninety-six pages of information which any one wishing to keep up with the advance in illumination will find valuable.

A unique event in the convention program was the method of studying street lighting, which involved the submission of a specific problem to a large number of engineers. Eleven definite answers as to how the street in the problem should be lighted were presented and proved the basis of instructive discussion. The interesting part of this procedure was to note how nearly in accord the various propositions were, indicating a certain amount of definiteness in illuminating engineering practice.

Illumination in industry was discussed in various phases in different papers. "The Relation of Illumination to Production," by D. P. Hess and Ward Harrison, to be presented more fully in these pages later, showed some definite experiments along this line. In discussion the points were made that these tests showed simply the saving in labor alone, which is only one of the items in the cost of production, and that the total saving from increased lighting was probably considerably more, on account of reduction in overhead expenses, space requirements, etc., all a function of labor costs. Nor could any such analysis show the improvement in accuracy of inspection which, of course, exists. Some unique applications of lighting in power stations were described in a paper on this subject by R. A. Hopkins. I. G. Priest presented an instrument which for the first time makes possible the scientific and not purely physiological comparison of light sources on different color values.

MOTOR-VEHICLE LIGHTING

Discussing the advance in motor-vehicle lighting regulations, general agreement was expressed that no satisfactory fixed system of headlights had yet been devised. It was the sentiment that progress was being made, although much would have to be done with the lamp as a whole, instead of placing dependence merely upon the lens. The equipment would, moreover, have to be simplified in order to get more satisfactory operation in the way of adjustment, etc., after it was placed in the hands of the public. An indication of an approach toward a more satisfactory understanding between illuminating engineers and architects was evident from a discussion of a paper on this subject presented by A. D. Curtis and J. L. Stair. In the discussion the society had the advantage of listening to a representative of the architects.

A large number of other very valuable papers in the illuminating engineering field were presented, indicating an advance along most of the lines which illuminating engineers are following. Experiments on speed of vision, advance in pageant and decorative lighting, relation of artificial light to plant growth, progress in nomenclature and standards and in research, were all subjects of interest.

M. Luckiesh made a public presentation of his new mobile light, in which varied and beautiful artistic designs were presented on a screen with the design constantly changing, in a riot of color or in blacks and whites, to the constant delight of the audience.

W. D'A. Ryan entertained the entire convention and several thousand visitors from local towns and resorts with his latest and most spectacular outdoor lighting effects and fireworks.

Stress Public Relations

Indiana Association Makes These and Power Factor Its Principal Themes at French Lick

MEETING at French Lick Springs on Wednesday of this week, the day preceding the annual convention of the Great Lakes Geographic Division, N. E. L. A., at the same place, the Indiana Electric Light Association devoted its chief attention to the inestimable value of harmonious public relations and to methods of establishing them. Retiring President Harry Reid, Martin J. Insull, whose address will be abstracted in a later issue, and F. J. Haas, vice-president and general manager of the Southern Indiana Gas & Electric Company, all emphasized this as the chief subject of the time.

"Power-Factor Correction, What It Means to the Central Station and the Customer," was the subject of a paper by C. W. Drake, Westinghouse Electric & Manufacturing Company. It is the large number of small customers, he explained, who are responsible for the power factor. This may be due to underloaded, improperly applied or low-speed induction motors or underloaded transformers. The remedy is in rearranging motor drives so that these conditions will not exist and in using other remedial measures such as synchronous motors, synchronous condensers, phase advancers and static condensers. Synchronous motors, he contended, constitute the cheapest means of improving power factor if a mechanical load is to be carried. If the losses and cost of an equivalent induction motor are charged against mechanical power production, the cost of power-factor correction is only $3 to $5 per kilovolt-ampere. Static condensers, he declared, are now just as reliable as cables and transformers and have losses of only 0.3 to 0.4 per cent.

R. T. Hurman, Indiana General Service Company, Muncie, announced that his company is inducing all customers using more than 100 kva. to install static condensers on the basis that the saving in energy charges will pay for the condenser in ten to fifteen months, after which the saving will be clear gain. Penalties are charged for power factors under 85 per cent and bonuses awarded for higher power factors. The power factor is based on the monthly average reactive kilovolt-amperes.

F. J. Haas was elected president of the association for the coming year, T. N. Wynne vice-president, and Thomas Donahue secretary.

Iron and Steel Men Meet in Buffalo

Electrical Engineers Discuss Roll and Ball Bearings, Skip Hoists, Power Production and Electric Furnaces—Manufacturers' Exhibit Includes Electrified Foundry

BUFFALO was this week the scene of the annual gathering of the Association of Iron and Steel Electrical Engineers, who met on Monday to Friday, Sept. 24 to 28. The most striking feature of the convention was the exhibits made by manufacturers of equipment used in this industry. Each year the association attracts in greater degree the interest of exhibitors, and a very striking feature this year was a completely electrified foundry in operation at the Broadway Auditorium, where the exhibition was staged. This was made possible by the co-operative effort of several manufacturers, and the installation included an electric furnace, molding machines, air hammers, crane, cleaning outfit, crushers, grinders, sand blast and compressors. Two heats were conducted each day and commercial castings were produced.

Views on Standardization

The technical sessions of the convention were interesting and covered a wide variety of subjects. On Monday afternoon committee reports were heard and that of the standardization committee excited a great deal of discussion. F. W. Cramer in submitting the report said that the first thing to be done was to get a rating for a motor that will mean something. He asserted that no one knows what is meant by a 25-hp. rated motor, for example, and added that the 40-50-degree controversy had left motor ratings "higher in the air" than ever. He reported that the committees of other organizations investigating motor ratings were composed too greatly of representatives of manufacturers and failed to ascertain the viewpoint of motor users.

The second thing needed to bring about standardization, Mr. Cramer said, is the selection of a standard list of motor sizes, and along with this holding-down bolt-hole dimensions and shaft diameters should be standardized. In controls also standardization is needed, as there are now more than ten thousand control parts in service operation, according to the committee; yet, in spite of this, there is not any basis even for rating contactors, coils for resistor tubes or grids.

The committee said that a big problem was encountered in getting the co-operation of the members and recommended more positive co-operation with the American Engineering Standards Committee. A resolution was passed asking the executives of each steel company to appoint one of their men, who must be a member of the association, to act as a standardization committee with authority to carry out the committee's decisions.

The chief reason for a greater degree of standardization, in the opinion of the committee, was to reduce the carrying charges incurred when there are big inventories of spare parts. Members in general agreed with the committee's recommendations, and Gordon Fox added a pertinent thought to the discussion when he asserted that the first job was to get an agreement among the steel-mill electrical engineers as to exactly what was desired. After this was done, in his opinion, the procedure necessary for realizing the expressed desires of the engineers could be quickly determined.

Ball and Roller Bearings

On Tuesday morning the report of the bearings committee, of which D. W. Petty is chairman, gave rise to an animated debate. In general the committee recommended the standardization of a few sizes of bearings and listed as tentative suggestions sizes 304, 305, 307, 309, 311, 314, 317, 320, 323, 329 and 336 for motors up to 150 hp. A committee of representatives of anti-friction-bearing manufacturers tentatively suggested the following sizes for motors of from 1-hp. to 100-hp. rating: 305, 306, 307, 308, 309, 310, 311, 312, 314, 315, 316, 317, 318, 320 and 322.

EXHIBIT OF FOUNDRY USING ELECTRIC FURNACE FOR MELTING AND PRODUCING CASTINGS

The committee stated that there was unanimous agreement as to the necessity for ball and roller bearings in the steel industry and added that ball and roller bearings should be interchangeable. Several members gave support to the committee's recommendations, but one member said that his experience with ball-bearing motors had proved costly as whenever an armature became grounded it was necessary to replace the bearings. The chief advantage of the ball and roller bearings was the fact that they prevented oil being thrown or leaking upon commutators and armature coils.

J. M. Hipple, representing the Electric Power Club, said that a committee of the Power Club had canvassed motor manufacturers and the results showed that it would be very difficult to limit the number of bearing sizes. He stated that the association might overshoot the mark in going to ball or roller bearings as the development was still experimental and there were good prospects of motor designers being able to make sleeve bearings that would hold oil for three months.

Other good papers presented on Tuesday dealt with motor-operated centrifugal pumps, skip hoists for blast furnaces and a system of coal and ore bridge traverse control against wind and "skewage" hazards.

Foundry Electrification

The electrification of a foundry was the subject of a paper by L. W. Egan on Wednesday morning. The author stated there was great need of a rational and comprehensive engineering study of foundry production and maintenance methods. He outlined the advantages and disadvantages of electric foundry equipment and accented the fact that central-station energy should be used.

F. A. Coleman said that of the four types of ovens—coke, oil, gas and electric—used in core baking, the electric offered the best possibilities. Among all these agencies electricity only was on the decrease as regards price and on the increase as regards application. He asserted that another element making for a greater use of electric core-baking ovens was the fact that the electric oven was more accurately and readily controlled and eliminated the human element to a greater extent than any other.

Mr. Shepard of the Shepard Electric Crane & Hoist Company said foundrymen had come to no agreement as to the relative advantages of alternating current and direct current and pleaded for the adoption of direct current for cranes. He stated that direct-current equipment gave at least 125 per cent greater activity and power for service than alternating-current installations. The tendency to use overload capacity in a crane for occasional overloads was bad practice, in his opinion, as the operators soon tried to use the cranes continuously on heavy loads and this resulted in a decrease in service reliability. He also recommended the use of factors of safety in design based on the elastic limit instead of the ultimate strength.

New Officers

Further proceedings of the convention will be printed next week. Officers of the association for the ensuing year were elected as follows: President, R. S. Shoemaker, Middletown, Ohio; vice-president, A. C. Cummings, Pittsburgh; secretary, J. F. Kelly, Pittsburgh; treasurer, James Farrington, Steubenville, Ohio.

Test Results on "Romex" Released

Electrical and Physical Tests Made by Electrical Testing Laboratories —Various Similar Materials Compared—Decision as to Trial Installation to Be Made Next Monday

THE question as to whether or not "Romex," a flexible, non-armored duplex cable manufactured by the Rome Wire Company, is to be accorded a formal field test through authorized installations under special supervision has aroused a great deal of interest throughout the industry. As reported in these columns last week, the matter comes up for decision on Oct. 1 before the National Fire Protection Association's sub-committee on new developments. The claims for consideration are based on a series of tests made by the Electrical Testing Laboratories of New York. Details of these tests, however, have not been made public up to this time. In view of the widespread desire for more actual facts as to the performance of this material, the ELECTRICAL WORLD has obtained the release of the following data from the Electrical Testing Laboratories report, showing the results of their experiments with "Romex" and other comparable materials.

Voltage breakdown tests are given in Table II. The result in each case is the average of five tests made on samples while normally dry and just after immersion in water for twenty-four hours. In the tests on distorted samples the samples were tightly wound around a gas pipe.

To determine the effect of electric arcs, the copper of one wire in each sample was exposed by rasping out a very small concave opening in the protective armoring or wall of material and in the insulation, the arc being established by a carbon pencil connected to a 110-volt load of 60 amp. Following are the results:

Material	Arc Broken in	Flame Then Sustained For
$\frac{7}{32}$-in. loom	17 seconds	67 seconds
Armored cable	17 seconds	65 seconds
"Romex" cable	17 seconds	0 second

A similar series of tests was made by driving a nail into loose contact with the copper, with the following result:

Material	Arc Broken in	Flame Then Sustained For
$\frac{7}{32}$-in. loom	3 seconds	62 seconds
Armored cable	14 seconds	51 seconds
"Romex" cable	7 seconds	0 second

TABLE I—PHYSICAL TESTS OF VARIOUS METALLIC AND NON-METALLIC WIRE COVERINGS

	$\frac{7}{32}$-in. Loom	"Romex"	Double-Strip Armored Cable	Single-Strip Armored Cable	Flat Armored Cable
Tensile strength:					
Fractured, lb.	282	390	361	800	455
Elongation, in.	6.0	7.2	20.3	3.5	6.0
	Loom and Wire				
Crushing:					
Thickness of materials—					
Before test, in.	0.445	0.355	0.605	0.582	0.420
After test, in.	0.225	0.312	0.375	0.358	0.318
Net compression, in.	0.220	0.043	0.230	0.224	0.102
Voltage breakdown	5,000?	26,500	6,300	5,000?	2,000
Abrasive blows:					
Net compression, in.	0.140	0 040	....	0.220	0.110
Voltage breakdown	5,100.	24,800	.....	21,800	5,600
Penetration:	$\frac{7}{32}$-in. Loom				
Screw driven at:					
Right angles, lb.	100	135	644	600	675
Parallel, lb.	122	200	850	730	780
Twisting strains					
Protective armor fractured, turns	8	7	....	5½	8½

Several of the more important physical tests on armored cables are given in Table I. These include tensile strength, crushing, abrasive blows, penetration and twisting strains. In the abrasive test the samples were subjected to blows by a weight being dropped from six different heights. The weights of the blows translated into foot-pounds were 20.4, 32.1, 42.8, 53.5, 64.2 and 74.9, and the net compression given in the table is that after the last blow. For the penetration test a screwdriver was forced into the covering until it made contact with the copper conductor.

The Underwriters' Laboratories standard flame test as established for flexible non-metallic tubing was used to determine the fire-resistance qualities of "Romex" and $\frac{7}{32}$-in. loom with the following results:

Romex	Condition
End of first 15 seconds	Slightly discolored
End of second 15 seconds	Blackened by flame
End of third 15 seconds	Blackened by flame
End of fourth 15 seconds	Slightly charred
End of fifth 15 seconds	Considerably charred
$\frac{7}{32}$-in. loom	**Condition**
End of first 15 seconds	Blistered
End of second 15 seconds	Badly blistered
End of third 15 seconds	Blistered and split
End of fourth 15 seconds	Blazing to height of 3 in.
End of fifth 15 seconds	Blazing and broken in two

Various tests were made to determine the danger due to accidental nail punctures. In all tests made either the nail was deflected or it did not come into contact with both wires. A series of 1,000 bends of 1-in. radius alternately made in two directions through an arc of 180 deg. did not break, displace or separate any of the several walls of the protective armorings of the cable. Then a second series of flatwise bends was made in which a 6-lb. weight was hung on the lower end of the test sample, the machine being set so that this weight threw a sharp jerk on the sample at the end of each 90-deg., 1-in. bend and the conductors being spliced at the lower end of the sample and cut into one leg of the motor-feed circuit at the upper end so that a break in the copper anywhere would stop the motor. The average number of bends of seven samples tested in this manner until the copper broke was 281.

Overhead Construction Theme at Grand Rapids

Overhead line construction was the subject of the first paper presented on Thursday, Sept. 20, the third day of the convention of the Michigan Electric Light Association at Grand Rapids. In this paper B. L. Huff of the Consumers' Power Company discussed the provisions of the Safety Code of the National Bureau of Standards affecting the strength of pole and wire, proper clearances, joint use of lines, railroad crossings, transformer installations and other points. Mr. Huff said that a new line should be built with permanence and low operating expense in view and that durability, safety and reliability should not be sacrificed to cost. M. F. Toeppen, chief engineer Michigan Public Utilities Commission, gave an interpretation of the new service rules of the commission and announced that there will be a final hearing on these standards on Oct. 16. R. C. Loughead, chief engineer Michigan Inspection Bureau, discussed the Safety Code.

TABLE II—VOLTAGE BREAKDOWN TESTS OF DIFFERENT TYPES OF WIRE ARMORINGS

Test	Unprotected Code Wire Dry	Unprotected Code Wire Wet	Two $\frac{7}{32}$-in. Looms and Wire Dry	Two $\frac{7}{32}$-in. Looms and Wire Wet	Armored Cable Dry	Armored Cable Wet	"Romex" Cable Dry	"Romex" Cable Wet	Porcelain Tubes Dry	Porcelain Tubes Wet	Porcelain Cleats Dry	Porcelain Cleats Wet	Porcelain Knobs Dry	Porcelain Knobs Wet
Voltage breakdown between conductors	41,760	33,380	51,180	33,740	37,100	36,340	75,220	70,900	......	......	......	......	......	......
Voltage breakdown to grounded sheath	20,180	16,200	23,680	17,900	17,840	17,640	38,800	33,760	37,520	25,580	28,280	18,740	26,320	16,640
Voltage breakdown of distorted samples	20,780	15,960	33,080	19,540	19,760	18,500	35,640	32,320	......	......	......	......	......	......
Voltage tests at crossovers*	45,660	34,400	49,440	36,340	57,060	42,820	57,060	42,820	58,520	42,020	......	......	......	......

* For this test standard type R wire was tied at right angles to each conductor or tube.

Coal Commission's Report Not Radical

Its Concluding Recommendations Propose Interstate Commerce Commission as Supervisory Body, but Look for Reform to Come from Within the Industry Itself

GOVERNMENTAL supervision of the coal industry through a new division of the Interstate Commerce Commission is proposed in the final report of the United States Coal Commission, which ceased its statutory existence at midnight on Sept. 22.

Besides authority to obtain and publish facts relative to costs, profits, investments and wages, this new agency under the legislation suggested would possess broad regulatory power through licenses issued to operators, wholesalers and middlemen. Consolidations of bituminous coal companies would be encouraged but with financing arrangements subject to governmental approval. In times of emergency it is recommended that the coal division of the Interstate Commerce Commission shall act as federal fuel distributor, with authority over transportation and distribution of coal under the direction of the President. The attitude that the United States courts would take on all the points involved cannot be predicted, though the commission believes the proposed legislation would be sustained.

The Coal Commission also recommends that the Geological Survey shall continue to gather data relative to production of coal, that the Bureau of Mines shall continue to deal with questions relating to safety in coal mining and the quality of coal, and that questions relative to labor conditions shall be taken care of by some other agency, such as the Department of Labor.

NON-LEGISLATIVE REMEDIES

"Self-regulation under governmental supervision" sums up the scope of this final report. Emphasis is put on the conviction that the industry can reform itself from within, and the remedies proposed are largely non-legislative in character.

Overdevelopment, irregularity of operation and consequent enforced idleness of miners and of invested capital constitute, in the commission's opinion, the chief evils in the bituminous industry. Very definite control over these evils can be exercised by the Interstate Commerce Commission under existing law, the commission insists. The Interstate Commerce Commission already has the power, the Coal Commission believes, to withhold transportation facilities from mines in the public interest. By concentrating car supply at places where it can be used to best advantage during emergencies the best interests of the country could be served. In that way regularity of production and storage can be secured. It is in the carrying out of this plan that the licensing of operators and wholesalers is suggested.

Important things which the commission wants the industry to do are the revision of some of its distribution and transportation practices, more use of engineering talent, better methods of conducting employer-employee business affairs, better forms of wage contracts and better contracts for the sale of coal. Action by the industry itself along such lines is where the commission pins its hope rather than on the exercise of compulsion from a Washington bureau.

Engineering Council Is to Discuss Coal Situation

America's coal problem will be brought before the engineers of the nation at Rochester, N. Y., Oct. 12 and 13, when, it is announced by President Mortimer E. Cooley, the executive board of the American Engineering Council of the Federated American Engineering Societies will convene for a discussion of pressing social, industrial and scientific questions. Of chief interest will be a report of the federation's committee on coal storage, which has been conducting a study in co-operation with 107 local committees all over the country. Characterizing the investigation, a statement by the federation declares that the engineers "are not viewing the storage of coal as a practice which should be adopted on any basis other than that of sound economic judgment."

N. E. L. A. Commercial Men to Study Industry Problems

The N. E. L. A. Commercial National Section, in a series of executive committee and bureau meetings just held, adopted as the policy for the year's work a combination of the usual bureau reports covering experience and practice into a single commercial progress report. The geographic section bureaus will be asked to assume the responsibility for covering the record of the year in detail, each for its own section. These complete reports will be available for use at geographic conventions. Copies of the reports are to be sent to the national bureaus to be abstracted and condensed by them into sections of the combined commercial progress report of the year. It is believed that this will serve to free the national bureaus for the study of definite industry problems.

The Power Bureau has decided to embark upon a national power survey and plans to set up a three years' program to insure the carrying out of the plan. An appropriation has been applied for to enable it to employ a paid secretary. The Power Bureau will also make a serious study of the value of electric heating business as compared with motor load and endeavor to develop definite ratios which will carry conclusive evidence to the executive.

The Appliance Bureau announced that it would carry forward the study of experience and practice in the compensation of salesmen which was initiated last year, and also make a survey of electric domestic cooking and heating and of the possibilities for the development of the refrigeration market.

The Vehicle Bureau will make its major work of the year a thorough survey of the reasons why the progress of the electric vehicle is being retarded. The bureau believes that there exist two fundamental obstacles to the development of electric transportation at the present time—first, a lack of knowledge in the central-station industry of the value of the vehicle load, which has resulted in indifference and sometimes active opposition on the part of central-station officials; second, destructive sales competition between various manufacturers of vehicles and batteries. The bureau will undertake to form a competent committee to make the investigation and report, under the chairmanship of a central-station executive of national reputation, and will announce the personnel of this committee at the next meeting of the executive committee of the national section, which will be held at Salt Lake City on Nov. 21 and 22. Another meeting has been scheduled for St. Louis on Feb. 27 and 28, 1924.

Power Plant at Great Falls, S. C., Completed

The Dearborn power plant of the Southern Power Company at Great Falls, S. C., has been completed and is in readiness for operation. The maximum capacity of the plant is 60,000 hp. Work is progressing on the company's Mountain Island plant and it will probably be completed about the first of the year. The estimated capacity of the latter plant is 80,000 hp. In order to facilitate distribution the company is building a transmission line from Great Falls to Gaston County.

All the power to be developed by the new plants was sold soon after the plans for building were projected, and the company now has many applications for power that it cannot fill. In this connection the return of President J. B. Duke from Europe has revived talk of building more plants. There is, however, no official announcement of impending building projects, and it is pointed out that building costs are as high now as they were last spring, when the great expense involved led to the discontinuance of plans to develop another unit on the Catawba River and a general suspension of construction activities.

Although the Southern Power Company's huge reservoir at Bridgewater is full to overflowing, as are all the other reservoirs of the company on the Catawba, there is a possibility of a power shortage, like that of last year, affecting industrial plants, according to Vice-president C. I. Burkholder, who has informed users of power that rainfall during August and July in the mountain section was deficient.

Four Hundred Meet at Dixville Notch

Light and Power Company Executives Consider Vital Problems of the Industry—Customer Ownership Urged as Universal Policy—Advances in Technical Practice

INTENSE interest felt in several vital problems of the central-station industry accounts for the attendance of more than four hundred at the forty-second convention of the Association of Edison Illuminating Companies, held at the Balsams, Dixville Notch, N. H., on Sept. 17-22. This convention was by far the largest this association has held. The tone of the entire convention indicated a sense of realization of the immense development taking place within the industry for which these men are so largely responsible and also of the greater demands which will be placed upon the industry and the opportunities presented thereby. Discussions naturally ranged around the problems now confronted and soon to be encountered.

In his presidential address Matthew S. Sloan pointed to the stability of the financing of public utilities, particularly light and power companies. The light and power industry, he said, has developed to such a sound state that, as indicated by several financial authorities, it can procure its funds at less cost than most ordinary industrial enterprises. A word of advice was uttered by President Sloan when he pointed to the large amount of industrial power load being taken by power companies. He called attention to the fact that great blocks of power load from large industrial concerns meant that central-station output and revenue would more and more depend on the business cycle and that central-station executives must study the cycles of business behavior and plan their developments and financing with reference thereto. Mr. Sloan emphasized the stability inhering in a policy of customer ownership and urged that it become a universally accepted business policy in the central-station industry.

ADVANCES IN TECHNICAL PRACTICE

Principal interest on Tuesday centered in the report of the prime movers committee, which pointed to a definite advance in turbine practice as indicated by the fact that base-load machines are used more than 84 per cent of the time as compared with the 78 per cent figure of last year's report. The committee included among other matters a valuable discussion on higher steam pressures, summarizing its conclusions as follows: "At present we are not justified in considering a temperature much above 700 deg. Fahr., but we may consider with more or less equanimity any pressure thus far suggested."

At Wednesday's sessions a discussion on reserve capacity in various parts of the system served to emphasize the already known fact that conclusive data or statistics for any generalization on this subject have never been developed, if, indeed, they can be. A similar discussion on various phases of standardization served to emphasize the fact that conclusions as to applicability to one community or system of practices found possible or desirable in another community or system must not be drawn. A desire to arrive at certain standards for voltages and for other practices was voiced, and the resultant savings possible were pointed out.

A subject of keen interest was the high-voltage cable question, discussion on which was opened by D. W. Roper's paper presenting a survey of European and American practices in preparing specifications for and in testing high-voltage cables.

Among other addresses of interest Wednesday evening was one on "Industry and the Man" by Charles A. Eaton, who made an earnest and effective appeal for more intimate attention on the part of executives to the problems of industrial employment.

HARTFORD'S MERCURY TURBINE

At Thursday morning's session the feature was an illustrated lecture by W. L. R. Emmet on the development of the mercury turbine installed by the Hartford (Conn.) Electric Light Company. This turbine, as already noted in these pages, has just gone into service. Mr. Emmet traced the development and gave the technique of the boiler which had made it possible to apply to commercial operation the new principle of extending the temperature range in power production to gain increased economy.

E. W. Rice, Jr., gave an entertaining and instructive talk about a four months' trip in Europe taken by himself and Dr. W. R. Whitney to investigate the progress of research and scientific development on that continent.

Progress reports only were heard from the committees on power factor and on rates. These reports enunciated facts and raised questions for discussion without stating definite conclusions or making definite recommendations.

The report of the committee on residence lighting was a valuable one and brought to a conclusion the analysis actually made in 1922, with the data reviewed, re-evaluated and analyzed. It will be recalled that certain test houses were studied in six or seven cities and that estimates were made by actual consultation with several thousand householders. The committee has now reached the conclusion that the proportion of total residence consumption of electricity which is attributable to appliances lies between 17 and 20.6 per cent. Discussion indicated, however, that, from experience with fully electrified houses, opportunity exists to turn the tables and make appliances responsible for four or five times as much energy consumption as lighting. An abstract and analysis of the figures used by the committee in arriving at its decisions will be printed in an early issue of the ELECTRICAL WORLD.

The annual report of the lamp committee, presented by its chairman, John W. Lieb, indicated the continued approach toward perfection which the lamp-manufacturing companies are making aided by the testing and criticism of the association.

In a short paper on residence rates D. C. Jackson raised some specific questions which added to the general discussion of the rate question originally presented by the committee on rates.

DOMESTIC REFRIGERATION

At Friday's session the committee on domestic electric refrigeration pointed most effectively to the opportunities for load which the electric refrigerator presents. Discussion showed an intense interest in the subject on the part of the companies and a belief that the art of electric refrigeration is in a developmental stage and that much is to be expected from it. The committee on metering and service methods indicated developments during the year, and the committee on merchandising policy, in reporting progress, made it evident that it would not be able to draw any definite conclusions from its studies until more time had elapsed in which to obtain analyses under the new system of accounting proposed by the National Electric Light Association.

At the session on Saturday morning the net result of a discussion on the relations with the Bureau of Standards, with the American Engineering Standards Committee, and also with the National Fire Protection Association, was a portrayal of the work of these bodies, a presentation of the manner in which their work affects the electrical industry as a whole and the central-station industry in particular, and an appeal to the central-station executives to take a more direct and intimate interest in them.

A symposium on "service wrinkles" brought out individual methods used by several companies in working out practices to give more rapid service to new customers and better service to all customers.

NEW OFFICERS

The following officers were elected for the coming year: President, John F. Gilchrist, vice-president Commonwealth Edison Company, Chicago; vice-president, Samuel Ferguson, vice-president Hartford Electric Light Company; treasurer, Horace P. Liversidge, assistant chief engineer Philadelphia Electric Company; secretary and assistant treasurer, P. S. Millar, general manager and secretary Electrical Testing Laboratories. The executive committee will contain, in addition to the officers,

Charles L. Edgar, W. W. Freeman, Samuel Insull, John W. Lieb and J. B. McCall.

The usual enjoyable entertainment features of the association's convention, augmented this year by a *bal masqué*, added materially to the pleasure of the delegates and guests.

American Capital in Italian Enterprises

Aldred & Company of New York have just completed a loan of $2,000,000 to the Edison Company of Milan, Italy. Negotiations have been under way for some time involving loans not only to the Milan company but to others in the northern section of Italy. For the present all other negotiations have been dropped pending the complete adjustment of the difficulties between Italy and Greece.

The loan to the Milan company still awaits the action of the Italian Minister of Finance. By a recent enactment of the Italian government foreign capital is exempted from taxation, but not until the Minister of Finance is satisfied that all of the provisions of the act have been complied with.

At the present time there is a shortage of energy throughout northern Italy, and although interconnection between the various power companies is extensive, the demand is greater than the supply. The Milan Edison Company has under construction a new hydro-electric station, and energy from this ought to be available in a year; but it is expected that by that time the demand will have so grown that it will still be impossible to satisfy it.

Dillon & Read of New York are interested in large projects in Sicily. So far the work has been chiefly civil engineering in character, but electrical work is also in contemplation. Owing to political conditions, however, all work has been held up.

Local Leagues to Set Up a National Organization

At the concluding session of the second annual conference of local electric leagues, held at Association Island, Henderson Harbor, N. Y., last week, definite action was taken toward the establishment of a national direction for the promotion and co-ordination of local bodies of electrical men. The three following resolutions were unanimously passed:

Resolved, that a committee be appointed by the chair to consider and as soon as expedient submit to the local electric leagues in all cities, and to the Society for Electrical Development, the Joint Committee for Business Development, the National Electric Light Association, the Electrical Manufacturers' Council, the Association of Electragists, the Electrical Supply Jobbers' Association, the Lighting Fixture Manufacturers' Council of America, the Association of Washing Machine Manufacturers, the Vacuum Cleaner Manufacturers' Association, the Illuminating Glassware Guild and other associations and interests within the industry, a plan for league organization and development that will provide for an organized co-ordination and co-operation of national scope, to the end that a constructive program may be evolved that may win the support of all branches of the electrical industry.

Resolved, that another conference of local electric leagues, to be known as Camp Co-operation IV, be held next year on Association Island in September at a convenient date before the closing of the island.

Resolved, that the Society for Electrical Development be requested to act in the interim for the leagues, to promote league activities throughout the country, and to make the necessary arrangements with the Association Island Corporation and other preparations to insure the success of Camp Co-operation IV next year.

The appointment of this national organization plan committee will be announced at an early date by Chairman W. E. Robertson through the Society for Electrical Development.

Empire State Association Arranges Program

For its annual meeting on Monday and Tuesday, Oct. 8 and 9, to be held at the Lake Placid Club, Lake Placid, N. Y., the Empire State Gas & Electric Association has adopted the business program printed below. There will be an entertainment program covering the period from the previous Saturday, Oct. 6, and including an informal dance on that evening and a golf tournament on Monday afternoon. The annual banquet and the president's reception and dance will be held on Monday evening.

MONDAY, OCT. 8, 10.30 A. M.

President's address; report of treasurer and auditing committee; report of secretary; report of rural-lines committee, Bert H. Shepard; report of transmission-lines committee, E. P. Peck; report of inductive co-ordination committee, John C. Parker; address, "Utility Management and Utility Securities," George E. Stevenson, Society for Savings, Hartford, Conn.; address by O. C. Merrill, secretary Federal Power Commission.

TUESDAY, OCT. 9, 10 A.M.

Report of accounting committee, H. O. Palmer; report of advisory rate committee, F. B. Steele; report of New York State Committee on Public Utility Information, M. S. Sloan; address, "Municipal Regulation Fallacy," Carl D. Jackson, past-president National Association of Railway and Utilities Commissioners; address, "The Psychology of Leadership," Dr. Murray Bartlett, president of Hobart College; election of officers.

The nominating committee will present the following nominations for officers and members of the executive committee: For president, S. J. Magee; for first vice-president, M. S. Sloan; for second vice-president, E. C. Scobell; for treasurer, W. J. Welsh; for members of the executive committee to serve three years, M. J. Brayton, H. L. Mann, H. M. Brundage and Frank W. Smith.

Program of Utilities Section of Safety Council

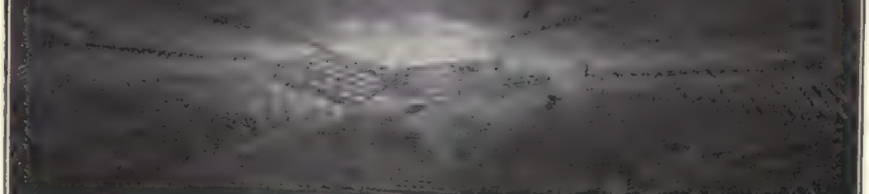
The Public Utilities Section of the National Safety Council, meeting at Buffalo in the Statler Hotel, will hold sessions on Oct. 2 and 4 and will have a joint meeting with the Electric Railway Section on Oct. 3.

On Oct. 2 C. J. Rutland, Texas Power & Light Company, will discuss "Accident Causes and Remedies," with discussion by H. W. Moses, Edison Electric Illuminating Company of Boston, and Harry Lucas, Philadelphia Electric Company. There will also be a discussion on the elimination of hazards in by-product plants.

On Oct. 4 H. J. Burton, Consumers' Power Company, will talk on "The Hazards of Improper Radio Installation," with discussion by George Opp, Detroit Edison Company; H. W. Lueck, Commonwealth Edison Company, and L. C. F. Horle, Federal Telephone & Telegraph Company. J. A. P. Crisfield, vice-president United Gas Improvement Contracting Company, Philadelphia, will speak on "The Prevention of Accidents During Construction of Gas and Electric Plants," and W. A. Jackson of Chicago, Wills Maclachlan of Toronto and E. A. Goff of Chicago will participate in the discussion.

At the joint meeting on Oct. 3 W. J. Canada, N. E. L. A. director of engineering, will give an address on "Valuable Sources of Information on Accident Prevention Not Generally Utilized." R. M. Searle, president Rochester Gas & Electric Corporation, and S. Russell Bowen, vice-president Washington Railway & Electric Company, will speak at the joint luncheon.

Lighting the Ringside for a Present-Day Prize Fight



ELECTRIC illumination takes night events of every kind into its catholic scope. The picture shows how the lighting was concentrated on the ring at the recent Dempsey-Firpo pugilistic contest at New York. The general lighting of the field area was taken care of by floodlamps mounted at various points of the roof of the grand stand. The photograph is supplied by the illumination bureau of the Westinghouse Lamp Company.

Brief News Notes

Laurel (Md.) Municipal Plant Sold to Annapolis Company.—The Maryland Public Service Commission has signed an order permitting the sale of the municipal electric lighting and power plant at Laurel, Md., with its rights and franchises, to the Annapolis & Chesapeake Bay Power Company.

Burlington (Vt.) System Enlarged.—The Burlington (Vt.) Light & Power Company has purchased the distributing system of the Powers Electric Company, which serves about 350 customers in the Williston, Richmond and Jonesville districts. The Powers company has purchased energy from the Burlington company for ten years.

Alabama Power Company to Make Kva. Demand a Rate Factor.—Permission has been granted by the Public Service Commission of Alabama to the Alabama Power Company to incorporate in its power rates a readiness-to-serve charge based on kva. demand, this charge to be in addition to the regular kilowatt-hour rate for energy.

Poughkeepsie (N. Y.) Company Seeks Expansion.—The Central Hudson Gas & Electric Company of Poughkeepsie, N. Y., seeks to purchase the capital stock to be issued by the Phillipstown Electric Corporation. The last-named company is constructing a distribution system in the town of Putnam, and the energy to be used by it will be purchased from the Central Hudson company.

"Twin Ports" Gets Under Way.—The *Twin Ports*, the new electrically operated and equipped freighter for lake and canal service built by the McDougall Terminal Warehouse Company, from designs of H. Penton, Cleveland, and intended to run from Duluth to New York, has been put in service. A sister ship, the *Twin Cities*, will soon be ready. These boats, the first of their kind, were described in the ELECTRICAL WORLD for July 14, page 91.

Muskogee Plant Near Completion.—Rapid progress is being made in constructing the 30,000-kw. steam plant of the Oklahoma General Power Company being built on the Arkansas River at Muskogee. This Oklahoma General Power Company is a subsidiary of the Oklahoma Gas & Electric Company, which will operate this new plant under a long-term lease. The structure is nearly completed and the equipment is being installed. The plant is expected to be in operation before winter. It is designed to utilize either coal or oil for fuel.

A Virginia Merger.—The Spotsylvania Power Company of Fredericksburg, Va., has purchased the Knox Mill, the Bridgewater Mill and the Rappahannock Electric Light & Power Company to be run under one management. This purchase by the Spotsylvania Power Company insures to that company the entire ownership of all the water power of the river at and above Fredericksburg for many miles and is a step toward the realization of a local desire for the complete development of the water power of the Rappahannock River and its application to the industrial development of Fredericksburg and vicinity.

Orange County (N. Y.) Plants Desire to Amalgamate.—The Orange County (N. Y.) Public Service Corporation and the Orange County Hydro-Electric Corporation have applied to the Public Service Commission for permission to transfer their franchises, works and system to the Orange County Public Service Company, Inc. The Orange County Public Service Corporation has electric light and power plants in Middletown, Port Jervis and Deer Park. The generating plant of the Orange County Hydro-Electric Corporation is on the Mongaup River, in Sullivan County.

Yosemite Power Company Gets Water Permit.—The Federal Power Commission has granted a permit to the Yosemite Power Company of San Francisco for the development of hydro-electric power on the south and middle forks of the Tuolumne River, near Groveland, Cal. The company proposes to construct two reservoirs for equalizing the flow of these streams and to erect two power plants, one using the water under a head of 630 ft. and the other using the same water under a head of more than 1,900 ft. The installed capacity of the two plants will be in excess of 30,000 kw.

Push-Button Control of Yacht's Steering Gear.—The *Wanda II.*, a 61-ft. motor yacht equipped with the first electrical push-button control ever adapted to marine craft, was, at the conclusion of the official trial of the device off Bridgeport, Conn., last week, pronounced a "convincing success." The yacht was controlled during the test by push-buttons on the bridge. These regulated an electric motor in the stern, which in turn controlled a new type of rudder inclosing the propeller of the craft within two concave leaves, adjustment of which produced "full speed ahead," "stop" and "reverse" without changing engine gear.

Spartanburg, S. C., Has New Source of Power Supply.—The Manufacturers' Power Company, headed by Walter S. Montgomery, president of the Spartanburg Mills, announces that it is now ready to supply Spartanburg, S. C. with electrical energy. It thus enters the local field in competition with the South Carolina Gas & Electric Company, instead of merely seeking, as was at first supposed, power for the mills associated with it. The Manufacturers' Power Company owns four water-power properties on Green River in North Carolina, with aggregate power possibilities of 100,000 hp. The original development of the company is at Tuxede, and a second development at Turner Shoals is being pushed to completion at a total cost of more than a million dollars. The company already supplies power and light to the towns of Greer, Landrum, Duncan, Wellford, Cheenee, Gramling, Tryon, Saluda and Hendersonville.

Associations and Societies

Electrical Co-Operative League of Denver.—Manufacturer members of this body took definite action looking toward the permanent organization of that group at a recent meeting of their division. They intend to hold more frequent meetings and to develop a line of action whereby definite assistance can be rendered the league in its work for wiring and lighting and in the maintenance of its information bureau.

Atlanta Section, A. I. E. E., Elects Officers.—Cherry L. Emerson, chief engineer and vice-president of Robert & Company, industrial engineers of Atlanta, has been elected chairman of the Atlanta Section of the American Institute of Electrical Engineers for the ensuing year. Other officers named were F. B. Davenport of the Georgia Railway & Power Company, vice-chairman, and H. N. Pye of the Southern Underwriters, secretary and treasurer.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

National Safety Council—Buffalo, Oct. 1-5.

American Institute of Electrical Engineers—Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

Empire State Gas and Electric Association—Lake Placid, N. Y., Oct. 8-9. C. H. B. Chapin, Grand Central Terminal, New York.

Association of Electragists International—Washington, Oct. 8-13. Farquson Johnson, 15 West 37th St., New York.

American Electric Railway Association—Atlantic City, N. J., Oct. 8-13. J. W. Welsh, 8 West 40th St., New York.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Oct. 19-20. Herbert Smith, Robson-Prichard Bldg., Huntington.

Telephone Pioneers of America—Atlantic City, N. J., Oct. 19-20.

Electric Power Club—French Lick Springs, Ind., Nov. 19-22. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Southeastern Division, N. E. L. A.—Tampa, Fla., Nov. 20-22. Charles A. Collier, Georgia Railway & Power Company, Atlanta, Ga.

American Society of Mechanical Engineers—New York City, Dec. 3-6. C. W. Rice, 29 West 39th St., New York.

Recent Court Decisions

Trespasser on Railroad Right-of-Way Not Trespasser as to Electric Light Company.—Conceding that a child on a railroad right-of-way was a trespasser as to the railroad, he was not a trespasser as to an electric light company maintaining its poles and wires on the right-of-way. So announcing, the St. Louis Court of Appeals sustained a verdict for the plaintiff in Grady vs. Louisiana Light, Power & Traction Company, where damages were awarded for the death of a five-year-old child who wandered on the right-of-way and came into contact with an improperly insulated broken electric light wire. The court held that a prima-facie case of negligence was made out and that the burden was on the company to show that the wire broke through no fault of its servants or agents. (253 S. W. 203.)*

Effect on Coal Contract of Fuel Company's Inability to Deliver Whole Amount.—In Jackson Hill Coal & Coke Company vs. Merchants' Heat & Light Company suit was brought to recover a balance due for coal delivered at the time of the war shortage, and a counterclaim was based on an allegation that the central-station company did not receive its fairly apportioned share of the coal actually sold by the fuel company. The Supreme Court of Indiana upheld a verdict for the defendant, holding that instructions given by the trial court were not erroneous as permitting defendant to recover on its counterclaim on the basis of its alleged loss in making up from purchases in the open market its entire requirements over and above that part supplied by the plaintiff, rather than limiting such basis of recovery to the quantity of coal necessarily purchased elsewhere to make up the amount to which defendant would have been entitled under a fair apportionment. (140 N. E. 532.)

Testimony of Experts Is Not a Controlling Factor in Fixing Rates.—Declaring that findings of the Public Utilities Commission fixing the rates to be charged by a public utility should not be disturbed by the Supreme Court unless they are so manifestly against the weight of evidence and so clearly unsupported by it as to show misapprehension, mistake or willful disregard of duty, the Ohio Supreme Court, in Ohio Utilities Company vs. Public Utilities Commission, confirmed the commission's findings. An order of the commission, the court said, fixing rates to be charged by a utility will not be upset merely because recommendations by experts of the commission were not followed in full. The testimony of such experts is to be regarded the same as that of other witnesses or means of gathering information which might be weighed and considered by the commission. (140 N. E. 497.)

Perpetual Franchises Illegal in Missouri.—A decision of great importance to Missouri cities in making franchises with public service corporations has been handed down in the Independence division of the Kansas City Circuit Court. The court rules that under the Missouri constitution cities cannot enter into a franchise contract for a period in excess of twenty years. The decision was made in quo warranto proceedings brought in the name of the state to oust the Warrensburg Light & Power Company from a perpetual franchise with the city of Warrensburg. The court in granting the suit said: "The general grant of power intended in the city's charter to make contracts with and authorize any person, company or association to erect electric light works in said city manifestly did not authorize the city to grant a perpetual franchise or make a perpetual contract for any such purpose. The use of the illegal franchise did not make it legal, and the city having exceeded in this regard the powers conferred upon it by the state, the state can interfere."

Distinction Between Functions of Commission and Court.—In its decision in Waukesha Gas & Electric Company vs. Wisconsin Railroad Commission (ELECTRICAL WORLD, Sept. 15, page 561), the Supreme Court of Wisconsin drew attention in the following terms to a fundamental distinction between rate proceedings before a commission and before a court: "It should be borne in mind that we have here discussed the present fair value of the property of the utility for the purpose of establishing a rate base, no other question being presented by the record. We do not consider questions of administrative policy. As pointed out, these matters belong in the field of administrative law. In the effort to find the just and reasonable rate which it is the duty under the statute to determine, the Railroad Commission may and should consider many factors which do not enter into the question presented to the court. Having sole regard for the public interest, it may appear to the Railroad Commission as a matter of policy that the rate should be large enough to earn a return which will attract capital to the utility field, which will readily permit of expansion and extension of the utility service and keep it in a high state of efficiency, which will attract to the utility field the best type of sound, economical, aggressive managerial ability and in other ways stimulate productive activity which will be for the benefit of the public and incidentally for the benefit of the investor. Capital is not attracted to an enterprise which must constantly travel near the financial dead line which divides prosperity from bankruptcy. The creative genius of managers is not stimulated by deficits. All those and many other considerations relate to matters of policy not within the judicial field. As has been pointed out, it is the duty of the commission to declare what is a just and reasonable rate, considering not only the rights of the parties but within the field prescribed by the Legislature the broader questions of public policy which are necessarily involved. It is the duty of the court to determine without regard to questions of policy whether or not the rates when established will permit the utility to earn a reasonable return upon the present fair value of its plant. The problems are entirely different. . . . It is apparent that the lowest possible rate that will pass the constitutional test is not the just and reasonable rate the statute prescribes."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Intangible Elements of Value Must Be Considered.—Neither the investment nor the reproduction-new theory is to be used as the sole criterion of value in the finding of a rate base, but all elements of value, including going-concern value, must be considered, said the Missouri Public Service Commission in determining a valuation for the Trenton Gas & Electric Company. Due consideration should be given to intangible elements of value, since the cost of attaching business, completing and coordinating the operating organization, demonstrating the value of the service to the customer and establishing the property as a going concern is as much a part of the value as the physical units thereof.

Justice of the Service Charge.—Defending the service charge, the Missouri Public Service Commission, in denying an increase of rates to the Joplin Gas Company, said: "The service charge is a uniform charge to all consumers, which together with another charge based upon the amount of gas consumed constitutes the entire rate to be paid. The sum of these two charges is such that the aggregate collected from all consumers is sufficient to pay operating expenses, including taxes and depreciation, and a reasonable return on the fair present value of the property used and useful in rendering service. The service charge does not require the consumer to pay for something he does not receive. The plant must be kept in condition to render immediate service to each and every consumer whether he uses it or not. The consumer who is connected to the mains and uses little or no gas should be compelled to contribute his full share of the burden that he imposes on the property. The very purpose of the service charge is equitably to distribute this expense among the consumers."

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

John F. Gilchrist Heads Edison Companies Association

John F. Gilchrist, vice-president of the Commonwealth Edison Company, was elected president of the Association of Edison Illuminating Companies at its meeting last week at Dixville Notch, N. H. He had previously been its vice-president. Mr. Gilchrist has been associated with the Commonwealth Edison Company and its predecessor, the Chicago Edison Company, during his entire business career, which began in 1887. He has served the company as office boy, assistant to the manager of the electric sales department, general contract agent, assistant to the president and since 1914 as a vice-president. Mr. Gilchrist is also a director and a member of the executive committee of the Public Service Company of Northern Illinois and a vice-president, director and a member of the executive committee of the Middle West Utilities Company.

J. F. GILCHRIST

The heavy responsibilities which these offices have placed on Mr. Gilchrist have not deterred him from engaging actively in the work of the electrical associations. He is a past-president of the National Electric Light Association, to the building up of which he has contributed much, and a member of the American Institute of Electrical Engineers and the Illuminating Engineering Society. Mr. Gilchrist is a native of Chicago and a graduate of Lake Forest University.

Garrett T. Seely, who recently resigned as vice-president and general manager of the Pennsylvania-Ohio Electric Company of Youngstown and its subsidiaries, has allied himself with the Yellow Coach Manufacturing Company as Western sales manager with headquarters at Chicago. Mr. Seely had had considerable experience in both the steam and electric railway fields before taking charge of the properties at Youngstown.

L. A. Magraw Vice-President at Macon

L. A. Magraw, formerly manager and treasurer of the utility companies at Macon, Ga., has been made vice-president of the companies, retaining his position as general manager, but relinquishing that of treasurer to W. E. Hauser. The companies affected are the Macon Railway & Light Company, the Macon Gas Company, the Central Georgia Transmission Company and the Central Georgia Power Company. R. Frank Jones, who has been associated with the Macon companies for some time, was appointed secretary and assistant treasurer of the three companies first named and secretary of the Central Georgia Power Company. The changes, which were made Sept. 20 by the board of directors of the public utilities companies at its regular annual meeting, also included the appointment of Paul W. Fisher of New York as assistant treasurer of the Central Georgia Power Company, the election of Roland Ellis as a director of the Central Georgia Power Company and of J. Clay Murphy and W. E. Dunwoody as directors of the Macon Railway & Light Company.

M. L. Hibbard Receives Promotion

M. L. Hibbard, manager of the Union Light, Heat & Power Company of Fargo, N. D., which operates under lease from the Northern States Power Company, has been made assistant to the vice-president in charge of operation of the Northern States Power Company. Mr. Hibbard will be in charge of operating work for the company in Minnesota, Wisconsin, North and South Dakota, Iowa and Illinois. He has been manager of the Union Light, Heat & Power Company since 1911, shortly after it was acquired by H. M. Byllesby & Company. He was with the Fargo company prior to that time from 1908 to 1910 as superintendent of electric distribution. In 1910 he went to San Antonio, Tex., with the San Antonio Traction Company and the San Antonio Gas & Electric Company, returning to Fargo as general manager of the Union company. John F. McGuire, manager of the Minot division of the Northern States Power Company since 1913, will succeed Mr. Hibbard at Fargo.

William A. Baehr General Manager of Middle West Merger

William A. Baehr, president and general manager of the North American Light & Power Company, operating electric light and power, street-railway, interurban and gas properties in Illinois and other states of the Middle West, was recently elected vice-president and general manager of the Illinois Power & Light Corporation. Mr. Baehr will make his headquarters in Chicago, where are the general offices of the new corporation, which is a consolidation of the North American Light & Power Company's properties and the Illinois Traction System. He entered the public utility field after being graduated from the University of Wisconsin. Having spent three years in general engineering work in Wisconsin,

W. A. BAEHR

he became superintendent of distribution of the Milwaukee Gas Light Company and subsequently joined the Denver Gas & Electric Company as superintendent of the gas department. In 1903 he became chief engineer of the Laclede Gas Light Company, St. Louis. In 1909 he opened offices in Chicago as a consulting engineer, in which capacity he has been employed by many of the leading utility companies in connection with construction, operation, valuation and financing problems.

Dr. Thomas Addison, who recently retired as Pacific Coast manager of the General Electric Company after thirty-three years association with the company, sailed for Europe on Saturday, Sept. 22, on board the White Star liner *Majestic.*

General Guy E. Tripp, chairman of the board of the Westinghouse Electric & Manufacturing Company, and Loyall A. Osborne, president of the Westinghouse International Company, are leaving New York for Japan on Oct. 4 in response to urgent cables from important Japanese interests. The Westinghouse officials will sail from San Francisco on Oct. 10 by the *Shinyo Maru* and will visit Shanghai, Hongkong, Pekin and the Philippines.

The Need for Interpreting Quality

An Example in the Study of Belt Specifications by the N. E. L. A.—What Has Come of This Attention

By H. B. Wilson

General Manager Mathias Klein & Sons, Chicago

A RECENT experience of Mathias Klein & Sons is, I consider, a most remarkable demonstration of the importance of a quality reputation in selling goods. Theoretically all men appreciate quality in the things they buy, although quality is naturally more vital in a product where there are hazards involved and where poor quality takes occasional toll of life or property. The fact remains, however, that buyers lose sight of quality very easily, if they are permitted to, and give it little thought. And the best proof of this is the reaction which has followed this recent case, where quality was featured before the market in a spectacular way, with the issuance broadcast of detailed specifications on safety belts and straps for linemen.

The business of this company dates back some generations to a blacksmith shop where the original Klein shod horses and between times beat out tools upon the anvil. Starting that way, the idea of craftsmanship was bred into the family, and as the sons and then the grandsons grew into the business the tradition has held and quality has been the dominating purpose. Klein tools have always been sold on arguments of quality, and the business has developed out of the performance of the product and this reputation for quality has become general. This much for background.

N. E. L. A. Standard

Now, it happens that the N. E. L. A. accident prevention committee is at work on the compilation of a set of revised specifications which it wishes to set up as standards by which men may compare and judge quality in buying leather belts and safety straps. Knowing that any established practice and experience available would be of value to the committee, we forwarded to it, as a matter of co-operation, copies of the specifications which this company has evolved through the years, covering belts and safety straps for linemen, suggesting these as a practical basis around which the committee might more easily construct its standard. The specifications committee has studied these specifications of ours and, after a thorough investigation and exacting tests, it is, we understand, recommending for adoption specifications very similar to the Klein standard.

This action, of course, is very gratifying to us as it has sustained in a conspicuous manner our confidence in the exceedingly high plane of quality we have required. How exacting the Klein standard is is shown interestingly, for example, in the specifications submitted to the committee reading:

All the leather used for the safety belts must be genuine oak-tanned harness leather cut from the back of the hide. No belly or neck leather showing barbed wire scratches or grub holes is allowed. Neither are splices in belts or safety straps permitted. Although the widths of the belts vary with the belt sizes, the safety straps must not be less than 6 ft. in length, with the lighter end of the leather running through the looped end of the strap. But no section of this safety strap shall be less than 3/16 in. in thickness. Tests on the leather require that it shall withstand being bent over a mandrel ½ in. in diameter through an angle of 180 deg. without cracking. In several recent tests the straps have withstood a deadweight up to 2,000 lb.

All the metal parts of the belt, including the buckle frames, "dee" rings and snaps, are drop-forged and galvanized. They are tested to withstand a directly applied load of 1,200 lb. The "dee" rings and snap hooks must be capable of being bent cold at any point about a ½-in. mandrel through an angle of 180 deg. without fracture on the outside of the bent portion. The same test is specified for the buckle frames on a ¾-in. mandrel.

Upon assemblying the tool belts, solid copper rivets ⅛ in. in diameter are used hand-set. All stitching is with genuine Irish thread, hot-waxed and lock-stitched, with a pitch varying from five to six stitches per inch not less than 3/16 in. from the edge. The "dee" rings are sewed and riveted into the main belt—which also passes through the "dee" rings. Reinforcing safety liners of sheet copper are fitted round the bar of the "dees" to take up any wear, and these liners are also riveted to the belt. The fixed snap and buckle on the safety straps are made doubly secure by pure-copper end reinforcements riveted through the double thickness of the leather.

Effect of Publicity

The value of quality in linemen's climbing equipment is, of course, self-evident. It prevents accidents and reduces the cost of accident insurance and sick benefits. Time is saved on the job and production increased when the line gang has absolute confidence in the tools it uses and enjoys a maximum of convenience, comfort and facility with them. All electric light, telephone and telegraph companies know this theoretically and have known that Klein tools were considered of the highest quality. The interest of the N. E. L. A. committee in Klein specifications on leather goods as a thoroughly practical standard of quality has served to emphasize and impress upon many the importance of quality and the exacting care which must be used in manufacturing this equipment to insure the maximum of safety.

Letters have come to us from all sides commenting on the rigors of our specifications and the value of our tests. Many public utility corporations have adopted Klein specifications; others have made minor changes. In short, the limelight has been thrown squarely on the value of quality, and men who all along have believed in the quality idea, but have given little actual thought to the details of it in their buying, have suddenly awakened to a realization that quality after all is a practical ideal, possible of achievement.

To me all this is an impressive evidence that we manufacturers do not ourselves give enough thought and effort to "selling" an appreciation of the quality of our product to our customers. This experience of ours could probably be repeated to greater or less degree with virtually every device used in line construction work. It shows that the market does indeed desire quality, but lacking intimate knowledge, it is not easily recognized and comes to be to some degree ignored.

Where We Fail in Appliance Merchandising

Some Fundamental Weaknesses in Central-Station Appliance Policy —Where the Manufacturer Has Contributed Confusion—How the Public Suffers

By Tom J. Smith, Jr.
President Apex Electrical Distributing Company, Boston

On reading the appliance advertisements of some of the public service corporations in New England this year, and those of not a few of the electrical dealers, I have felt that I was not living in 1923, but back in those dark unwelcome days of 1921 when non-employment stalked the land and business was almost a dead issue. This year of 1923, however, is a prosperous business year. There is no reason at this time why a purchaser should receive any premium for buying. Advertising of this kind on the part of even a few of our public service corporations leads only to retaliation on the part of the less scrupulous dealers, who will foist upon the public appliances that are detrimental to the industry.

If some of the public service corporations in New England are to persist in endeavoring to sell upon a price basis, or an extravagant premium basis, or on a deferred-payment basis which the average merchant cannot meet, retaliation by the electrical contractors, furniture stores, department stores, hardware shops and others who are endeavoring to obtain a share of this great potential market will occur in some such way as to hamper the industry as a whole. And what I say of New England is probably true of other sections also.

In fact, I have heard that it was seriously considered in the legislature of one of the New England states last winter that the new-business departments of the utilities in the state should be placed by legislative action under the jurisdiction of the public service commission. In effect this means that the one department unhampered in its commercial relations with the public by the legislature or any commission would be placed under the restrictions that the operating department already knows so well.

"Ghosts of a Wrong Start"

For nearly twenty years now I have had more or less intimate contact with public service corporations in both the gas and the electrical fields. In fact, when I first began my selling work there were no new-business managers.

In those days many of the appliance manufacturers struggled hard to obtain the business of the public service corporations upon the fallacious argument that the sale of their respective goods increased consumption of energy or gas, and they induced many utilities to sell appliances at practically cost. Do not gather that this apparently altruistic attitude on the part of this type of manufacturer was for the public weal—not at all! It was simply a deeply conceived scheme to prevent competition of any character in that town, as no legitimate dealer could do business on the ridiculous basis upon which the utility was offering goods, deluded by the mirage of increased consumption. I still see stalking through certain areas those old ghosts of increased consumption through profitless sales effort, which, if this industry is to grow and become the thing that Roger Babson has predicted, must be for all time buried.

New England, hampered by the self-imposed tradition that New England is different and more deliberative, is not making the per capita showing in the number of appliances that areas west and south of this locality are making, and it may be due in part to the fact that we are not all striving to sell our goods in as businesslike a way as possible. I am speaking of New England here because I have my own business here in New England and can talk of conditions that I know. It does not mean that this situation exists only in New England.

John F. Gilchrist of the Commonwealth Edison Company of Chicago has been carrying on a campaign for some time as to the proper selling of electrical appliances upon the part of the public service corporations. Mr. Gilchrist maintains that where the public service corporation is selling appliances it should be the leader in the sales effort, carrying only the best merchandise and selling at prices and terms that are sufficiently business-like to induce the better local merchants to compete, with equally good merchandise, upon an equitable basis.

Fruits of Unjust Competition

When a public utility—as one in New England recently did—offered $10 for a defunct wooden washboard to popularize the sale of the particular washer which this utility was endeavoring to sell, what happened? Other public service corporations within the sphere of this company's advertising faced competition that was as unwarranted as it was unwelcome. A local department store retaliated by offering the stock of a defunct washing-machine manufacturer at a ridiculous price, seriously affecting the washing-machine market in that and adjoining localities for some time.

The question has been raised whether or not a public service utility may, under its charter, engage in wholesaling of appliances. Several New England utilities have, it is alleged, accepted certain franchises for the distribution of certain appliances, and it has been intimated that this may not be lawful. Capital requirements in the utility field are bound to increase right along, and poor sales policies discourage investors and by antagonizing other commercial enterprises increase sales resistance on the part of local capital.

Unfairness of "Orphans"

Do not gather from this article that the full burden of the relatively poor showing that more central stations are making in the sale of electrical appliances need of necessity fall entirely upon those public utilities that are or are not engaged in the sale of appliances—not at all!

Many manufacturers by encour-

aging the sale of inferior merchandise upon a purely price appeal basis have also to answer for the present situation. There are literally thousands of orphaned appliances, purchased in good faith by consumers from the retail distributor of manufacturers whose mechanical structure, sales plan or standard of quality was so inferior that these makers passed into the limbo of total bankruptcy, to appear no more. So serious has this situation become that many of the larger utilities insist that the approval of their testing laboratories shall be obtained upon the mechanical structure of every appliance before the sales department may purchase. The purchasing of new appliances from small or comparatively unknown manufacturers is also discouraged.

The hard-working washerwoman who has been induced to invest, by laborious monthly payments, nearly $200 in a washing machine which will after less than two years' service have neither dealer nor manufacturer to provide essential service or parts, cannot be classified as a booster for "Do it electrically" propaganda. Wealthier women who have been so trapped affect a correspondingly larger sphere of prospective users.

But when several large New England appliance distributing companies crash into bankruptcy, as several did early this year, and when the majority of manufacturers find New England an expensive market, and when an area containing at least one-tenth of the electrical homes in America fails to absorb a proper pro rata of this great appliance demand, it is time for a serious inquiry.

I have written this in the hope that it may influence a serious consideration of these conditions by our electrical associations. If we will look this situation squarely in the eye and make those recommendations that are needed to dealers, distributors, manufacturers and the public, we can undoubtedly stimulate the improvement of the standard of living in the home and bring to our channels of distribution an assurance of at least a profitable competence, however modest. But it is up to the manufacturers and distributors of electrical appliances to take the initiative. They must, to get their own thinking straight on these matters of fundamental policy, make it all clear to their wholesalers and retailers and then work for the maintenance of fair play and creative market development among them.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

THE westward course of the wave of better business which was predicted here three weeks ago, when the first stirring of the fall demand appeared in the Boston district, has reached the Pacific Coast. Boston, New York and now San Francisco are reporting growth in sales and a very satisfactory quality of business. There has been a marked increase in orders for heavier types of machinery in the Eastern market. Some of this is for immediate delivery, presumably equipment required for installation in recently completed buildings, but much of it is placed for twelve months' delivery and indicates the continuance of the program of expansion through next season. Orders for material required now are coming largely from small central stations that are apparently getting in readiness for the winter load to come.

Demand for conduit, wire and line equipment has fallen off somewhat. The conduit situation in the East has not improved. Large stocks are held in New York, some houses reporting more on hand than at any time since 1920. Jobbers continue to quote on the lower price cards No. 56 and No. 55, as No. 57 is far too high for the present market.

Promising crop expectations in the Southeast are bringing good business to the electrical industry. Deliveries throughout this section are reported as improving.

High-Grade Fixture Business Striving for Lower Costs

MAKERS of the better grades of fixtures are quite well satisfied with the even prices which continue for all raw materials. Wages of labor are also satisfactory to the manufacturers in this important branch of the electrical industry, an increase of $1 a day in cities of the East to woodcarvers being the only raise exacted during the last three months.

The largest supplier of silk for shades in the Eastern territory has informed his customers that prices of this material are not likely to advance within the next six months. It is said that this unusual announcement, directly after the Japanese disaster, was made in order to keep the market at normal for both distributors and consumers and to avoid any inflated buying which would tend to demoralize the silk market for another season.

During the last few months the fixture manufacturers have been showing greater co-operation in the problem of straightening out cost accounting in their relative departments. One of the largest and most important individuals in the business says that his costs for special orders (which, of course, are the bulk of the better fixture business) are never the same. Other makers agree with him and state that, while these costs do not vary widely, it is impossible to know the exact cost before manufacture, and that a set extra cost must be applied before the whole estimate is given to the customer. Among the many different forms of extra value which might enter into production are sickness of employees who must be paid, delayed materials, the workers' absence from the job even if it be for a few moments, temperament of workers, among other things.

Highly competitive conditions prevail, and it is felt that if costs could be figured more accurately, lower prices could be quoted to the trade, which in turn would result in a more satisfied and heavier buying market. All of these makers, of course, are always receptive to those who can help them reduce their costs. During the month many orders have been placed with a certain manufacturer of an insulation stripper which is in the form of a plier and, when used in place of the ordinary jackknife, saves considerable time in removing the rubber and cotton.

A distinct trend of style is to clear glass, now that lamp manufacturers have brought out more attractive designs in frosted and milk-white bulbs. More brackets without shades to cover attractive miniature candle styles in bulbs are being offered. Some beautiful Egyptian designs which are not too extreme are shown by the high-class firms.

One of the most interesting of these is made with the canopic jars used by the Egyptians to contain the entrails of their dead in the tombs. It is said there are hundreds of these jars in the art houses of the world. Portable lamps with the genuine jars were selling at $450 in New York City last week.

Delinquent Electrical Accounts Showed Decrease in August

THREE of the five territories reporting to the National Electrical Credit Association for the month of August, 1923, reported decreased average delinquency over the same period in 1922. However, the total number of accounts for this period has decreased in all five divisions.

In the central division, centering at Chicago, there was a gain of fifteen accounts over July, 1923, with a respective average increase of $28.38. The New York territory decreased its number of delinquent accounts over both July, 1923, and August, 1922, but the average amount increased $34 over

DELINQUENT ACCOUNTS IN AUGUST

Branch and Month	Number of Delinquent Accounts Reported	Total Amount	Average Amount
Central Division:			
July, 1922.....	727	$87,643.24	$120.55
July, 1923.....	724	91,394.71	126.23
Aug., 1922.....	773	104,433.30	135.10
Aug., 1923.....	739	114,261.15	154.61
New York:			
July, 1922.....	395	54,704.00	139.00
July, 1923.....	404	61,434.00	152.00
Aug., 1922.....	578	79,764.00	138.00
Aug., 1923.....	380	70,770.00	186.00
Philadelphia:			
July, 1922.....	261	23,083.53	88.44
July, 1923.....	238	20,651.30	86.77
Aug., 1922.....	258	37,013.70	143.47
Aug., 1923.....	176	20,660.96	117.39
New England:			
July, 1922.....	55	6,779.49	123.26
July, 1923.....	26	3,062.32	117.78
Aug., 1922.....	63	9,491.30	150.65
Aug., 1923.....	54	5,117.10	94.76
Pacific Coast:			
July, 1922.....	13	1,280.71	98.51
July, 1923.....	36	7,992.57	222.01
Aug., 1922.....	21	3,450.23	154.77
Aug., 1923.....	17	2,583.80	151.99

July of this year. Philadelphia also reduced its accounts during July and August by sixty-two, although the average amount increased from $86.77 to $117.89. In both the New England and Pacific Coast territories the number of accounts is lower than it was in August, 1922, with a corresponding reduction in amount. The tabulated list of the accounts is given above.

Higher West-Bound Steamship Freight Rates in Effect

EAST COAST to West Coast freight rates which are now being quoted by steamship companies that operate via the Panama Canal were published subject to change Oct. 1. This schedule has been extended to Jan. 1, 1924, and it is predicted that the rates will be finally confirmed as they now stand except for a few minor adjustments. It is claimed that the previous rates from Atlantic Coast to Pacific Coast ports showed no profit, despite the immense volume of trade carried, and that the previous practice of charging the same rate for either a carload or a less-than-car-load shipment was contrary to general rail practice.

TABLE I—COMPARISON OF NEW AND OLD COAST-TO-COAST STEAMER RATES

Commodity	Former Rate per 100 Lb.	Present Rate per 100 Lb.* C.-L.	L. C.-L.
Copper wire, bare or insulated	$0.40	$0.50	$0.85
Pole-line hardware..	0.40	0.55	0.80
Porcelain insulators.	0.50	0.60	0.90
Schedule material...	0.80	0.90	1.40
Rigid iron conduit..	0.30	0.45	0.90

*Car-load minimum, 40,000 lb.; all other items, 24,000 lb.

TABLE II—COMPARISON OF PRESENT THROUGH RATES

Commodity	All-Rail, per 100 Lb.	Rail-Water, per 100 Lb.
Copper wire, bare or insulated	$1.65	$0.66
Pole-line hardware.	1.50	0.87
Porcelain insulators	1.32	0.915
Schedule material..	2.50	0.25
Rigid iron conduit..	1.34	0.7775

The steamer rates resulted from a conference of several months' duration between competing lines, during which it was rumored that one of the larger companies wished a 25 per cent advance, while the others desired 40 per cent.

It is too early to estimate the effect of these increases, but it is predicted that recent rail-rate decreases, coupled with an endeavor to lower Pacific Coast stocks in the face of a falling market, will react upon the steamer traffic. In fact, San Francisco inbound steamer tonnage for August has already shown a 10 per cent decrease over July.

The average carload rate increase in electrical commodities is 25 per cent, while the newly created less-than-carload rates (with their dilemma of cost increase either by freight or by investment) are approximately double the old carload rates.

Table II shows the present through carload rates by rail, as compared with the through rates by rail-water, from the average Eastern factory to the average Pacific Coast port.

Heavier Material Buying Picks Up in Eastern Territory

TRADE in the Eastern territory is more active this week in the heavier material distributed by jobbers, although a fair volume of wiring devices and appliances is moving. Demands on central stations for service are being reflected in a large amount of short-line extension and local overhead construction work. Industrial power business is thriving and the demand for motors is excellent in both the textile and general purpose fields. Prices reflected weakness in wire at the week end and fir cross-arms dropped about 20 per cent within the past few days.

Electrical retailers are preparing stocks and stores for a vigorous fall trade, but manufacturers of ranges and other heating devices report increased activity. Interest in radio apparatus is picking up, and the opening of many institutions of higher education is being accompanied by increased sales of portable lamps from electric shops.

Fall campaigns for the sale of domestic socket appliances are starting out well. General business in New England is in excellent volume, money being easy and new projects active in the industrial world.

Wiring and Radio Improve in Chicago

WITH the start to finish up jobs of construction, the demand for wiring materials, conduit and schedule material is increasing, according to Chicago jobbers. Although there is no plunging in current purchasing, active buying is sustained, with firm prices. The conduit situation has not improved. Some jobbers report low stocks on this commodity. No price changes have been announced. Lamp sales are improving owing to longer periods of necessary lighting, with the public evincing greater interest in colored lamps, which have now been on the market long enough to acquaint them with their characteristics and the opportunities of their use.

Radio is also experiencing an improved demand. The call of this equipment is well balanced between complete sets and spare parts. Stocks are in good condition and many jobbers declare that radio demand is further ahead than at this time last year. The motor market is also picking up materially after the recession of the summer months. Practically all sizes are in good demand, with a special call for motors under 10 hp. going to manufacturers of motorized machinery.

General Improvement in Trade Conditions in the Southeast

DELIVERIES on almost all lines of electrical equipment are lengthening, particularly on wire and cable, but Southeastern jobbers are maintaining fairly good stocks, even in the face of excellent business. The movement of clay conduit has picked up sharply on account of the shortage of fiber conduit. The expansion programs of the larger Southeastern power companies are reflected in the brisk movement of high-tension equipment and pole-line hardware reported by all jobbers.

The electrical contractors report that they have about as much textile-mill construction as they can handle, one firm alone reporting the closing of contracts during the past week for three mills in north Georgia, the cost of which will total approximately $4,000,000.

The Metal Market

PRICE of copper dropped to 13¼ cents last week and then advanced to 13½ cents. The London market also declined and then started to rally. It is thought that the low price was made by anxious sellers who held only 10 per cent of the copper surplus. This low level has not been touched since May, 1922, and was evidently attractive to buyers, who bought several million pounds, and in addition to this several million pounds more were sold for export to France.

Latest government returns to be issued show that imports of copper for the first seven months of the year totaled 358,734,608 lb., as against 232,403,540 lb. during the corresponding period last year, an increase of about 35 per cent.

NEW YORK METAL MARKET PRICES

	Sept. 19, 1923 Cents per Pound	Sept. 26, 1923 Cents per Pound
Copper, electrolytic...	13.62½	13.50
Lead, Am. S. & R. price	6.75	6.85
Antimony...........	7.50	7.50
Nickel, ingot.........	27.00 to 32.00	27.00 to 32.00
Zinc, spot........	6.50	6.50
Tin, Straits..........	42.00	42.00
Aluminum, 98 to 99 per cent...........	26.00 to 27.00	26.00 to 27.00

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Crescent Truck Company Increases Production 300 per Cent

The Crescent Truck Company, Lebanon, Pa., has just completed its new factory, 50 ft. x 220 ft., in that city. All new machinery has been installed for the rapid production of electric industrial trucks, which is the only product the company manufactures. This new equipment and building will enable the company to increase its production 300 per cent.

At the present time orders on file will keep the factory working to its full capacity for the next three months. The company maintains sales offices in Boston, New York, Pittsburgh and Philadelphia. All export sales are handled by the International General Electric Company.

G. E. and Allis-Chalmers Get More Newark Equipment Orders

The Public Service Electric Power Company, Newark, N. J., has awarded additional contracts for equipment for its proposed new power plant at Kearny, totaling about $1,000,000 and making an aggregate of approximately $5,000,000 in machinery awards up to the present time. The present orders include eighteen 15,000-kva. self-cooled, oil-insulated outdoor-type transformers, to be furnished by the Allis-Chalmers Manufacturing Company, Milwaukee, and nineteen oil-insulated circuit breakers, outdoor type, with constant current transformers, to be supplied by the General Electric Company, Schenectady, N. Y. It is stated that the last noted equipment will have a higher circuit-breaking capacity than any similar apparatus yet manufactured.

Electric Storage Battery Firm Buys St. Louis Factory Site

The Electric Storage Battery Company, Philadelphia, has just purchased a two-acre site on the east side of Vandeventer Avenue south of Chouteau Avenue, in St. Louis, on which it will erect a series of plants. The first plant, to cost about $200,000, will be erected at once. It will contain 30,000 sq.ft. of floor space and will be used as a general assembly and manufacturing plant. It is planned to erect two other plants of the same size as soon as they are needed.

Increased business and the advantages of St. Louis as a distribution point were responsible for this decision to purchase this site and to build this plant. When the new plant is completed the offices in the Federal Reserve Bank Building and the assembly plant at 2038 Walnut Street will be consolidated there. The site is conveniently located adjacent to the Missouri Pacific Railroad, and a switch track will be provided to facilitate handling freight both to and from this plant.

Packard Electric Starts Building $350,000 Transformer Plant

Ground was broken recently for the construction of an addition to the Packard Electric Company's plant at Warren, Ohio, to cost $350,000. The new building, which will be of two stories, devoted exclusively to the manufacture of transformers, will triple the company's output of transformers. The present building will be altered and turned over to the production of automotive cable.

Need of the addition to the present factory is evidenced by the fact that the present output of the plant, working both day and night, is not sufficient to supply demands for the product of the company, according to the statement of J. C. Bowman, advertising manager for the Packard Electric Company. The construction of the addition has been under consideration by officers of the company for several years, but was postponed during the war. With the return of stable business conditions it was believed that the time for the expansion had come.

Electric Tool Manufacturer Makes Further Price Reductions

A couple of years ago the Black & Decker Manufacturing Company, Towson Heights, Md., publicly announced that it was its policy to put its entire line on a quantity production basis and that as rapidly as this could be done prices to the user would be reduced according to the reductions which could be effected by manufacturing goods by these methods. The first of these reductions went into effect in November, 1922, at which time the Black & Decker quarter-inch drill, previously selling for $39, was reduced to $28. On Jan. 1, 1923, the Black & Decker half-inch "special," which formerly sold at $85, was reduced to $68. On June 1, 1923, reductions were made in a number of machines, the new prices averaging 10 per cent or 15 per cent lower than they had previously sold for, and now it is announced that the Black & Decker five-sixteenths-inch drill is reduced from $65 to $52.

This company announces that it is its policy to reduce prices to the user as soon as reduction in manufacturing costs makes this possible and that reductions will not be made at any specified times or seasons, but whenever manufacturing conditions permit.

Boston Firm to Specialize in Rural Electrification

Harold C. Stepson and Alvin Sloane, both of Boston, have organized the firm of Stepson & Sloane, engineers and contractors, with offices at 3061 State Street, that city, and will engage in the development of group and community electric light, water and sewage-disposal systems, and particularly specialize in rural electrification.

Stepson & Sloane have just completed 4 miles of distributing lines at a North Shore beach development and are now engaged in preliminary surveys for a distribution system to contain 10 miles of line at Nuttings Lake in Boston. With this new organization will be merged the staff and facilities of the Stepson Engineering Company of Boston. This company is sales representative for Kewanee and several other makes of electric and water equipment.

Square D Sales Appointments

The Square D Company, safety-switch manufacturer, Detroit, announces the following recent additions to its sales force: Ferguson Fague and J. F. O'Hara have been added to the Cleveland sales office. C. E. Cook, recently with the electrical department of the Ford Motor Company, River Rouge, has been appointed to the Detroit sales office.

Electric Material Firm Appoints W. C. Gerler Sales Manager

The Electric Material Company of Chicago has appointed W. C. Gerler sales manager. Previous to his connection with this organization Mr. Gerler was city salesman of the Electric Appliance Company of Chicago. The sales staff of the Electric Material Company is to be expanded by the addition of five more men, bringing the total force up to twelve. The territory now covered includes Illinois, Iowa, Indiana, Wisconsin and Michigan.

E. C. Morse Joins Triumph

E. C. Morse, a director of sales under the Wilson administration, previously in the Boston and Washington offices of the Westinghouse Electric & Manufacturing Company, has joined the Triumph Electric Company, Cincinnati, as vice-president in charge of sales.

Million-Dollar Building for Westinghouse's Peru Agent

A fine example of the type of building that is taking the place of former structures in many of the South American cities is a new office building just completed in Lima, Peru, at a cost of about a million dollars by August W. Wiese, one of the proprietors of the importing firm of Emilio F. Wagner & Company, the representatives of the Westinghouse Electric International Company in Peru. When the building is completed its main floor and basement will be occupied by Emilio F.

Wagner & Company. The structure is five stories high and occupies a ground area of about 16,000 sq.ft. The construction is of reinforced concrete throughout with finish and trimmings of granite and marble.

Uehling Instrument Orders

The Uehling Instrument Company, Paterson, N. J., reports considerable demand for its CO_2 recording and indicating equipment among central stations, the following orders having been received very recently: Queensborough Gas & Electric Company, New York City, four units; Metropolitan Edison Company, Reading, Pa., two units; Philadelphia Electric Company, six units. The Philadelphia Electric Company purchased its first Uehling equipment in 1917 and will have twenty-three units including the above order.

Western Electric Supply Will Move Offices Oct. 1

Removal on Oct. 1 of the general sales offices of the supply department of the Western Electric Company to the Pershing Square Building, Forty-second Street, New York City, is announced by the company. This change is brought about by the physical separation of the supply department from the telephone-manufacturing end of the business.

Coincident with the removal, Herbert Metz is appointed advertising manager of the supply department, with offices at Pershing Square. P. L. Thomson continues in the capacity of publicity director of the Western Electric Company. All advertising covering the supply business of the Western Electric Company will be handled through the advertising department at Pershing Square.

Burke Electric Appointments

The Burke Electric Company, Erie, Pa., manufacturer of direct-current and alternating-current machinery, announces that on Sept. 1 the manager of its Pittsburgh office, James R. Downs, was promoted to the position of manager of its mining department, with headquarters at Pittsburgh, and his assistant, William S. Wallace, was promoted to be manager of the Pittsburgh office in place of Mr. Downs. The Pittsburgh office remains at 739 Oliver Building.

Opens Power and Heating Agency

Joseph H. Spurgeon has recently opened a sales agency for power and heating equipment at 818 Woodmere Avenue, Detroit, to cover eastern Michigan and northern Ohio territory.

Mr. Spurgeon has been actively engaged in power and heating design and construction work in various parts of the country for more than ten years, the last four of which were spent in the territory in which he is now starting business.

General Electric Holds Two-Day Motor Convention at Pittsfield

One hundred engineers and sales representatives of the General Electric Company's motor department had a two-day convention at the plant in Pittsfield, Mass., Sept. 10 and 11, all parts of the United States being represented. The special purpose of the gathering was to demonstrate the construction and workings of the new "SCR" motor.

F. M. Kimball, manager of the small-motor department at Lynn, presided, and A. F. Blasdell, manufacturing superintendent, welcomed the representatives. Following this was a general review of single-phase motors by S. R. Bergman, an explanation of the theory of the "SCR" motor by H. R. West, description and demonstration of its operating characteristics by J. R. Rue and of its mechanical construction by Neil Currie.

Later came a round-table discussion of single-phase motors led by Mr. Currie. On Tuesday morning D. R. Kimball spoke on manufacture in relation to sales, and there was a talk on production by F. R. Whittlesey, an outline of the special field for the "SCR" motor by J. F. Johnson and a discussion of sales methods by Mr. Kimball. Group discussions followed the general session.

Electric Sales Firm Opens in Chicago to Serve Manufacturers

The Electric Industrial Sales Company, Inc., recently opened offices in the American Fore Building, 844 Rush Street, Chicago, to represent manufacturers in Illinois and surrounding states in electrical equipment. The company is incorporated in Illinois. It has a five years' contract with the Kuhlman Electric Company as exclusive agent in Illinois and the northern part of Indiana for all of Kuhlman's products.

Electric Machinery's New Office

The Electric Machinery Manufacturing Company, Minneapolis, manufacturer of synchronous motors, announces the establishment of its Detroit office in charge of R. L. Gomon, 520 McKerchey Building, 2634 Woodward Avenue, Detroit. The Schiefer Electric Company of Rochester and Buffalo, N. Y., has been appointed representative for the western New York State territory.

The Ajax Electric Specialty Company, St. Louis, has just moved its factory and office to 1926 Chestnut Street, where it will have increased facilities.

The Buchanan Locust Pin Company, Buchanan, Va., has awarded a contract for a new plant for the manufacture of insulator pins, brackets, etc., estimated to cost about $35,000, with machinery.

J. W. Wallace & Company, 246 Wakefield Street, Wellington, New Zealand, desire to obtain exclusive sales agencies in that country for tubular telegraph poles, copper and aluminum wire, steel conduit and insulators.

The Watson Elevator Company, 407 West Thirty-sixth Street, New York City, is arranging for enlargements in its machine shop, service and repair departments and will occupy the entire buildings at 407-409 West Thirty-sixth Street. The general manufacturing plant will be maintained at Hoboken, N. J., as heretofore.

The All-Rite Company, Virginia Avenue, Indianapolis, manufacturer of electrical specialties, will remove its plant to 418 South Pennsylvania Street, where increased facilities will be provided for larger production.

The Electric Storage Battery Company, Philadelphia, is completing plans for the construction of the first building of its proposed branch plant at St. Louis, where a site was acquired recently on Vandeventer Street. The factory will be two and three stories in height and will cost approximately $250,000, with equipment. The other plant units will be constructed in the near future.

The Western Electric Company, 910 River Avenue, Pittsburgh, has concluded negotiations for a lease of a new five-story industrial building to be constructed on the R. G. Jackson property on West Street, extending from Water Street to First Avenue. It will provide about 50,000 sq.ft. of floor area and will be occupied by the leasing company as soon as completed. The lease is for a long term and involves a consideration of approximately $500,000.

The Jeffrey-Dewitt Insulator Corporation, Kenova, W. Va., manufacturer of high-tension electric insulators, has secured under lease the former works of the Ferguson Shipbuilding Company, Abbott Road, Buffalo, and will occupy for a new branch plant. A portion of the existing buildings will be remodeled and improved and equipment installed at an early date. Production for the most part will be given over to the manufacture of electric switches, and at a later date it is purposed to occupy the entire property for this production.

The Arnold Electric Drill Company, Inc., West Haven, Conn., has changed its name to the National Electric Manufacturing Company.

The Steel City Electric Company, 1207 Columbus Avenue, Pittsburgh, announces the appointment, effective Oct. 1, of J. F. McGreevey, 10 High Street, Boston, as its sales representative for Massachusetts, Rhode Island, Maine, New Hampshire and Vermont.

The Hurley Machine Company, Chicago, manufacturer of household appliances, reports sales from 60 to 70 per cent ahead of last year, while profits have increased materially. Orders, the company says, are coming in at a better rate than in the first half of 1923. Plants are operating at capacity.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Agency is desired in Halifax, Nova Scotia (No. 7,782), for electrical appliances.

Purchase is desired in Matamoras, Mexico (No. 7,780), of lighting fixtures, wires, insulators, switches and other equipment.

Purchase is desired in Koono, Lithuania (No. 7,781), of 600 electric meters.

Purchase is desired in Riga, Latvia (No. 7,770), of nickel anodes.

MARKET FOR FUSE BOXES IN SOUTH CHINA.—Fuse boxes (round and rectangular porcelain types), for which there is a fair demand in South China, are at present being supplied almost entirely by Japanese and Chinese manufacturers, the latter being established principally at Canton. Importations of foreign-made cutouts are gradually decreasing.

WATER-POWER PROJECT IN EASTERN ALGERIA.—At Constantine, the capital of eastern Algeria, there are to be built for its benefit and also that of its neighboring towns two dams for developing power and light, according to the *Semaphore* of July 13. One dam at Kreneg, which is to be about 115 ft. high, will provide a storage reservoir of 41,000,000 cu.m. capacity. It is thought that this size is sufficient to prevent any considerable filling up with silt during the next thirty years. The installation planned for this site will require 4 cu.m. of water a second for sixteen hours per day. The total cost of this plant, which will be able to obtain a maximum head of about 350 ft., is estimated at 13,200,000 francs. About 5,790 hp. will be available, and an output of about 25,000,000 kw.-hr. annually is expected. The lower dam, called the Beni-Haroun, will be 130 ft. in height, with a canal 650 ft. long. The power available will be about 2,175 hp. and the cost of construction 7,000,000 francs. The power will be furnished at the rate of about 0.171 franc per kilowatt-hour, or about 40 per cent of the present retail price of power at Constantine. The cost of electricity to lighting customers in Algiers is 1.50 francs per kilowatt-hour.

PYKARA RIVER HYDRO-ELECTRIC SCHEME.—An application for the sole right to develop electrical energy from the Pykara River in the Nilgiri Hills of south India has recently been made to the government of Madras. It is proposed to construct a dam 150 ft. high across the river, forming a lake which will have a storage capacity of 6,000,000,000 cu.ft., with a catchment area of 38 square miles. The water from the lake will be conveyed by an aqueduct 1 mile in length on the right bank of the river to a forebay and from there through a pipe line to the power house situated at the bottom of the gorge. The project is so outlined that the tailwater after use will be allowed to flow into the Moyer River. As the Moyer River flows through a deep gorge, the establishing of another power house is contemplated at a suitable point to generate electricity by the further fall of the river from the deep gorge. It is expected that a total of 50,000 hp. will be generated under the present scheme, together with its future possibilities. This is subject to small annual fluctuations due to variation in rainfall. The power obtained is to be utilized for electrochemical industries and electrical reduction of ores. Surveys are at present being made to locate suitable sites for industrial works, and, although Calicut is regarded as a likely center, it is probable that another site which offers better advantages may be selected for the purpose. A part of the energy will be utilized for the supply of power and light to Calicut and other towns situated around it, as well as for industrial uses in that vicinity.

New Apparatus and Publications

BENCH LATHE.—J. D. Wallace & Company, 1401 West Jackson Boulevard, Chicago, has placed on the market a new portable single-speed 6-in. bench lathe.

ELECTRIC WASHING MACHINE.—The Getz Power Washer Company, Morton, Ill., has placed on the market a new model of its "American Beauty" electric washer.

SAFETY CHAIN.—The F. W. Wakefield Brass Company, Vermilion, Ohio, hereafter will equip its "Red Spot" line of commercial lamp hangers with the "Absotite" safety chain.

ELECTRIC HOIST.—The Stamp Electric Hoist Company, 968 East Sixty-ninth Street, Cleveland, has placed on the market a new electric hoist.

ELECTRIC WATER HEATER.—An electric water heater provided with an automatic thermostat cut-off has been placed on the market by the Christian Electric Manufacturing Company, 1625 Euclid Avenue, Detroit.

ELECTRIC WASHER.—The Holland Maid Company, Holland, Mich., has placed on the market an electric clothes washer of the oscillating type.

KITCHENETTE RANGE.—V. O. Strowe, 942 Prospect Avenue, Cleveland, has developed a kitchenette range, the dimensions of which are 17 in. x 21 in. x 39 in.

LIGHTING FIXTURES.—A complete line of lighting fixtures, each unit using the "Adjust-all" hanger and offset bridge, has been placed on the market by R. M. Starbuck & Sons, 54 Allen Street, Hartford, Conn.

JACK BINDING POST.—A combination jack binding post which will take all regular sizes of telephone cord tips and direct wire connections in sizes from No. 10 to No. 14, as well as fork-style or spade-tip terminals, has been brought out by the Globe Phone Manufacturing Company, Reading, Mass.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

PORTSMOUTH, N. H.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 2, for 2,800 ft. of electric wire for the local navy yard. (Schedule 1334.)

BOSTON, MASS.—The New England Power Company, 50 Congress Street, plans for a new bond issue of $2,800,000, the proceeds to be used for its hydro-electric generating plant at Davis Bridge, Deerfield River, with initial capacity of 60,000 hp.

FALL RIVER, MASS.—The Montaup Electric Company has applied for permission to issue common stock for $2,900,000 and preferred stock for $1,500,000, the proceeds to be used for its proposed electric generating plant and system in this section.

WORCESTER, MASS.—A power house will be constructed by the Board of Directors, Worcester Hahneman Hospital, 261 Lincoln Street, in connection with a new institutional building, estimated to cost $350,000. Kandall, Taylor & Company, 142 Berkley Street, Boston, are architects.

Middle Atlantic States

BINGHAMTON, N. Y.—The Kroehler Manufacturing Company will install electric power equipment in connection with a new addition to its furniture plant estimated to cost $100,000.

NEW YORK, N. Y.—The Great Eastern Sugar Company, Willard N. Bayliss, 141 Broadway, attorney, representative, recently organized, plans for the construction of a power plant at its proposed mill on a site to be selected on Long Island, estimated to cost $1,500,000. Kurt Grunwald is head.

NEW YORK, N. Y.—The Long Island Railroad Company, Pennsylvania Terminal, will purchase electric power equipment in connection with orders to be placed for rolling stock, etc., for which an appropriation of $2,860,000, has been made.

NEWARK, N. J.—The Intercoastal Lumber Terminals, Inc., will install electrically operated cranes, hoisting and conveying equipment in connection with its proposed terminal plant on property leased at Port Newark, estimated to cost $2,000,000. A substation will be constructed. George Quayle, Grand Central Terminal, New York, heads the company.

PHILADELPHIA, PA.—Electric power equipment will be installed in the five-story addition to be erected by the J. Frank Shellenberger Company, Front and Race Streets, manufacturer of confectionery, to cost in excess of $200,000. Clarence E. Wunder, 1415 Locust Street, is architect.

PHILADELPHIA, PA.—Plans have been authorized by the Ford Motor Company, Highland Park, Mich., for a power plant at its proposed local assembling works on site recently acquired on Sixty-third Street, to cost in excess of $750,000, with machinery. Albert Kahn, 1000 Marquette Building, Detroit, Mich., is architect.

SCRANTON, PA.—The Scott Township Electric Corporation, the Ransome Township Electric Corporation and the Newton Township Power Company, recently organized, are perfecting plans for the construction of transmission lines in their respective territories. Duncan T. Campbell, Scranton, is treasurer of all companies.

WEST HAZELTON, PA.—Plans have been authorized for the installation of a municipal fire-alarm system, using a portion of a bond issue for $25,000 recently voted.

WILLIAMSPORT, PA.—Contract with the Lycoming Edison Company for a local ornamental lighting system has been approved by the Public Service Commission, and work will be placed in progress.

HAZELTON, PA.—Plans are under consideration for the installation of an electric fire-alarm system.

LEWISTOWN, PA.—The Lewistown & Reedsville Electric Railway Company contemplates extensions and improvements in its electric plant and system to cost about $125,000.

RURAL VALLEY, PA.—The West Penn Power Company has acquired the system of the Rural Valley Electric Corporation. Extensions and improvements will be made and the property merged with that of the purchasing company.

SPANGLER, PA.—The Northern Cambria Company plans for the installation of electrically operated pumping machinery at its proposed local pumping plant, estimated to cost $50,000. Tannett, Seelye & Fleming, Caplan Building, Harrisburg, Pa., are engineers.

NORTH BEACH, MD.—The North Beach Electric Light & Power Company, recently organized, plans for the construction of a plant and transmission system for service in this district. William J. Duncan and A. C. Breitenstein, both of North Beach, head the company.

FROSTBURG, MD.—The Laurel Run Lumber Company contemplates the construction of a power house at its proposed plant at Laurel Run. The company was organized recently with a capital of $250,000. Joseph T. Blake is head.

GRANTSVILLE, MD.—The Wilbur Coal Mining Company, recently formed by a merger of local companies with capital of $1,200,000, contemplates the installation of electric power and other equipment at its properties. Telford Lewis, Johnstown, Pa., is vice-president.

LAUREL, MD.—The Annapolis & Chesapeake Bay Power Company has secured authority to purchase the local municipal power plant and system. The transmission system will be extended and improvements made.

BRISTOL, VA.—Electric power equipment will be installed in the proposed local ice-manufacturing plant, to be erected on Commonwealth Avenue, by the Bristol Ice & Coal Company, recently organized. Plans are being completed. R. F. Wagner is president.

COEBURN, VA.—The Clinch River Coal Company plans for the installation of electric power equipment and mining machinery at its local properties, formerly held by the Odle Coal Company. William J. Jegen, Edge Hill, Pa., is president.

NORFOLK, VA.—Bids will be called at once by the local supply officer, Navy Department, for four batteries. (Ord. req. 412.)

NORFOLK, VA.—The Virginian Railway Company will install a power distributing and lighting system at its proposed coal pier at Sewalls Point, estimated to cost $3,000,000. Contract has been let to the General Electric Company for machinery for a substation.

WEST UNION, W. VA.—The Midland Electric Service Company, recently organized, is completing plans for the construction of a generating plant on Middle Island Creek, with transmission lines to West Union and vicinity. The project will involve close to $100,000. J. Lambert McCormick and H. C. Gray head the company.

CHARLESTON, W. VA.—The R. S. Carr Realty Company plans for the installation of an electric lighting system on a 12-acre tract of land, to be developed for residential service. R. G. Hubbard heads the company.

KEYSER, W. VA.—The West Virginia Transmission Company has been granted a fifty-year franchise on county highways and plans for the early construction of a number of new lines.

LOGAN, W. VA.—The Interstate Power Company has authorized plans for the construction of a local substation. The transmission system will be extended.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, until Oct. 12 for electrical and mechanical equipment, including motors, fans, electrical fixtures, lamp sockets, wire and cable. (Circular 1558.)

North Central States

CHEBOYGAN, MICH.—The Iosco Land Company has acquired a tract of property on the lower Pigeon River, heretofore held by the Gerow estate, and purposes to constructure a hydro-electric power plant.

DETROIT, MICH.—Electric power equipment will be installed in the proposed plant to be erected by the Detroit Aero Metals Company, 657 Lycastle Avenue, comprising six units, estimated to cost in excess of $100,000. J. E. Thompson is president.

LANSING, MICH. — The Atlas Forge Company contemplates the construction of an addition to its power plant, comprising a complete operating unit.

PONTIAC, MICH.—The Wilson Foundry & Machine Company will install electric power equipment at its proposed two-story and basement addition, estimated to cost $400,000. C. B. Wilson is vice-president.

LOUISVILLE, KY. — The Ford Motor Company, Highland Park, Mich., plans for the construction of a power house at is proposed local assembling plant, estimated to cost about $600,000.

OWENSBORO, KY. — Plans are being arranged for the installation of electrically operated pumping machinery at the municipal waterworks in connection with extensions to cost about $100,000. Bonds are being arranged.

PLATTSBURG, OHIO.—Plans are being perfected for the construction of a transmission line from South Vienna for local commercial service.

SALEM, OHIO.—Plans are under consideration for the installation of electric pumping machinery in connection with a proposed waterworks system, to cost approximately $300,000.

SPRINGFIELD, OHIO.—The Ohio Power Company has issued bonds for $6,000,000, the proceeds to be used for a 25,000-kw. generating plant on the Mad River, construction of additional transmission lines, and for the acquisition of the Marysville Water & Light Company and the Northwestern Ohio Light Company, including extensions and improvements in the latter plants and systems.

TOLEDO, OHIO.—The Citizens' Necessity Company, 614 Virginia Street, will install electric equipment at its proposed cold-storage plant, estimated to cost $350,000, for which plans will be drawn early in the coming year.

CINCINNATI, OHIO. — The William Powell Company, Spring Grove Avenue, manufacturer of valves, etc., will install electric power equipment in its proposed plant addition, estimated to cost $150,000.

CROWN POINT, IND.—A power plant will be constructed at the proposed local sanitarium, estimated to cost $350,000. Karl D. Morris, Calumet Building, East Chicago, Ind., is architect.

GARY, IND. — The American Steel & Wire Company, Chicago, Ill., contemplates the construction of a power house at its proposed local mill on site recently acquired, for which plans will be perfected early in the coming year. The works are estimated to cost more than $500,000.

GARY, IND.—The Calumet Electric Company has acquired the Gary & Hobart Traction Company for a consideration stated to be $500,000. Additional equipment will be installed, including lines and other electric power apparatus. The system will be operated in conjunction with that of the Gary Street Railways.

ROCKVILLE, IND.—The Ferguson Lumber Company contemplates the rebuilding of the portion of its power house and mill, destroyed by fire Sept. 15, with loss estimated at $40,000.

WARSAW, IND.—The Interstate Public Service Company has acquired the electric plants and systems at Silver Lake and Claypool. The transmission system will be extended for local service and substations installed.

ELLISVILLE, ILL. — A franchise has been granted to the Central Illinois Public Service Company for the installation and operation of a commercial system. A street-lighting system will also be installed. A ten-year contract has been given to the company for furnishing service.

SHELBYVILLE, ILL.—Plans are under way for the installation of electrically operated pumping machinery in connection with extensions and improvements at the local waterworks. The W. A. Fuller Company, Railway Exchange Building, St. Louis, Mo., is engineer.

ST. CLOUD, MINN. — The Minnesota-Edison Company has been formed with a capital of $11,000,000 to take over local power properties and consolidate. Extensions and improvements will be made in generating plants and transmission systems, including the installation of additional equipment. Frank H. Hughes is one of the heads of the new organization.

LA CROSSE, WIS.—Following the purchase of local properties by the Northern States Power Company, plans are being perfected for a consolidation of interests here and at Eau Claire, Sparta, Chippewa Falls and vicinity, including extensions in transmission system.

MILWAUKEE, WIS.—Motors, controllers and other electric power equipment will be installed in the five-story-and-basement printing plant, to be erected at Fourth and State Streets by the Milwaukee *Journal* 182-84 Fourth Street, to cost $550,000.

OSAGE, IOWA.—The Consumers' Power Company will double the capacity of its local steam-operated electric power plant. The transmission system will be extended to Johnsburg, Taopi and vicinity, at a cost of about $30,000.

WATERLOO, IOWA.—The Citizens' Gas & Electric Company has an improvement and extension program in progress to cost $1,000,000, of which about $300,000 will be used for the purchase of electrical equipment; hydro-electric power plant at Cedar Falls, $200,000; power plant on the Waterloo River, $150,000; street-lighting extensions $60,000, and remainder of the fund for dam construction and miscellaneous work.

BRECKENRIDGE, MO. — Electrically operated pumping machinery will be installed in connection with the proposed new waterworks system, estimated to cost $45,000, for which bonds will be voted Oct. 9. E. T. Archer & Company, New England Building, Kansas City, Mo., are consulting engineers.

HOLLIDAY, MO.—Plans are being arranged for the construction of a transmission line for municipal service.

MOUNTAIN GROVE, MO. — Arrangements are being made for a special election to vote bonds for $35,000 for a municipal electric lighting plant. The issue was defeated at a previous election. An engineer will soon be selected to prepare plans.

GORDON, NEB.—Plans are under consideration for the use of central-station service, with construction of transmission line from the hydro-electric power plant at Valentine and discontinuance of the local municipal lighting plant.

KEARNEY, NEB.—Plans are under way for the installation of electrically operated pumping machinery in connection with a waterworks and storm sewerage system, estimated to cost $200,000. The Burns & McDonnell Engineering Company, Interstate Building, Kansas City, Mo., is engineer.

MERRIAM, NEB.—Steps are being taken for the installation of a municipal substation and distributing system. A transmission line will be constructed from Cody.

OMAHA, NEB.—The Nebraska Power Company is arranging a fund of approximately $1,000,000 for extensions and improvements in plants and transmission system during the next eighteen months. Plans are also being considered for electric generating-plant expansion, to cost in excess of $1,500,000.

BONNER SPRINGS, KAN.—The Kansas Portland Cement Company, Federal Reserve Bank Building, Kansas City, Kan., operated by the International Cement Company, will commence the construction of its proposed local mill, with power plant, estimated to cost $1,000,000.

SERVICE CITY, KAN.—Superstructure work is in progress on the new steam-operated electric generating plant by the Kansas Gas & Electric Company. Equipment will be installed for an initial capacity of 60,000 kw., to be extended at a later date. It will cost in excess of $5,000,000, with transmission system.

TECUMSEH, KAN.—Construction is in progress on a new local generating plant to be operated jointly by the Topeka Edison Company and the Atchison Railway, Light & Power Company, estimated to cost in excess of $250,000, with generating and auxiliary machinery.

HERNDON, KAN. — Bonds have been voted for $30,000 for the construction of a transmission line and installation of a municipal power system. W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., are engineers.

Southern States

ANDREWS, N. C.—Bids will soon be asked for the construction of a municipal electric power plant and system, for which bonds for $350,000 recently were voted. The Ludlow Engineers, Inc., Winston-Salem, N. C., are engineers.

CHARLOTTE, N. C.—An electric substation will be constructed in connection with the new municipal waterworks plants near Biddleville.

GASTONIA, N. C.—A bond issue of $200,000 is being arranged for the construction of a municipal electric plant and system and electrically operated waterworks.

FLORENCE, S. C.—The Atlantic Coast Line Railway Company will commence the construction of an electrically operated air plant at its local yards, to be used for train-testing service.

PAHOKEE, FLA. — A bond issue of $100,000 is being arranged for the installation of a municipal power plant and system, with ice-manufacturing plant to be operated in conjunction.

PENSACOLA, FLA.—Bids will be called at once by the local supply officer, Navy Department, for twenty-four navy-type storage batteries. (N. S. A. req. 49.)

OCALA, FLA.—Plans are being arranged by the Marion County Estates, Inc., for the installation of an electric lighting system on a local tract. C. E. Kiplinger is president.

PAHOKEE, FLA.—A bond issue of $100,000 is being arranged for the construction of a municipal electric power plant, ice-manufacturing plant and electrically operated pumping plant for waterworks. A special election will be held Sept. 28.

STUART, FLA.—The Ricou Farms Company plans for the installation of a light and power system in connection with the development of a 300-acre tract of land on the Great St. Lucie Canal.
sewerage system, to cost about $100,000.

GREENVILLE, ALA. — The Alabama Power Company plans for the construction of a transmission line from Montgomery, about 50 miles.

LUVERNE, ALA.—The French Stave Company contemplates the construction of a power house at a proposed local mill. L. French heads the company.

TUSCALOOSA, ALA. — The Tidewater Coal Company, Birmingham, Ala., recently organized, contemplates the installation of electric power equipment and other machinery on local coal properties. J. W. Lewis and F. W. Hopkins are heads.

LITTLE ROCK, ARK.—The Arkansas Bauxite Products Company, P. O. Box 381. G. W. Goodman secretary, plans for the installation of electric power equipment at its proposed local alum-manufacturing plant.

PINE BLUFF, ARK.—The Jefferson Cotton Mills Company, recently organized, plans for the construction of a power house at its proposed local mill, estimated to cost $250,000.

CARVILLE, LA.—Bids will be received by the Supervising Architect, Treasury Department, Washington, D. C., until Oct. 16 for the construction of a power house and complete mechanical equipment at the new additions to be erected at the local National Home for Lepers; also, for refrigeration equipment. Bids will also be received at the same time on another contract by the same office for one engine, generator and auxiliary electrical equipment, for installation at the home.

LAWRENCEBURG, TENN.—Bids will be asked at an early date for the construction of a municipal electric plant on Shoal Creek, estimated to cost $80,000. Freeland-Roberts, Inc., Nashville, Tenn., is engineer.

OLIVER SPRING, TENN.—The Eagle River Coal Mining Company, recently formed with a capital of $25,000, contemplates the installaton of electric power and mining machinery at its properties. W. A. Montgomery heads the company.

SAYRE, OKLA.—Plans are being perfected for a bond issue of $85,000, a portion of the proceeds to be used for the installation of equipment for municipal light and power service. V. V. Long & Company, 1300 Colcord Building, Oklahoma City, Okla., are consulting engineers.

COLORADO, TEX. — Electric power equipment will be installed in the proposed local ice-manufacturing and cold-storage plant to be constructed by the O. Lambeth Company, estimated to cost $100,000.

DALLAS, TEX.—The Wilson Construction Company plans for the installation of an electric lighting system, in connection with the development of a local tract of land for residential purposes. Fred W. Wilson is president.

FRANKLIN, TEX.—The Western Service Company plans for the construction of a transmission line from Calvert. The local municipal power plant has been acquired and will be converted into a substation.

STAMFORD, TEX. — Electric power equipment will be installed by the Fraser Brick Company, Dallas, Tex., in connection with extensions and improvements at its local plant, estimated to cost $60,000.

Pacific and Mountain States

ABERDEEN, WASH.—Plans are under consideration for the construction of a hydro-electric power plant on the Wynooche River, with initial capacity of about 25,000 hp., estimated to cost approximately $2,000,000, for municipal and local commercial service. The City Council is interested in the project.

SEATTLE, WASH.—Bids will be received by the chief of the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 17 for three 200-ft. radio masts for the Puget Sound Navy Yard. (Specification 4897.)

SEATTLE, WASH.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 16 for 50,000 ft. of telephone wire for the local navy yard. (Schedule 1339.)

PENDLETON, ORE.—The Pacific Power & Light Company plans for the construction of a local substation to cost about $150,000, with equipment. A transmission line will be built from Kennewick, Wash.

PORTLAND, ORE.—The Portland Railway, Light & Power Company will build a two-story addition to its substation on East Thirteenth Street, 20 ft. x 44 ft.

HOT SPRINGS, CAL.—The California Hot Springs, Inc., has applied to the State Water Department for permission to construct and operate a hydro-electric power plant on Deer Creek.

ROSEVILLE, CAL.—The Pacific Gas & Electric Company will install additional equipment at its local power plant, to cost approximately $25,000.

SANTA CRUZ, CAL.—Plans are projected for the construction of a municipal hydro-electric power plant on the San Lorenzo River, with initial capacity of 3,200 hp. Application has been made to the State Department of Public Works for permission.

TRACY, CAL.—The Banta-Carbona Irrigation District plans for a bond issue of $705,000 for a local system, including electrically operated pumping equipment and transmission system.

EVANSVILLE, WYO.—Plans are being arranged for the installation of electrically operated pumping machinery in connection with a new waterworks system, estimated to cost $45,000. Black & Veatch, Mutual Building, Kansas City, Mo., are engineers.

Canada

CHEMAINUS, B. C.—The Victoria Lumber & Manufacturing Company, Victoria, B. C., plans for the construction of a power house at its proposed mill here. Electric traveling cranes will be installed.

Mexico

EPALME, SONORA, MEX.—The Southern Pacific de Mexico contemplates the construction of a substation and the installation of electric power equipment at its proposed local ice-manufacturing plant, estimated to cost in excess of $225,000, with machinery. F. O. Goodell is local manager.

LAMPAZOS, NUEVO LEON, MEX.—The Stucky Mining & Milling Company is planning for the installation of electric power and other machinery at its plant.

Electrical Patents

Announced by U. S. Patent Office

(Issued Sept. 4, 1923)

1,467,085. TEMPERATURE CONTROLLED SWITCH; R. S. Blair, Sound Beach, and B. D. Wells, Danbury, Conn. App. filed June 8, 1921. Fusible switch construction for heated appliances.

1,467,109. SERVICE SWITCH BOX; H. F. Holkenbrink, Portland, Ore. App. filed May 2, 1921. Means for bringing wires from within flush box to instruments.

1,467,119. ELECTRIC CONDUCTOR SECURING MEANS; T. C. Russell, Chicago, Ill. App. filed Nov. 23, 1922. For fastening heating elements of grill plates.

1,467,126. VAPORIZING DEVICE FOR GASOLINE ENGINES; C. D. Turner, Indianapolis, Ind. App. filed Dec. 12, 1921.

1,467,154. SYSTEM OF RADIO-DIRECTIVE CONTROL; J. H. Hammond, Jr., Gloucester, Mass. App. filed June 7, 1912. Movements of bodies controlled and directed by radiant energy.

1,467,155. RAILWAY BOLT; J. Hartley, Philadelphia, Pa. App. filed Nov. 3, 1921. For supporting telegraph or telephone wires along rails.

1,467,178. ELECTRICAL RESISTANCE ELEMENT OF ELECTRIC SOLDERING IRONS AND SIMILAR HEATING APPARATUS; P. E. Landberg, Stockholm, Sweden. App. filed March 20, 1922.

1,467,181. ELECTRIC IRON; J. Lewisky and A. Hedtrich, New York, N. Y. App. filed Aug. 29, 1922. Method of controlling heating element.

1,467,187. LUMINESCENT TUBE; F. J. Metzger, New York, N. Y. App. filed Aug. 6, 1921. Neon lamp.

1,467,202. PROCESS OF AND APPARATUS FOR SEPARATING PLATINUM FROM PLATINIFEROUS MATERIALS; E. Slatineanu, Cressy-Onex, near Geneva, Switzerland. App. filed Feb. 26, 1921. Electrolytic process.

1,467,210. PHONOGRAPH; E. J. Tomlinson, East Orange, N. J. App. filed May 31, 1919. Electrically operated.

1,467,217. ELECTROLYTIC CELL; J. M. Williams, Henryetta, Okla. App. filed June 24, 1920. Production of chlorine and caustic soda.

1,467,240. DRY-CELL PRIMARY BATTERY; W. S. Doe, Kent, Ohio. App. filed Nov. 2, 1920.

1,467,253. MOTOR-DRIVEN CIRCUIT CARRIAGE; S. H. Sharpsteen, Tenafly, N. J. App. filed Aug. 2, 1920. Vehicle electrically driven from trolley wires upon which current-collecting device is self-driven by separate motor.

1,467,261. COVER PLATE FOR PLUG RECEPTACLES; W. L. Babcock, Waterbury, Conn. App. filed Aug. 19, 1919.

1,467,269 and 1,467,270. IGNITION DEVICES FOR INTERNAL-COMBUSTION ENGINES; A. Erickson, Chicago, Ill. App. filed July 21, 1919.

1,467,281. MANIFOLD HEATER; A. N. Armstrong, Oneida, N. Y. App. filed Jan. 27, 1922.

(Issued Sept. 11, 1923)

1,467,301. SIGNALING SYSTEM; C. E. Beach, Binghamton, N. Y. App. filed Jan. 7, 1920. Telegraph system.

1,467,303. HIGHWAY CROSSING PROTECTION; H. Bezer, Arlington, N. J. App. filed Aug. 28, 1918. Signal automatically operated by train.

1,467,318. ELECTRON DISCHARGE DEVICE; W. J. Herdman, Toronto, Ontario, Can. App. filed Aug. 17, 1920. Two-electrodes.

1,467,339. ELECTRIC DYNAMIC MACHINE; A. N. Sammarone, Cleveland, Ohio. App. filed May 31, 1921. Construction of direct-current and alternating-current generators or motors.

1,467,345. SECTIONAL INSTRUMENT CASE; H. A. Wallace, Pittsburgh, Pa. App. filed July 26, 1919. Housing of relays employed for railway signaling.

1,467,360. WAVE FILTER; H. W. Elsasser, New York, N. Y. App. filed March 24, 1921. For telephone lines.

1,467,381. ELECTRIC HOT-WATER HEATER; A. C. Hurlbert, San Carlos, Cal. App. filed Oct. 17, 1921. Automatically controlled.

1,467,398. PROCESS OF COATING; E. E. Schumacher, East Orange, N. J. App. filed March 19, 1920. Manufacture of thermionic cathodes.

1,467,432. CLAMPING CONTACT TERMINAL; G. F. Johnstone, Chicago, Ill. App. filed April 17, 1922. For etching equipment.

1,467,441. OIL PUMP; B. W. Macy, Jacksonville, Fla. App. filed Jan. 21, 1922. Electric heating system in which object is heated by fluid medium.

1,467,458. SIGNALING CIRCUITS; J. F. Toomey, New York, N. Y. App. filed Nov. 24, 1919. Cord circuits for interconnecting long-distance telephone lines.

1,467,467. COMMUTATOR; C. A. Adams, Cambridge, Mass. App. filed Aug. 19, 1916. For reciprocating element of electric hammer.

1,467,538. SAFETY LOCK FOR ELECTRIC BULBS; J. W. Doward, Halifax, Nova Scotia, Can. App. filed Sept. 4, 1920. Removal breaks bulb when device is locked.

1,467,574. TRAY FOR USE IN CONJUNCTION WITH THE CHEMICAL CLEANSING OF SILVER; R. A. Faralla, New York, N. Y. App. filed April 11, 1922. Where cleaning is done by electrolysis.

1,467,580. AUTOMOBILE SIGNAL; C. L. Hyde, Plainfield, N. J. App. filed April 23, 1921. Rear direction signal.

1,467,590. ALUMINOUS ABRASIVE AND METHOD OF MAKING THE SAME; H. A. Richmond and R. MacDonald, Jr., Niagara Falls, N. Y. App. filed April 25, 1922. Made in electric furnace.

1,467,596. HIGH FREQUENCY MODULATION DEVICE; P. I. Wold, East Orange, N. J. App. filed May 28, 1918. Condenser transmitter used with electronic operated device.

1,467,651. BATTERY CONNECTION; J. F. Prax, Rochester, N. Y. App. filed June 30, 1921. Length of connector adjustable.

1,467,667. ELECTRIC HEATER; C. E. Barr, Detroit, Mich. App. filed April 18, 1921. Resistance type.

1,467,677. ELECTRIC HAMMER; S. Lake, Milford, Conn. App. filed March 5, 1920. Electric hammer for riveting, metal cutting, etc.

1,467,707. STORAGE BATTERY; T. R. Cook, Pittsburgh, Pa. App. filed Jan. 16, 1922. Means for circulating electrolyte.

1,467,716. INSPECTION INDICATOR; J. D. Elsom, Oak Park, Ill. App. filed July 6, 1920. For railway cars. Based on amount of energy used.

1,467,745. METHOD OF STARTING ELECTRIC MOTORS; W. Zederbohm, Berlin-Charlottenburg, Germany. App. filed Aug. 23, 1919. Changing from star to delta connection without interrupting field of three-phase motor.

1,467,749. PROCESS OF MAKING STORAGE-BATTERY PLATES; R. C. Benner, Bayside, N. Y. App. filed July 29, 1922. Of the "preformed" type.

1,467,771. CURRENT-LIMITING REACTANCE COIL; V. E. Alden, Wilkinsburg, Pa. App. filed Nov. 20, 1917. Adapted for use with electric furnaces.

1,467,776 and 1,467,777. CONDENSER AND METHOD OF MAKING THE SAME; P. E. Demmler, Pittsburgh, Pa. App. filed Feb. 15, 1919. Tinfoil and paper condenser.

1,467,792. UNITING METAL PARTS; H. S. Holmes, New York, N. Y. App. filed Oct. 14, 1921. By percussion welding.

1,467,810. HIGH-TEMPERATURE RESISTOR MATERIAL; N. B. Pilling, Wilkinsburg, and R. E. Bedworth, Pittsburgh, Pa. App. filed Oct. 25, 1921. Furnace resistor composed of a cadmium oxide.

1,467,823. ENGINE-STARTING APPARATUS; L. M. Woolson, Dayton, Ohio. App. filed July 10, 1918. Electric motor.

1,467,825. ARC-WELDING COMPOSITION; J. C. Armor, West View Borough, Pa., App. filed Aug. 9, 1921. Contains zirconia combined with flux.

1,467,829. ELECTRIC TRANSFORMER ARRANGEMENT; F. E. Berry, Hayes, England. App. filed Jan. 20, 1921. Auxiliary transformer associated with main transformer for voltage regulation.

1,467,843. PROTECTIVE SYSTEM; W. M. Dann, Wilkinsburg, and C. Le G. Fortescue, Pittsburgh, Pa. App. filed Sept. 10, 1915. Water-cooled transformer system.

1,467,850 and 1,467,851. DENTAL-FILM HOLDER; D. L. Hall, Columbia, S. C. App. filed Dec. 15, 1921. Used when making radiographs.

1,467,876. FILM PACKET FOR X-RAY WORK; H. R. Raper, Albuquerque, N. M. App. filed June 17, 1922.

1,467,882. SPARK GAP; F. A. Ryder, Chicago, Ill. App. filed Nov. 18, 1921. For automobile spark plugs.

1,467,922. LIGHTNING ROD; M. Creighton, Rensselaer Falls, N. Y. App. filed Oct. 19, 1921. Method of fastening rod to grounded cable.

1,467,952. GRID RESISTANCE; L. Satchwell, Slough, England. App. filed June 11, 1923. Method of holding cast grids rigid.

1,467,954. ELECTRIC WELDING FURNACE; I. D. Shipper, Philadelphia, Pa. App. filed June 7, 1922.

1,467,958. POWER TRANSMISSION CONTROL; W. A. Stevens, Maidstone, England. App. filed Oct. 4, 1921. Engine- generator-motor drive for automobiles.

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Electrifying Industry

THE progress which engineers have achieved in assisting industry to make use of electricity in various forms has, as all who have followed this phase of electrical development are aware, been really remarkable. Manufacturing processes have been simplified, flexibility in factory construction and operation has been wonderfully increased, quality and refinement in production have been improved, schedules have been bettered and made easier to follow, new products otherwise impossible have been made available, and, not least among the contributions which electricity has made to industry, the productivity of the individual worker has been greatly enlarged, and at times it has been possible to replace him entirely, thus relieving him for work where human ingenuity is necessary. Electricity has done this by the application of motors and by improvement in control, by the scientific advance of electrical heat treatment, by the development of the electric furnace, by improved illumination and by various other methods.

The interest of the engineer, however, lies not so much in past accomplishment, except as it may point the way to future achievement, as it does in the problems connected with the further extension of electricity to industry. A great work remains to be done, and it is fairly safe to assume that the unaccomplished tasks are among the most difficult. One of these tasks is still further to replace human hands and human muscle, and in some cases human minds, in the performance of the routine work which is now done by a constantly diminishing class of labor. As has been said before in these columns, electricity will eventually be the most effective of all agencies in minimizing or solving what is called the immigration problem. To accomplish this not only must new machines be developed, but there must be a radical advance in control equipment in order to reduce the need for human supervision.

Two other aspects, aside from the engineer's viewpoint, are of significance in the further electrification of industry. The engineer, the manufacturer and others who know must educate the man who labors to see and understand that his own estate is raised by the substitution of a machine for his muscle, and it is only right to point out that the education of that man will be much more certain and stable if he shares directly and immediately in the increased production per man thereby made possible. The second point is that further electrification of industry by means of central-station power will release to the manufacturer money now invested in power equipment for direct use in his manufacturing business.

Approached from whatever angle, the electrification of industry is a service to society and to humanity. It presents to engineers and to all other electrical men an opportunity which they will not fail to grasp in their efforts to bring to a realization the electrical industry's desire to have electricity render its maximum of service.

David Lynde Huntington

A central-station executive under whose leadership a small power company of the Northwest has grown until it now forms an important link in the interconnected transmission system of that section.

ENGINEERING training and experience and a thorough schooling in public utility management, coupled with a keen memory, a passion for truth and the faculty of covering small details, endow David Lynde Huntington, president of the Washington Water Power Company, with the qualifications to manage this large utility of the Northwest with its diversified engineering and managerial problems. These things, together with an intimate knowledge of the company gained from his twenty-nine years' association with it, have made him an important factor in its growth.

Born in 1870 at New London, Conn., Mr. Huntington was educated in the public schools of Washington, D. C., afterward attending Yale, where he specialized in mechanical engineering and was graduated in 1891 with a Ph.B. degree. In 1916 the Washington State College conferred on him an honorary degree of master of science in engineering. After leaving Yale he went to Lynn, Mass., with the Thomson-Houston Electric Company. When the General Electric Company was organized he was sent to the Philadelphia district, doing there all kinds of work from the selling of appliances to the building of pole lines and power plants. He resigned in 1894 to become treasurer of the Washington Water Power Company. He became general manager in 1896, vice-president and general manager after several years, and in 1910 was elected president.

When Mr. Huntington first became connected with the company its lines went only to the suburbs of Spokane. In 1902-1903 a 60,000-volt line was built to the Cœur d'Alene mining district. This line was among the first high-voltage lines in the country, and from this time on, year by year, the company's transmission lines were extended in all directions from Spokane until now they cover a considerable portion of northern Idaho and the greater part of eastern Washington. In succession hydro-electric plants have been constructed at Spokane, Post Falls, Idaho, Little Falls, Long Lake and finally the upper falls at Spokane, and preparations are now under way to begin construction on a much larger development at Kettle Falls on the Columbia River.

Mr. Huntington is a student of public relations and has interested himself in this particular phase of the work of the Northwest Electric Light and Power Association. He is a past-president of that organization, a fellow of the American Institute of Electrical Engineers and a member of the Yale Engineering Society.

Editorial Comment

Electrical World, October 6, 1923
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Advance in Illumination Technology Is of Widespread Importance

THE recent convention of the Illuminating Engineering Society at Lake George brought out many things of interest to others than the illuminating engineers themselves. Essentially all of these things are in the direction of a greater use of light and therefore of quite practical value to central-station executives, commercial managers and engineers. And, also, those engineers who have to do with layout of factories cannot overlook the contribution the illuminating engineer is making to increased production through increased illumination.

Definite data were presented, as the result of convincing tests, to show how production is increased by greater illumination. Street-lighting advances were indicated, all in the direction of greater use of light and on a more intelligent basis. Higher intensities in general were shown to be more conducive to gaining the end sought by the use of illumination. The greater use of electric light for pageant decoration and for general outdoor decorative effect was strikingly shown.

The illuminating engineer is constantly studying those things which tend to improve lighting practice and which, at the same time, make it most practicable and possible to sell more light and therefore more electrical energy. He deserves encouragement, and he deserves co-operation. His advances should be watched by central-station men. In fact, more of the latter could with profit attend the I. E. S. conventions if they continue to be up to the standard of 1923.

The Future of Muscle Shoals

AS WAS to have been expected, the government has acknowledged the right of the Alabama Power Company to exercise its option to purchase the now famous Gorgas steam plant and has accordingly sold it to the company for a sum approximating three and a half million dollars. As is usually the case when affairs requiring engineering judgment and business experience become matters for congressional debate and action, the merits of the question were drowned in the noise of political debate, the clatter of "blocs" and the thunder of the Ford boom. But any one with an appreciation of the facts involved must realize that the only reasonable solution to the question as to who should own half of a certain power house is the person who owns the other half—and this was the point in connection with the Gorgas plant.

As to what is to become of Muscle Shoals itself, there can only be speculation. The Ford offer is shown by the sale of the Gorgas plant to reduce to about $1,500,000 for Muscle Shoals itself. Henry Ford has as much right as any one to make an offer for the right to develop the water power there and to purchase the government property now on the site. Whether he is willing to devote his energies to the work of developing hydro-electric power for general distribution or whether he will insist in any offer that he have the sole benefit of power for his own industries remains to be seen. Others will doubtless come forward with plans and proposals, and all which emanate from those experienced in the development of power will without doubt provide that the power produced shall be fed into the growing interconnected system of the Southeast in line with what is recognized as the most practicable and economical way to provide an electric power service to the public.

Certain it is, also, that those charged with the administration of the matter for the government will not fail to consider the future of power development with interconnections which may become nation-wide and the relation of the various water powers to the total system. They will, as trustees of the public, be sure that the power development is in the interest of supplying power to the greatest number and to the greatest good.

A Remarkable Magnetic Alloy

THE desirable range of the magnetic properties of iron for use in communication engineering falls far outside that which usually pertains to other types of electrical equipment. The exceedingly small values of current which are involved in telephony and telegraphy render it important that the material of magnetic circuits should have the highest possible permeability within the very lowest ranges of magnetizing force. Moreover, as is well known, the efficiency of transmission of ordinary communication wire circuits is very low, and the distance and degree of excellence of transmission is often a matter of a certain minimum amount of delivered energy. Hence it becomes important that any magnetic circuits within the line of transmission should have the lowest possible magnetic losses.

In the early days of communication these matters were not of special importance because the amount of magnetic equipment used was relatively small. However, in these latter days of increasing distances and of improvements in the quality of the delivered signals, iron is used in transformers, filters, amplifiers, loading coils and other types of auxiliary equipment. As a consequence a considerable amount of intensive research has been directed by both scientists and the research agencies of communication companies to the discovery of new forms of magnetic material which should in some measure meet the needs indicated. One of the most striking results of this work is the discovery of "permalloy," consisting of approximately 80 per cent nickel and 20 per cent iron and whose permeability at

low field intensity is many times greater than any values hitherto known.

An account of this remarkable alloy has been recently published by H. D. Arnold and G. W. Elmen in the *Journal of the Franklin Institute.* The largest value of initial permeability for permalloy—that is, the permeability at zero magnetic-field intensity—is about 13,000, and this value is more than thirty times the corresponding value so far found for the best soft iron. How extraordinary this is may be appreciated by considering that this material, although it has a saturation value of magnetic intensity comparable with that of iron, nevertheless approaches magnetic saturation in the earth's field. Permeability approaching the value of 100,000 has been observed, thus largely exceeding the highest values available in silicon steel. As regards hysteresis loss, the area of the hysteresis loop for the low values of field intensity at which it would be used is only about one-sixteenth that of the loop for soft iron. The development of permalloy assures a revolutionary change in submarine cable construction and operation and also means the accomplishment of results in other directions heretofore believed impossible. The only apparent shortcoming is the sensitivity of the magnetic properties to mechanical operations on the material. It appears certain, however, that this disadvantage will be overcome, and in the meantime this sensitivity places in the hands of the scientist a valuable instrument for a study of the ultimate nature of magnetic properties.

Real Progress in Electrical Furnaces

A VERY notable series of tests on electric furnaces were presented at the convention of the Association of Iron and Steel Electrical Engineers in Buffalo last week. An abstract of the conclusions which appears in this issue gives answers to many controversial questions. The chief of these involves the question of phase unbalance and the desirability of the furnace as a central-station load.

The tests showed that the maximum unbalancing was 21 per cent of the connected load, but that this effect was not important because of the very short time duration of the unbalance. The fact that six furnaces are used in the plant and that energy is supplied over long-distance transmission lines would seem to offer the best possible opportunity for unbalance effects to cause trouble, yet the steel company has had no complaints from the central-station company.

That the furnace control has been adequate is indicated by the data showing that the highest current value used during the melting period was one and one-tenth times normal. This, combined with monthly operation at any average power factor above 90 per cent, gives positive evidence that electric furnaces are welcome additions to the central-station company's system.

The tests also gave valuable data on the effect of reactance in stabilizing loads and damping harmonics. The distortion of the primary voltage and current waves is very appreciable, and high-frequency waves of the order of 5,000 cycles were found to exist. The reactance has a beneficial effect on these phenomena provided that a resonance condition is not set up.

Tests of the same kind should be made on other types of furnaces, and the investigation should be extended to cover annealing furnaces and furnaces used in the melting of non-ferrous metals. The data and information thus obtained would afford material to central-station power salesmen, industrial engineers and others interested in promoting a greater degree of electrification in the metal industries.

Another Relativity Trick

A RECENT national radio conference has recommended the use of frequency in kilocycles (abbreviated "kc.") instead of the customary wave length in meters. To an outsider this may seem almost like a difference without distinction, in that for a given frequency the corresponding wave length can be immediately obtained, knowing that the velocity of propagation of electromagnetic waves in vacuo is 300,000 km. per second. Thus a wave length of 300 m. corresponds to a frequency of 1,000 kc. It seems, however, that the recommended change is of considerable import in assigning bands of frequencies for different purposes and in adjusting interference between stations working on slightly different wave length *K*. Thus it has been pointed out that the frequency band existing between 150 m. and 200 m. (2,000 kc. and 1,500 kc.) is enormously wider than the band from 1,000 m. to 1,050 m. (300 kc. to 286 kc.). While it is possible to carry on fifty simultaneous radio-telephone communications between 150 m. and 200 m., only one should be carried on between 1,000 m. and 1,050 m.

Electric power engineers are familiar with a similar situation in which two "bands" of quantities seem equal or different according to the manner in which they are expressed. To improve a power factor from 95 per cent to 100 per cent means shifting the current vector by over 18 deg., while to improve a power factor from 60 per cent to 65 per cent requires turning the current vector by less than 4 deg. Yet the power factor "band" is 5 per cent in both cases.

Marine Electrical Equipment Deserves Competent Supervision

MARINE engineering has always seemed to electrical engineers to be something remote from their immediate interest, except for the recent and somewhat spectacular development of electric drive for battleships and what this may signify in the development of electric drive for other ships. But the gradual growth of the use of electricity in the operation of auxiliaries and miscellaneous equipment on board ships of all kinds has given both the electrical engineer and the electrical manufacturer an increased interest in knowing the exact state of affairs. As the use of electricity on board ship increases, electrical engineers see opportunity for professional service in that field and the entire industry is interested in having the installations operate with full satisfaction.

One problem which the marine committee of the American Institute of Electrical Engineers has met in its work has been the lack of authority of the electrical men on board ship and the lack of electrical training and information which characterizes those officers who have the responsibility for the electrical equipment. The history of marine power engineering starts, of course, with the steam engine and the "steam bureau," and steam officers have always been respon-

sible for all the engineering equipment of ships. As developments occurred in boilers and prime movers and other steam equipment, these were naturally followed by the steam engineers. When the internal-combustion engine appeared, it was mastered like its thermodynamic cousin, the steam engine. But the gradual growth of electricity on the ship has not been accompanied by any corresponding increase of definite knowledge on the part of the "steam" officers in charge, nor has there been developed any corresponding electrical officer to take that responsibility. Rather has the work been left to enlisted electricians, without particular authority or responsibility.

It is believed that the electrical industry as a whole has sufficient interest in the successful operation and service of electricity on board ship to see to it that some change is made in this situation. One way would be to create "electrical" engineer officers. This should surely be done at least on those ships with electric drive or with heavy electrical equipment, but there are probably many cases in which it would not be justified. Another way would be to insist that all engineer officers responsible for electrical equipment have sufficient electrical training to use this equipment with judgment. That is, electrical engineers with enough knowledge of steam and internal-combustion engines to handle them as minor equipment should be authorized for the more highly electrified ships, and steam officers responsible for any electrical equipment should be made to acquire some knowledge of electricity.

The whole question is one of importance to every one interested in the advance of the use of electricity and in the opportunities for electrical engineers. It is a subject in which action is likely to be slow, but in which constant pressure from many directions may serve to bring results.

Reconstruction at 220,000 Volts

THE most economical way to do a job is not always the most easy, and it requires courage to choose a method which involves great detail and careful planning when there is a short way out, even though it be more expensive. The engineers of the Southern California Edison Company faced the problem of providing additional transmission-line capacity to transmit 100,000 hp. over a distance of 240 miles upon the completion of the Big Creek plant No. 3. Two existing 150,000-volt lines were of insufficient capacity, and to build an additional line was the obvious solution. To have built a new line would have avoided all criticism, and the engineers could have reasoned that the line would be useful some time anyway.

Instead, they undertook to raise the height of the steel towers ten feet and reinsulate the line for 220,000-volt operation without having any major portion of either circuit out of service at any time. The ingenious manner in which this plan was carried out is described elsewhere in this issue by H. A. McIntosh. The numerous small engineering details involved and the great pains necessary in laying out and executing the work are shown in the article. In addition to the engineering aspects of the problem, it must have been no small task to convince the operating department that rebuilding the lines under operating conditions was the most practicable thing to do.

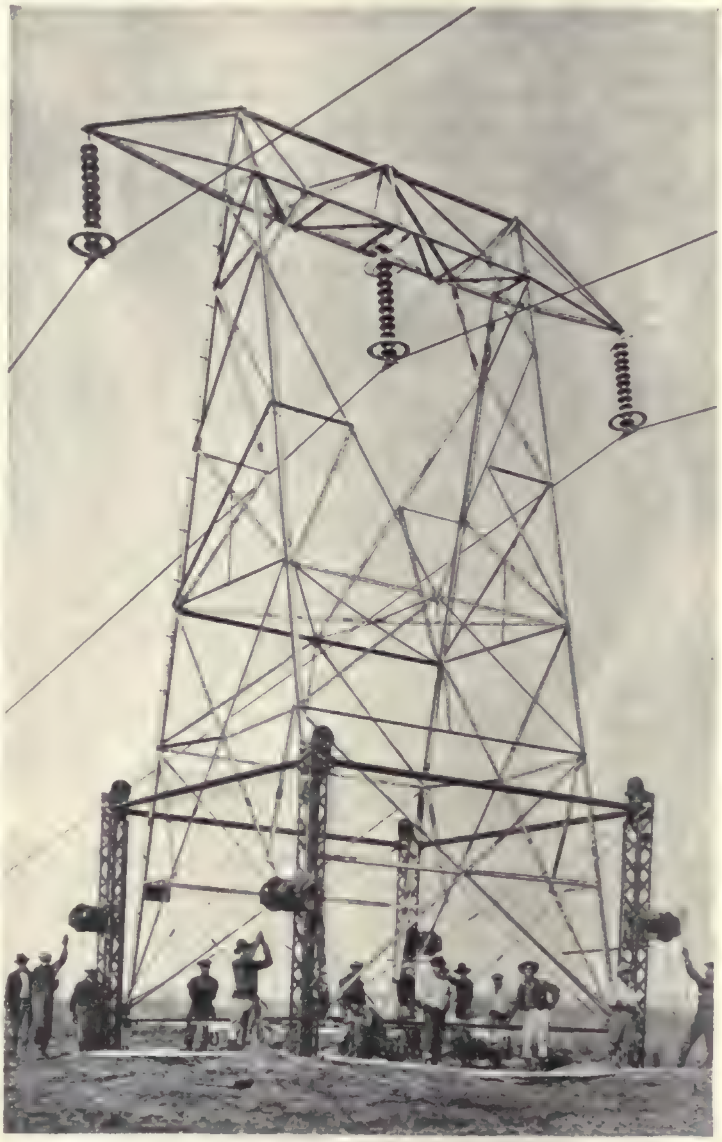
What Does the Residence Survey Mean?

AFTER three years of investigation, the Association of Edison Illuminating Companies has completed an extensive survey and analysis of residence electrical installations in eight of the larger cities in the northeastern part of the United States. It represents a generous expenditure of effort and of money and is a valuable contribution to knowledge on the subject. Conclusions drawn in the report of the survey, which is abstracted on page 708 of this issue, show that of the total residence consumption of energy 17 to 20.6 per cent is attributable to appliances while lighting accounts for the remaining four-fifths of the energy used in homes. These figures represent conditions in the eight cities surveyed—Boston, Brooklyn, Chicago, Cincinnati, Detroit, Philadelphia, Toledo and Washington—and are not intended to be taken as an index for all cities and towns. How closely they approximate conditions the country over is open to debate. At first glance the percentage of appliance consumption appears low as a nation-wide average. This is probably accounted for by the well-known fact that in all of the larger cities of the East the development of the use of household devices and even the wiring of old houses have been slower processes than in the West and in many smaller cities and towns where most of the residential sections have been built since the advent of electric lighting.

What the survey does indicate is that there is a deep and yawning chasm, not merely a valley, in the residence customer's load curve. Yet discussion of the report brought out the fact that experience with fully electrified houses has proved again and again that an actual opportunity exists to turn the tables and make appliances account for from four to five times as much energy consumption as lighting. Why is this not being done? Why are there only the few isolated cases?

The industry knows of a dozen homes or more where everything is done electrically, and these households offer the most convincing demonstration that complete electrical equipment is practical and economical. But most electrical men still seem to regard them as interesting abnormalities, the expression of somebody's hobby. The fact that here is proof that any normal household can use a full outfit of electrical appliances does not seem to register as a sales opportunity. Surely it justifies an immediate effort to put appliances in the homes of every city, but the central-station executive either misses the point or fails to take it to himself. Yet the responsibility is his both to develop and expand the service which his company renders to the public and to increase the earnings of his stockholders. As a matter of fact, if as much thought and study were given to making ten dollars' profit from the sales of appliances to the home and from the energy they will consume as is commonly given to saving one dollar at the coal pile, central stations would soon be out of the commercial doldrums that beset them now, and a completely equipped home would not stand out as a freak but as an accepted standard.

It is interesting to know that in eight cities of the Northeast appliances contribute 17 per cent of the load. But the greatest interest and the greatest value from this survey will come when it is approached from the other angle and frankly studied as definite evidence of wasted opportunity and a neglected market.



Transmission Line Raised Without Suspending Service

TO ADAPT its 150,000-volt lines from Big Creek to Eagle Rock substation to 220,000-volt operation the Southern California Edison Company had to increase the clearances between conductors and also between conductors and ground and to insulate for the higher voltage. To raise the towers, and thereby increase the clearance of conductors to ground, without interrupting service the method illustrated here was used. For further details see the article on page 695.

Changing Lines to 220,000 While Hot

Additional Section Is Placed Under Steel Towers on Big Creek Transmission System of Southern California Edison Company with Lines in Operation—New Insulator Units and Shield Rings Are Installed

By H. A. McINTOSH
Superintendent Big Creek Line Construction, Southern California Edison Company

THE necessity of transmitting more than 100,000 kw. of additional power from the Big Creek plants of the Southern California Edison Company to Los Angeles required transmission-line capacity in addition to that afforded by the two existing 150,000-volt circuits. Two methods were considered — first, building additional lines; second, rebuilding the existing lines for 220,000-volt operation. After careful study the latter method was decided upon as being the most economical, although it presented some difficult problems due to the necessity of doing the reconstruction work under operating conditions. Calculations showed that by increasing the voltage of the two existing 240-mile circuits, consisting of 605,000-circ.mil aluminum cable with ⅜-in. steel core carried on two single-circuit steel-tower lines, from 150,000 volts to 220,000 volts their capacity would be increased from 125,000 kva. to 250,000 kva. The reconstruction of the transmission lines involved two operations so different in character as to necessitate their being handled almost independently. One operation consisted of increasing the height of a large percentage of the towers in order to provide the minimum clearance of 30 ft. above ground required for ordinary conditions by the Railroad Commission instead of the normal clearance of 25 ft. provided for by the original construction. The other was the placing of two additional insulator units in each string of insulators as well as installing static or shield rings to distribute the electrostatic stress uniformly over the insulator strings and at the same time to provide a greater degree of protection to the insulators in case of flashovers.

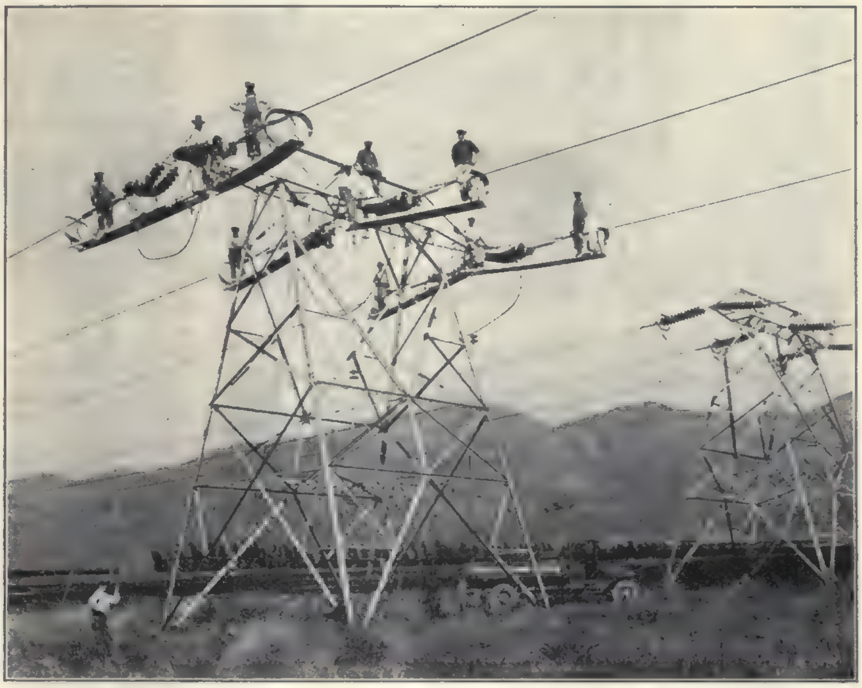


FIG. 1—REINSULATING ON A DEAD-END TOWER FOR 220,000-VOLT OPERATION DONE FROM SPECIALLY DESIGNED SCAFFOLDS

Owing to load conditions, only a short section of one of the transmission lines could be spared at a time for this reconstruction work. Accordingly it was first necessary to construct cross-over switching stations by means of which short sections of line could be taken out of service. These sections had to be short because of the excessive losses and poor voltage regulation which would result if longer sections were taken out of service. To meet these conditions four complete layouts of open-air, manually operated sectionalizing and cross-over switching stations were installed. Sectionalizing switches only were installed at Vestal substation, and these, together with an existing switching station at Magunden, divided the line into seven sections, each approximately 35 miles in length. Study indicated that six months would be sufficient time for reinsulating the lines and that one-half of one section of double circuit, or one-fourteenth of the total length of both circuits, could be released from operation for this purpose without an unreasonable line loss. However, this meant that the work of raising the towers must be done with both lines energized and carrying their normal load at 150,000 volts.

In order to obtain the clearance required from the ground to the conductors, it was necessary to increase the height of the towers, increase the tension in the conductors or put in more towers. Increasing the tension in the conductors would not give the additional clearance required and would put too great a stress on both the conductors and the strain towers. Increasing the number of towers would give greater clearance than required, but the job would be very costly. Furthermore, both of these methods would mean more interference with operation than could be permitted. Raising the towers would require the erection of an extension just below either the "basket" or the cross-arm, which in turn would mean either great interference with operation or an extension at the base, the latter involving new locations for the footings if the present slope of the tower legs was to be maintained. However, investigation showed that the towers had been designed with a sufficient factor of safety to permit

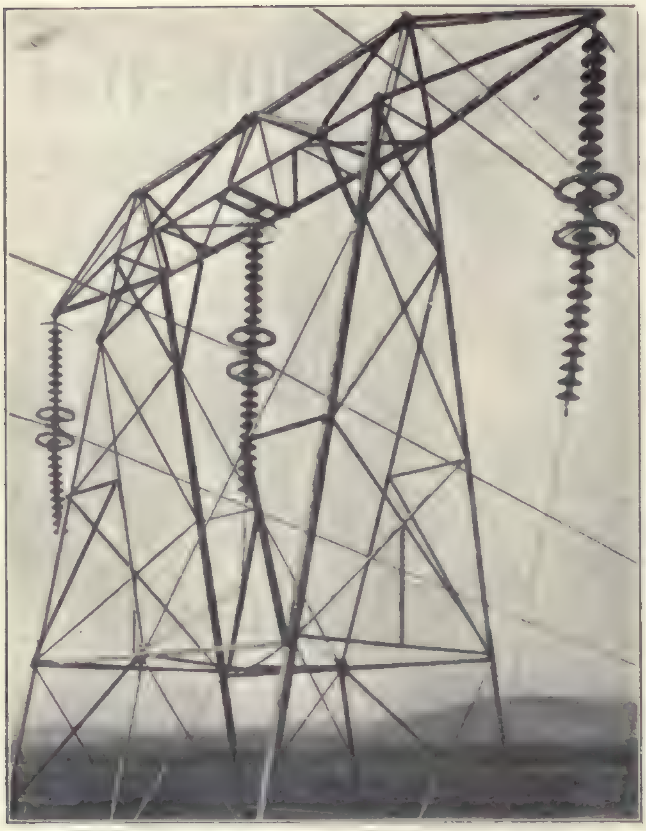


Fig. 2—Special Tie-down Construction on Big Creek Line

of a vertical extension of the base, thus allowing the use of the present footings without changing their location and reducing interference with operations to a minimum. Both standard and angle towers already carried extensions ranging from 5 ft. to 20 ft. as well as side-hill extensions ranging from 5 ft. to 15 ft. As new extensions would be required within the same limits, the number of types of extensions required, owing to the varying base dimensions of the towers as then standing, would be large. However, careful study kept the number of types down to a minimum.

How Towers Were Raised

The process of raising the towers consisted of lifting them bodily and holding them suspended while an extension of the proper height was erected underneath. The elevator for this purpose, two legs of which are shown in Fig. 3, consisted of four structural-steel latticed posts joined at the top by pipe struts which fitted into sockets and were held in place by king pins. The ground was leveled off and wooden pads were placed to prevent any settling of these posts under load. A plate connection was bolted to each post and the adjacent footing. Steel-cable guys with load binders and turnbuckles for tightening were used, extending from the top of each post to the bottom of the two adjacent posts, thus making diagonal bracing for the elevator. Each post carried a 3-ton differential hoist for lifting. This was similar to a chain block, except that it had a drum instead of a load chain, and was mounted on a frame which was bolted to the post. The hoisting cable passed over a sheave in the top of the post to a plate clevis which bolted onto the tower leg at the point where the connection was broken from the footing.

Great care was used in keeping the towers plumb during raising to avoid any undue strains being produced by tilting. One tower leg and elevator post were carefully grounded to the footings by No. 4/0 copper cable and broad terminals to avoid any possibility of accident due to the tower becoming energized. The crew for this work was made up of four first-class towermen, four second-class towermen, four groundmen, a truck driver and a foreman. The best record made was seven towers raised and bolted in ten hours, the elevators being left in place for the night on the last tower. As with the insulator work, accessibility was the greatest factor in determining speed. As already stated, virtually all tower raising was done with the line energized at its normal voltage of 150,000. Before any raising was done the ground wire was slacked off at its dead-end points and the clamps at intervening points were loosened to permit slack to run through in order that there might be no abnormal strains set up in case a tower did not remain truly vertical while being raised. At points where ground-wire loads were unbalanced, such as angle points, or where any particular conditions made the hazard more than normal, the line was de-energized before raising the tower.

Reinsulation of Lines

The operation of reinsulation on dead ends or strain towers consisted of increasing the number of insulator units in each string from eleven to thirteen and in placing a shield ring on the outer end of the double strings. These rings are of cast aluminum of "U" cross-section, consisting of two semi-circular segments joined by two straight segments, the joints being V-shaped to get a close fit and good alignment automatically. They are supported by strap-steel arms bolted to the rings at the joints and to the outer or conductor yokes.

In order to maintain the present tension in the conductors, it was necessary to cut out of each conductor a length equal to the length of the two insulator units added. This meant that the conductor clamp had to be moved out the corresponding distance to a new position on the conductor. Aside from wrenches, small tools and hand lines required, the important items of equipment were specially designed swinging scaffolds (shown in Fig. 1), which were supported by hooks on the tower members at two points at the inner end and by a leather-covered hook on the conductor at the outer end. These were very light and easily transported and served most effectively. The scaffolds had buried in each leg a heavy steel wire, so that in case a leg should break they would still support their load. Eight-ton double-action turnbuckles with fixed lengths of plow-steel-cable strain lines and two specially designed five-bolt hinged temporary clamps, or "come-alongs," were used.

Handling Dead Ends

The procedure on dead-end work was to put on the "come-along" far enough out on the conductor to allow the conductor clamp to be set out in its new position with sufficient space left for flexibility in handling the large cable. The strain lines were hooked to the chains of the "come-along" and sufficient strain was taken on the conductor on each side of the tower at the same time to permit the connection between the yoke and clamp, as well as the core clamp, to be removed. The permanent clamp was then removed and set in its new

position. Before the connection was broken the insulator strings were supported from the strain lines by means of a wooden yoke under the second pair of insulators, with a hook over the strain line. After the additional units and the shield rings were in place the strain was released and the jumper loop was remade. In setting out the permanent clamp a distance equal to the length of two insulator units, an equal length of cable was thrown into each end of the jumper loop. To reconnect the core clamp the jumper clamp had to be removed, the aluminum unwoven adjacent to the permanent clamp so that the "two-insulator unit" length of core wire could be cut off and the core clamp bolted in its new position. A false core of the same length was inserted to stiffen the cable, the aluminum rewoven about it and the jumper clamp rebolted in place.

Construction of Suspension Towers

On suspension towers the major equipment consisted of a half-ton chain block for lifting and holding the conductor while the connection was broken and a "bosun's" chair in which the towerman worked. The two insulator units were then added and the shield rings put on. Where a tower was on a peak with considerable down pull in addition to the weight of the cable, a turnbuckle was used in place of the half-ton block used in their locations.

In country where access was easy a gang for work on dead-end towers consisted of six first-class tower men, three second-class tower men, three groundmen, a truck driver and a foreman. The minimum time consumed from the time a truck drove up to the tower with a crew and equipment to the time the truck was loaded ready to drive away was one hour and fifteen minutes. In mountainous or inaccessible country where the man-

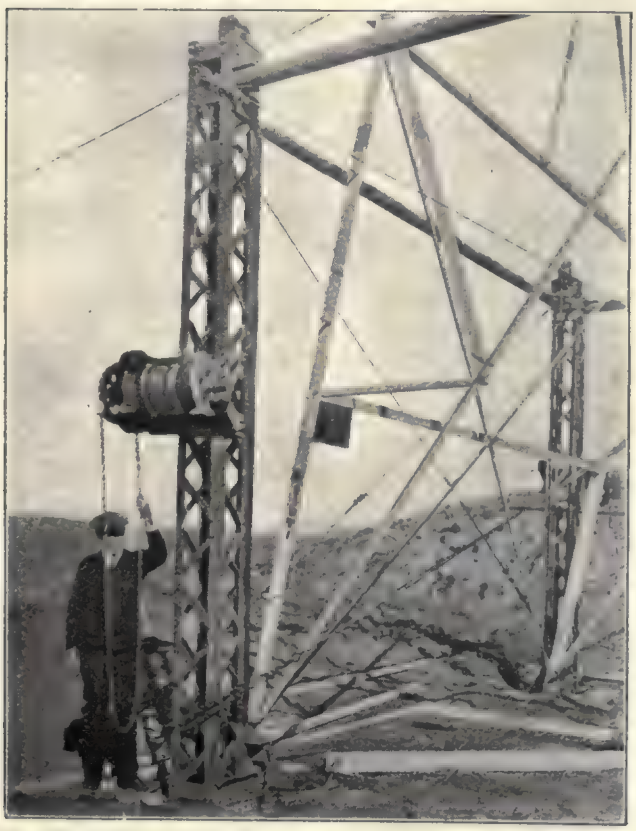


FIG. 3—STEEL TOWERS WERE RAISED BODILY WITH THIS ELEVATOR AND A 10-FT. SECTION WAS PLACED UNDERNEATH

FIG. 4—COMPLETED DEAD-END TOWER

hours consumed in transportation exceeded the man-hours consumed in actual work the number of men was reduced to three or four.

The work of adding insulators and shield rings has been accomplished in a period of six months for the 480 circuit miles, with an average crew of about seventy men, aside from the camp and office forces. About 1,400 towers were raised during the last six months of 1922, the number of crews averaging about four, or a total average of about eighty men, exclusive of camp and office men. This work will go forward through a large part of 1923. Transportation has been by trucks wherever possible, 2-ton trucks with pneumatic tires having been found to give the best results. In the mountain sections, which compose roughly a third of the distance, resort was had to wagons, pack animals, or even the men's backs, where necessary. All equipment was selected to combine greatest efficiency with easiest transportation and the actual field results showed that this policy was warranted.

System Dispatcher Controlled Operations

Work has at all times been under the control of the system dispatcher, who in emergency would clear the construction men from the line in an hour or two. At night all work has been left in complete operating condition. Each crew foreman got clearance from the dispatcher before going to work and cleared his crew at night after accounting for all men and ground cables. The work has been accomplished with a minimum of interference with operations, a minimum of loss due to line drop and a maximum of speed and economy. Reconstruction of the Big Creek transmission lines for 220,000-volt operation has effected a great saving in cost over what additional lines would have cost to carry the same amount of power.

The reconstruction was successful because of the careful preliminary studies made to secure the best organization and equipment and in addition the use of competent men in the field.

Electric Furnace Tests*

Determination of Furnace Phenomena — Operating Data in Making Alloy Steels—Electrodes, Heat Losses and Effect of Dual Voltages

BY EDWARD T. MOORE
Electrical Engineer Halcomb Steel Company, Syracuse, N. Y.

AN ELABORATE series of tests were made on a standard 6-ton counterweight type of Heroult furnace in the Halcomb Steel Company plant under the auspices of the electric furnace committee of the Association of Iron and Steel Electrical Engineers. These tests were designed to afford a thorough study of heat losses in furnaces, operating data on electrodes, the merits of dual voltages, the effect of high voltages for melting purposes and electric furnace phenomena.

The furnace used was supplied by three 500-kva. transformers, 11,300/120 volts, with delta connection for meters and star connection on the high-tension side during refining to give 70 volts on the secondary, inherent reactance 5 per cent. In addition, three 25-kva. external 3 per cent reactors were used on the incoming lines, with switching arrangements for cutting them in or out as desired.

Some data on the furnace operation are:

1. Phase balancing exists on an individual furnace. The maximum unbalancing in the tests was 340 kw., or 21 per cent of the connected load. This effect was practically instantaneous.

2. During the melting period the greatest value of current obtained was 1.1 times normal. With the electrodes submerged in the bath the greatest short-circuit current was 3.66 times normal.

3. High-frequency waves of the order of 5,000 cycles are set up by the arcs in the furnaces as shown by oscillograms. The primary current and voltage waves are considerably distorted by higher harmonics, and rectification is indicated by the flattened character of the wave as it passes through zero. No resonant condition was observed in any of the tests.

4. External reactance in furnace line will reduce the power factor and the amplitude of load peaks of swings; also, harmonics will be somewhat smoothed out.

5. During the melting period the power factor averages 90 per cent, during the refining period it averages 88 per cent, and for the entire heat the average power factor is 89 per cent.

6. Furnace transformers should be built with 5 per cent inherent reactance and variable-tap external reactors are advisable, particularly on 25-cycle circuits.

7. It is advisable to get at least 27 in. clearance from the refractories for all the electrodes in this type of furnace and to increase the capacity of the transformers to 2,000 kw.

8. From the standpoint of disturbance to power systems caused by fluctuations and from a speed-of-production standpoint, it would appear that a 25-ton furnace with a connected transformer capacity of 4,500 kva. on a 25-cycle circuit is as large as should be installed when melting is done with one set of electrodes. For hot-metal works a 40-ton furnace with 3,300 kva. capacity and 24-in. electrodes is very satisfactory. For melting furnaces using one set of electrodes on 60-cycle circuits 15 tons is the maximum size recommended, but 40-ton furnaces may safely be used for hot-metal work.

9. The relative merits of 25 cycles and 60 cycles for furnace work are still to be determined. More reactance must be used on 25 cycles, but more energy may be admitted to the furnace. Arcs on 60 cycles have a greater tendency to persist than arcs on 25 cycles. There is an unsubstantiated impression that 60-cycle arcs produce less cutting action on refractories.

10. Short circuits in furnaces do not generally occur across all phases at once. The unbalancing effect will not cause any disturbance to a power system of adequate capacity.

11. Circuit breakers for furnaces should be based on the total kva. which can be concentrated at the terminals of the transformers.

12. The higher the speed of electrode travel, the faster the melting and the greater the load factor.

An elaborate series of readings, oscillograms, photographs and graphic charts were obtained which afforded accurate data for making the test analyses.

Summarized results of the tests are given in the two tables for chrome-nickel steel and nickel steel respectively.

Heat No. 14612. CHROME NICKEL STEEL August 1, 1922.
(Composed of boiler clips and punchings, washed metal and small amount o mixed scrap.)

Total time to charge (by hand)	36 min.
Length of melting period	2 hr. 40 min.
Length of refining period	2 hr. 50 min.
Total length of heat	5 hr. 30 min.
Power used for melting	3,460 kw.-hr.
Power used for refining	1,940 kw.-hr.
Total power for heat	5,400 kw.-hr.
Total net weight of ingots	13,560 lb.
Power per net ton of ingots	803 kw.-hr.

ANALYSIS OF METAL

Carbon Between	Silicon Under	Manganese Under	Phosphorus Under	Sulphur Under	Chromium Between	Nickel Between
0.10-0.17	0.32	0.50	0.025	0.025	1.00-1.50	3.75-4.25

Heat No. 14620. NICKEL STEEL August 3, 1922.
(Composed of boiler clips and punchings, washed metal and mixed scrap.)

Total time to charge (by hand)	45 min.
Length of melting period	2 hr. 40 min.
Length of refining period	1 hr. 55 min.
Total length of heat*	4 hr. 35 min.
Power used for melting	3,380 kw.-hr.
Power used for refining	170 kw.-hr.
Total power for heat	3,550 kw.-hr.
Total net weight of ingots	12,900 lb.
Power per net ton of ingots	550 kw.-hr.

ANALYSIS OF METAL

Carbon Between	Silicon Under	Manganese Under	Phosphorus Under	Sulphur Under	Nickel Between
0.10-0.15	0.35	0.50	0.025	0.025	2.75-3.75

*Twenty-five minutes' delay to patch furnace; ten minutes' delay to place new electrode.

*Abstract of paper presented before the Association of Iron and Steel Electrical Engineers at Buffalo, Sept. 24-28, 1923.

Electrification of Michigan Mines

Construction plans of the Oliver Mining Company provide for opening what, it is said, will be the deepest and in all probability the largest iron mine in the world in the Gogebic iron range between Ironwood and Bessemer, Mich. It will be called the Geneva mine. Announcement has been made by officials of the company that the entire mine will be electrically operated throughout, and this electrical equipment will be extended to the Puritan and Davis mines when they are united to the Geneva mine. Other plans of the company provide for an underground electric railway system.

High-Pressure Steam Systems

Design and Arrangement of Boilers, Economizers and Superheaters in Plants Using These High-Pressure Devices—Discussion of the Problems Connected with Automatic Temperature Control

By D. S. JACOBUS*
Advisory Engineer Babcock & Wilcox Company

BOILERS built for 1,200-lb. working pressure will be supplied with individual steam turbines. It is the idea to generate eventually all of the steam for a power plant with high-pressure units and, after passing the steam through several of the high-pressure steam turbines, to pass the exhaust steam from these high-pressure steam turbines to a main steam turbine. The steam supplied to the high-pressure steam turbines is superheated to say 725 deg. F. by primary superheaters. The exhaust steam from each of the high-pressure turbines is returned through a secondary superheater at a pressure of about 300 lb., is resuperheated to about 725 deg. F. and is then supplied to the main turbine. The individual high-pressure steam turbines, therefore, serve to reduce the pressure of the steam from the initial rating of 1,200 lb. to that used at the main steam turbine. With the economical main steam turbine operated with the exhaust steam from the high-pressure steam turbines the amount of power generated by the latter would be 20 to 25 per cent of that generated by the main steam turbine. Should the main steam turbine be run at a lower pressure than 300 lb. and at a lower temperature than 725 deg. F., the gain through using the high pressure would be increased and might reach, say, 30 per cent or more. There is a possibility, therefore, of revamping present power stations and considerably increasing their efficiency through using the high-pressure units with individual steam turbines and exhausting the steam into the present steam mains. In order to warrant the additional investment necessary for installing the high-pressure boilers in an old plant it would be necessary to have a very steady load, or what is known as a "base-load condition." The investment would not be warranted under present conditions for a widely fluctuating load.

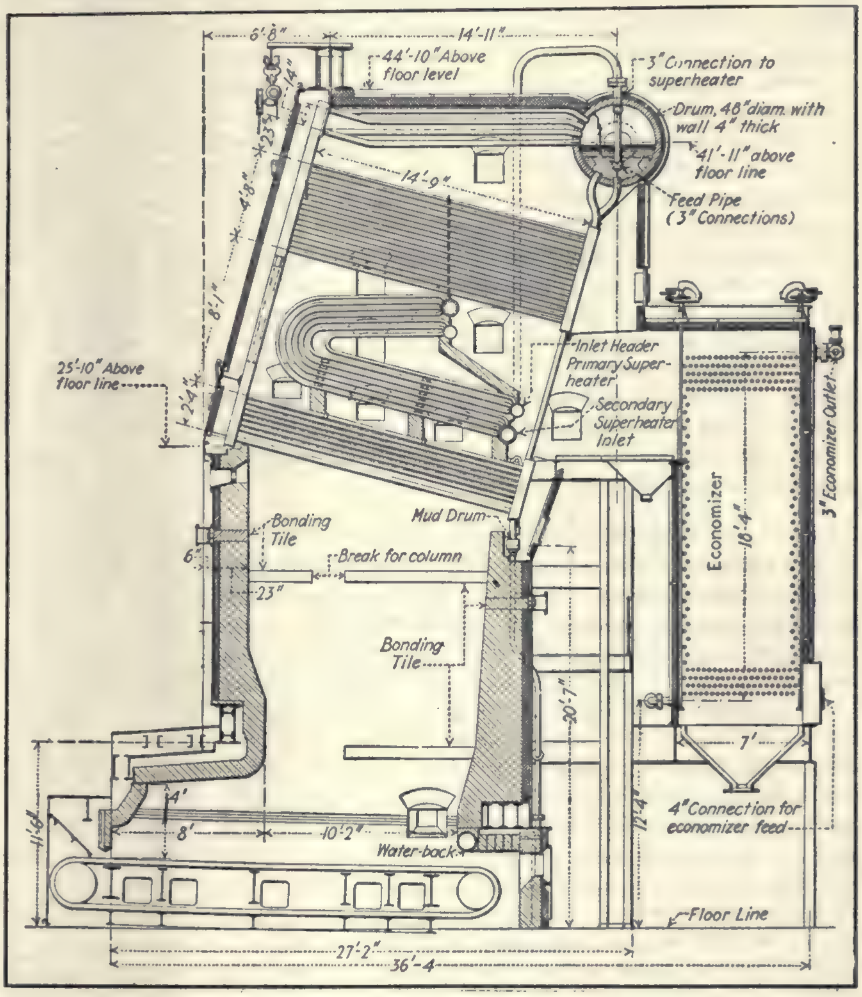


FIG. 1—GENERAL SECTION OF 1,200-LB. HIGH-PRESSURE BOILER

In place of using individual high-pressure steam turbines for each boiler, the high-pressure steam from a number of boilers could be used for larger high-pressure turbines. Experience alone can demonstrate which system will be best, and no one can say what plan will be adopted in the future in the effort to secure higher and higher efficiencies. There will no doubt be difficulties that cannot be foreseen to be worked out, and those who are pioneers in installing high-pressure units of the sort should be commended for their willingness to spend the time and money that will be necessary in their development.

If it were possible to maintain absolutely tight surface condensers, it would be unnecessary to clean the interior of the boiler tubes and the problem of designing high-pressure boilers for power-plant service would be greatly simplified. Under present conditions there is always a chance of leakage at the condensers, either at the tube ends or through the cracking or corrosion of the tubes, and this necessitates arranging the boiler so that it can be cleaned on the inside. Tight condensers and the use of a closed system would also overcome any

*Abstract of paper presented at the seventeenth annual convention of the Association of Iron and Steel Electrical Engineers, Buffalo, N. Y., Sept. 24-28, 1923.

trouble through corrosion due to oxygen in the feed water on the interior of the economizers and boilers. The fact remains, however, that leakage in condensers has not as yet been overcome, and the problem both of cleaning the interior of the tubes and of removing any excess oxygen from the feed water must be faced in all cases.

The effect of temperature on the lowering of the elastic limit of steel has been referred to by engineers as something that might give trouble in a high-pressure steam boiler. At a temperature of about 750 deg. F. the elastic limit may drop to half that obtained at ordinary room temperatures, and it is important that the effect of this falling off be understood. The temperature of the saturated steam corresponding to 1,200 lb. pressure is somewhat less than 570 deg. F., and at this temperature the strength of the steel is higher than at ordinary room temperature and the elastic limit is about the same or only slightly lower, so there need be no apprehension with respect to the boiler proper. The only part that is affected through being brought to a temperature that would cause any material difference in the strength or the elastic limit of the steel is the superheater. Of all parts of a boiler the superheater is the safest as far as its liability to injure any one or to cause property damage is concerned, as the worst that might happen in case the superheater became overheated would be to burn out or blow out some of the tubes, and this would not ordinarily result in any damage other than to the superheater itself.

Temperature Affects Elastic Limit

The effect of a rising temperature is first to increase the tensile strength of steel from, say, 10 to 20 per cent and afterward to decrease it, and at 700 deg. F. the tensile strength is about the same as at ordinary room temperatures. At 750 deg. the tensile strength falls off, say, 10 per cent below what it is at ordinary temperature, and the elastic limit is about one-half what it is at ordinary room temperatures. In a complicated structure used under pressure at 750 deg. F. the falling off in the elastic limit would result in a liability of leakage, and in such a structure it might be well to use a factor of more than five based on the tensile strength. In a structure like a superheater, however, there would seem to be no necessity of providing a factor of safety of more than five based on the tensile strength. We have become so accustomed to the use of factors of safety in boiler construction relatively high compared with those used in some other lines that there is danger of overdoing matters to make sure of being on the safe side. When one considers the relatively low factors used in the design of large guns and for torpedo tubes carrying very high pressures, one feels a great deal safer when it comes to boiler design. Again, in the work we have done in designing and building oil stills and tanks for use at high pressures and a temperature of 825 deg. F., a careful study has been made of the falling off of strength and elastic limit and of the practice in still design that has been found to give safe results, and all this increases confidence that the factors of safety we are using in boiler and superheater design are ample.

As superheated steam of higher and higher temperatures is being used in power plants the time is approaching when it may be necessary to provide some automatic means for preventing the temperature from exceeding a certain figure. It has been the general practice to run at a temperature which can be exceeded for a time without giving trouble. The Babcock & Wilcox Company made experiments more than ten years ago to develop an apparatus for attemperating superheated steam and maintaining the temperature at a given figure, provided the initial temperature of the steam entering the attemperator was at a somewhat higher temperature than the steam discharged. It was found entirely practicable to hold the temperature within a range of, say, 5 deg. or 6 deg. F., between the highest and lowest points by spraying a regulated amount of water into the superheated steam. The apparatus consisted of a vessel containing water placed in the exit pipe conducting the superheated steam away from the attemperator. There was a definite pressure generated in the vessel for each particular temperature through boiling the contained water, and this pressure acted on a diaphragm and actuated an apparatus for admitting more or less water to the superheated steam. The temperature of superheated steam that could be handled in this way was limited to, say, 650 deg. F. For higher temperature than this it was proposed to use mercury in place of water in the vessel.

Applying this principle in another way, soon after experimenting with the attemperating device the idea was applied to an independently fired superheater as a superheat-limiting device where, on the temperature rising to a given point, doors were opened in the setting for admitting cold air. This arrangement proved to be entirely reliable through trials made every twenty-four hours, when the temperature was purposely raised to the point for which the apparatus was set. An interesting feature developed as it was found possible to operate the independently fired superheaters much more closely through observing the pressure in the vessel containing the water than by reading a thermometer. The vessel consisted of a coil having a considerable surface in contact with the superheated steam in proportion to its volume, and an attached pressure gage indicated changes in temperature much more effectively than a thermometer, as the change in pressure due to the boiling of the water was greater than the corresponding change in the temperature. For example, raising the temperature from 490 deg. to 500 deg. F. resulted in raising the pressure 62 lb. per square inch, so that there was a change indicated by the pressure gage of about 6 lb. for each degree Fahrenheit. It was found that the superheater could be operated at such a constant exit temperature through observing the pressure gage that a recording thermometer placed on the outlet gave practically constant readings.

Holding Temperature Constant

An apparatus of the sort could be used for attemperating the steam and holding it at a given temperature, or it could be used as a limiting device to reduce the superheat in an emergency without attempting to maintain the temperature of the steam at a given figure.

In the latest boilers for high-pressure and high-temperature superheated steam built by the Babcock & Wilcox Company the superheater is placed above a series of tubes in a drop leg and below the main body of tubes of the boiler. A superheater properly arranged in this position in a properly designed boiler gives a more constant degree of superheat at different ratings than if

placed in the ordinary position above the boiler tubes and permits a higher degree of superheat to be obtained with a given amount of superheating surface, and for the temperature of superheated steam now employed the superheat obtained with a superheater of the sort is near enough constant for use without an attemperating device.

There is little gain in economy in increasing the steam pressure to a higher point than 350 lb. per square inch without interstage heating of the steam; that is, the steam from one stage of the turbine must be withdrawn from the turbine, resuperheated and returned to the following stage of the steam turbine. Interstage heating necessarily involves additional conplication and added expense, and the possible difficulties in operation due to the additional complication have an important bearing on the use of the higher steam pressures.

DESCRIPTION OF BOILERS

The boilers being built for 1,200 lb. pressure are of the general form shown in Fig. 1, which is illustrative only as certain features of the tube arrangements may be changed. In developing this boiler we had before us the results obtained with the use of 1-in. tubes in a great number of our White-Forster marine boilers for destroyer service and the results of the experiments with the series boiler. A great number of different arrangements were laid out and considered, and the one finally adopted was that shown in Fig. 1, which approaches very closely to a standard Babcock & Wilcox boiler.

In this boiler the steam-generating tubes are 2 in. in diameter, which is a convenient size for internal cleaning, whereas it is difficult, if not impossible, to clean properly tubes say of of 1 in. diameter and smaller. The steam and water drum, which is 48 in. in internal diameter and of forged seamless steel construction, provides a reserve water capacity, making it easy to operate the boiler under all sets of conditions, such as starting up and under variable loads, and making it unnecessary to provide pumps having 100 per cent reliability, such as would be necessary for a series boiler. The tubes are arranged so that they can be thoroughly cleaned on the outside from between the diagonal lanes. The feed water from the economizer passes directly into the boiler, which makes it necessary to build the economizer for a somewhat higher pressure than the boiler. The economizer is made of 2-in. seamless-steel tubes expanded into forged-steel boxes. The boxes are spaced apart to allow the removal and replacement of the economizer tubes from between the boxes with the tubes at an angle, which allows the tubes to be removed and replaced with a relatively narrow aisle width. The ends of the horizontal circulating tubes of the boiler are bent so that they enter the drum in circumferential lines which are twice as far apart as the distance between the horizontal circulating tubes where they enter the headers. There are two circulating tubes running from the top of each uptake header to the steam and water drum. The A. S. M. E. code was closely followed in designing the boiler, but certain features of the forged-steel drum are not covered in the code. The general character of the steel used in the boiler plate conforms closely to the code specifications and the maximum allowable stress is taken at 11,000 lb. per square inch.

Roller and Ball Bearing Motors*

Viewpo'nts of Users, Builders of Motors and Builders of Bearings—Trend Toward Standardization and Still Greater Use

BY D. M. PETTY
Electrical Superintendent Bethlehem Steel Company

THE committee on bearings of the Association of Iron and Steel Electrical Engineers during the past year made a careful study of the problem of applying roller and ball bearings to motors. It held one joint meeting with a committee representing the Power Club and appointed to study the same problem. The following are some of the "high spots" which came out in the discussions classified according to users of motors, builders of motors, and builders of bearings.

Among the users of motors there are a relatively small class who have used ball or roller bearings in motors. A vast majority of this class are very enthusiastic over the results obtained. They have had some bearing failures, but have been able to explain these failures satisfactorily and have rather definitely fixed the causes for the failures. A few of these are: (1) Improper mounting; (2) improper size of bearing; (3) grounded armatures†; (4) improper lubrication. Item (4) may be divided into: (a) Improper lubricant; (b) lack of sufficient quantity of the proper lubricant.

There are a much larger class who believe in ball or roller bearings but who have hesitated to put them into service because of insufficient information and because the motor builder does not urge their use and, when asked for a quotation, makes the price almost prohibitively high. Users of this class are in general merely waiting for the first class to say more about their experiences, and for the motor builders to come out with a definite recommendation for the roller or ball bearings.

There is a third relatively small class who do not believe in ball or roller bearings, primarily because they feel that the sleeve bearing, as now in general use, is satisfactory and meets the needs of their particular industry. As a whole, this class are using motors on relatively easy work or else do not know the real causes of their motor failures.

BUILDERS OF MOTORS

In the motor builders there are also three classes:

1. Those who have used ball bearings extensively. These builders usually report good results, and where a standardized method of mounting has been worked out do not quote excessively high prices for motors equipped with ball bearings when compared with their prices for sleeve-bearing motors.

2. This class of motor builders include those who believe that ball or roller bearings can be successfully applied and are entirely willing to furnish motors equipped with these bearings, provided the motor user will pay the bill. The bill is high because no standardized method of mounting has been worked out.

3. There are the motor builders who believe that motors are good enough with the present type of sleeve bearing and who furthermore believe that if bearing improvements are necessary, such improvements can be made in the sleeve bearing. Their arguments against

*Abstract of the report of the special bearing committee of the A. I. and S. E. E. at Buffalo, Sept. 24-28.

†In this connection, however, it should be noted that with ball bearings a smaller number of armatures are grounded in a given length of time.

ball bearings include those of excessive cost of changing existing designs and excessive cost and difficulty of doing the accurate machine work necessary in mounting the ball or roller bearings.

Builders of Bearings

With the builders of bearings the ball bearing has been standardized internationally. This standardization includes three general weights of bearings, the light, medium and heavy. Each of these three general classifications includes many varieties. This standardization does not include the size of ball or shape of race, but the outside diameter of the outer race and the inside diameter of the inner race; in other words, the international standards make the mounting dimensions of ball bearings entirely interchangeable from one manufacturer to another. The ball-bearing industry is to be congratulated upon its excellent work along this line.

Roller bearings of the large diameter, short-length, solid type have been somewhat standardized along the same line. There is, however, still room for improvement in the standardization of roller bearings. There are several lines of roller bearings on the market which are interchangeable with the medium series of ball bearings.

Ball or roller bearings properly mounted are good or bad, depending upon the accuracy of the grinding. Great improvements have been made in the past five years along this line. It seems that the ball-bearing builders in general have made more progress than the roller-bearing builders. However, the latter are rapidly catching up, and even now no trouble results from this cause.

The use of ball and roller bearings is constantly increasing; consequently the manufacturing facilities have been constantly increasing also, so that the cost of the finished bearing has been decreasing and should continue gradually to decrease.

Roller bearings of small diameter and great length do not line up with the ball bearings as well as the roller bearings of large diameter and short length. Therefore the standardization of this general type of roller bearing has not advanced to the same extent. Owing to the marked difference between this type of bearing and the ball bearing, it will very likely be found necessary to make a separate standardization.

As stated above, these are only the "high spots" of the information which has come into the hands of the committee, but they will serve as a general guide to any one who is making a study of the situation. It should be emphasized, however, that within any series of bearings there lies a wide choice of design, ranging from the shallow flat race with a small number of large diameter balls to the very deep race with a large number of small diameter balls. These various designs have their particular points of advantage which should be taken into consideration by the user as well as the builder of motors with the liberal co-operation of the bearing engineer.

Conclusions of Joint Meeting

At the joint meeting of the bearing committee, A. I. and S. E. E., and the Power Club the conclusions that follow were arrived at:

1. It was considered desirable to standardize bearings as quickly as possible so that motor users may install roller or ball bearings in existing motors and use sizes which will line up with standards to be used by motor builders in the future.

2. It was considered desirable and practicable to standardize on ball-bearing sizes that will be interchangeable with roller-bearing sizes so far as outside and inside diameter is concerned. Roller bearings in this discussion being limited to the solid-roller type, it was pointed out that while a roller bearing and ball bearing of the same inside and outside dimensions would be interchangeable from a mounting standpoint, the roller bearing would almost invariably be capable of carrying a somewhat heavier load.

3. After a general discussion it was considered advisable to adopt the standard ball-bearing sizes of the 300 series, and that the roller bearings be made to conform to these sizes so far as inside and outside dimensions are concerned.

4. It was thought advisable that the number of sizes standardized upon for motors be limited to the smallest practicable number so as to reduce the number of spare bearings necessary to stock for protection against breakdowns.

5. It was agreed that no attempt should be made to standardize on any particular size of bearing for a given frame size of motor of any given horsepower rating or speed, it being held that the selection of the sizes for any line of motor should be left in the hands of the designing engineers.

Sizes Selected for Bearings

In line with paragraphs 3 and 4 above, the association committee set up the tentative list of sizes shown in the table. This list of sizes will take care of motors up to an approximate rating of 150 hp. The committee desires a full discussion of this selection, not only from the builders of motors, but from the builders of bearings, as well as from the users of motors. It should be pointed out that while it is desirable to have the number of sizes held down to the irreducible minimum, it would be unwise to unduly penalize certain sizes of motors by compelling the designing engineer to use a bearing much too large. On the other hand, it should be pointed out that one of the pitfalls into which motor designers most frequently fall is that of using a bearing too light for the hardest service in which the particular motor under consideration eventually finds itself.

MOUNTING DIMENSIONS OF RACE

	Inside Diameter (In.)	Outside Diameter (In.)		Inside Diameter (In.)	Outside Diameter (In.)
304	0.7874	2.0473	317	3.3465	7.0866
305	0.9843	2.4410	320	3.9370	8.4646
307	1.3780	3.1493	323	4.5276	9.8426
309	1.7717	3.9370	329	5.7087	12.2047
311	2.1654	4.7244	336	7.0866	14.9606
314	2.7559	5.9055			

The committee recommends that each association section save a place on its program for the coming year for one paper discussing the general subject of ball and roller bearings, because it is recognized that only by a thorough discussion of the subject will the best possible solution be reached. The data which will naturally come out in these discussions should then enable the bearing committee for the following year to reach a definite conclusion as to the minimum number of sizes which can be used for motors up to 150 hp. Above this size it will probably be best to give the motor designer a little more freedom than in the smaller sizes. However, this question can be more definitely settled after a year's discussion.

Relation of Illumination to Production*

Tests in Green Inspection Department at the Columbus Plant of the Timken Roller Bearing Company Show Marked Effect — Production Increased 12.5 per Cent at Cost of 2.5 per Cent of Payroll

By D. P. HESS† and WARD HARRISON‡

THIS test was conducted in an effort to establish what relationship, if any, exists between illumination and production in a roller-bearing plant. About 15 per cent of all those employed in the plant are inspectors, and the section chosen for the test was known as the green inspection department. The nature of the work in this department consisted of inspecting the material in the green, i.e., just as it was turned out by the automatic screw machines and before heat treating. The material inspected, as illustrated in Fig. 1, consisted of various sizes of cups, cones and threaded cones, which are separate parts of a roller bearing.

The work is carried on in three stages. The first group of inspectors gage the material for diameter and depth; the second inspect for defects such as chatter, tool marks, ingot breaks, thin ribs and bad chamfer, and the third group inspects for imperfections in the thread on the inside of the cones, bad mill, bad chamfer and inadequate burnishing. Some of the work, such as the inspection of threaded cones, ingot breaks and chatter marks, requires close visual inspection, while in some of the gaging, which is done by means of indicating and limit gages, as shown in Fig. 1, relatively little use is required of the eyes.

The personnel of this department at the time the test was begun consisted of a foreman, a clerk and thirty-eight inspectors. This number varied each week, the average number of inspectors during the test being forty-four. Table I shows the weekly change in personnel of the department during the entire test.

*Presented at the 1923 convention of the Illuminating Engineering Society.

†Manager of the Columbus (Ohio) Plant of Timken Roller Bearing Company.

‡Illuminating engineer National Lamp Works of the General Electric Company.

The area occupied by the green inspection department has dimensions of approximately 30 ft. x 60 ft. and is near one corner of a large one-story building covering about 6 acres (Fig. 3). The lighting system in this department at the beginning of the test consisted of six outlets, four of which were equipped with 200-watt clear lamps and two with 150-watt clear lamps. The six lamps were equipped with enameled steel reflectors and gave an average illumination of about 2 foot-candles. The distribution of light, however, owing to wide and irregular spacing of the units, was uneven and caused bad shadows.

TABLE I—DETAIL OF EMPLOYEES DURING THE TEST OF THE EFFECT OF ILLUMINATION ON PRODUCTION AT THE COLUMBUS PLANT OF THE TIMKEN ROLLER BEARING COMPANY

	February 15-21	February 22-28	March 1-7	March 8-14	March 15-21	March 22-28	March 29-April 4	April 5-11	April 12-18	April 19-25
Total inspectors	38	48	43	43	41	45	45	46	48	43
New inspectors hired...	8	12	7	7	1	6	5	4	6	1
Inspectors' services discontinued...	2	12	7	3	2	5	3	4	6	6

The department is so located that it receives daylight from windows at a distance on one side and from skylights in the saw-tooth roof construction. During the greater portion of the time through the first two weeks of the test the lighting system was used as a supplement to the natural daylight. The resulting average illumination in the test section for this period was approximately 5 foot-candles.

The new system (Fig. 3, No. 3) consisted of 28 "Glassteel" diffusers on 8-ft. x 10-ft. centers and mounted 12 ft. from the floor. This type of lighting

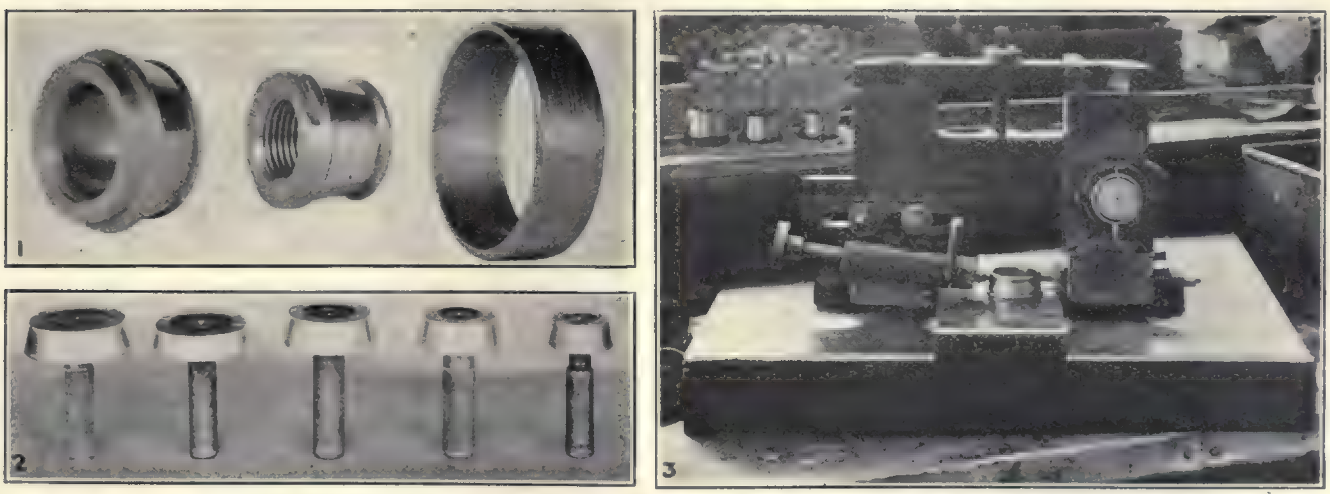


FIG. 1—LIMIT AND INDICATING GAGES FOR TESTING VARIOUS MATERIALS

No. 1 shows some of the type of materials inspected during the test. Limit and indicating gages are shown in Nos. 2 and 3 respectively. These gages require relatively little use of the eyes and give very accurate results.

TABLE II—SCHEDULE OF THE TEN WEEKS' TESTS, SHOWING THE PERIODS FOR EACH INTENSITY OF ILLUMINATION

Week	Old Lighting, 5-Foot Candles	New Lighting, 6-Foot Candles	New Lighting, 13-Foot Candles	New Lighting, 20-Foot Candles
Feb. 15-21	X			
Feb. 22-28	X			
Mar. 1-7				X
Mar. 8-14			X	
Mar. 15-21		X		
Mar. 22-28			X	
Mar. 29-Apr. 4				X
Apr. 5-11		X		
Apr. 12-18				X
Apr. 19-25			X	

TABLE III—PERCENTAGE OF SUNSHINE RELATIVE HUMIDITY AND INTERIOR TEMPERATURE DURING THE TESTS

This information was taken in the effort to determine whether these conditions have any effect on production.

Week	Per Cent Sunshine	Relative Humidity	Interior Temperature
Feb. 15-21	63.0	...	...
Feb. 22-28	22.0		
Mar. 1-7	61.0	66.4	74.8
Mar. 8-14	69.0	63.8	72.0
Mar. 15-21	58.0	66.5	71.0
Mar. 22-28	47.0	68.6	72.3
Mar 29-Apr. 4	62.0	71.0	71.6
Apr. 5-11	76.0	70.3	72.0
Apr 12-18	52.0	68.3	72.4
Apr. 19-25	90.0	65.5	72.7

TABLE IV—TOTAL PER WEEK, NUMBER OF HOURS AND AVERAGE PIECES INSPECTED PER PERSON PER HOUR

More than 7,300,000 pieces were inspected during the tests.

Foot-Candles	Total Pieces Inspected	Total Inspection, Hours	Average Pieces Inspected per Person per Hour
Old system:			
5.0	684,164	1,644	415
5.0	581,709	1,449	400
New system:			
20.0	681,621	1,476	462
12.8	708,559	1,620	437
3.7	739,627	1,778	415
11.9	735,316	1,698	432
20.2	763,762	1,737	440
6.2	809,631	1,866	434
20.2	842,138	1,783	472
13.5	766,796	1,700	451

unit (No. 5) has an inclosing globe that entirely surrounds the lamp, producing an even distribution of light with soft shadows and a noticeable absence of objectionable specular reflection. The lighting effect obtained is shown in No. 3. In an effort to maintain as uniform as possible the levels of illumination, the skylights in the saw-tooth roof were blackened.

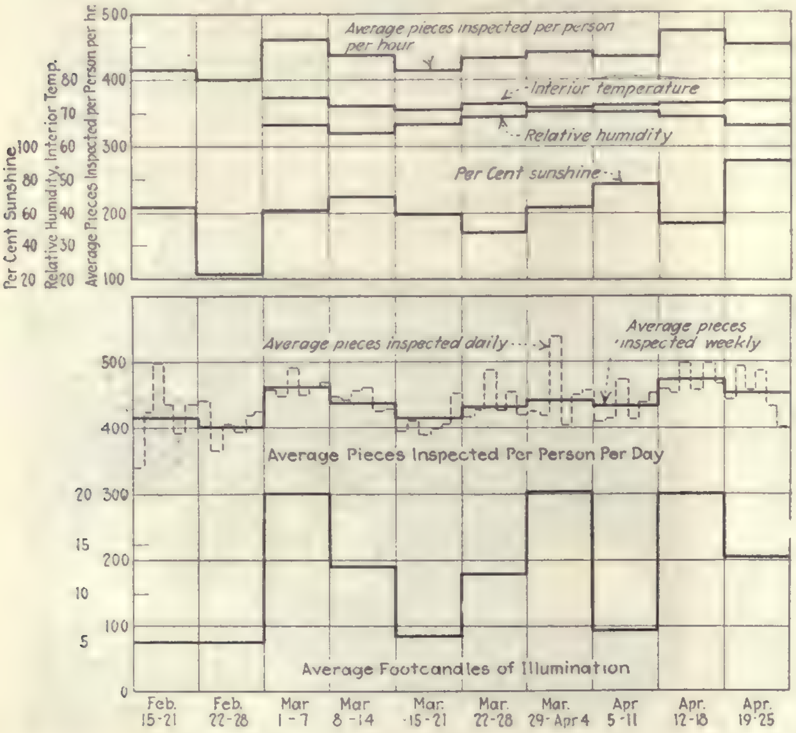
Procedure Followed

The test was planned to include investigations of the old system, a 6-foot-candle system, a 13-foot-candle system and a 20-foot-candle system. The test weeks in each case were begun on a Thursday and ended on a Wednesday, continuing for a period of ten weeks. Owing to the advancing season and much stronger daylight, it was found impossible to return to the original 5-foot-candle system obtained from the unobstructed skylight and six incandescent lamps. Table II gives the order of tests.

Records were available in the green inspection department which showed the number of pieces inspected per day with the total number of actual inspection hours. Often, especially in the case of overtime, an inspector is called upon to do general work in the department, such as moving containers and cleaning up. In that event his time is not shown on the inspectors' records, but only on the time cards. If an experienced inspector is required to instruct a new worker, the experienced inspector's time does not appear in the inspection records. All employees in this department are paid on an hourly basis.

The question has often been raised as to whether atmospheric conditions materially affect the output of factory workers. In an effort to obtain data on this point wet and dry bulb thermometer readings were taken four times a day at the test area and from these the relative humidity was calculated. The daily weather bureau record showing the percentage of sunshine, the exterior temperature and the amount of precipitation was also tabulated.

Table III and Fig. 2 show the percentage of sunshine, average weekly relative humidity and average weekly



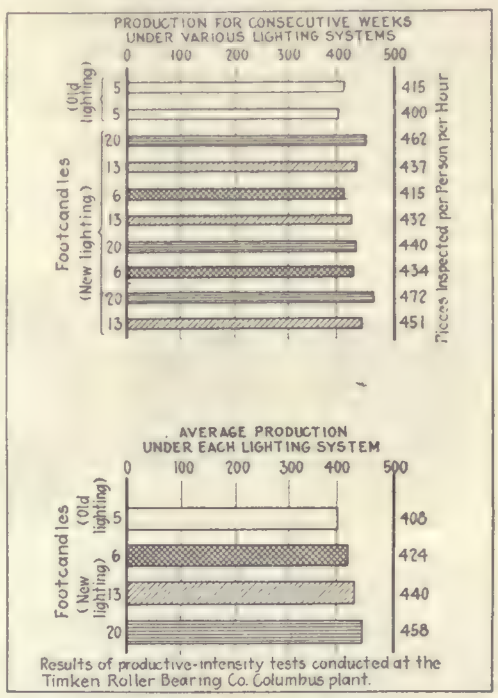


FIG. 2—EFFECT OF TEMPERATURE, HUMIDITY, SUNSHINE AND ILLUMINATION ON PRODUCTION

Left, top—Graphical presentation of production, temperature, humidity and sunshine conditions during illumination and production test at the Columbus plant of the Timken Roller Bearing Company.

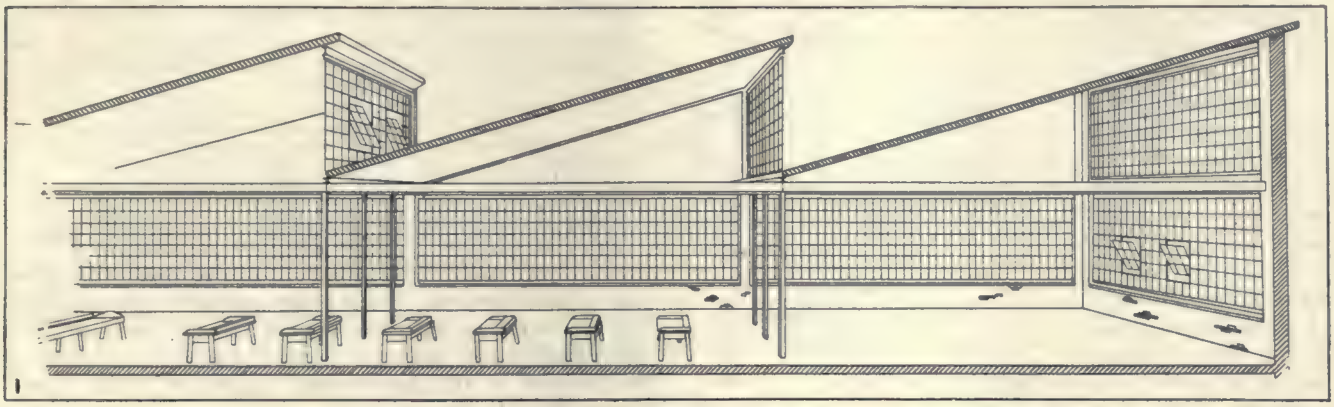
Left, bottom—Effect of illumination on production. Curves show the average of the tests.

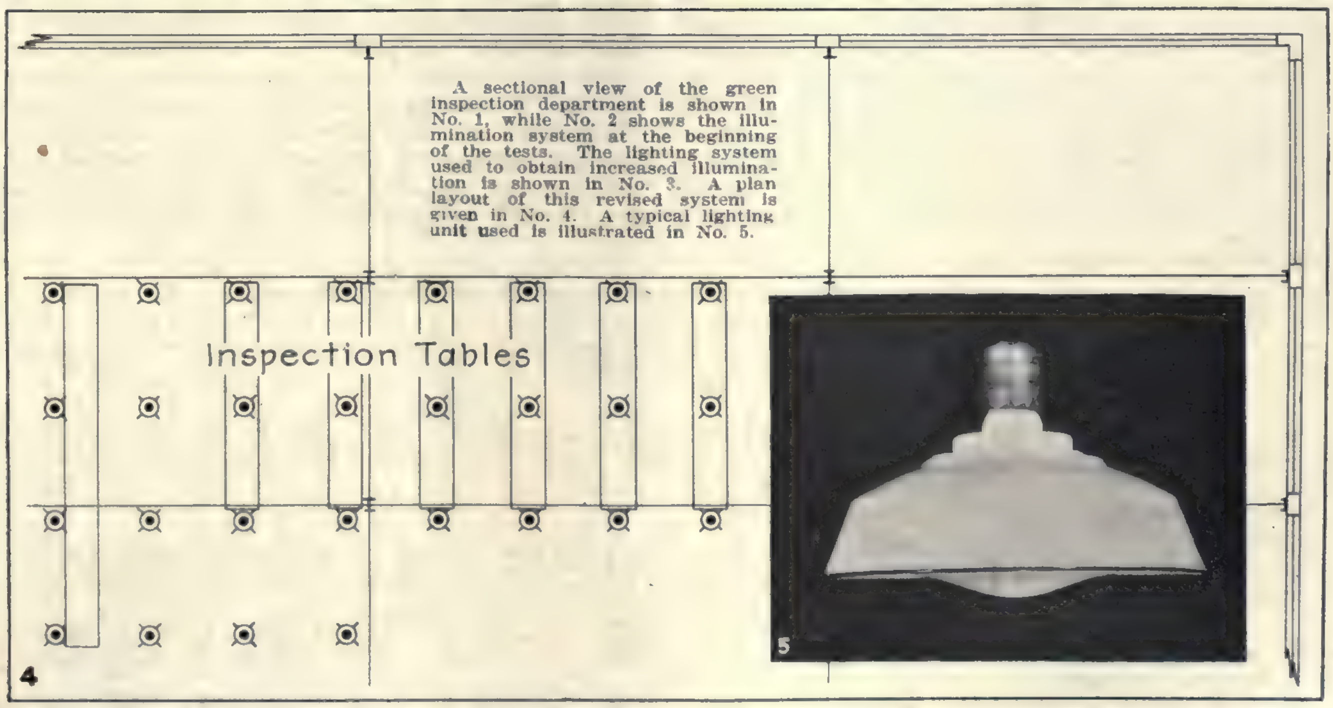
Right—Production for consecutive weeks under various lighting systems and average production under each lighting system.

interior temperature. It will be noted that the tests were run at a season of the year when artificial heat was necessary, and as a result both the interior temperature and the humidity were fairly constant. There was a considerable variation in percentage of sunshine for the several weeks, but the variation apparently did not influence the production.

Table IV shows the total number of pieces inspected and the number of actual inspection hours for the department during each of the ten weeks of the test. The total number of pieces inspected was 7,313,323. Table V shows the average of all weeks under the same lighting system with the percentage increase in production.

These results are shown graphically in the four charts of Figs. 2 and 4. The tests furnish apparently conclusive proof that in the class of work carried on in the green inspection department the production is materially affected by the character of illumination supplied.





A sectional view of the green inspection department is shown in No. 1, while No. 2 shows the illumination system at the beginning of the tests. The lighting system used to obtain increased illumination is shown in No. 3. A plan layout of this revised system is given in No. 4. A typical lighting unit used is illustrated in No. 5.

FIG. 3—GREEN INSPECTION DEPARTMENT OF TIMKEN ROLLER BEARING COMPANY, COLUMBUS, IN WHICH THE ILLUMINATION TESTS WERE CONDUCTED

It will be noted that a well-designed system of illumination, giving approximately 6 foot-candles with a minimum of glare and of objectionable specular reflection, results in an increase of 4 per cent in production over that obtained under a faulty system which gave about the same average foot-candles. Likewise, an increase in illumination from 6 foot-candles to 13 foot-candles with a well-designed system results in a further 4 per cent increase in production. Increasing the illumination from 13 foot-candles to 20 foot-candles results in an additional 4.5 per cent increase, or, comparing the 20-foot-candle system with the one originally in use, a 12.5 per cent increase in production is found. The energy consumed with the 20-foot-candle system amounts to 8.4 kw., which at the rate of 3 cents per kilowatt-hour results in a cost of 25 cents per hour for energy, to which should be added approximately 7 cents for lamp renewals and other charges, making a total cost of 32 cents per hour. With the old 5-foot-candle lighting system, about half of which was daylight, the cost for energy and lamp renewals was 4 cents per hour. The inspectors receive an average wage rate of approximately 30 cents per hour, or for forty-four persons a total of $13.20 per hour. Now since a 12.5 per cent increase in production means that less men are needed to obtain 100 per cent production the number needed would not be 87.5 per cent, but 88.9 per cent, since the difference between 100 and 12.5 per cent plus 87.5 per cent times 12.5 per cent would give only 98.4 per cent production. The fallacy of this first reasoning can be seen since it would mean that no men would be required at all if production was increased 100 per cent, whereas only half as many are needed. This is easily shown from the algebraical equation

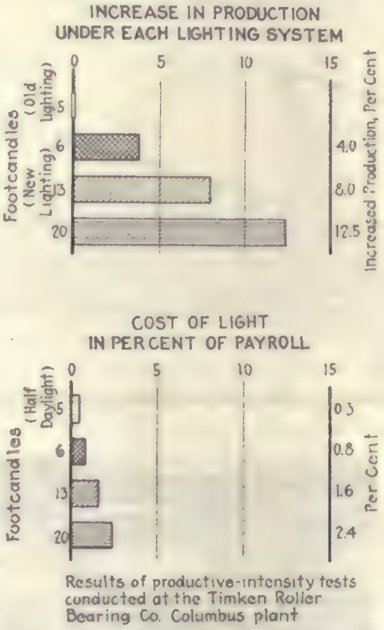


FIG. 4—INCREASED PRODUCTION OBTAINED AND COST IN PERCENTAGE OF PAYROLL

Where

$$x + 0.125\,x = 100 \text{ per cent.}$$

Then

$$x = 88.9 \text{ per cent.}$$

Accordingly if only 88.9 per cent men are needed where 100 per cent formerly were required there would be a wage saving of $13.20 minus $13.20 times 88.9 per cent or $1.47 per hour in labor, which is five times the added cost of the lighting. To put the matter in another way, the new lighting increased production 12.5 per cent at a total cost of less than 2.5 per cent ($0.28 ÷ $13.20) of the payroll of the department concerned, where forty-four people were employed.

TABLE V—AVERAGE PIECES INSPECTED PER HOUR AND THE INCREASE IN PRODUCTION FOR THE HIGHER ILLUMINATION INTENSITIES

Foot-Candles	Averaged Pieces Inspected per Person per Hour	Increase, Per Cent
20.0	458	12.5
13.0	440	8.0
6.0	424	4.0
5.0 (old system)	408	0

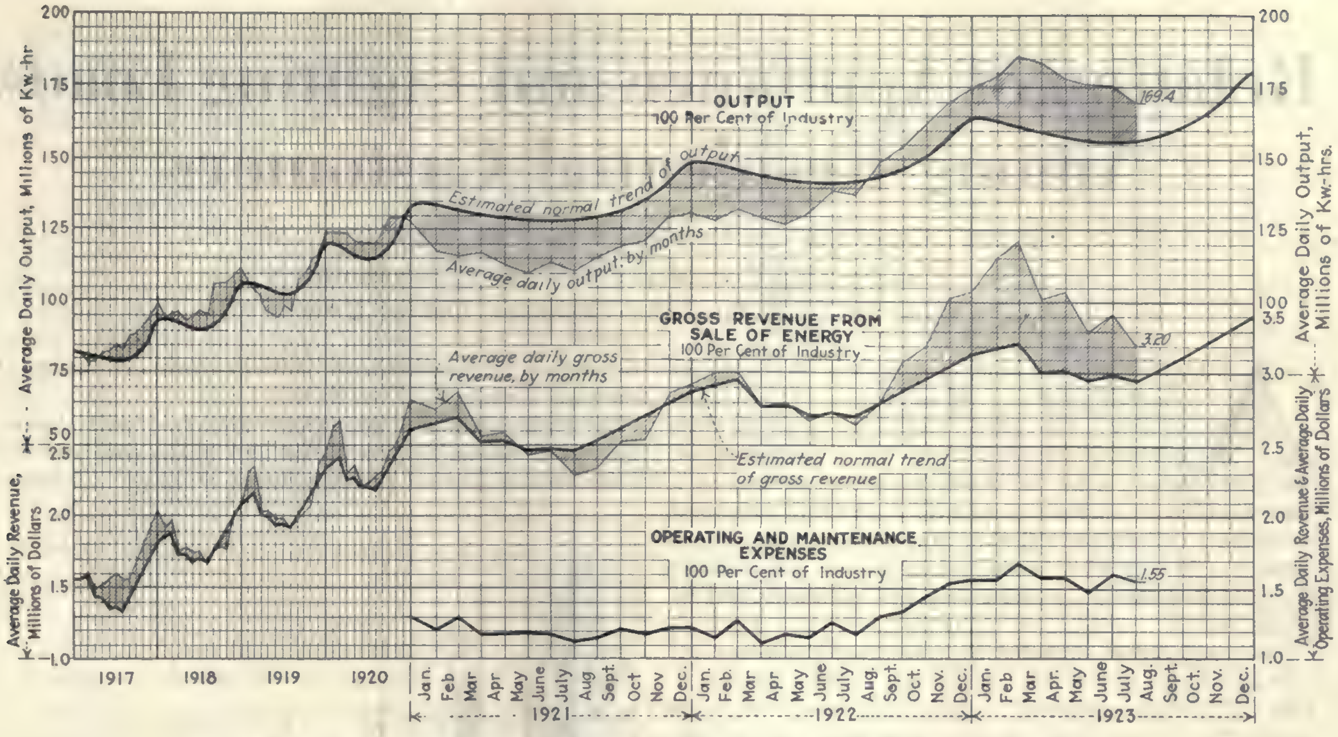
The authors desire to express their appreciation of the valuable services rendered by C. M. Snyder of the National Lamp Works in the conduct of the tests which have been described.

Seasonal Curtailment in Energy Consumption

REPORTS received by the ELECTRICAL WORLD for the month of July from central generating and distributing companies representing 76 per cent of the installed generator rating of the country indicate that the output in the aggregate was about 4.2 per cent below the output reported in June. According to government reports, several of the primary industries which purchase large quantities of electrical energy from the central-station companies were operating considerably below the point of activity reached in June, resulting in reduced energy requirements. It is probable that the addition of new electric lighting customers during July was more than sufficient to overcome any seasonal decrease in domestic lighting requirements and that the decreased output must be attributed almost wholly to decrease in the industrial energy

TABLE I—CENTRAL-STATION RETURNS BY SECTIONS OVER A THREE-MONTH PERIOD

Month	Percentage of Installed Ratings Represented	New England States			Percentage of Installed Ratings Represented	Atlantic States			Percentage of Installed Ratings Represented	North Central States			Percentage of Installed Ratings Represented	South Central States			Percentage of Installed Ratings Represented	Pacific and Mountain States		
		1923 Thousands	1922 Thousands	Per Cent Increase		1923 Thousands	1922 Thousands	Per Cent Increase		1923 Thousands	1922 Thousands	Per Cent Increase		1923 Thousands	1922 Thousands	Per Cent Increase		1923 Thousands	1922 Thousands	Per Cent Increase
KW-HR. OUTPUT:																				
May....	73	297,497	235,595	26.2	74	1,503,195	1,217,489	23.4	72	1,258,618	1,040,387	21.0	57	203,951	156,144	30.6	86	792,756	658,345	20.4
June....	73	282,003	236,456	19.3	75	1,460,008	1,187,480	23.0	72	1,253,203	1,060,924	18 1	57	197,744	156.952	26.0	87	778,819	681,212	14.3
July.....	73	289,950	225,965	28.4	76	1,468,154	1,167,906	25.8	73	1,219,776	1,042,352	17.0	57	195,989	158.765	23.5	89	816,539	707,088	15.5
REVENUE:																				
May....	73	$7,106	$5,815	22.2	69	$27,289	$22,634	20.5	62	$20,648	$17,152	20.4	56	$4,583	$3,871	18.4	87	$11,318	$9,575	18.2
June....	73	6,842	5,679	20.5	70	27,598	22,956	20.2	61	20,821	17,316	20.3	56	4,578	3,874	18.2	87	11,661	10,390	11.9
July.....	73	6,892	5,739	20.2	71	26,510	22,327	18.8	62	20,005	16,828	18.8	56	4,519	3.668	23.2	89	11,625	10,376	12.0
OPERATING EXPENSES:																				
May....	44	$2,159	$1,642	31.5	53	$9,477	$7,708	23.0	51	$8,672	$7,293	18.9	56	$2,293	$1,926	19.1	86	$3,908	$3,463	12.8
June....	44	2,463	1,763	39.7	57	10,621	8,747	21.5	51	8,852	7,832	13.0	56	2,328	1,972	18.0	86	3,747	3,435	9.0
July.....	44	2,551	1,762	44.7	58	10,656	8,709	22.4	52	8,828	8,029	9.9	56	2,341	2,027	15.5	87	3,952	3,634	8.7



THE CENTRAL STATION OUTPUT DURING JULY WAS 8.2 PER CENT ABOVE NORMAL AND THE GROSS REVENUE WAS 8.5 PER CENT ABOVE NORMAL

requirements. Notwithstanding this decreased energy consumption, however, the output of the central stations during July was 8.2 per cent above what would have been the seasonal energy requirement if the industry had been normal.

The gross revenue from the sale of energy during July also took a decided drop, the average daily revenue of $3,203,000 being the lowest reported since October of last year. This figure is, however, 8.5 per cent above what would have been the revenue if growth in the industry had been normal. The revenue reported for January of this year was 13.7 per cent above the estimated normal revenue for that month.

Every section of the country reported operations under those of June, but this curtailment was most noticeable in the industrial sections of the Middle Atlantic and North Central States, which was undoubtedly due to the fact that these sections are intensely industrial. During the midsummer months a large portion of the factories closed down for repairs and to cover the vacation period. This was especially noticeable this year on account of the high rate of production which had been maintained since last November. In the Mountain and Pacific section, on the other hand, the irrigation load was at its peak during June and July, and consequently there was little curtailment in the use of electric energy in this section during those months.

TABLE II—CENTRAL-STATION RETURNS FOR THREE MONTHS

Mos.	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting) 1923 Thousands	1922 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting) 1923 Thousands	1922 Thousands	Per Cent Increase
May..	74	4,056,017	3,307,960	22.6	69	$70,942	$59,059	20.1
June..	75	3,971,777	3,323,024	19.5	69	71,500	60,215	18.7
July...	76	3,990,408	3,302,076	20.8	70	69,551	58,938	18.1

Mos.	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies Reporting) 1923 Thousands of Dollars	1922 Thousands of Dollars	Per Cent Increase	Operating Ratio: Steam Plants 1923	Steam Plants 1922	Hydro Plants 1923	Hydro Plants 1922	Combined Systems of Steam and Hydro 1923	Combined Systems of Steam and Hydro 1922
May..	57	26,509	22,032	20.3	51.3	52.5	29.4	25.6	44.2	43.5
June..	58	28,011	23,749	18.0	50.2	54.2	28.0	26.4	43.7	44.9
July....	59	28,328	24,161	17.3	49.0	55.3	28.0	27.9	43.0	46.1

Electrolysis Survey at Galveston

THE final report of the Bureau of Standards covering its investigation of electrolysis conditions in Galveston has been completed and copies submitted to the utilities concerned. A somewhat unusual condition was found to exist in that city, although it is not unlike that prevailing in other places situated on low, sandy ground close to the sea. A considerable part of the area of Galveston has been filled in with sand dredged from the Gulf, and consequently the resistivity of the soil is extremely low, ranging around 100 ohms per cubic centimeter as compared with average figures of several thousand ohms commonly found in interior cities. Because of this extremely low soil resistance, some of the methods found effective in mitigating electrolysis in other cities were not adapted to conditions in Galveston. Improvements in track conditions were carried out and further improvements recommended as a result of these tests.

Supplementary to this improvement in track conditions, the investigation showed that a properly designed and restricted pipe-drainage system offered the best means of taking care of electrolysis conditions in Galveston. A pipe-drainage system was already in existence, but it was found to be improperly installed and for this reason in many locations the drainage system itself was a source of danger to the pipes. Detailed recommendations were made for a rehabilitation of the drainage system to afford proper protection to the pipe network without introducing serious local hazards.

Relation of Appliance and Lighting Loads Among Residential Customers

An Extensive Survey Conducted by the Association of Edison Illuminating Companies in Eight Cities Indicates Large Field for Increasing the Domestic Use of Energy

AT THE last two annual meetings of the Association of Edison Illuminating Companies, reports have been presented dealing with results of surveys of residence installations. The 1921 report dealt in detail with the results of a census of medium-class residences and their electrical equipment in several cities of the eastern part of the country. It included some estimates of the proportionate consumption of electricity by appliances and by lamps.

The 1922 report included in lesser detail a census of the electrical equipment of medium-class residences and of "above-medium" and "below-medium"-class residences in several cities of the eastern part of the country. It included estimates of the annual consumption of electricity by appliances and by lamps and also an actual determination for one week of the consumption by appliances and lamps in carefully chosen representative residences.

The cities in which these surveys were made and the number of residences surveyed in each city are shown in Table I. Some statistics of the residences surveyed are presented in Table II.

Extent to Which Residences Are Furnished with Appliances

Large differences were found among the several cities with respect to the proportions of various kinds of appliances available in the residences. The range for each of the more usual kinds of appliances in the three classes of houses is illustrated in the accompanying diagram (Fig. 1), where the average extent to which each kind of appliance was encountered, and also the three highest and the lowest proportions found in the several cities, are indicated. The corresponding consumption by appliances in the three classes of houses in different cities appears in Fig. 2.

Table III shows a comparison between the data taken from the 1921 and 1922 surveys in which the prevalence of the various appliances is contrasted for medium-class residences. This indicates a fairly close agreement of the two surveys.

In both years the surveyors discussed with householders their use of lamps and appliances and recorded estimates of annual kilowatt-hours consumed by lamps

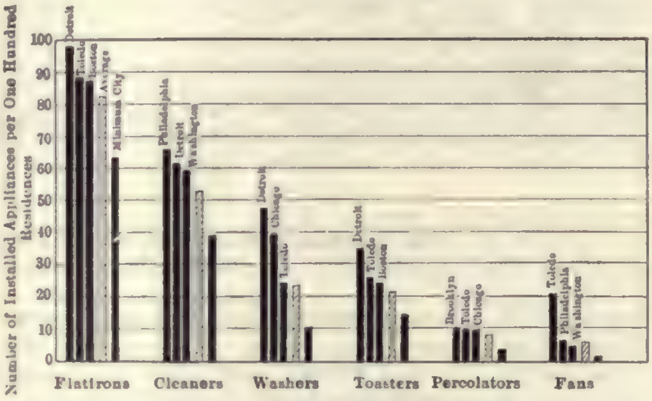


FIG. 1—APPLIANCES INSTALLED PER HUNDRED CUSTOMERS

and by each kind of appliance in each residence. A summary of these estimates appears in Table V.

Weighted, the estimates of the consumption by appliances are, for houses 17.6 per cent of the total, for apartments 15.1 per cent of the total, and for all residences 17 per cent of the total. The corresponding figure for the 1921 survey is 18 per cent. This close accord is significant in itself when it is considered that the surveys were made a year apart, by different men, in different residences and, to some extent, in different cities.

The method of determining the proportionate consumption by appliances and by lamps consisted briefly in choosing for detailed study residences which in all essential particulars approximated the average of all residences surveyed, of analyzing the actual consumption in each such residence for a brief period in order to ascertain the actual consumption by each kind of

TABLE I—CITIES AND CLASSES OF RESIDENCES SURVEYED

	1921 Survey				1922 Survey					
	Above Medium Class		Medium Class		Above Medium Class		Medium Class		Below Medium Class	
	Houses	Apartments	Houses	Apartments	Houses	Apartments	Houses	Apartments	Houses	Apartments
Boston	...	...	114	127	246	26	282	.	62	262
Brooklyn	...	...	...	...	146	70	121	...	70	109
Chicago	...	...	61	164	75	147	119	158	85	229
Cincinnati	...	...	...	...	101	55	146	.	219	.
Detroit	...	...	153	100	261	...	223	32	218	34
New York	...	86	...	145	...	...	...	.	...	...
New York (two companies)			...	273						
Philadelphia	...	...	...	...	.	.	193	..	471	...
Rochester	...	.	222	52	.	...	...	...	..	...
Toledo	...	...	...	...	*	.	111	...	90	...
Washington	...	...	...	...	106	127	225	..	163	33
Totals†	0	86	550	861	935	425	1,420	190	1,378	667

* Thirty-three surveyed but omitted from report because non-representative.

† Total above medium class, 1921 survey, 86; medium class, 1,411; in all, 1,497. Total above medium class, 1922 survey, 1,360; medium class, 1,610; below medium class, 2,045; in all, 5,015. Total residences surveyed both years, 6,512.

appliance and by lamps, and of deriving, if practicable, from such analyses of consumption in a relatively small number of residences data which would indicate the probable relative consumptions in all of the residences covered by the survey.

The test weeks in the several cities occurred between the third week of April and the first week of June inclusive. In most cases the tests fell in the early part of the daylight-saving period. The test period is referred to as a "week in May."

When summarized by classes (i.e., "above medium class," "medium class," etc.), the records for the several cities exhibit certain differences of a material order which the committee is unable to classify as being due either to characteristic differences in the habits of the people or to chance vagaries of use during the test week. The record shows, for example, an unusually

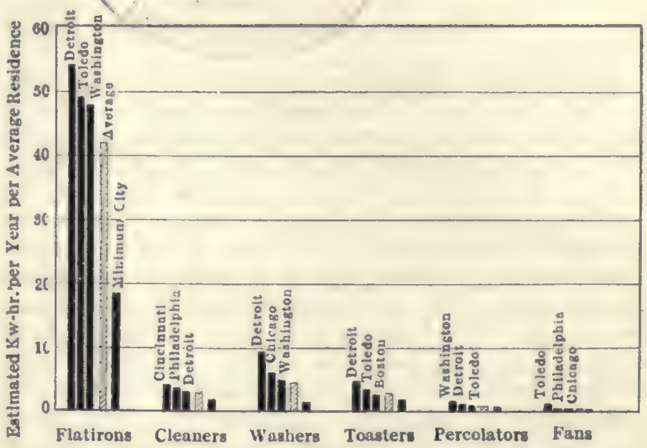


FIG. 2—YEARLY ENERGY CONSUMPTION OF APPLIANCES

TABLE II—SOME STATISTICS OF THE RESIDENCES SURVEYED

	1921 Survey Medium Class		1922 Survey Above Medium Class		1922 Survey Medium Class		1922 Survey Below Medium Class	
	Houses	Apartments	Houses	Apartments	Houses	Apartments	Houses	Apartments
Number of cities	4	5	6	5	[illegible]	2	8	5
Number of residences surveyed	550	947	935	425	1,420	190	1,378	667
Size of residences:								
Average number of rooms	10.4	7.8	11.9	8.6	8.9	7.9	8.1	6.5
Mean floor area in square feet	1,232	831	1,710	1,124	1,149	792	1,034	820
Persons occupying residence—average	4.6	3.6	4.4	3.1	3.9	3.4	4.6	2.9
Average annual kilowatt-hours per residence	469	375	553	367	351	367	271	227
Average kilowatt-hours used per month	39.3	31.0	52.7	36.6	31.4	37.1	24.9	21.6
Ditto in terms of mean for all residences in same cities	127%	118%*	162%	115%	103%	108%	81%	67%
Average number lighting sockets per residence	24.3	17.9	38.3	25.4	22.4	18.7	17.0	12.9
Average number "convenience outlets" per residence	2.0	0.8	3.4	1.5	1.6	0.7	0.7	0.4
Connected load in watts—all lamps:	860	682	1,347	924	791	708	608	491
Active lamps	780	637	1,025	662	606	556	489	396
All appliances	1,014	902	973	673	812	881	527	460

* Not known for two companies, comprising 504 apartments.

TABLE III—PREVALENCE OF ELECTRICAL APPLIANCES IN MEDIUM-CLASS RESIDENCES OF VARIOUS CITIES

Kinds of Residences	Number of Residences Surveyed	City Ranking	Flatirons	Vacuum Cleaners	Washing Machines	Toasters	Percolators	Radiators	Grills	Sewing Machines	Fans	Curling Irons
			Number of Appliances per 100 Residences									
1922 Residence Survey												
		Highest	100	86	51	50	20	19	10	12	46	21
Houses	1,420	Average	89	66	28	30	12	10	4	5	10	6
		Lowest	80	43	8	21	6	6	0	2	3	1
		Highest	100	72	31	59	28	4	4	16	6	8
Apartments	190	Average	99	62	20	45	22	3	2	10	3	5
		Lowest	[illegible]	51	8	31	16	3	0	4	0	3
1921 Residence Survey												
		Highest	99	70	59	41	21	13	8	10	11	5
Houses	550	Average	94	58	41	32	13	9	6	6	9	3
		Lowest	..	42	16	18	3	8	3	3	3	..
		Highest	99	67	45	46	21	13	8	6	12	6
Apartments	947	Average	83	40	15	30	13	6	4	4	8	3
		Lowest	37	9	0	7	3	2	2	1	6	0

TABLE IV—CONSUMPTION OF VARIOUS APPLIANCES DURING THE TEST WEEK

	Above Medium Class: Houses Kw.-hr. per Appliance			Above Medium Class: Apartments Kw.-hr. per Appliance			Medium Class: Houses Kw.-hr. per Appliance			Medium Class: Apartments Kw.-hr. per Appliance			Below Medium Class: Houses Kw.-hr. per Appliance			Below Medium Class: Apartments Kw.-hr. per Appliance		
	Installed	Used	Per Cent of Total Consumption	Installed	Used	Per Cent of Total Consumption	Installed	Used	Per Cent of Total Consumption	Installed	Used	Per Cent of Total Consumption	Installed	Used	Per Cent of Total Consumption	Installed	Used	Per Cent of Total Consumption
Flatiron	2.132	2.410	27.21	1.246	1.952	23.25	1.677	1.793	27.87	1.345	1.345	16.16	1.145	1.163	25.77	1.113	1.113	24.90
Vacuum cleaner	0.086	0.141	0.60	[illegible]	.....	.....	0.071	0.102	0.93	0	.....	.....	0.097	0.111	1.41	.....	.....	.....
Washing machine	0.339	0.361	2.55	.....	.....	.....	0.354	0.412	2.92	.....	.....	.....	0.442	0.505	3.19	.....	.....	.....
Toaster	0.513	0.594	3.10	0.254	0.254	4.32	0.216	0.370	2.33	0.378	0.378	3.03	0.090	0.179	0.37	0.018	0.018	0.13
Percolator	0.410	0.683	1.60	0.072	0.072	0.22	0.131	0.196	0.16	0	.....	.....	.....	.....	.....	.....	.....	.....
Radiator	0.873	0.873	1.83	.....	.....	.....	0.446	0.726	0.62	.....	.....	.....	0.186	0.186	0.12	.....	.....	.....
Grill	0.008	0.008	0.01	.....	.....	.....	0	.....	.....	.....	.....	.....	0	.....	.....	.....	.....	.....
Sewing machine	0	.....	.....	0	.....	.....	0.004	0.013	0.01	0	.....	.....	.....	.....	.....	.....	.....	.....
Fan	0.204	0.409	0.35	0	.....	.....	0	.....	.....	.....	.....	.....	0	.....	.....	.....	.....	.....
Curling iron	0.059	0.059	0.06	0	.....	.....	0.013	0.052	0.02	.....	.....	.....	0	.....	.....	.....	.....	.....
Miscellaneous appliances	.....	.....	0.47	.....	.....	0.40	.....	.....	0.57	.....	.....	.....	.....	.....	.....	.....	.....	0.07
Total			37.8			28.2*			35.4			19.2			30.9			25.1

* Data from one company not classified as to kinds of appliances. When total for this company is included this figure becomes 20.9 per cent.

large use of appliances in Boston medium-class houses on Sunday.

However, the differences referred to are not sufficiently serious to offer an impediment to the consolidation of the data for the several cities, and the committee therefore has combined the test data for the respective classes of residences in order to show for each the relative consumption by lamps and by appliances throughout the hours of each day of the test week. These appear, for medium-class houses on the accompanying chart (Fig. 3), in which the total hourly consumption of all test houses is expressed in terms of the average hourly consumption for the entire test week and is divided to show the proportion attributable respectively to lamps and to appliances. This shows the relative use of appliances in the several days of the week and the relative lighting peaks attained. The largest appliance consumption is encountered on Tuesday, with Monday a close second. The chart presenting a weekly analysis of lamp and appliance consumption bears also a diagram showing variation of average daily kilowatt-hours in percentage of weekly average, in each case indicating the relative proportions of lamp and appliance consumption.

CONCLUSION

The work of the committees during the past three years has provided information which may be epitomized in the following brief statement concerning the proportion of total residence consumption of electricity which is attributable to appliances:

	Per Cent
Estimates of 5,015 householders as collected by 108 surveyors in eight cities, each estimate being made after a discussion between householder and surveyor......	17
Derived from actual measurements in 105 residences during a week in May—adjusted for departure of May consumption rate from average annual rate—adjusted for slight departure of test residences from all residences surveyed	20.6

The committee feels therefore that, as a result of its efforts and those of the predecessor committee, the vague ideas on this subject which have resulted in estimates ranging from 5 to 50 per cent have been replaced by well-established information indicating that a representative figure for the proportion of residence

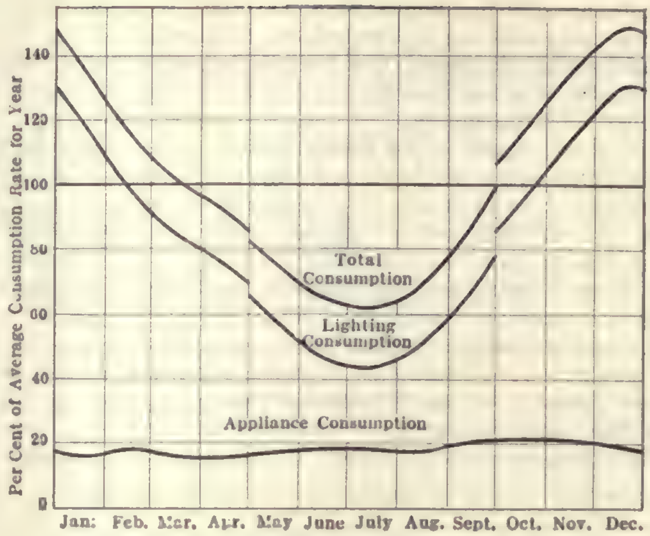


FIG. 4—SEASONAL VARIATION OF ENERGY CONSUMPTION IN AVERAGE RESIDENCES

consumption which is attributable to appliances is of the order indicated in the foregoing statement.

While the consumption by appliances for the year as a whole averages 17 to 20.6 per cent of the total consumption, it should be borne in mind that the monthly appliance consumption is relatively large in the sum-

TABLE V—PERCENTAGE OF ANNUAL ELECTRICITY CONSUMPTION ATTRIBUTED BY SURVEYOR-CUSTOMER ESTIMATES TO APPLIANCES IN VARIOUS CITIES

	Houses			Apartments		
Class of Residence	Highest City	Average City	Lowest City	Highest City	Average City	Lowest City
		1922 Survey				
Medium........	20 5	18 1	15.6	20.8	17 2	13.5
Above medium..	19 6	17.1	12.3	13.9	10.3	5.0
Below medium..	23.6	17 4	12.8	19.2	14.8	10.1
		1921 Survey				
Medium. ..		18.7			16.1	

mer, when the consumption by lamps falls off greatly. In the summer season the appliance consumption may attain to as much as 27 to 33 per cent of the total. Further, it is generally an off-peak part of the residential load. On these accounts it is a load which is much prized.

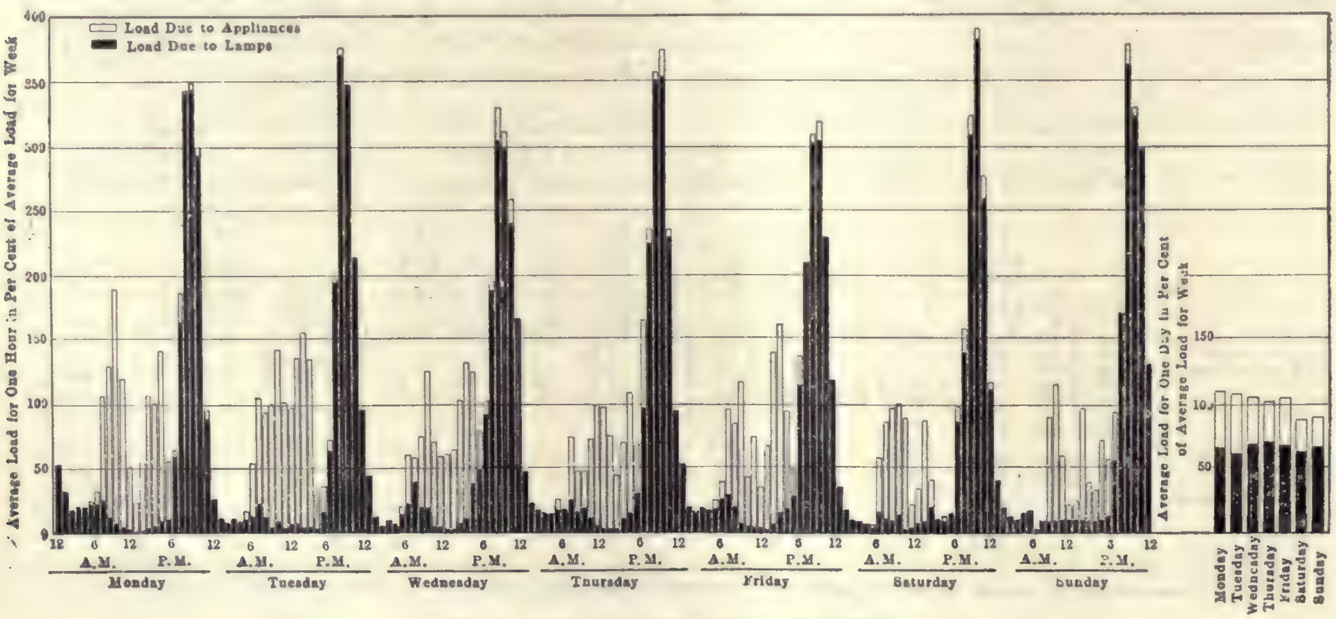


FIG. 3—LOAD VARIATION DURING TEST WEEK

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Planning the Distribution System

To the Editors of the ELECTRICAL WORLD:

The writer heartily agrees with the repeated editorial assertion of the ELECTRICAL WORLD that frequently too little thought has been given to the planning and construction of central-station distribution systems. Many distribution systems cost more than the power station feeding them, yet careful design work is lavished on the station and the distribution system is allowed to "grow" without comprehensive planning or thought of logical development. In such a case extreme refinements of station design may go for naught through dissipation of energy in an inefficient distribution system. On the other hand, needless cost is added to an already high charge for money if a distribution system planned for high efficiency costs more than it should.

C. A. Bacon's paper in the ELECTRICAL WORLD for Sept. 8 on the "Layout of Secondary Networks" is one more boost for engineering treatment of this phase of the distribution problem. Mr. Bacon's method of designing secondaries is practically the same as that presented by the writer in the ELECTRICAL WORLD for Oct. 8, 1921. It is rather unfortunate, however, that two-wire secondaries are even mentioned for carrying such loads as are given in the typical example. Smaller companies all over the country are handicapped in giving good service by the prevalence of a two-wire secondary and the accompanying small transformer units, and I feel sure that Mr. Bacon does not intend to recommend construction that all too frequently causes low voltage, loss of revenue and numerous complaints.

The procedure outlined can be simplified by use of somewhat different constants. The steps outlined seem about as follows:

1. Count the connected load.
2. Convert the load to 40-watt units (if larger lamps are used).
3. Convert the 40-watt units to kilowatts.
4. Apply diversity factor.
5. Add all the loads grouped at a pole.
6. Multiply kilowatts by a constant times distance to secure impedance drop for No. 6 wire.
7. Multiply by conversion factor to obtain drop with other sizes of wire (where used).
8. If drop secured is too small or too large, multiply by factor for other sizes of wire until the desired result is obtained.

By using a factor "kilowatt-spans" (kilowatts carried times number of average length spans from transformer) and a tabulation showing kilowatts demand (at the transformer) of houses of different sizes (grouped by number of rooms) it is possible to reduce the number of steps to four, which reduction would, of course, tend to decrease errors and increase speed of survey work.

1. Determine the kilowatt demand at the transformer by exterior inspection of the house.
2. Add all loads (in kilowatts) grouped at a given pole.
3. Multiply load at pole by number of spans away from transformer to secure "kilowatt-spans."
4. Refer to table to determine what size wire should be used to keep drop within predetermined limits.

With these data a comparison of "kilowatt-spans" each way from the transformer will show at a glance whether the transformer is located at the load center.

Appliance loads are constantly increasing, and there is an increasing use of 60-watt and 75-watt lamps in the home-lighting fixtures. This development seriously handicaps good service where two-wire secondaries are still used, as the greater loads can economically be carried only on 220-volt mains since the voltage drop is only one-fourth as great in transmitting a given load. The old figure of 10 per cent demand factor for residence service has increased to 30 per cent, 40 per cent and 50 per cent, but it is probable that much of this increase is due to larger lamps and appliances of which the central station has no record. In the absence of adequate records it seems logical to forget all reference to "number of 40-watt units" and base the reckoning on the size of the house and the class of the neighborhood, a method which has been found to be as accurate and satisfactory as any other now generally followed.

The great merit of such a procedure, however, is that interior inspection of residence connected loads is unnecessary and that many central-station records are thus eliminated. Residence load records, if kept properly, involve too much expense for the benefit rendered. If kept improperly, as they often are, they are worse than useless. After the initial check for meter installation, the above method confines these to the survey sheets.

Mr. Bacon's diversity-factor information is very interesting, and it would be of value to see similar data from other companies. It would be of especial interest to see reports of actual demand-meter tests on a typical secondary, for the purpose of ascertaining ratio of demand to connected load, to size of house and to kilowatt-hour consumption, diversity factors between customers (measured at the transformer), etc. Most of the data available have been computed, and there is practically nothing available covering simultaneous demand-meter readings.

L. C. PETERMAN,
Engineer Electrical Division.
Dwight P. Robinson & Company,
New York.

Indorses Protest Against Seven-Day Week

To the Editors of the ELECTRICAL WORLD:

Your issue of Sept. 8 contains a letter protesting against a seven-day working week, and I should like heartily to indorse "A Young Engineer's" plea that something should be done to avoid this. Experience leads me to believe that in addition to causing our young engineers to become stale it has a detrimental influence generally. I have formed this opinion both here and in other countries and have previously contributed articles to the press showing how a seven-day week can easily be obviated by a little extra cost, which is more than balanced by the brighter outlook and better health of the staff. Unfortunately most of the men who have to work seven days a week are juniors who are afraid to speak against this accepted practice, but I feel sure that if the question were taken up it would lead to a rapid rectification.

A BRITISH READER WHO SUFFERED WHEN A JUNIOR.
London, England.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

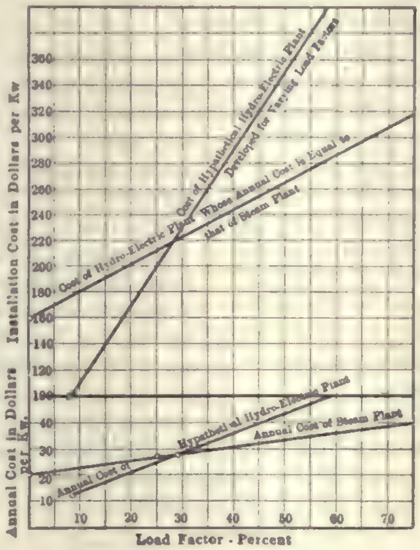
Supplementing Steam Plants with Hydro

Factors Determining Availability of Water-Power Additions Outlined —Distribution of Costs in Hydro Plants—Illustrative Data Give Method of Analysis

AN OPPORTUNITY to increase the use of hydro-electric power lies in the incorporation of such plants into systems now supplied by steam power, according to views expressed by R. M. Riegel in a paper given in the report of the hydraulic power committee presented recently before the annual meeting of the Pennsylvania Electric Association. This incorporation of power should be done in such a way that at periods of limited flow the hydro-electric plant may be used to carry peak loads. These loads, at the low load factor required for such operation, may be of considerable magnitude, while requiring only a moderate supply of water.

Two essential factors determine the availability of hydro-electric additions: (a) The load characteristics of the operating system, together with the determination of the present and anticipated costs of producing energy in base-load and peak-load units by steam generation, and (b) the cost of producing reliable energy of a corresponding character from the hydro-electric plant under consideration.

If the load curve of any electrical distribution system be examined, a marked variation in the magnitude of the load is evident throughout the day or the year. If horizontal lines be drawn across such a load diagram corresponding to the capacity of various generating units in the system, it will be seen that some units could be operated all the time while other units would operate at smaller proportions of time as the top of the load is approached. At the very top the proportion of time during which any unit must operate would be very small; that is, the load factor of such units is relatively very low. It is, of course, common station practice to operate the least economical units at the top of the load (that is, at low load factor and at low energy output) in order to keep the coal consumption and general operating costs at a minimum. This procedure is, of course, modified somewhat by the necessity of cutting out units from service from time to time at the base of the load on account of accident, repairs or overhauling, and also by the necessity of maintaining voltage in the



COSTS OF HYDRO-ELECTRIC DEVELOPMENTS PER KILOWATT OF CAPACITY

case of a system fed by a number of stations.

It is a comparatively simple matter to determine for any system the annual cost of operating units and classify them according to their load factors or to determine the cost per kilowatt-hour of the production of energy of various load factors.

Distribution of Costs in Hydro-Electric Stations

Let the elements of cost of a hydro-electric development now be considered. These include: (a) Works to develop power, that is, to turn water from its natural channels to artificial channels which will permit the power to be developed; the construction of dams for direct development may be regarded as a special case of such works. (b) Works to store water from the season of maximum flow to the season of minimum flow. (c) Generating machinery and equipment. (d) Transformers, switches and transmission lines.

Of the above items, (a) and (b) will usually constitute the greater part of the cost. To a great extent they are independent of the costs involved under items (c) and (d). It is evident, therefore, that once the developing and storage works have been provided, the plant capacity can be increased at less than proportionate cost by merely adding the generating machinery and its appurtenances. In other words, the cost of a plant per kilowatt of plant installation can be reduced by adding generating and switching equipment. It is evident that, provided such large capacity can be utilized, the hydro-electric plant of large capacity may be constructed at a unit cost which compares favorably with that of steam plants.

Method of Analysis

In order to show how the problem of economical use of water power may be approached from the point of view of the owner of an existing steam system who must increase his capacity, the following illustrative data are presented. With modifications to suit the particular circumstances of his own case, he could set up the annual cost per kilowatt of a steam extension somewhat as follows:

The generating station, including high-tension transformers, switching equipment, etc., would cost, say, $100 per kilowatt of steam capacity (name-plate reading), upon which the annual capital charges may be taken at $14. This includes cost of money, including amortization charges of 8 per cent, depreciation of 4 per cent and taxes and insurance 2 per cent. The station labor and maintenance may be assumed at $4 per kilowatt per year. Coal for banking the boilers may be taken at 1,000 lb. per kilowatt per annum, and coal consumed for the production of energy at 1.5 per kilowatt-hour at the switchboard. (These figures are assumed to represent results in large economical stations with high-grade

fuel and would have to be modified somewhat for smaller stations and less efficient conditions.)

Let it be assumed that the plant will operate at 25 per cent load factor, and that coal costs $4 per ton at the generating station. Following is the calculation of annual cost per kilowatt of capacity:

Capital charges	$14.00
Labor, supplies and maintenance	4.00
Banking coal	2.00
Generating coal (4/8,760 × 0.25 × 2,000 × 1.50)	6.57
Total	$26.57

If no energy be delivered at all and the plant be maintained for reserve service only, its annual cost on the above basis would be approximately $20, and if operated at 50 per cent load factor it would be approximately $33.16. From these figures the lower curve in the accompanying illustration is plotted.

Now, let the annual charges upon a hydro-electric development be taken at 12.5 per cent including the following items:

	Per Cent
Interest	8.0
Depreciation	2.0
Taxes and insurance	1.5
Operation (approximately)	*1.0
Total	12.5

*The assumption of 1 per cent of operation is, of course, made only for convenience, since operating charges are not properly capital charges.

Applying the ratio of 12.5 per cent to the curve just described, we can obtain the cost per kilowatt of a hydro-electric installation which, when operating at the same load factor, will have the same annual cost as that of a steam station. That is, division of the ordinate of any point in the lower curve by 0.125 gives the corresponding point in the upper curve of costs of hydro-electric plants.

To determine the availability and economy of a hydro-electric extension, it is, therefore, necessary to fix from the characteristics of the anticipated load the load factor which the extension contemplated, whether steam or hydraulic, will be required to maintain. The cost per kilowatt of plant capacity of the hydro-electric development which will have sufficient water supply to carry the anticipated load at this load factor must then be estimated. (This may or may not involve the construction of special storage works to maintain sufficient water for the service required.) If the cost of such a project falls below the upper curve of the illustration, the use of hydro-electric power will be obviously economical.

Even if the point falls above the curve, such use might be profitable, for the installation of a large capacity to operate at a low load factor during seasons of water stringency implies the ability to generate a large amount of energy—that is, secondary energy—at periods of high discharge in the stream. While the latter cannot be valued at much more than the saving in coal, it will generally be a material item in any comparison of annual costs.

The third curve is merely suggestive. It represents the way in which the cost of installation may vary when developments are made for different load factors with a constant reliable supply of water. The shape and position of the curve are dependent on the peculiarities of the power site. It will be observed that this curve crosses the curve of limiting cost, and in a typical case these curves may be expected to cross. A corresponding crossing is noted in the curves of annual costs. It is evident, therefore, that hydro-electric developments which could not be economical when developed and operated at high load factors can readily be economical if developed for use at low load factors. The former condition is characteristic of independent developments; the latter is readily obtainable by operation in conjunction with a steam base-load plant.

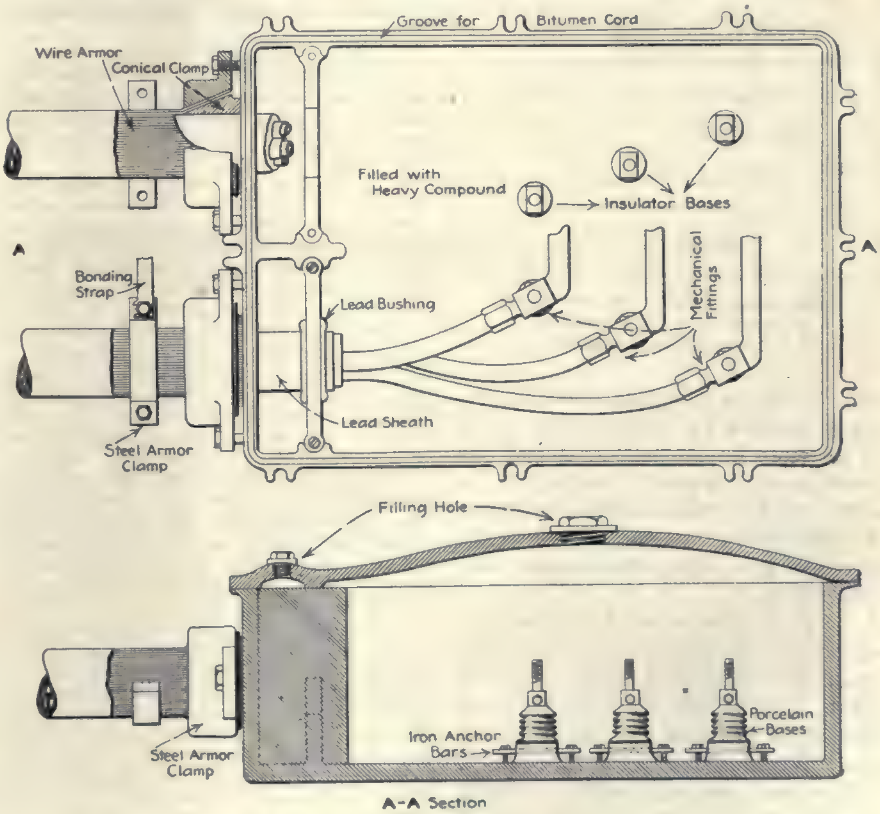
Requirements of Joint-Box for Mine Cables

By W. E. Boyle
Engineer, New York, N. Y.

THE absolute necessity for well-designed joint boxes in mine work cannot be stressed too greatly, not only as a method of sealing the cables against the ingress of moisture, but also for the electrical and mechanical bondings for the armor, thus assuring continuity of the sheathings. If on account of the mining regulations sweated connectors cannot be used, mechanical connectors having the same conductivity as the sweated joint should be utilized. Some of the requirements of a good joint box are:

1. Complete water-tightness.
2. Mechanical strength.
3. An adequate method of bonding the sheathing.
4. A design that will not create voids when filling and will not allow strain to be placed on the cable or internal fittings.

It is never advisable to make joints actually in the shaft except under great necessity. In that case the cable above and below the joint should be well supported with long cleats to take all the weight off and have the actual joint itself completely boxed in. It is far better policy to make a heading or inset in the shaft of sufficient depth to allow a man to work therein. In that case a single-ended box should be used; that is, one in which the cable enters and leaves the same end of the box, as illustrated. Cable lengths should therefore be ordered from pit mouth to bottom or to some intermediate heading where there are facilities for jointing. The filling compound is of importance, and one that has a pouring temperature of 330 deg. F. is to be recommended. The joint should be well flushed out in order to avoid "blowholes" forming because of the trapping of air. If monthly tests are insisted upon for insulation resistance, for continuity of sheathings and the frequent checking of earth connections, the results of any damage can be traced before serious troubles arise.



DOUBLE-ENDED 6,000-VOLT JOINT BOX REDUCES MINE FIRE HAZARD

Recording Construction and Decapitalization Charges

BY G. H. MCKELWAY
Westfield, N. J.

THE book figures of many public service companies do not satisfactorily reflect the cost and value of the property except soon after the property is constructed. In after years it will be found that the books of many corporations do not show the value of improvements that have been made and likewise omit to charge off the value of portions of the property that have been abandoned or have become obsolete.

The omission of these records from the books is particularly likely to happen when the work in question is done by the company's forces. When the work is performed by an outside contractor it is easy to keep the charges separate from all others and to make sure that they are shown on the books; but if the work is done by company forces, it is likely to be charged to one of the maintenance accounts unless it is done under a special authorization or in some other manner by which its charges are kept apart from any others.

......................COMPANY

Date................

The following material has been removed from ....

Expense charged to:................

Authorization....... Account No.....

Cost to remove......................

Credit account ....

Date of original installation.........

Installed on authorization............

Date of removal.....................

Owning company ....

Original cost in place...............

Disposition of material removed......

Signed....................

THIS FORM SERVES TO SEPARATE CONSTRUCTION AND MAINTENANCE ACCOUNTS

This trouble in keeping the construction and maintenance accounts separate is particularly marked when part of the work to be done should be charged to maintenance and the rest of it to construction.

The way that one large company handles these accounts is to give a specific authorization number to each new piece of work and mark on the authorization whether the work is to be charged to construction or maintenance. When the work is of such a character as to require that some of the charges be placed against construction and others against maintenance, the authorization as a whole is charged to maintenance; but it is marked with a stamp stating that after the work is completed an adjustment will be made crediting part of the work to construction. Then, when the work has been completed, what is called a construction bill is prepared, giving the former value of the piece of work and its value after the improvement has been made. The difference between these two values is then charged to construction. When something is to be decapitalized a report similar to the one that is shown herewith is made out.

Copies of these reports are kept in both the controller's department and in the department doing the work. By this means both departments have records showing the amount decapitalized, and, if there are several subsidiary companies in the one system, there is no possibility of the wrong books being credited with the amount written off.

Extracts from an Operating Code*

Continuity, Ground and Short Circuit Tests

DETAILED instructions for making continuity, ground and short-circuit tests on lines are given below. In making any of these tests it is very important not to touch any bare equipment until after the foreign voltage test has been made. The testing equipment referred to was described in the ELECTRICAL WORLD for Sept. 22 on page 610.

Check-Up on Continuity Test

110-Volt and 250-Volt Sets.—1. Remove the fuses from the potential transformers connected to the section of the line under test.

2. Make the test for foreign voltage.

3. If foreign voltage is indicated, report it to the load dispatcher and proceed no further until directed by the load dispatcher; then repeat the test for foreign voltage.

4. If no foreign voltage is indicated, the sender will throw the switch to the supply side (110-volt set), or close the grounding switch (250-volt set). If no foreign voltage is indicated, the receiver will throw the switch to ground (110-volt set or 250-volt set).

5. Firmly hold the test lead at the sending station on the A conductor.

6. The receiver will touch his test lead to each of the conductors, noting that his lamp lights on only one conductor. He will then hold the lead on this conductor. The sending and receiving lamps should then burn at half brilliancy. Note.—If the receiver finds that the lamp does not light on what should be the A conductor, he must note in what order the signals are received and report this information correctly to the load dispatcher.

7. As soon as the sender's lamp lights he will signal three times at intervals of three seconds, each signal lasting for a period of three seconds. At the termination of the last signal he will hold the lead on the conductor.

8. The receiver, after waiting three seconds, will return the signal three times in the same manner.

9. When the last signal is made the receiver will continue to hold his lead on the A conductor until the sender moves his lead to the B conductor. This will be indicated to the receiver by his lamp's going out.

10. Test the B and C conductors in the same manner.

600-Volt Set.—Rules 1, 2 and 3 same as above.

4. If no foreign voltage is indicated, throw the switch of the sending set to the lamp-bank position and that of the receiving set to the ground.

5. Connect the A conductor at the sending station to the test bus.

6. The receiver will connect each of the conductors in turn to the test bus, noting that his lamp bank lights on only one of the conductors. He will then hold his lead on this conductor. Note.—If the receiver finds that the lamp does not light on what should be the A conductor, he must note in what order the signals are received and report this information correctly to the load dispatcher.

Rules 7, 8, 9 and 10 same as above.

Ground Test

110, 250 and 600-Volt Sets.—1. Remove the fuses from the potential transformers connected to the section of the line under test.

2. Make the test for foreign voltage.

3. If foreign voltage is indicated, report it to the load dispatcher and proceed no further until directed by him; then repeat test for foreign voltage.

4. If no foreign voltage is indicated, throw the switch of the testing set to the supply side (to ground for the 250-volt set) and firmly hold the test lead in succession upon each of the conductors. If the lamp lights, a ground is indicated. Note.—In a station equipped with a receiving 600-volt set, the terminal of the lamp bank must be temporarily disconnected from ground and connected to a source of 600 volts.

Short-Circuit Test

110-Volt Set.—1. Remove the fuses from the potential transformers connected to the section of the line under test.

2. Make the test for foreign voltage.

3. If foreign voltage is indicated, report it to the load dispatcher and proceed no further until directed by the load dispatcher; then repeat the test for foreign voltage.

*Abstracted from the operating code of the Philadelphia Electric Company.

4. If no foreign voltage is indicated, ground the B conductor.
5. Throw the switch of the testing set to the supply side.
6. Test from A to B and from B to C by touching the test lead to the A and C conductors in succession.
7. Ground the C conductor and test from A to C by touching the test lead to the A conductor. If the lamp lights in either case, a short circuit is indicated.

250-Volt Set. — 1. Remove the fuses from the potential transformers connected to the section of the line under test.
2. Make the test for foreign voltage.
3. If foreign voltage is indicated, report it to the load dispatcher and proceed no further until directed by the load dispatcher; then repeat the "test for foreign voltage."
4. The single-pole switch on the test panel must be open.
5. If no foreign voltage is indicated, touch the test leads to each pair of conductors in succession. If the lamp lights, a short circuit is indicated.

600-Volt Set. — 1. Remove the fuses from the potential transformers connected to the section of the line under test.
2. Make the test for foreign voltage.
3. If foreign voltage is indicated, report it to the load dispatcher and proceed no further until directed by the load dispatcher; then repeat the test for foreign voltage.
4. If no foreign voltage is indicated, ground the B conductor.
5. Throw the switch of the testing set to the lamp-bank position.
6. Test from A to B and from B to C by connecting the A and C conductors in succession to the test bus.
7. Test from A to C by grounding the C conductor and connecting the A conductor to the test bus.

If the lamp bank lights in either case, a short circuit is indicated.

Condenser Tubes Cleaned by Acid in 12 Hours

BY A. C. SALZMAN
Chief Engineer Bloomington & Normal Railway & Light Company, Bloomington, Ill.

CLEANING condenser tubes in localities where the cooling water contains a large amount of insoluble salts is a problem both annoying and expensive. The usual method of removing condenser scale by drilling wears away the tubes. Since it is also a very slow process continuity of service may be endangered, especially when little reserve generating capacity is available.

At the plant of the Bloomington & Normal (Ill.) Railway & Light Company, a system of hydrochloric-acid treatment of the tubes for a 6,000-sq.ft. condenser has now been in service for more than two years which has given very satisfactory results. This treatment is generally started on Saturday midnight when about eighteen carboys, weighing about 2,500 lb., of muriatic acid are dumped into the condenser. This period was chosen because of the small load which the auxiliaries would carry. The acid runs about 18 per cent pure hydrochloric. For simplicity of handling it was preferable to buy this prepared solution rather than the pure hydrochloric acid, which would require considerable care in mixing to insure a uniform solution.

The circulating-water pump is run at intervals of thirty minutes throughout the entire cleaning period, which lasts about twelve hours. As yet no appreciable damage has been made to the pump housing or impeller. But a smaller special pump will soon be installed solely to handle this acid agitation since the larger pump was found to be too large for this work. This cleaning is done every six weeks and the time of this operation is now reduced from the four to five days required by the old drilling method to twelve hours.

	Grains per U. S. Gal.
$CaCO_3$	17.37
$MgCO_3$	5.84
$MgSO_4$	9.38
SiO_2	0.35
Fe_2O_3 and Al_2O_3	Trace
NaCl	2.33
Total solids	38.13
Organic matter	Trace

The percentage of pure hydrochloric acid in the condenser averages between 3 and 4 since the total weight of the water is about 8,000 lb., and the 18 per cent acid averages about 2,500 lb. A chemical analysis of the cooling water from the deep well is given in the accompanying table.

Terminating a 50-Kv. Line on a Single Bridge

ECONOMY in steelwork is insured in a New England outdoor substation by the construction illustrated herewith, where a single pair of towers and a connecting member form the framing for a complete 50,000-volt outgoing line and bus layout.

Energy from adjacent generating units is delivered by cables through a conduit riser and pothead at the left of the nearer tower to a set of three-phase horizontally mounted copper-bar buses supported by clamps and insulators attached to the inter-tower frame shown. The frame is stiffened by diagonal braces at the ends and two intermediate points. From these low-tension busbar taps are run to the transformer secondaries in short lengths of cable, the transformers being mounted directly below the center line of the bridge.

The high-tension leads from the transformers are carried upward from the terminal bushings to three-wire buses suspended horizontally between quadruple-disk strain insulators attached to extension brackets at the towers as shown. These buses clear the bridge sufficiently to permit short runs of wire to the three outgoing phases at the top of the bridge, which, with series choke coils, are supported by strain insulators of the four-disk size, lightning-arrester taps being dropped downward from the outgoing line to horn gaps supported on pipe frame.

SYMMETRICAL BUS ARRANGEMENT INSURES ECONOMICAL USE OF MATERIAL

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

New Business Policies*

Analysis of Load Conditions and Character of Territory Necessary to Determine Where Selling Effort Should Be Directed

By M. C. Huse

Assistant to Vice-President in Charge of Commercial Department, Philadelphia Electric Company

THE slogan of the central-station companies for the last two years has been "More business—better business," and this call to action will probably always be needed, to some extent, in our industry. This slogan was adopted during that troublous post-war period when we were confronted with the need for readjustment and for reorganization and as we were groping our way back to that normalcy which seemed to be forever lost.

Now has come a period which requires thorough organization, properly trained personnel, a well-developed selling program and adequate means for taking care of new business. It is at such a time that we search expectantly for ideas on new business getting, for suggestions which may increase our selling efficiency, or for plans which may effect some improvement in general operating conditions.

It is, of course, fundamental that we must obtain the fullest possible use of existing generating and substation capacity in order to minimize the fixed charge per kilowatt of maximum demand. This means that we must study the effect of prospective business on our present station facilities and obtain, so far as is possible, such business as will improve the system diversity factor.

Results of Haphazard Extensions

To insure that full use of distribution facilities will be possible, complete plans must be made for efficiently taking care of future developments. It too frequently happens that extensions of lines are made in a haphazard manner to take care of local conditions, rather than planned on the broad basis of complete system development. The result of this lack of planning is frequently a burden of heavy fixed charges on account of the increased investment, combined with an inadequate return from customers served. In other words, the maximum benefits can be obtained from the application of correct selling policies only when a careful survey of future requirements has made possible a logical development of the entire distribution system, including lines and substations.

HIT-OR-MISS sales plans have all too often marked the new-business activities of central-station companies, with the result that undesirable or unprofitable loads have been sought after and secured. Lack of definite planning also may make campaigns very costly in proportion to the added revenue or the volume of sales. Mr. Huse in this paper points out the importance of directing the creative sales effort toward high-profit business.

Since cost of service varies, in part, in accordance with the density of the grouping of customers, it may be advisable to expend considerable effort in reaching the highest possible saturation in the territory served by the existing lines, while restricting as far as possible the extension of facilities into new territory having a less dense grouping.

For each customer there is a certain amount of electricity which should be consumed in order that he may reach his maximum efficiency of use. Anything less than this amount of electricity represents a selling possibility which should be energetically followed, since here we find the ideal combination of additional business without appreciable additional investment. This condition is encountered in residential lighting and appliance use, particularly in retail store lighting and factory lighting, and also in many power applications which are not sufficiently electrified.

It may be that the central station's most vital problem is the high cost of service on account of the low load factor on all equipment. Here is indicated the necessity for intensive selling effort directed toward diversity of use with special regard for those classes of business whose maximum demands occur at periods which are not coincident with the system peaks. A special low rate may be necessary to stimulate the sale of electricity to the desired class of business, but this particular remedy need be employed only after the selling organization has found itself unable to cope with the situation without this additional assistance.

Testing Value of New Business

Perhaps the most essential test which we must apply to our prospective business is an analysis of the amount of additional investment which will be required per dollar of additional revenue. Too many central stations are today laboring under the disadvantage of abnormally heavy fixed charges caused by an unreasoning desire to get new business and a failure to give sufficient attention to the relative amount of new capital which will be required. It is, therefore, important that the selling policy should be directed toward correcting rather than aggravating this condition.

Briefly stated, it is necessary in planning any new business to give consideration to two fundamental factors—first, the choice of those localities where spare substation and line capacity exist or can be most economically installed, and, second, the study of the effect of the new business upon the general situation as regards load factor, power factor, voltage regulation, additional investment per kilowatt of additional business and revenue per kilowatt of maximum demand.

There is, however, one additional

*Abstract of a paper presented at the sixteenth annual convention of the Pennsylvania Electric Association at Bedford Springs, Pa., Sept. 5-8.

factor of primary importance which must be given careful consideration. I refer to the periodic fluctuation in those classes of business which are affected by the cycles of business prosperity and depression.

RESIDENCE LOAD DESIRABLE

There was a time in our development when the residence business was considered a somewhat expensive luxury. There seemed to be an impression that large blocks of power combined with a proper proportion of commercial light and power were the only desirable load. It is true that this produced a good diversity factor and a long-hour use of station capacity, but it is also true that the residential business in itself constitutes perhaps the most important part of the market which we supply. It might be considered the backbone of our business, as was proved during the recent business depression. At that time factories were shut down, stores were closed, manufacturers decreased their production, and virtually all business stagnated. The interesting fact to be noted is that the residence business during that period continued practically without change. Our good customers in the home continued to burn electricity for the same number of hours and with practically the same wattage in use.

THE RESIDENCE CUSTOMER

If, then, our analysis of a proper selling policy is correct, the obtaining of additional residential business by stimulating the wiring of old houses will measurably improve our operating characteristics. This new business will be found, for the most part, along existing distribution lines. It will cause an improvement in the density of use and also in the saturation of the existing market. It has good power factor and causes no voltage fluctuation. Its inherently poor load factor may be considerably improved by stimulating the use of appliances. There should be a low investment per kilowatt of additional business, a high revenue per kilowatt of maximum demand and an increased business stability in time of depression.

The value of new business is too often judged by considering a particular class by itself, without analyzing the effect of this class of business upon the general situation. Low-load-factor business may have the utmost desirability, provided that it has high diversity and provided that the specific investment, necessary for its supply, is low in proportion to the average investment required per dollar of revenue.

After a selling policy is satisfactorily determined, it can be made effective only through adequate selling effort. The securing of new residential business is a different problem in practically every community. For example, in the Philadelphia territory there are communities where every house is served with electricity, and there are other communities where not more than 30 per cent of the houses are connected to the lines. Such varying conditions also are found to exist throughout the state, so that any words upon this subject can be applied to all communities in only a general way.

75,000 OLD HOUSES WIRED

In Philadelphia various plans have been used for uniting the contractors and the utility in general campaigns for stimulating the wiring of houses. In the period from Jan. 1, 1921, to July 1, 1923, there were 75,000 old houses wired in Philadelphia. This would represent the complete electrifying of the houses for a city having a population of not less than 375,000 persons.

It has been well demonstrated that appliance advertising is one of the best forms of publicity for stimulating house wiring. The appeal to the desire for doing housework electrically constitutes the greatest selling argument that it is possible to put forth. A selling talk is, of course, primarily based on the advantages of good and convenient illumination, but the real point that puts the idea across is usually some fascinating picture of the delights which follow the use of electrical appliances. We owe a great deal to our friends the appliances. They are new-business getters, revenue producers and satisfaction breeders. They have helped materially in bringing the central-station industry to its present degree of success and in accelerating the growth which it has experienced.

This growth has been tremendous, but if it is to continue, increased sales efforts must be employed. The chart of the growth of the total industry shows a doubling in output with every five years, but we know that our communities are not growing at this rate in population or in productive capacity. We must therefore continually seek new markets for our service. It has been estimated that we are serving only 12 per cent of the total market which we could logically supply. This can only mean that there are practically unlimited opportunities ahead for the activities of the sales organization.

As a concluding thought, let us consider for a moment some phases of this available market. One of the most important fields for increased sales is found in the possibility of improving standards of lighting and supplying the full amount of electricity for illumination which could be efficiently used in homes and in commercial establishments. The appliance market has been scarcely touched. The annual consumption per residential customer in Philadelphia has increased from 275 kw.-hr. a few years ago to 360 kw.-hr. last year, and 50 per cent more electricity could be effectively used in the home.

It should be borne in mind that electricity is now being introduced into houses of a less expensive type than have formerly been considered as good "prospects" for electric service. It is frequently found that the occupants of these small houses become intensive users of electricity, and considerable revenue may be derived from sales work directed toward this class of property, which has been too often overlooked or neglected.

AN UNLIMITED FIELD

The field for extending the sale of electricity among power users is practically unlimited. In Pennsylvania more than one-half of all the industrial power is supplied by private plants. Most of this business could be supplied better and cheaper by the central station. Electric heating, electric drying, electrochemical processes, heat treating and tempering, welding, metal furnaces and new motor applications constitute a few of the fields which are awaiting more intensive development.

Now we have throughout our industry the necessary organizations for active selling effort; there are funds available for any financing which may be necessary; the market is waiting for development. We should be sure that our selling policies are broadly conceived and soundly planned, and then, most important of all, we should make our policies effective by intensive selling effort consistently and continuously applied.

Utility Securities Improve, Says Research Expert

HOW public utility securities have improved in their investment position in the first half of 1923 is shown by the decline in the average yield of public utility bonds and in the decrease of the average disparity between municipal credit and public utility credit. This conclusion is based on an analysis by Herbert B. Dorau of the Wisconsin University Research Institute staff of the comparative borrowing power of twenty-five public utility companies and fifteen municipalities. The analysis compares the status of utility securities with that of municipalities as follows:

Rapid improvement in the public utility industry in the first six months of 1923 is reflected in the decline in the average yield of twenty-five public utility bonds from 5.91 per cent for 1922 to 5.66 per cent for the first half of 1923. Measured from the base of municipal credit, the improvement is seen to be even more marked. The average disparity dropped from 1.68 per cent to 1.44 per cent. This is a greater change for the better than has been recorded in any previous year. The institute's "Public Utility Index," based on this disparity, shows a drop from 94.4 per cent to 80.9 per cent for the first half of 1923.

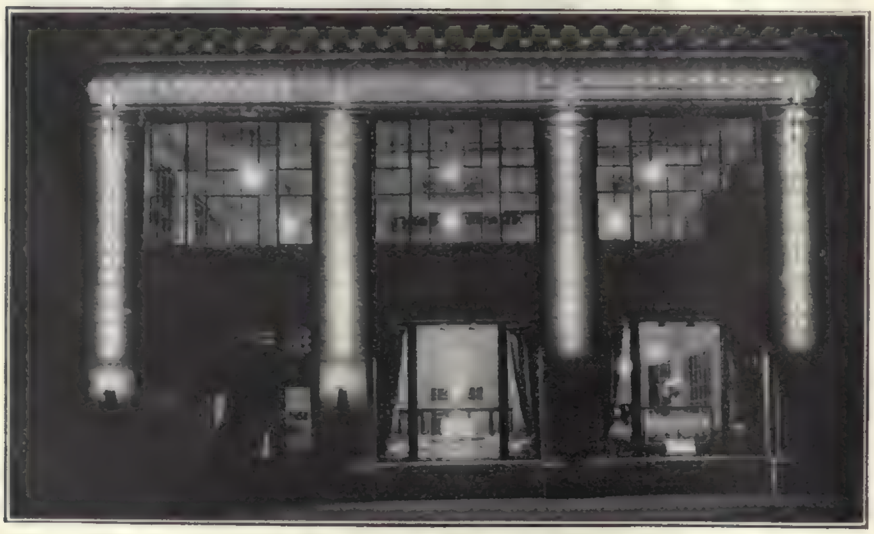
Continued improvement at this rate will soon bring the disparity between municipal and utility security yields back to the low levels of the years 1907 to 1913. Tax exemption accounts for part of the increased disparity in recent years. How much of the difference is due to this is difficult to ascertain. The institute is studying in this connection the problem of the market value of tax exemption.

High-grade bonds of electric light and power companies have sold at a lower average yield than comparable electric railway or gas company securities since 1911. With very little change, the preference of investors has been, first, for the securities of exclusive electric companies and, second, for the bonds of companies rendering two or more utility services.

Average disparities were lowest in 1913 for high-grade utility bonds, except those of electric railway companies. Improvement in these electric railway securities has been most marked since 1922. The average yield fell from 6.45 per cent to 5.97 per cent for the first half of 1923, a change of 0.48 per cent. No other class of public utility securities shows as great a decline in yield.

That the study of security yields is a satisfactory way of approximating the cost of money to service companies is evident from a comparison of the averages used by these studies and the actual rate paid on new financing in 1922.

Central Station Sets Example in Commercial Lighting



THE new office of the Baton Rouge (La.) Electric Company, pictured above, is an excellent illustration of what the central-station company can do in setting the pace for better illumination. In this case the power company renovated an old building and paid particular attention to the installation of modern lighting equipment. The new quarters were opened with a public reception and the illumination aroused keen interest on the part of many of the local merchants.

What Other Companies Are Doing

Providence, R. I.—The Rhode Island Electrical League held a successful dinner at the Turks Head Club recently with E. A. Barrows, president of the Narragansett Electric Lighting Company, as the principal speaker. Mr. Barrows spoke on the subject of "Customer Ownership of Utility Securities" and emphasized the importance of all local electrical men becoming stockholders in their central stations. The speaker also emphasized the importance of the contractor as the first line of contact of the public in the sale of electric service.

Omaha, Neb.—A department of advertising and publicity has been established by the Continental Gas & Electric Corporation, which operates in Iowa, Missouri, Nebraska and Manitoba. Hereafter all advertising copy and publicity of the company will be handled through the office of this department in Omaha. The department will be managed by C. H. Galloway, formerly of the faculty of the University of Kansas.

Springfield, Ohio.—At the annual meeting of the local Power Club Percy Hyde was elected president for the ensuing year. The club is composed of employees of the Springfield Light, Heat & Power Company, and was formed to bring about a closer relationship between the company and its employees.

Madison, Wis. — Announcement has been made by the Wisconsin Power, Light & Heat Company of the establishment of a welfare and relations department with T. F. Keefe, formerly manager of the company's Baraboo properties, as director in charge for the entire Wisconsin properties of the company. In this capacity he will direct certain company policies and also direct the efforts of employees so that each will be better fitted to handle his present job and be prepared for the job above.

Portsmouth, N. H.—Through the efforts of General Manager F. A. Belden, every employee of the Rockingham County Light & Power Company will shortly receive paid-up insurance in amounts ranging from $500 to $2,000, depending on the length of employment. This action is entirely voluntary on the part of the company, and much appreciation has been expressed by employees.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Generation, Control, Switching and Protection

Test of Diesel Fuel Consumption.—W. B. GREGORY. — Operating tests are given on two Fulton four-stroke-cycle Diesel engines directly connected to three-phase, 60-cycle, 2,300-volt generators. One engine is a four-cylinder unit, rated at 380 brake-horsepower at 200 r.p.m., while the smaller is a three-cylinder unit developing 285 brake-horsepower at 200 r.p.m. A review of the tests is given in the accompanying table.—*Power*, Aug. 21, 1923.

RESULTS OF TESTS ON TWO DIESEL ENGINE GENERATORS

Per Cent of Rating	R.P.M.	Generator, Kw.	Exciter, Hp	Brake-Hp.	Fuel per Brake-Hp. per Hour
285-HP. UNIT					
100.0	199.9	200.1	8.5	299.5	0.430
89.3	201.8	165.7	8.9	254.3	0.460
53.6	205.1	97.6	6.7	152.8	0.506
36.7	206.2	62.9	6.0	104.6	0.579
380-HP. UNIT					
101.3	200.7	261.0	8.3	385.3	0.430
81.4	202.4	207.0	6.9	309.0	0.439
53.3	205.0	128.5	6.6	202.3	0.451
28.3	206.5	65.2	4.9	107.7	0.627

Operating Experience with Current-Limiting Reactors.—N. L. POLLARD.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. spring convention, May 5, 1923, on page 1030.—*Journal of A. I. E. E.*, September, 1923.

Hydro-Electric Development and Steam Equipment

Test Code for Stationary Steam Generating Units.—This code applies to the boilers, fuel-burning apparatus, superheaters, economizers, but not to auxiliary apparatus in a power plant. The code outlines the instruments and apparatus to be used in testing, operating conditions, starting and stopping of tests, records and the calculation of results. Tables representing the form that the data and results should take are given.—*Mechanical Engineering*, September, 1923.

Drive of Power-Station Auxiliaries.—L. BREACH and H. MIDGLEY.—This paper deals only with the supply of power for the auxiliaries of a modern power station, no attempt being made to discuss the relative merits of apparatus such as evaporators, ejectors, etc. The following aspects of the problem are dealt with: (1) Consideration of the different types of auxiliaries used in a station; (2) consideration of the different types of supplies available, and (3) suitability of different auxiliaries and supplies for various conditions of station operation. Seven alternative schemes for the supply to the auxiliaries of a proposed new station are described and tabulated, and the advantages and disadvantages of each are considered. Certain of these are recommended by the authors, this recommendation being based on the principle that no expense should be spared to obtain a simple and reliable system of station auxiliaries. Observations are made on features to be taken care of when auxiliary supplies are being laid down.—*Journal of Institution of Electrical Engineers (England)*, August, 1923.

Hydro-Electric Plant Operating with One-Mile Head.—F. A. NOETZLI.—The Fully hydro-electric power plant of 12,000 hp., operating under a head of virtually one mile and having a single penstock less than 2 ft. in diameter, has recently been placed in operation in Switzerland. Special Pelton wheels of unusual design are used in this plant. — *Engineering News-Record*, Sept. 6, 1923.

Transmission, Substations and Distribution

Jointing of High-Pressure Cables.—A type of joint for 20,000-volt cables has been evolved in which the actual conductor joint is inclosed in a paper tube. Several tests made on this type of joint are enumerated.—*Electrical Review (England)*, Aug. 10, 1923.

Computation of Losses in a System of Power Distribution with Two Loads of Different Characteristics.—R. LUNDHOLM.—This investigation has special reference to the contemplated electrification of the railroad from Stockholm to Gothenburg in Sweden. A certain section of the system is assumed to have two loads, one from domestic consumption with comparatively slow variations and one from the railroad with rapid variations. The total loss in the section is made up of three terms—one for each load and a third which represents the loss due to the superposition of the two loads. If W_m and U_m represent the maximum values of the two loads and ϵW_m and ξU_m the average values, the loss over a certain time, T, is shown to be:

$$\int_0^T w df = k\left[\int_0^T W^2 df + \int_0^T U^2 df + 2\epsilon W_m \xi U_m T\right].$$

The constant, k, is determined by the resistance in the line, the voltage, etc. This symbolic equation is especially useful because it gives a quantitative expression for the losses independently of the form of the load curves. It is also shown that this method gives a lower value than the customary and more approximate method of combining the two average values into one. The result obtained with this equation is theoretically correct when the periods of one load are commensurable with the periods of the other, but errors are introduced when the periods become less regular.—*Teknisk Tidskrift (Swedish)*, *Elektroteknik*, Aug. 4, 1923.

Comparative Study of the Merits of Overhead Lines of Copper, Aluminum and Steel-Aluminum.—L. LEGROS.—Much valuable information is given in this elaborate study, written by a metallurgist and electrical engineer. By means of a large number of tabulations and curves the comparative characteristics of copper, aluminum and bimetallic (aluminum-steel) lines are compiled for the purpose of selecting for any given case and condition the most economical line material. The data consider not only the cost of the conductor, but also the cost of the necessary poles or towers to carry the line. Conductivity, mechanical strength, chemical durability and voltage drop are all considered separately and combined, but, unlike most previously published papers on this subject, the author does not confine his conclusions exclusively to high-voltage transmission lines but considers also the possible savings which can be realized under certain conditions on medium-voltage and even on distribution lines from the use of non-copper conductors. In addition to the generally applicable formulas, tables and curves, many numerical examples are introduced to illustrate some special features.—*Revue Générale de l'Electricité*, Aug. 4 and 11, 1923.

Present-Day Practices in Grounding of Transmission Systems.—An abstract of this report of the sub-committee on grounding of protective devices may be found in the ELECTRICAL WORLD report of the A. I. E. E. spring convention, May 5, 1923, on page 1019.—*Journal of A. I. E. E.*, September, 1923.

Units, Measurements and Instruments

Application of a Revolving Magnetic Drum to Electric Relays, Siphon Recorders and Radio Transmitting Keys.—N. W. MCLACHLAN.—The instrument described consists essentially of an iron drum with an annular recess, in which are situated one or more coils of wire, the ends being connected to pairs of corresponding slip rings. The drum is mounted on ball bearings, and its periphery, which is shod with cast-iron rings, is machined to run true to 0.0001 in. A small iron or steel shoe fits accurately the curvature of the rings. When a current passes through the coil the drum is magnetized, and this causes the shoe to be pressed on the rings with considerable force. Thus, if the drum is revolved, a pull is required to cause the shoe to slide relatively to the rings. The magnitude of the tangential pull thus obtained is many times greater than that calculated from the product of pressure due to magnetic attraction. The present paper deals with the application of this instrument to electric relays, siphon recorders for line and radio telegraphy and transmitting keys for radio telegraphy. The electric circuits

for single-current, double-current and valve-circuit working are described.—*Journal of Institution of Electrical Engineers (London)*, August, 1923.

Instrument Practices of the United Electric Light & Power Company.—W. E. CALDWELL.—The author tells how the above company safeguards the accuracy of its fundamental test data. Complete instructions are given for the construction of a precision mercury vacuum gage and for testing steam gages in position. Practical comments on thermometer selection are given.—*Power*, Aug. 21, 1923.

Effect of Continued Heating on the Power Factor and Resistance of Impregnating Compounds.—D. E. HOWES. —A large number of field-coil windings were impregnated with four kinds of compounds and heated at temperatures of 105 deg., 125 deg. and 150 deg. C. for a period of 120 days. At intervals the electrical condition of the insulation was determined by measurement of its power factor and resistance. Even though considerable oxidation took place, the electrical properties continued to improve throughout. The results show that continued heating at these temperatures, while it does not seriously affect the electrical properties of the insulation, does destroy its practical value because of its mechanical deterioration.—*Paper presented before the American Electrochemical Society at Dayton, Ohio*, Sept. 27-29, 1923.

Illumination

Art of Sealing Base Metals Through Glass.—W. G. HOUSEKEEPER.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. summer convention, July 7, 1923, page 20.—*Journal of A. I. E. E.*, September, 1923.

Relation Between Current Voltage and the Length of Carbon Arcs.—A. E. R. WESTMAN and W. J. CLAPSON— In a previous paper presented before the society it was shown that for currents from 300 amp. to 400 amp. the voltage over a carbon arc is approximately equal to the arc length in millimeters, where the arc length is measured from the tip of the cathode to the bottom of the anode crater. This paper describes much more accurate measurements over a range of currents from 100 amp. to 700 amp. The results obtained, which support the conclusions of the previous paper, are compared with those of Grotrian, Nottingham and Watts.—*Paper presented before the American Electrochemical Society at Dayton, Ohio*, Sept. 27-29, 1923.

Motors and Control

Twin Motor Versus Single Motor for Alternating-Current Locomotives. — J. WERZ.—The author claims that for single-phase locomotives with individual drive for each axle the twin motor is more advantageous than the single-unit motor. To substantiate his claim a detailed description is given of a Swiss Federal engine, equipped with twin motors, and the main data are compared with a similar engine with single-unit motors. The twin-motor type used as an example and shown in a sectional drawing and a photograph is a machine with a common shell casting within which are lodged the two fields and the two armatures. The two gear pinions engage in a common spur gear, which is connected elastically to the driven shaft by means of six interposed helical springs. It is of interest to note that in case of unusual difficulty in starting the train the armatures may turn as much as 20 deg. before the drivers begin to turn. This extremely flexible drive will safely eliminate the dangerous burning of commutator segments which is otherwise not infrequently experienced on all heavy-duty alternating-current locomotives.—*Elektrotechnische Zeitschrift*, July 12, 1923.

Electrophysics, Electrochemistry and Batteries

Heat Losses and Chemical Action in the High-Voltage, High-Frequency Discharge Through Air.—F. DANIELS, P. KEENE and P. D. V. MANNING.—A discharge was produced by a Tesla coil at about 100,000 volts in a large chamber constructed from a terra-cotta sewer pipe. A central wire 91.5 cm. long and a wire screen 41 cm. in diameter formed the electrodes. Outside of the netting was a large cylinder of paraffined paper, and the whole chamber was arranged to function as a calorimeter. Of the electrical energy supplied to the primary of the transformer, 40 per cent to 50 per cent appeared as heat in the discharge chamber and 1 per cent to 2 per cent as chemical energy. The air was analyzed for ozone and nitric acid. There is no advantage in discharges of this type for fixing nitrogen. The "cold" discharges waste just as much electrical energy in the form of heat as do the arcs, the only difference being that the consumption of electrical energy is small and so the temperature rise is less.—*Paper presented before the American Electrochemical Society at Dayton, Ohio*, Sept. 27-29, 1923.

Traction

Electric Railway Construction and Operation in Cuba.—L. GEENENS.—In the second and concluding article on electric railways in Cuba an account is given of the rolling stock used, the shops in which the cars and locomotives are maintained and some facts about transportation conditions on the line.—*Electric Railway Journal*, Aug. 11, 1923.

Electrification of the Austrian Railways.—A short description of the Innsbruck section, which is nearing completion. Part of the article is given over to a description of the construction of two dams by which the level of a lake will be raised 28 m. to supply water to a power house under construction which will have six sets of machines of 8,000 hp. each. — *Electrical Review (England)*, Aug. 10, 1923.

Use of Train Signals at Interlocking Plants.—Confusion on the part of the enginemen between the indications given by the separate train-order signal and the interlocking signals at interlocking plants has contributed to numerous accidents. Recently there has been a tendency to use interlocking signals as train-order signals in order to eliminate confusion. The various systems that are being used throughout the country are described. —*Railway Age*, Aug. 4, 1923.

Telegraphy, Telephony, Radio and Signals

Design of Inductances for High-Frequency Circuits.—C. L. FORTESCUE. —The paper consists of an investigation of the proportions and the arrangement of the winding of high-frequency inductances in order to obtain the minimum ratio of R/L. Both stranded and solid wire coils are dealt with, and the unavoidable limitations arising from the space factor are considered. Results and tables are given which enable simple comparisons to be made between stranded and solid wire coils having either single-layer or multiple-layer windings.—*Journal of Institution of Electrical Engineers (England)*, August, 1923.

Measurements of Voltage Amplification of Audio Frequency Amplifiers.— The results of voltage amplification measurements made on sixteen audio-frequency amplifiers which were on the market during 1921 and 1922 are given. All these amplifiers employed transformer coupling. Measurements were made over a range of 400 cycles to 2,100 cycles per second.—*Letter Circular No. 98 of the Bureau of Standards.*

Miscellaneous

Composition and Aging of Insulating Varnishes.—H. C. P. WEBER.—It has been shown that during the drying and oxidation of varnishes conducting materials are formed which produce appreciable lowering of the insulation resistance of electrical apparatus. Values are given to show that the amount of these "low-resistance materials" is proportional to the amount of oil in the varnish and that there is a noticeable difference in the amount produced by different oils. Linseed oil, for instance, yields these substances in much greater quantity than other varnish oils.—*Paper presented before the American Electrochemical Society at Dayton, Ohio*, Sept. 27-29, 1923.

Electrical Development in Australia. —G. G. CREE.—The author gives a general review of the developments that have taken place in Australia. It is a noteworthy fact that distributing costs are usually greater than generating costs, the ratio being approximately sixty to forty, while in comparable American utilities this ratio is reversed. The reason for this is that apartment houses are hardly known and that practically the entire population is housed in one-family houses with a garden, which means a scattered population. For example, the metropolitan area of Melbourne is greater than that of New York or Paris, but the population is only 800,000.—*General Electric Review*, September, 1923.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

A. I. E. E. at Del Monte

Busy Session of Institute Held on Coast —Ryan and Baum Among First-Day Speakers

THE annual Pacific Coast convention of the American Institute of Electrical Engineers opened at Del Monte, Cal., on Wednesday of this week with a registration of well over 200 members and an attendance of 175 at the first day's sessions. Harris J. Ryan, president of the Institute, opened the convention in the absence of Past-president Jewett, who telegraphed his regret at being unable to attend.

As there were twenty-nine papers and addresses to be presented during the three-day session, no time was lost in preliminaries and the convention got down to business at once. President Ryan in an address on "Research Relating to High-Voltage Transmission" laid the groundwork for many of the papers and discussions which followed. He outlined the experiments and investigations which he and his associates have been making into the nature and basic laws of corona in an attempt to develop rational formulas for the determination of power loss in transmission lines due to that phenomenon.

DEPLORES ATTACKS ON POWER SYSTEMS

In an address on "Some Factors in the Power Problems of the United States," Frank A. Baum deplored steps which are being taken against the public's interest by municipal-ownership propagandists in an attempt to break up the highly successful and economical power systems which have been developed by the private electric utilities of the country. Thus to tear down the constructive economic development of the nation which these agencies have achieved during the past two decades is, Mr. Baum declared, a backward step which must necessarily result in a stagnation of the efforts of the engineers to keep pace with the demands of twentieth-century civilization.

Considerable interest was added to the convention by the participation of engineers of international reputation, such as Dr. C. P. Steinmetz, in the papers and discussions. An important feature of the proceedings was the banquet on Thursday evening, at which the Edison medal was presented to Dr. R. A. Millikan by Dr. Jewett in an address from New York made over the transcontinental telephone.

An attraction which proved particularly popular with delegates and guests from distant points was the inspection trip to the Big Creek developments of the Southern California Edison Company scheduled for the week end following the convention. Other inspection trips were arranged to take in the Pit River development of the Pacific Gas & Electric Company and the important high-voltage substations in the San Francisco Bay region.

Committee Meeting on "Romex" Postponed

The meeting of the National Fire Protection Association's sub-committee on new developments to decide whether or not a formal field test through authorized installations is to be accorded to "Romex," a new flexible nonamored duplex cable manufactured by the Rome Wire Company, which, as announced in these columns last week, was to have been held on Monday last, Oct. 1, has been postponed to Monday, Oct. 15.

Insull Refutes Conspiracy Charges

That the charge of conspiracy to place the control of the Chicago Elevated Railroads in the hands of the Commonwealth Edison Company is a direct lie was the statement made by Samuel Insull, the president of the Commonwealth Edison Company, after a suit was filed in the local circuit court in behalf of the holders of the preferred stock of the Chicago Elevated Railroads' collateral trust asking appointment of either a new trustee or a receiver to take charge of the assets of the company. The Commonwealth Edison Company is a creditor of the elevated lines to the extent of more than $1,000,000 for power and under the new reorganization plan will receive, as payment for this debt, 101,795 shares of common stock of the total 203,295 shares of common stock to be issued.

Mr. Insull declared that the Commonwealth Edison Company had absolutely no desire to gain control of the elevated lines, but would be glad to pass the burden on to some one else. The indebtedness to the Commonwealth Edison Company is for energy supplied, and without this energy the lines could not have been kept in operation. Except for a sense of public obligation to maintain a much-needed transportation service, the Commonwealth Edison Company could have refused credit to the Chicago Elevated Railroads years ago.

Girand May Get License

Predicted that Federal Power Board Will Vote Two Against One for Diamond Creek

WHEN the Federal Power Commission meets on Oct. 15 it is expected that action will be taken on the Girand license covering the much-discussed project at Diamond Creek on the Colorado River, favored by Arizona and opposed by the other states of the Colorado River basin. The prospects seem to favor the granting of the license. Secretary Wallace is openly in favor of such action. Under present conditions it might be expected that Secretary Work would vote against it. The deciding vote will be cast by Secretary Weeks. Chairman Weeks has been careful not to express any convictions in connection with the matter, but, judging from questions he has asked, it would seem that he would favor the granting of the license provided it be made subject to the Colorado River compact or any other interstate agreement that may be made. There is also the possibility that conditions may be worked out between Mr. Girand and the representatives of the up-stream states which would remove the objection of the latter.

Unquestionably the strongest point being made in favor of the Girand license is the fact that the good faith of the federal government is involved. On the other hand, the up-stream states argue that there is no legal requirement that the government act precipitately, especially when the welfare of a great region is at stake. They think all questions of rights should be settled before any physical structures go in. In that connection it is claimed that the Arizona copper companies would suffer more by an unwise settlement of the Colorado Basin question than they will by a slight prolongation of the period during which they will have to use higher-cost power.

Big Creek Plant No. 3 Goes Into Commission

The Big Creek plant No. 3 of the Southern California Edison Company, just completed, was placed on the line Sunday evening, Sept. 30. This plant has three 27,500-kva. generators operating under a head of 740 ft. It is the fourth in the chain of plants in the Big Creek development and brings the total capacity of this development up to 200,000 kva. The power is transmitted to Los Angeles over the Big

Creek 220,000-volt, 240-mile transmission lines. All switching at the generator end of the lines is done through a 20,000-volt switching station at the new Big Creek plant No. 3. Extensive tunnel construction is under way for increasing the water storage for the four existing plants. Increased power demand for the next few years will be taken care of by the installation of additional generating units in the existing plants.

School Lighting and Colored Lighting

These Are Topics at Closing Sessions of Illuminating Engineering Society's Convention—Unit-Cost Analysis of Industrial Lighting

AT THE last day's session of the Illuminating Engineering Society's convention at Lake George, N. Y., last week a preliminary report on a proposed code of lighting for school buildings was presented for discussion. This preliminary draft was not in sufficiently advanced form for publication, but in the discussion pertinent points were brought out. George H. Stickney, illuminating engineering assistant to the sales manager of the Edison Lamp Works, emphasized the fact that experience shows poor lighting to be doing a great deal of harm in the schools and said also that some of the fundamental principles of lighting which the committee includes in its preliminary draft are of great value and really lie at the bottom of the subject in that they voice basic principles which those who light and operate schools should know.

It was brought out that the old edition of the code had been of much benefit to school boards and architects. Harry I. Day, an architect, said that he saw advantages in one-story school buildings with roof daylighting. While recognizing the benefits from improved lighting in new schools, some speakers called attention to the difficulty of rectifying poor lighting in existing buildings. Recommendation was made that double shades be used on windows, one operating from below and one from above. There was considerable debate pro and con on glossy versus flat-tone finishes for ceilings and the upper portions of the walls.

IMPORTANCE OF COLORED LIGHTING

The paper by M. Luckiesh and A. H. Taylor on colored lighting pointed out the importance which this method of illumination has assumed not only for outside decorative effects, but also in show-window illumination and for interior illumination work in residences as well as theaters and other places. The paper included the accompanying table as to various methods of obtaining colored lighting. It also gave information as to the transmission factors of various colored media and other definite factors which help in the more accurate use of colored lighting.

Mr. Luckiesh said that, in his estimation, sprayed insoluble pigments on bulbs will form the future method of obtaining colored lights. A. L. Powell said that average data rather than actual ratings should be used, and he called attention to the fact that Belasco's latest stage color effects are based on the reflection of white lights from concealed colored surfaces. From the manufacturing standpoint it was brought out that users ought to agree on the exact tint of various colors so that colored lamps can be produced in quantity and therefore at a lower price. Mr. Luckiesh, saying that there are only four fundamental colors, red, green, blue and yellow, maintained that the users themselves should get the desired effects by mixing lamps rather than by asking manufacturers to produce lamps of many tints. "Flame" tint, often desired, is natural to the human eye, and any shade of it can be used by combining yellow and red.

ANALYSIS OF UNIT COSTS

Davis H. Tuck presented an analysis of unit costs of industrial lighting reduced to cents per foot-candle per square foot, the figures being both of installation costs and operating costs. Some of these figures will be given in an early issue of the ELECTRICAL WORLD.

In discussion it was brought out that lighting from the standpoint of manufacturing is an investment and not an expense and that current lighting costs should be expressed in terms of a percentage of labor costs rather than in dollars and cents. Exception was taken by some to the tabular statistics presented by Mr. Tuck, and the suggestion was made that these should be divided into items referring to general illumination and items referring to localized general lighting.

The convention closed with a banquet on Thursday evening, General George H. Harries acting as toastmaster in his usual happy mood. One feature of the banquet was the presentation of a gold badge to each of the past-presidents, of whom eight were in attendance at the convention. The principal address of the evening was by Dr. Laurence A. Hawkins of the General Electric Research Laboratory, who spoke of the relationship between pure research and light and its applications. He expressed his hope that a better and more efficient illuminant might be produced before long.

Friday morning was devoted to a meeting of section and chapter representatives at which discussion was had as to the ways in which both chapters and sections might more constructively work in the advance of illumination, and particularly in the spread of information about illumination to the general public. A study was also made as to where additional sections and chapters could advantageously be established.

APPROXIMATE RATINGS OF VARIOUS METHODS OF OBTAINING COLORED LIGHT

E=excellent; G=good; F=fair; P=poor.

Medium	Transmission	Color Permanence	Cost of Maintenance	Resistance to Weather
Colored glass bulbs.....	E	E	F	E
Colored glass accessories	E	E	E	E
Colored gelatine........	E	P	F	P
Lamp dips and lacquers	E	P	F	P
Spray coatings	F	E	G	G

National Electrical Code for 1923 Out

The 1923 edition of the "Regulations of the National Board of Fire Underwriters for Electric Wiring and Apparatus, as Recommended by the National Fire Protection Association," is out. This edition contains the revisions and amendments adopted in the early part of this year. Three important modifications in practice permitted by these amendments were detailed in the ELECTRICAL WORLD for March 17, page 650. The 1923 edition of the code has been rewritten according to a new plan of arrangement shown by the table of contents.

Municipal Electricians Give Views on Field Trials

It was apparently the consensus of opinion at the convention of the International Association of Municipal Electricians held at Reading, Pa., on Sept. 25-28 that the electrical code committee of the National Fire Protection Association was not the proper body to order field trials on new materials. The delegates were largely in favor of this being done through a general consultative body of manufacturers, inspectors and others concerned. They viewed the electrical code committee as really a legislative body.

A recommendation for a standard local inspection ordinance to apply to all parts of the country was adopted. Papers on wires and cables for municipal use, street lighting, measurement of insulation resistance, inspection, fire alarms and signal systems were presented. W. J. Canada of the National Electric Light Association spoke on "Present and Future Relations Between Municipalities and Public Utilities."

These officers were elected: President, J. L. Caldwell, Colorado Springs, Col.; first vice-president, Dr. Charles P. Steinmetz, Schenectady, N. Y.; second vice-president, Jacob Grim, Buffalo, N. Y.; treasurer, William C. Crane, Erie, Pa.; secretary, William Arbuckle, Bayonne, N. J.

Public Relations Uppermost at French Lick

Trend of Legislation, Commercial Possibilities and Technical Subjects Round Out Convention Program of Great Lakes Division, N. E. L. A.

A PROGRAM well rounded through its inclusion of managerial, commercial, technical and accounting subjects was carried out at the third annual meeting of the Great Lakes Division of the National Electric Light Association, held at French Lick Springs, Ind., Sept. 27 to 29. Public relations, trend of legislation, opportunities for increasing central-station loads and tendencies in technical practices dominated the discussions. Thirty-two papers, addresses and reports were presented, and about 500 delegates were in attendance.

Public relations were referred to in President C. W. Tippy's address as the keynote topic of the times. In improving them publicity through news articles and advertising has, he said, played no small part, but greater efforts should be exerted by public utilities to develop speakers who can get the utilities' message across to the public. Stock sales by women in the industry have been very helpful. Mr. Tippy uttered a warning by saying that the stock must be made absolutely safe and regular dividends assured.

A talk on actual experiences in improving public relations was given by W. S. Vivian, Middle West Utilities Company, who pointed out that service is more than delivery of power. It is doing more than one is paid to do; it is the spirit back of the action—the attitude and action of every one from the president down to the most lowly employee.

COMMISSIONERS' VIEWPOINT

Members of the Michigan and Wisconsin public utility commissions addressed the convention on public relations as viewed from their position. Sherman T. Handy, Michigan Public Utilities Commission, likened the utility industry to a three-cornered partnership in which the utility, commission and public are equally interested. It cannot be prosperous, he declared, unless each of the partners is satisfied.

Utility financing and consolidation are not understood and are looked upon with suspicion by the public, declared Lewis E. Gettle, chairman Railroad Commission of Wisconsin. Consolidation is the order of the day, but there have been some regrettable accompaniments. Properties have been acquired at excessive prices, and the issuance of securities on inflated valuations cannot be allowed.

"Are we all cognizant of the benefits of good public relations?" asked F. R. Coates, vice-chairman of the National Public Relations Section. The first person who should be convinced is the chief executive. He should acquaint himself first-hand with the service that the company is rendering, get personally acquainted with the employees, develop an intimate contact with the public and know the press. No member of a utility company should lean backward in carrying out regulations, he declared.

WOMEN'S INFORMATION COMMITTEE

The organization and activities of the Great Lakes women's public information committee were referred to at length by Mrs. P. W. Evans, its chairman. She announced that the committee is prepared to provide women speakers on the utility relations to governmental bodies, utility organization and financing, public utility securities and valuation, and she urged more extensive utilization of women in good-will work because of their innate courtesy and tactfulness.

Representatives of the Illinois, Indiana, Michigan and Wisconsin public utilities information committees spoke of the work accomplished in their territories. H. M. Lytle of the Illinois committee urged establishing a "Friend-a-Day Club" among utility employees as a means of improving public relations. John A. Mellett of the Indiana committee said that the job of such committees is to protect the moral credit of the utility, and urged consistent, regular advertising regarding subjects like capital turnover, credit arrangements and improvements of service. Expenditure of from 2 to 10 per cent of income for advertising is justified, he contended. Alfred Fischer of the Michigan committee expressed the belief that it is the ease with which electric service is rendered which makes its value seem so small to the public. Hence the public must be made acquainted with the work, apparatus and cost involved. Franz Herwig of the Wisconsin committee pointed out that too few companies have applied public relations measures, maintaining that every company should be individually organized for the work and should carry on timely advertising.

Recent commission and court decisions and recent or contemplated legislation which, while not directly aimed at electric utilities, will seriously hamper and even cripple them were alluded to by Carl B. Jackson, former chairman of the Wisconsin commission and now general counsel of the N. E. L. A. Unless the electric utility industry realizes that the principles established in connection with other utilities may be binding on electric utilities and co-operates through its organizations with other national organizations in opposing anything that is unjustified, equally detrimental restrictions may follow. Every time a bad precedent is laid down in one state it will affect utilities in other states, even though it originally applied to some other interest, he said. The ability to render service depends on the absence of unwise restrictions.

An address full of facts and figures regarding the growth of the public utility industry, its definitely planned expenditures for new construction, capitalization, extent of customer ownership, problems of rural service and transcontinental superpower lines, possibilities of savings on utility insurance, and legislation that is desired, was delivered by President Walter Johnson of the national body at the banquet on Thursday evening. To induce and maintain good public relations the industry must expand, he pointed out, but it is a mistake to grow too fast. The expenditures must be kept proportional to the income or definitely estimated increase in income.

Legal situations existing in a number of states which unjustifiably handicap utility developments were referred to by Executive Manager M. H. Aylesworth, who declared it to be the utility's job to tell the people the real story so that demagogues cannot mislead them. For example, he said, Wisconsin is withholding water-power development until the state investigates whether it should be undertaken by the state or private interests, Maine will not let power into, through or out of the state, California is starting the old state ownership discussion again, the New York Legislature was within two votes of declaring for state ownership of utilities, and the State of Washington is advising citizens to build their own lines and buy power wholesale.

Superpower is no longer an engineering problem, Mr. Aylesworth pointed out. From a technical viewpoint it is solved, but politics and economic conditions are still obstacles.

Because of conditions which have arisen, every central station in this country will again come to selling appliances, Mr. Aylesworth declared. It is the best point of contact with the public, he said.

RURAL SERVICE AS VIEWED BY FARMERS

The objects and purposes of the American Farm Bureau Federation were presented by J. W. Coverdale, executive secretary, who said the farmer feels that he is being discriminated against because electric service is not readily available now. With the work now under way by the joint committee on rural service, including the farm power survey and the study of central-station farm service, foreign uses of electricity on the farm and experimental applications, the speaker expressed the belief that the much-needed rural service can be established as promptly as economic conditions will justify.

The relation of college work to public utilities was discussed by Charles M. Thompson, dean of the College of Commerce and Business Administration, University of Illinois, and an extensive discussion on business research in public utilities was presented by Stanley P. Farwell, director of the Bureau of Commercial Economics.

The educational committee, of which John H. Mitchell is chairman, expressed the belief that graduates of

universities and colleges should be called into the service of public utilities to a much greater extent than they are today. However, employees who have not had the benefit of such education, as well as the college graduates, must receive institutional training which cannot be given in any university. This is afforded by the N. E. L. A. educational courses. The suggestion was made that each company finance the original cost of these courses to its employees, the cost to be met by the student in small monthly installments which may be reimbursed in part or in full by the company upon completion of the course.

H. P. Liversidge, chairman of the National Technical Section, said that the growth of the industry is faster than the existing organization can cope with, so that it is essential that the geographic divisions take on the detail work and direct their attention particularly to activities which will work toward greater economy in investment and operating expense.

Power Survey

The power survey of the Middle West which was undertaken by the power survey committee after the 1922 convention has been extended beyond the limits of the Great Lakes division, but to lessen the amount of study necessary before results can be reported the study is being concentrated on a single portion of the district. R. F. Schuchardt announced that the first definite report will be prepared before the end of the year. It will include the location and size of existing power plants, extent of coal deposits and production, characteristics of rivers, population and power studies. Nine principles which should guide utilities in securing interconnections were presented. These dealt with the attitude of companies, capacity, service protection, load-dispatching arrangements, maximum-load limitations, rates of service, diversity of loads, construction costs of interconnections, and public relations.

N. T. Wilcox, chairman of the National Commercial Section, pointed out that entirely too much detail work has been handled in the past at headquarters and urged that the geographic divisions should organize to handle more of it. Speaking of the Commercial Section particularly, he said that each division should have at least a three-year program to follow.

A. D. McLay of the Detroit Edison Company expressed the belief that the electric utility is going "to be the iceman" in the next five to ten years because of the increasing interest in domestic refrigerators. If so, it will have to give refrigerating service and not merely provide power, since ice manufacturers are alert to the competitive situation.

Central-station companies must study trucking conditions and show that the electric vehicle meets the requirements, declared J. C. Manley of the Electric Vehicle Bureau. He said that the New York Edison Company is reported to take in $1,000,000 revenue a year from battery charging alone. A truck customer is equivalent to 900 lighting customers. The committee of which Mr. Manley is secretary has prepared a map showing the location of battery-charging stations available along automobile routes in the Great Lake district.

After considerable discussion the Power Sales Bureau of the Great Lakes division, B. H. Gardner chairman, decided that it would not be advisable to conduct a school for teaching power salesmen about electric heating since one is now conducted in Pittsburgh. Furthermore, it was decided that it would not be necessary for the section to maintain power salesmen to help the smaller companies, since manufacturers already give this service.

Owing to the fact that many japanning-oven installations have been made by containing a conglomeration of parts, the efficiency of some of these ovens has run as low as 4 lb. per kilowatt-hour instead of about 20 lb. or 30 lb., declared John D. Noyes of the Detroit Edison Company. Co-ordinated design would greatly remedy this situation. It was pointed out that in considering the relative cost of operating fuel-fired and electric ovens the expense of operating fuel-fired oven accessories is sometimes overlooked. Insistence on guaranteed performance, emphasis on thermal economy, designing ovens for average load conditions, careful cost comparisons and relative control advantages were emphasized as points to keep in mind.

Service to Coal Mines

In Illinois and Indiana alone, where about a hundred million tons of coal a year are mined in normal times, there is a potential coal-mine energy consumption of 250,000,000 kw.-hr. per year, according to C. O. Dunten, Central Illinois Public Service Company. As a help to the power salesmen who might benefit by this load, he discussed the power requirements of different operations, the order in which the loads can be obtained, load characteristics, rates, production costs and advantages of purchased power. Considerable data were presented regarding results secured with specific installations.

The committee on commercial service relations with customers, of which R. T. Duncan is chairman, reported that it was engaged in formulating efficient methods of conducting relations between the customer, the public and the supplying company, including such matters as application of contract routine, order and "disconnect" routine, inquiries, complaints, meter reading, collections, credit and general commercial activities. At present the study of contract and order routine is being undertaken in order that the multiplicity of records may be simplified.

Only two papers of a technical nature were presented at the convention, one on the trend of power-plant design by C. H. Berry of the Detroit Edison Company, or, as the author expressed it, "The Scramble of Power Plant Design," and the other on the activities of the meter committee by J. C. Langdell, the chairman. Mr. Berry expressed the belief that operating companies will most certainly come to an initial steam pressure of 400 lb. or 500 lb. and perhaps considerably higher. It does not seem probable that initial temperatures will rise much above 700 deg. F. for some time to come. The turbine will be arranged for bleeding steam from three or four stages for heating the condensate, and the final water temperature can possibly be higher than has been considered good practice in the past. The economizer must be greatly reduced or entirely eliminated, the speaker declared, since with hotter feed water there is less work for the economizer. To cool the flue gas and maintain higher boiler-room economy, companies will then be forced to use the air preheater. In the large central stations it now seems that pulverized-coal combustion is very promising, but it must be granted, the speaker contended, that it has not yet shown itself superior to the up-to-date stoker. No place has been given to the reheating type of turbine, the author declared, because plant cost and complexity will rule out this design except in very favorable situations, despite the noteworthy installations now in progress of construction. Within a decade or two, Mr. Berry prophesied, such radical changes will be made in plants that they will differ as much from those of today as these in turn differ from those of a generation ago.

Mr. Langdell said that the outstanding accomplishment of the Great Lakes meter committee was the establishment of a meter school at the University of Michigan. Seventy-five students attended and eighteen plants and companies were represented at the school held in April last.

Work under way by the accident prevention committee was outlined by Harry J. Burton, chairman.

Accounting Subjects

Three papers of accounting interest were presented—one by B. W. Lynch on the plans and activities of the national section; another on the benefits derived from the N. E. L. A. course, by C. B. Boulet, Wisconsin Public Service Corporation, and the third on bookkeeping machines in connection with light and power customers' accounts, by J. B. Mahan, Terre Haute, Indianapolis & Eastern Traction Company. Mr. Lynch explained that it is the purpose of the National Accounting Section to expand the scope of the section to include financial subjects as well as accounting. Among the advantages of the N. E. L. A. courses, according to Mr. Boulet, are increased self-reliance, ability to make decisions and a broader viewpoint for the individual, the co-ordination of related departments, and a means for keeping pace with the phenomenal growth of the industry. Mr. Mahan discussed methods of handling customers' accounts with bookkeeping machines.

Edgar Discusses Boston Edison Financing

Declaring that the cost of issuing long-term bonds is prohibitive on a 6 or 7 per cent basis and pointing out the benefit capitalization through stock shares has been to Massachusetts central stations in recent years, President Charles L. Edgar of the Edison Electric Illuminating Company of Boston appeared before the Massachusetts Department of Public Utilities on Monday in support of the company's petition for authority to issue 64,881 additional shares of capital stock at $140 per share in order further to finance the expansion program now under way on the system. Mr. Edgar said that when the plans now in hand are completed the Boston Edison property would represent a hundred-million-dollar investment. If the board approves the present issue, the total capital and premium account will reach $63,524,236, representing a paid-in value of $163 per share. If current dividends of $12 per share annually are maintained, the net return upon the total investment would be 7.36 per cent. In the past eight years the company has expended and committed itself to early outlays aggregating nearly $49,000,000, and of this nearly $16,000,000 has been determined upon since June 30.

During the hearing a question arose as to the company's practice in capitalizing expenditures after these had been incurred. Mr. Edgar said that for some years the company had waited until its floating debt had attained substantial volume before applying to the commission for authority to capitalize expenditures. By presenting the commission with information as to contracts made and actual costs in the field a more tangible case is set up. The present petition covers only a part of the program of expansion under way, the pendency of the company's rate case preventing complete financing far ahead. Chairman Attwill pointed out that the capital asked is well below what the city's expert has approved.

Former Senator Sage Is for Ferris Amendment

Controversy over the so-called Ferris amendment to the New York State Constitution allowing power houses and transmission lines to be erected in the Forest Preserve of the state in the Adirondack region continues to be waged. The contending views were briefly stated in the ELECTRICAL WORLD for Sept. 22, page 622. Opponents of the amendment center their attack on the injury they see involved to the state parks, on the opportunities in their opinion permitted for exploitation of the state by timber and power corporations, and on what they regard as the suspicious way in which the amendment was twice jammed through the Legislature in the closing hours of the session. Advocates of the alteration in the fundamental law of the state emphasize the need for more power and the wastefulness of delay and characterize their adversaries' arguments as unfounded and misleading.

Among these advocates is former State Senator Henry M. Sage, who makes the point that the right to erect power transmission lines across the Forest Preserve is now denied both to private companies and to the state itself and that it would be ridiculous for New York State to provide for the development of hydro-electric power in the Adirondack region if it failed to make provision for the transmission of this power to the industrial centers and large cities of the state, including New York. Minimizing the harm that could result from building power houses on the few publicly owned water-power sites in the mountains, Mr. Sage declares transmission lines through the Adirondack region a necessity and holds that the fear that leases will be granted by the state for a nominal sum is groundless. "It is no part of the basic law of the state," he says, "to provide for methods of leasing and compensation therefor." He takes up the summarized arguments of the Committee to Prevent the Exploitation of the Adirondacks and replies to them seriatim. He does not touch on the fact emphasized by other advocates of the amendment that transmission through the mountains would provide a short cut for St. Lawrence power to the lower end of the state, but bases his argument entirely on the development of interior sites.

Average Yield Lower During September

EIGHTEEN new stock, bond and note issues of electric light and power public utilities offered investors during the month of September totaled $37,150,000. This figure represents a decrease of more than eleven million dollars under the volume reached in August of this year and of more than seventeen million dollars under September's total last year, when a period of brisk activity followed the summer lull. Evidently little financing is needed for the purpose of refunding maturing obligations, and the issues for the most part represent applications for new capital. Attention is called to the low average yield, 6.16 per cent, as compared with 6.30 in August and 6.58 in July. Long-term financing predominates, and the largest single offering was the ten-million-dollar issue of gold bonds of the Pacific Gas & Electric Company offered at 95½ and yielding 5.80.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN SEPTEMBER

Name of Company	Amount of Issue	Period, Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Southern Arizona Power Co.	$675,000	15	First and refunding mortgage gold bonds		6½	95½	7
Jamaica Public Service Co., Ltd. (West Indies)	550,000	..	Cumulative preferred stock	Refunding and additions	7	95	7.38
Central Mendocino County Power Co. (Cal.)	100,000	30	First mortgage sinking-fund gold bonds	Additions and extensions	6½	98	6.68
Coast Valleys Gas & Electric Co. (Cal.)	250,000	29	First mortgage bonds	To reimburse for betterments	6	95½	6.35
Ohio River Edison Co.	7,000,000	25	First mortgage sinking-fund gold bonds	Construction	6	95	6.40
Orange County Public Service Co., Inc. (N. Y.)	550,000	2	Bond-secured gold notes	To pay off floating debt and other corporate purposes	6½	99	7
Ottawa & Hull Power Co., Ltd. (Que.)	2,500,000	25	First mortgage sinking-fund gold bonds	Extensions	6	98½	6.13
Toledo Traction, Light & Power Co. (Ohio)	1,100,000	2	Secured gold notes	Acquisition of properties	6½	98¾	7.25
California Oregon Power Co. (Cal.)	1,000,000	19	First and refunding mortgage sinking fund gold bonds, series B	Additions, extensions and to reimburse for underlying bonds retired	6	99½	6.05
Ohio Power Co.	6,000,000	30	First and refunding mortgage gold bonds, series C	Construction	6	[illegible]	6.07
Pacific Gas & Electric Co. (Cal.)	10,000,000	29	First and refunding mortgage gold bonds, series C	Additions and extensions	5½	95½	5.80
Vermont Hydro-Electric Corp.	325,000	30	First mortgage gold bonds, series B	Additions and to reimburse for construction	6	93½	6.50
Eastern Wisconsin Electric Co.	1,150,000	25	First lien and refunding mortgage gold bonds, series B	Refunding	6½	97	6.75
Monongahela-West Penn Public Service Co. (W. Va.)	1,500,000	5	First lien and refunding convertible gold bonds, series A	To reimburse for expenditures and for other corporate purposes	6	96½	7
Southern Colorado Power Co.	400,000	24	First mortgage gold bonds, series A	Construction	[illegible]	91	6.75
Kansas Electric Power Co.	1,000,000	20	First mortgage series of 1943 gold bonds	Additions and extensions	6	96	6.35
New England Power Co. (Mass.)	2,800,000	28	First (closed) mortgage sinking-fund gold bonds of 1911	Additions	5	96½	5.25
New Jersey Power & Light Corp.	250,000	13	First mortgage gold bonds of 1916	To reimburse for expenditures for additions and extensions	5	90½	6.05
Total	$37,150,000						

Power Board Activities

Engineers Against Warrior River Project—Andrews, N. C., Must Conform to Law

INVESTIGATIONS by the engineering staff of the Federal Power Commission have led to the conclusion that the commission would not be justified in granting a license to the Alabama Power Company for its project at Lock 17 on the Warrior River. Reports indicate that 80,000 primary horsepower could be developed on the Warrior were three storage reservoirs constructed on upper tributaries. Assuming that the installation would amount to 200,000 hp., it is estimated that under those conditions water power could be made available for $80 per horsepower installed. Lock 17 is the key to the situation as the construction of the reservoirs would not be undertaken by any one who did not have the right to develop this site.

The commission engineers also were influenced by the apprehension that the development of the power resources of the Warrior might be delayed for an indefinite period owing to the fact that the Alabama Power Company already has ahead of it large projects on the Coosa and Tallapoosa Rivers. The company has been allowed until Dec. 1 to file objections to the opinions expressed by the engineers.

Ignoring the Commission

An injunction will probably be sought if the town of Andrews, N. C., insists on carrying forward the construction of a dam in the Hiawassee River, 8 miles above Murphy, N. C., without filing the requisite declaration of intention. Officials of Andrews are convinced that the dam, where they expect to produce 1,250 kw., will interfere in no way with navigation, and they have already advertised the bond issue intended to provide the necessary funds.

The city of Louisville has requested the commission to set aside its ruling under which a preliminary permit was authorized for the Louisville Hydro-Electric Company to develop the power resources of the government dam at the Falls of the Ohio. The petition is a long legal presentation attempting to prove the commission in error.

The State of Illinois will make early application, it is understood, for a license covering the development of water power on the Fox River. The state has complied with the conditions of the preliminary permit.

Says Power from Duke-Price Plant Will All Be Taken

The huge Duke-Price hydro-electric power plant that is being developed at Isle Maligne, on the Saguenay River, in Quebec, will have no power to sell when it is completed for the reason that its output will all have been contracted for long before that stage is reached, according to W. S. Lee of Charlotte, N. C., who is vice-president and chief engineer of the company developing the plant besides occupying the same positions with the Southern Power Company. A large part of the expected development already has been contracted for, according to Mr. Lee. He considers the rapid taking of this power most remarkable because the development is in a remote section with few industries. He believes that with the advent of cheap power there will be a rapid expansion of industry, such as came about in the Carolinas following electrical development there.

The Isle Maligne plant, as already recorded in the ELECTRICAL WORLD, is owned by the Quebec Development Company, of which J. B. Duke, president of the Southern Power Company, and Sir William Price of Canada are the promoters. It will have a total generating capacity of 480,000 hp. Work on the plant was started Jan. 8, 1923. It is expected to have the first generating units in operation by Jan. 1, 1925, and the entire station completed by Jan. 1, 1926.

When the plant now under construction is completed the company expects to turn its attention to its other site, 20 miles down the Saguenay River. The potential power at this second site is put as high as 1,000,000 hp. by engineers.

Power Projects in Mountain and Pacific States

The development of 120,000 hp. and the irrigation of 17,700 acres of land in the Ashley Valley in Utah are contemplated in projects for which filings have recently been made with the State Engineer of Utah by A. E. Humphreys of Denver. The power projects cover the Split Mountain site and the applications ask permission to divert 5,500 sec.-ft. of water from Green River and to erect a dam at Split Mountain 150 ft. high.

Tentative plans for a power and irrigation project on the Bill Williams River in western Arizona have been announced by the Williams River Corporation. Four dams on tributaries of the Bill Williams River are planned for the development of power and irrigation of lands in the Parker district.

Three applications for water rights in Lake, Yolo and Napa Counties, California, have recently been filed with the Division of Water Rights of the California Department of Public Works by Ray L. Allin, a Sacramento civil engineer. The applications state that the irrigation of 300,000 acres is intended and that the applicants want to develop 273,000 hp.

C. L. Tibbals, Sacramento engineer, has made three applications for sites in Plumas County. Mr. Tibbals is acting for E. P. Vandercook, the promoter of a project on the Feather River near Oroville. The project includes the storage of water in two large reservoirs and several small ones. After the water is used in the generation of electricity it will irrigate a large area in Butte County.

Electric Furnace Tests

Results from Them Are Discussed by Iron and Steel Engineers at Buffalo

THE convention of the Association of Iron and Steel Electrical Engineers at Buffalo, several sessions of which were reported last week, came to a close on Friday, Sept. 28, when the topics were electrical transportation and the organization of the work of an electrical department.

A very detailed paper on electric furnaces was presented on Wednesday afternoon by E. T. Moore. This paper represented the results from an elaborate series of tests conducted on furnaces installed at the Halcomb Steel Company's plant in Syracuse. An abstract of the paper appears elsewhere in this issue of the ELECTRICAL WORLD.

In discussing the paper D. M. Petty stated that the failure of power for more than fifteen minutes was very serious if it occurred during the finishing process. Other delegates who discussed the paper were Messrs. Richards, Kennedy, Stanley and Priestley.

Mr. Richards, a furnace builder, said the furnaces used an unusually small amount of water. He knew of tests showing furnaces using 32 gal. per minute as compared with the value of 6 gal. per minute assumed in the paper.

Mr. Kennedy said the energy consumption seemed low, his experience showing that a 15-ton furnace with 24-in. electrodes uses 3,750-kva. transformers. With this furnace trouble occurred because of the burning out of back wall refractories. He also said that some tests he had made gave no indication of a counter-emf. in the arc.

The phase-unbalancing effect was very important, in the opinion of Mr. Stanley, particularly if energy were purchased. If several furnaces were used, the peak demands might be coincident, and he wondered whether experience showed this to be detrimental.

Mr. Priestley asserted that bigger furnaces were needed in the steel industry. His experience showed 55-ton melts in 40-ton furnaces. The bigger furnaces were easier to operate and made a more uniform and higher-grade steel.

Unbalanced Effects Unimportant

In closing the discussion, E. T. Moore said that unbalanced effects were not important as affecting power contracts because they were almost instantaneous, and no complaint had been received from the power company. He said that the central-station energy supply was splendid—there had not been any interruption for years—and that the power factor over a month was as high as 93.2. He considered the furnace load desirable from a central-station standpoint and stated that the use of a maximum-demand regulator enabled his company to save as much as $2,500 a month on the demand charge for the six furnaces.

In the opinion of Mr. Moore, the ideal furnace should be operated with a low-reactance transformer and an external

reactor having taps in series, which should be short-circuited during the refining period. He asserted that the water rate was low as experience showed it desirable to operate with at least a 17-deg. temperature difference between inlet and outlet water.

On Wednesday evening a formal showing of the exhibits took place, as well as a smoker and vaudeville entertainment. On Thursday the technical sessions treated of power production in the steel industry, and in the evening the annual banquet was held.

Soundness of Utility Industry Emphasized by Tenney Men

That the future prosperity of the public utility industry depends upon good management and the development of the best possible relations between operating companies and the people at large was the keynote of addresses before the fourteenth annual convention of Charles H. Tenney & Company of Boston, held at the New Ocean House, Swampscott, Mass., Sept. 28 and 29. About two hundred representatives of the organization registered, and the program included addresses by Col. Charles H. Tenney, Boston; Gen. A. E. Bliss, Malden Electric Company; B. F. Griffin, associate editor Boston News Bureau; Dr. Charles A. Eaton, General Electric Company, Harrison, N. J.; H. A. Lemmon, Stone & Webster, Inc.; Boston; Benjamin N. Johnson, of Johnson, Clapp, Ives & Knight, Boston; Dr. E. W. Bullock, New England Telephone & Telegraph Company, Boston, and Henry C. Attwill, chairman Massachusetts Department of Public Utilities, Boston.

Improvements in public and industrial relations were dwelt upon by the speakers. D. E. Manson, H. T. Sands and A. B. Tenney presided at the various sessions. Twenty-one companies under Tenney management in the East were represented.

The Fatal Accident at the Bureau of Standards

The deplorable accident at the Bureau of Standards in Washington on Sept. 20, when an explosion of a mixture of gasoline fumes and air in the altitude chamber of the dynamometer laboratory caused four deaths and injured six others, tends to emphasize the importance of a resolution adopted by the executive board of the American Engineering Council at its meeting in Cincinnati on March 23. In that resolution it was pointed out that the government "is paying heavily in the form of employees' compensation, as well as in loss of time and efficiency, for its failure to adopt a thoroughgoing safety program." Attention was called to the fact that the government falls far short of the standard set by many private employers, the more progressive states and some of the municipalities. Federal safety standards were drawn up during the war, but there is no officer having the authority to enforce such standards, the resolution stated.

Brydon Blames Coal Situation on Miners

Speaking before the American Mining Congress at Milwaukee last week, J. C. Brydon, president of the National Coal Association, laid the blame for "runaway markets" in the coal industry on high wages and "runaway strikes." He said that when the United Mine Workers' contracts in the bituminous fields expire on April 1 next the American public must bear a hand and make sure that representatives of the public in official positions do not "befog or run away from the issue, but meet it squarely and vigorously."

According to Mr. Brydon there must be arranged a system of contractual relationships in which responsibility for observance of contracts will be enforced and recurring crises in the industrial life of the nation eliminated. "There has never been and there is today not the remotest possibility of monopoly of capital in the soft-coal industry, for, as some one has said, 'geology enforces the Sherman act,'" declared Mr. Brydon. "There are enormous undeveloped coal reserves. Under these circumstances supply always potentially equals or exceeds demand."

The congress adopted a resolution favoring equal opportunity to all in the development of America's water powers. The resolution also called for the united support of the congress in movements to develop and promote legitimate water-power projects.

Many New York Utilities Still Want Assigned Cars

Sixteen companies of New York City and Westchester County, N. Y., furnishing electric light and power or gas have petitioned the Interstate Commerce Commission to reopen the proceedings in the case in which use of assigned coal cars was prohibited and to postpone the effective date of the order from Nov. 1 to April 1, 1924. The companies aver that application of the order will seriously interfere with their coal supply and affect their ability to render adequate service to their consumers.

The petitioners, which include the New York Edison Company and its associated companies, say they annually buy upward of 2,000,000 net tons of bituminous gas and steam coal, of which a large tonnage is moved in private cars. They declare they have stored as much coal as possible and have still in storage on Aug. 31 in excess of 500,000 net tons of coal, but that such storage is not adequate protection against the contingencies of extended coal shortages which have arisen and which are likely to arise again. Unless the extension of time is granted, they fear the possibility of being forced to make spot purchases in a speculative market.

Electric Furnace Operation

Round-Table Meeting of Electrochemists at Dayton Is Means of Assembling Valuable Experience

A RECOMMENDATION that the American Electrochemical Society should co-operate with the American Ceramic Society for the purpose of working out the common problems of refractories was indorsed during an animated round-table discussion on electric brass furnace practice that took place at the A. E. S. convention held at Dayton, Ohio, last week. This suggestion was the outcome of much debate concerning the proper kind of refractory material to be used. More than seventy men, including operators, designers, electrochemists and manufacturers, presented specific data.

It was brought out that most of the central-station energy rates for electric furnace operation run below 2 cents per kilowatt-hour, the majority ranging from 1¼ cents to 1½ cents. Ernest Lunn, Pullman Car Works, Chicago, asked whether a furnace producing 2 tons per day, operating on a nine-hour day at a 3-cent initial energy charge, could compete with oil-fired furnaces. Dr. H. W. Gillett, Bureau of Mines, Ithaca, basing his reply on experience related at the meeting, felt that it certainly could. H. M. St. John, Detroit, declared that with a rate below 2 cents he had been able to effect a saving of 40 per cent over the older method of oil firing. J. E. Seede, Schenectady, felt that the quality of the finished metal should be the determining factor in the final analysis of the cost, rather than worry over the greater cost of electrical energy when this would produce a better grade of material.

Continuous Operation

W. R. Clarke, Bridgeport Brass Company, gave a masterly presentation of his operating experience with electric furnaces which are run twenty-four hours a day and seven days a week. He uses two sizes of the Ajax-Watt induction type, holding 1,400 lb. and 2,000 lb. of metal and pouring 800 lb. and 1,300 lb. respectively—the remainder staying in the furnace to form the start of the next heat. For refractories he uses an asbestos compound rammed in with an air hammer. These refractories last from three to five weeks when using a 70 to 80 per cent copper content, but with an 85 per cent content he found it necessary to use a magnesia refractory. Owing to the non-uniformity of some refractories and to resultant cracking and improper vitrification, Mr. Clarke felt that it was highly necessary to get a cement that would prevent this trouble. In his examinations of spoiled refractories he had found such erratic cracking that he was convinced of the need for a refractory which would completely vitrify for its entire depth at a much lower temperature.

Regarding the life of various linings, figures were given ranging from 100,-

000 lb. to 1,500,000 lb., according to the alloy melted, the type of furnace employed and the refractory.

G. W. Bole, Bureau of Mines, Columbus, directed atttention to the fact that with the five refractories under discussion, varying from acidic to basic, various operators had reported fairly good success, all of them melting the same metal.

Opinion regarding the correct size for an electric furnace appeared to hinge upon the use to which it was to be given. Unless it is known for what purpose an electric furnace is to be employed, no choice can intelligently be made. When large molds must be cast as rapidly as possible, it would be poor economy to use several small furnaces, with the attendant risk of cooling the first charge before the second can be poured; but the sizes casting 800 lb. appeared to be in most use in brass-foundry practice.

Asked why his company had not changed its foundry over to electric furnace operation, C. B. Gibson, Westinghouse Electric & Manufacturing Company, quoted the old saying, "The shoemaker's boy is the worst shod"; but since forty alloys are handled in the company's foundry, he thought that the greatly increased investment involved had prevented the use of electric furnaces.

Dr. E. F. Northrup, Princeton, mentioned a high-frequency furnace which was producing 1,000 lb. of steel a day at the Hawthorne works of the Western Electric Company. He also told of the new 25-kw. high-frequency furnace which operated under test for $91.83 a week, producing 4.4 tons. A. Kelleher, Niagara Falls, dealt with some of the problems of operating three-phase arc furnaces melting aluminum.

New Chairmen of A. M. E. S.

The secretary of the Associated Manufacturers of Electrical Supplies has given out the following list of the chairmen of some of the sections of the organization elected at the meetings held in June at New London, Conn.:

Armored Conductor and Metallic Flexible Conduit Section—George F. Holly, Youngstown, (Ohio) Sheet & Tube Company.

Electrical Porcelain Section—Paul G. Duryea, Cook Pottery Company, Trenton, N. J.

Heating Appliance Section—R. P. Tracy, Manning, Bowman & Company, New York City.

Non-Metallic Conduit Section—Russel Dart, Alphaduct Company, Jersey City, N. J.

Lamp Receptacle and Socket Section—R. M. Eames, Bryant Electric Company, Bridgeport, Conn.

Laminated Phenolic Condensation Products Section—D. J. O'Conor, Formica Insulation Company, Cincinnati.

Molded or Formed Insulation Section—A. W. Fox, Johns-Pratt Company, Hartford, Conn.

Outlet Box Section—W. W. Merrill, Chicago Fuse Manufacturing Company, Chicago.

Snap Switch Section—Harvey C. Pond, Arrow Electric Company, Hartford, Conn.

Radio Apparatus Section—E. B. Mallory, Westinghouse Electric & Manufacturing Company, New York City.

Metal Molding Section—C. E. Corrigan, National Metal Molding Company, Pittsburgh.

Brief News Notes

Rate Reductions in Indiana.—A reduction totaling $45,000 annually in the rates of the Richmond (Ind.) municipal electric department has been approved by the Public Service Commission. It affects principally large power users. Reductions at Hammond, Whiting, East Chicago and Roachdale have also gone into effect and the commission hopes to bring about reductions in other cities, including Gary.

The "Highest Signs in the World."—Twin electric signs now flashing above the new Gotham National Bank on Columbus Circle, New York, which

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stands 347 ft. from the curb, only its upper stories being shown here, are confidently declared to be the highest electric signs on any building in the world. One of the signs can be seen far up the Hudson River and the other far out on Long Island. The signs are 67 ft. high and 80 ft. wide. They rest on central steel columns and are constructed to withstand 35 lb. wind pressure to the square foot. The signs required steel construction weighing 80 tons. The letters are 12 ft. high, and each sign contains a thousand 50-watt lamps. They were built by P. J. Martin.

A Minnesota Municipal Plant to Close Down.—The village of Lake Wilson, Minn., has granted a franchise to the Northern States Power Company to furnish it with light and power. The municipal plant will be closed down as soon as a line can be run to Lake Wilson from the high-tension line one mile south.

New Orleans Will Not Grant Competitive Franchises. — The applications for franchises to manufacture and sell electric light and power in competition with the Public Service, Inc., of New Orleans have been rejected by the Commission Council of that city, Mayor McShane casting the only dissenting vote. The applicants had failed to observe certain legal requirements. Moreover, it was held that to grant such franchises would create confusion and be a breach of good faith toward the present company.

Sibley, Iowa, May Turn to Central-Station Service.—An offer of $100,000 for the electric light plant and distributing system of Sibley, Iowa, made by the Iowa Light & Gas Company, will probably prevail. The company will agree to furnish electrical energy at a reduction of about 10 per cent under the present rates. The City Council has passed a resolution favorable to submitting the proposition to the vote of the people.

A Texas Municipal Plant Gives Up.—The Franklin (Tex.) electric light and waterworks plant has been sold to the Western Service Corporation, which is purchasing a number of small plants in central Texas and is preparing to build one central power plant and transmit electrical energy to all the smaller towns. The Franklin plant had been municipally owned for several years, but the service rendered had not been satisfactory. As soon as a high-tension line can be constructed from the plant at Calvert the plant at Franklin will be discontinued.

Airplane Survey of Hydro-Electric Sites.—The engineering firm of Mees & Mees of Charlotte, N. C., is making an aerial survey of the headwaters of Green River in western North Carolina. A complete survey of the watershed will be made. The local engineering firm is in charge of the development work of the Manufacturers' Power Company of Spartanburg, S. C. One plant already has been developed and is in operation, a second is being built, and a third is to be constructed when final surveys are completed. It is expected also that another generating unit will be added to each of the first two plants after the total resources of the stream are learned and that a total of 100,000 hp. will eventually be developed by the three plants.

Sherman Island Plant of International Paper Company.—The Sherman Island (N. Y.) plant of the International Paper Company, recently placed in operation, has a total ultimate capacity of 37,500 kw. and ranks as the largest hydro-electric development on the Hudson River. Surplus power is being sold to the Adirondack Power & Light Corporation, which serves the Schenectady and Glens Falls district. Construction was started on this plant three years ago, primarily to permit use of part of the power in adjacent mills of the company. The dam, of the multiple arch type, rests on outcroppings of rock on each side of the river. The water powers of the International Paper Company, developed and undeveloped, are estimated at about 275,000 hp., placing it in this respect in a class with the largest public utilities.

Rival Electric Systems at St. John, N. B.—The New Brunswick Power Company is the plaintiff in a suit against the city of St. John, N. B., charging interference with the company's wires on the part of the St. John Power Commission, which is constructing a competitive distributing system. In the course of the hearing M. A. Pooler, chief engineer and general manager of the company, said a fall of 4 ft. 4 in. would destroy the usefulness of the Musquash hydro development from which the commission will obtain electricity for the second distribution system. New York City engineers contended that there is insufficient power available to supply the city of St. John and suburbs. F. P. Vaughan of St. John, electrical engineer, has been appointed to investigate the situation.

New Water-Power Plant in Iowa.—A new hydro-electric power station at Pinhook, on the Maquoketa River, 2 miles from Maquoketa, which will be completed about Dec. 1, will be one of the largest water-power developments in Iowa, aside from the Keokuk Dam. It will have an installed capacity of 1,800 hp. The Cedar Rapids hydro-electric plant is rated at 1,600 hp. The Pinhook dam will form a lake 6½ miles long and about 1,000 ft. wide at the widest point. Engineers in charge of the construction for the Eastern Iowa Power Company estimate that the plant will generate 3,400,000 kw.-hr. a year, operating seventeen hours each day and seven months each year. Steam reserve equipment with capacity equal to that of the hydro-electric plant will be installed. The Iowa Electric Company of Cedar Rapids will purchase all the power generated.

Columbia, S. C., Seeks More Power.—At a meeting held in Columbia, S. C., to discuss the possibilities of developing more electric power in that vicinity J. T. Woodward of Spencer Trask & Company, bankers of New York, said that if the litigation over the Columbia canal were eliminated there would be no doubt about the development of hydro-electric power at or near the confluence of the Broad and Saluda Rivers. He declared that 40,000 hp. to 45,000 hp. could be developed and that with the litigation out of the way responsible promoters would have no trouble in getting the money to finance the project, asserting that his company was willing to furnish the funds. The franchise of the Columbia public service company provides for maintenance of the canal by the company. The canal, however, is not used now, and the electric company has offered the state $75,000 for release from this part of its contract.

The Alabama Legislature and the State's Water Power.—After a bitter fight the House of Representatives of the Alabama Legislature has defeated the bill providing for an appeal from decisions of the Alabama Public Service Commission with regard to the issuance of certificates of necessity and convenience to public utility corporations. The name of the Alabama Power Company came prominently into the discussion on the floor, and some representatives charged that the bill was designed to benefit this company in view of the recent refusal of the commission to grant it a permit for the erection of a transmission line from Huntsville to Muscle Shoals and to build a power plant at Lock 12 on the Warrior River. A resolution adopted by both houses provides that the Alabama Public Service Commission shall follow up a recent resolution adopted by the House and concurred in by the Senate memorializing Congress to make various surveys of Alabama's streams and tributaries and to compile a comprehensive survey of possibilities of water-power development in the state.

Electric Vehicles at New York Show.—With exhibits by manufacturers of electric commercial trucks, industrial trucks, passenger cars, storage batteries and battery-charging accessories, the electric vehicle section of the annual Electrical and Industrial Exposition at the Grand Central Palace in New York will be a complete automobile show in itself. The 1923 electrical show is, as already announced, to be held during the ten days beginning Oct. 17. The whole north side of the second floor will be devoted to exhibits showing electrical transportation methods. There will be finished trucks showing the different types of bodies, stripped chassis showing the principles of electric vehicle construction, and special displays of parts and accessories. The monthly meeting of the Electric Motor Truck Association, to be held during the show, will be devoted to the discussion of transportation problems, and a number of speakers from out of town will have places on the program.

An English Hydro-Electric Plant.—Despite the scarcity of water power in England, such sources as exist are being called upon to aid the production of electricity. The York Corporation has recently opened a hydro-electric station on the River Ouse at Linton Lock, 12 miles above the historic city of York. The energy generated will be transmitted to York and to villages and farms along the route. An average flow of 100,000 cu. ft. per minute is anticipated, and the available energy is expected in years of normal rainfall to amount to more than 2,750,000 kw.-hr. per annum. The power station is on an island formed by the river and canalized to enable boats to get round the weir. The water is led to the forebay by means of the existing weir, which was built a hundred years ago, and large automatic shutters have been constructed to keep the river at its correct level. The water entering the headrace on its way to the power house passes through strainer racks and the main sluicegates to three turbines, two of 430 hp. each running at 60 r.p.m. and driving a 540-kw. generator and one of 330 hp. running at 75 r.p.m. and driving a 210-kw. generator. The three generators are all alternating-current three-phase, 50-cycle machines working at a terminal pressure of 6,000 volts to 7,000 volts.

Associations and Societies

Atlanta Section, A. I. E. E.—At the first fall meeting of the Atlanta Section of the American Institute of Electrical Engineers plans for the promotion of greater co-operation between engineers, salesmen and contractors were discussed. Austin Emerson of the Carolina States Electric Company, Charlotte, N. C., was the principal speaker.

Springfield Section, A. I. E. E.—Reports covering the first year of the Springfield (Mass.) Section of the American Institute of Electrical Engineers, read at a meeting on Sept. 28, told of a substantial gain. A. J. Lush described new developments in electrical measuring instruments. Officers installed were: Chairman, John M. Newton, Holyoke; vice-chairman, J. B. McKearin; secretary-treasurer, J. Frank Murray.

New Officers of Michigan Electric Light Association.—At the Grand Rapids convention of the Michigan Electric Light Association the following officers were elected for the ensuing term: President, Samuel B. Tuell of Houghton; first vice-president, R. T. Duncan of Detroit; second vice-president, F. D. Avis of Hudson; secretary and treasurer, Herbert Silvester of Ann Arbor. The new executive committee is composed of the following men: Eugene Holcomb, Alma; F. A. Newton, Jackson; B. E. Waltz, Ludington; H. A. Wing, Adrian, and Tom Chandler, Saulte Ste. Marie.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

Empire State Gas and Electric Association—Lake Placid, N. Y., Oct. 8-9. C. H. B. Chapin, Grand Central Terminal, New York.

Association of Electragists International—Washington, Oct. 8-13. Farquson Johnson, 15 West 37th St., New York.

American Electric Railway Association—Atlantic City, N. J., Oct. 8-13. J. W. Welsh, 8 West 40th St., New York.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Oct. 19-20. Herbert Smith, Robson-Prichard Bldg., Huntington.

Telephone Pioneers of America—Atlantic City, N. J., Oct. 19-20.

Electric Power Club—French Lick Springs, Ind., Nov. 19-22. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Southeastern Division, N. E. L. A.—Tampa, Fla., Nov. 20-22. Charles A. Collier, Georgia Railway & Power Company, Atlanta, Ga.

American Society of Mechanical Engineers—New York City, Dec. 3-6. C. W. Rice, 29 West 39th St., New York.

Recent Court Decisions

Payment of Surtax Under Duress Not Consent to Pay Increased Rate.—The Supreme Court of Nebraska has held, in State ex rel. City of Chadron vs. Intermountain Railway, Light & Power Company, that the payment of a surcharge of 33⅓ per cent in addition to the maximum contract rate by the city of Chadron and its inhabitants, under threat of shutting off the electrical current unless the increased rate were paid, cannot be construed as a consent to such increased rate or a change of the contract between said city and the public service corporation. A mandamus ordering the company to abide by the contract was sustained. (194 N. W. 793.)*

Municipality Maintaining Electric Lines Passing Through Trees Liable for Damages.—Disregarding a plea of contributory negligence, the Springfield (Mo.) Court of Appeals sustained a verdict awarding damages to a boy injured while climbing a tree on a railroad right-of-way through which the municipality's 2,300 - volt conductor passed uninsulated (Beckwith vs. City of Malden). The court held that the presence of children in a tree which they can climb must be anticipated—it is not essential that the tree be one easily climbed. Every precaution should be taken to insulate wires in such places. The court further held that the boy was not a trespasser as to the city, the tree not being on the city's property. (253 S. W. 17.)

New York State's Highest Court Sustains Finding in Tonawanda Explosion Suit.—Rosebrock vs. General Electric Company and Tonawanda Power Company, one of the suits growing out of the explosion in the power station of the Niagara Falls Power Company at Tonawanda, N. Y., on Oct. 31, 1920, in which thirteen men were killed, has been finally settled by the Court of Appeals of New York, which has affirmed the judgment of the Supreme Court, Appellate Division. (See ELECTRICAL WORLD, Dec. 16, 1922, page 1355, and Jan. 27, 1923, page 242.) In this last trial the plaintiff appealed from so much of the judgment as dismissed the action against the Tonawanda Power Company, and the General Electric Company appealed from so much of the judgment as allowed recovery against it. The Court of Appeals coincided with the lower courts in holding that failure of the manufacturing company to give warning of the presence of wooden blocks in new transformers about to be set up warranted the jury's verdict. The manufacturing company's liability was not affected by subsequent negligence of the power company in failing to inspect the transformers before installing them, nor could the manufacturing company claim that the dismissal of the complaint as against the power company was prejudicial to the seller as a direction to the jury that the turning on of the full power was not negligent, where there was no breakdown in the wires or installation and the turning on of full power had nothing to do with the breakdown of the transformers. (140 N. E. 571.)

Powers of West Virginia Commission.—In City of Bluefield vs. Public Service Commission of West Virginia the city tried to force the commission to take jurisdiction over complaints of leakage from the local water company's pipes said to be due to electrolysis caused by escaping current from the trolley rails of the Princeton Power Company, with resultant damage to the pavement. The Supreme Court of Appeals of the state sustained the commission's refusal, saying: "The plenary power and authority given to municipalities by their charters and by general law to lay out, pave and keep in good repair the streets free and clear for the security and convenience of the public, and to prevent damage thereto by public service corporations licensed to use them, has not been impaired by the Public Service Commission act; nor has the Pacific Service Commission jurisdiction to usurp or interfere with the police power of a municipality in the control of its streets." (118 S. E. 542.)

Right of Power Company to Carry Its High-Tension Lines Across Railroad Right-of-Way.—The South Georgia Public Service Company built a transmission line from Albany to Valdosta by way of Tifton, its line crossing the right-of-way of the Atlantic Coast Line Railroad. The power company first built a 40-ft. tower on the right-of-way of the railroad and from it swung its high-tension wires across the track. When the railroad company cut the wires and tore down the tower the power company obtained an injunction restraining the railroad from interfering with its lines and rebuilt the tower, this time outside of the railroad's right-of-way. The legal battle that followed centered on the form of the railroad's title to its right-of-way. If the title of the railroad was a freehold or fee absolute, it could prevent the power company from crossing its line either in the air above or through the earth beneath. If, on the other hand, its title was held under easement, it had no right to prevent the power company from crossing its line, provided the towers of the company were not built on its right-of-way and did not interfere with the safe operation of the railroad. The Tifton Judicial Circuit has just ruled that the railroad held its title under easement, and that therefore the power company had a right to cross the tracks in the air if it built its towers outside of the right-of-way. If this decision is not upset, it means that in Georgia, where most railroads hold their titles under easement, a power company will not, as a general rule, have to procure the consent of a railroad to cross its lines if it sets its towers outside the right-of-way, sees that there is the proper clearance of high-tension wires above telegraph and telephone wires and signal towers and uses ordinary precautions for safety.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Alabama Commission Adopts Policy for Extensions.—The Alabama Public Service Commission, which has been under attack for refusing certificates to the Alabama Power Company for desired extensions, has announced as its future policy in passing upon each application the determination of whether or not the extensions will bring such a financial return as will not put an undue burden upon the old customers. It made this announcement in granting the Alabama Power Company a permit to construct a power line from Montgomery to Greenville.

Considerations Affecting the Rehearing of Rate Cases.—Denying a motion made by the city of Kellogg in a case involving the water rates of the Kellogg Power & Water Company, the Idaho Public Utilities Commission held as follows: (1) A rehearing of a rate case should not be granted on the ground that the value found by the commission exceeds the value alleged by the cross-complaint of the utility in its demand for an increase of rates, since proceedings before the commission are not necessarily limited by the pleadings of the parties. (2) A rehearing should not be granted on the ground that the cross-complaint of the utility asked for a minimum return of 6 per cent and that the return allowed was upon a basis of 8 per cent, where it became evident in the course of the proceedings that the percentage so advanced as a minimum would not give weight to certain important considerations. (3) Rate proceedings before a commission are not properly subject to partisan presentation in the sense in which that expression is ordinarily used, but the solution of a public utility problem for which the commission has responsibility requires a fair establishment of the facts as they actually are and not such an adaptation of them as either consumers or company might feel would be to their advantage. (4) A rehearing of a rate case should not be granted unless and until it appears affirmatively either that the commission did not get the facts so that it could fairly pass upon all of the essential elements or that there has been such a change in the situation, or some portion of it, as would, if shown, justify a revision, since the consumers of a public utility's product ultimately have to pay the cost.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

F. J. Haas Heads Indiana Association

F. J. Haas, vice-president and general manager of the Southern Indiana Gas & Electric Company, Evansville, Ind., was elected president of the Indiana Electric Light Association for the coming year at its convention at French Lick Springs, Sept. 26. Mr. Haas has served as vice-president and as member of the executive committee of the association and has held his present position with the Southern Indiana Company since 1916. During the preceding eight years he was secretary of the company. In all he has been connected with the company thirty years, giving particular attention of late to the subject of public relations.

P. W. Thompson, formerly technical engineer of power stations with the Detroit Edison Company, has been appointed assistant chief engineer.

George C. Danforth, formerly chief engineer with the Maine Water Power Commission, now non-existent, has become associated with Charles T. Main, consulting engineer of Boston.

H. E. Sandoval has succeeded Don Ray as manager of electric sales of the Pacific Gas & Electric Company. Mr. Ray relinquished the duties of that office when he was appointed manager of the bureau of public relations.

John T. Harrington, who has been vice-president and general counsel of the Pennsylvania-Ohio Power & Light Company, Youngstown, Ohio, has been elected president of that company. Mr. Harrington will also continue as general counsel of the company.

C. D. Gibbs, formerly electrical engineer with the Raystown Water Power Company, Huntingdon, Pa., is now associated with Dwight P. Robinson & Company, consulting and construction engineers, in the capacity of transmission engineer.

A. E. Fitkin was the guest of honor at a dinner given on Wednesday evening, Sept. 26, in the Italian Gardens of the Ambassador Hotel, New York, by executives of the A. E. Fitkin Organization and the General Engineering & Management Corporation, operators of Fitkin public utilities. Mr. Fitkin sailed for Europe on Sept. 29 on the *Leviathan*.

Dr. Lee de Forest, inventor, returned from Europe on Monday, Oct. 1, on board the French liner *Paris*, accompanied by his wife and daughter. Dr. de Forest brought with him a device known as the oscillating audion which he said would greatly facilitate broadcasting and which will replace the equipment now in general use. The device has been employed in the Eiffel Tower for a year and a half.

C. L. Carr, formerly assistant chief engineer of the Detroit Edison Company, has been made superintendent of power for the Kansas Gas & Electric Company, with headquarters at Wichita.

James A. Cranston Succeeds Dr. Addison

James A. Cranston, for the past three years Northwest district manager of the General Electric Company with headquarters at Portland, Ore., has been appointed Pacific Coast manager of the General Electric Company to succeed Dr. Thomas Addison, retired. The appointment was effective Sept. 1, 1923, and Mr. Cranston will hereafter be in San Francisco. Mr. Cranston became identified with the Northwest Thomson-Houston Company in 1888, spending that year in St. Paul. In 1889 he was transferred to Portland, Ore., to represent the company as sales agent. At the time the General Electric Company was organized in 1892 he associated himself with that company and was made manager of the Portland office in 1900. He served in this capacity until 1919, when he became Northwest manager. Mr. Cranston has been a prominent figure in the electrical industry in the Northwest and has associated himself with all progressive movements in that section.

J. A. CRANSTON

Frank H. Riddle, director of research with the Champion Porcelain Company, Detroit, Mich., sailed on the *Leviathan* on Sept. 29 to inspect the ceramic manufacturing plants of several European countries. He will also attend the international conference on high-tension transmission lines which will be held in Paris this fall, where he will read a paper on the "Relation Between the Composition, the Microstructure and the Physical Properties of Porcelain." Mr. Riddle is planning to visit the recently completed plant of the Compagnie Générale d'Electro Céramique, which was constructed especially for the manufacture of high-tension insulators under the Jeffery-Dewitt patents.

Col. Charles Keller of the Corps of Engineers has been retired from active duty in the army after more than thirty-seven years of service. The action, taken at the request of Colonel Keller, means that he has definitely cast his lot with the hydro-electric industry. He is now engaged in the solution of some particularly difficult engineering problems in connection with water-power development on the Pit River in California.

Obituary

Thomas G. O'Dea, treasurer and manager of the Erie County Electric Company, Erie, Pa., died at his home in that city on Sunday, Sept. 23. A complication of diseases forced Mr. O'Dea to retire from active participation in the company's business about fourteen months ago. He was one of the pioneers of electrical development in Erie, having entered the service of the Erie County Electric Company thirty-two years ago, shortly after it was established through the consolidation of two small lighting companies. Mr. O'Dea was sixty-two years of age.

Edmund Cobb Morgan, inventor of coal-mining machinery, recently died suddenly at his home on Riverside Drive in New York. Mr. Morgan started as a pioneer in the electric mining-machine field. While working to improve a pick machine he obtained the backing of J. P. Gardner, and the Morgan-Gardner Company of Chicago thus had its beginning. Later Mr. Morgan developed an electric mine-haulage system and built a large factory in East Chicago, Ind. Subsequently he formed the American-Morgan Company for the purpose of building machines for mining and loading coal and took out many patents on this type of machinery. For the past fourteen years Mr. Morgan's time was devoted almost exclusively to the development of coal-mining machinery. He was fifty-six years of age.

Charles H. Davis, president of the Davis Slate & Manufacturing Company of Chicago, died on Saturday, Sept. 15, at his home in that city. Mr. Davis entered the slate industry in Chicago about nine years ago and had become one of the important manufacturers of electrical slate panels in this country and Canada. At the time of his death he was director from the Canadian district of the National Slate Association. Before going to Chicago Mr. Davis was associated with the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa., in charge of the overhead-line material division.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Shall We Go Back to "Bootlegging" New Products?

How Demand from the Industry Brought the N. F. P. A. New Developments Committee—Critics Forget that Similar Hysteria Marked Introduction of Many Beneficial Contrivances

BY EARNEST MCCLEARY
President McCleary Harmon Company

FOR many years the manufacturer who brought out a new wiring material or device not specifically covered by the rules of the National Electrical Code or by the standards of the Underwriters' Laboratories was forced to resort to so-called "bootleg" methods to introduce his product and to obtain enough field experience to warrant its consideration by the national committee. His usual course was to approach various field inspectors who were personally known to him or his representatives and get permission to install his new product in certain classes of properties or certain areas under such rules as the individual inspector or department chief might consider necessary for his particular community.

EARNEST MCCLEARY

This practice naturally led to constant misunderstanding and confusion. New products, passed under certain restrictions or under no particular restrictions in one inspection district, were not allowed to be installed at all in adjoining districts. Inspectors who permitted trial installations of new products were frequently denounced by the manufacturers of established materials, and by the same token inspectors who refused new ideas a chance to prove themselves were criticised as reactionary by the man who felt his material or device worthy of a trial.

Jobbers were often uncertain as to whether an article freely used in their own city could be used in the next county, while contractors who operated in more than one inspection jurisdiction were frequently forced to remove and replace some material or device that they had come to look upon as standard. And, finally, and perhaps of greatest importance, the wiring industry was constantly in the position of using rather large quantities of material which was not covered by the National Electrical Code, which was often forbidden by the letter of certain code rules and which was not approved by Underwriters' Laboratories

DEMAND BROUGHT NEW COMMITTEE

For these reasons dissatisfaction with this whole process of introducing new material was widespread for many years, but it did not crystallize until an effort was made during 1915 to introduce the use of concentric wire. The discussions which followed this attempt, however, eventually put an end to the "bootleg" method under which virtually all of our present wiring materials were originally introduced and under which they were installed until in due time they had proved themselves and obtained code recognition.

This elimination of new material "bootlegging" was undoubtedly a long step in the right direction, but as it left no means open through which field experience could be obtained on new wiring products, it began to look as though the industry had suddenly reached a stage where progress of any kind was almost impossible. As one observer put it: "Nothing could be used until it was approved and nothing could be approved until it had been used."

Finally the electrical committee of the National Fire Protection Association, with its usual desire to cooperate with the industry, sought to break the deadlock by creating a subcommittee, to be known as the "committee on new developments" and to be made up of the chairmen of all standing committees of the parent committee. The appointment of this new committee was apparently received with great favor by all branches of the industry, for it obviously did away with all the evils of the old "bootleg" system and represented a long step forward for many reasons:

First, because it made available to the manufacturer of a new product a thoroughly competent, nonpartisan body before which he might lay his product at any time during the two-year interims between revision and publication of the code, with the certainty that his ideas would receive full and unbiased consideration.

Second, because by insisting upon complete data and its right to carry on complete tests the committee would automatically protect the industry against even temporary use of any new material or device of questionable character.

Third, because it made it possible for any inspector or inspection department wishing to permit field trial of a new product to obtain accurate, unbiased data as to the character of the product as well as definite, carefully considered rules under which trial installations might be made—rules which would thereby be the same in each jurisdiction where trial was permitted.

Recently, however, if the writer is correctly informed, certain groups in

the industry have suddenly begun to criticise the new development committee and have even challenged its right to recommend field trial of any material or device not specifically anticipated by the national code rules or which is in conflict with the strict letter of certain rules, regardless of whether or not such material or device may be in accord with the fundamentals of the code and, in the light of the committee's investigation and best judgment, a sound product and worthy of field trial.

OTHER CRITICISMS AND SUGGESTIONS

It is also alleged that some interests feel that the new development committee is exceeding its authority in proposing to "write new rules into the code" and that it should equally represent all the various branches of the industry. This idea has been further amplified by the suggestion that a manufacturer having a product idea should submit it to the entire industry for several months' consideration, and to an industry mass meeting at the end of that period, before the new development committee should be permitted to pass upon it.

It would seem to the writer that most of these various criticisms and suggestions must be due to a misunderstanding or misconception of the new development committee's functions. It is not the purpose of the committee, for example, to "write new rules into the code," but to confine itself to tentative or suggested rules under which trial installations of materials examined and found worthy of trial may be permitted by such inspection departments as are willing to permit field trials pending final action by the committee.

In other words, the new development committee does not seek to dictate to any one, but its findings do provide what would appear to be a dependable and highly desirable substitute for the old "bootleg" methods of introducing material referred to above. And as for substituting a committee equally representing all branches of the industry, the writer cannot but wonder how progress could be made through such a course when groups of any given branch of the industry often find it almost impossible to agree on standards or practices for their own particular work. In other words, it would seem fair to assume that the chances of agreement would be well-nigh impossible if, in addition to agreeing among themselves, each group had to find basis of agreement with various others.

One should not lose sight of the fact that the wiring industry has reached its present point of development under the guidance of what are commonly referred to as "the Underwriters," and that while their decisions could not of necessity please every one at all times, these decisions have invariably proved to be both wise and equitable in the long run.

In recent years the Underwriters have shown no disposition to act hastily on any question or without due regard to the best interests of every one concerned and of the industry as a whole, although certain disgruntled groups or individuals, with their own particular interests in mind, may have felt that they have done so. Certainly, it would seem that the Underwriters represent the only unbiased, non-partisan group we have in the industry to-day and that any attempt to substitute for their largely disinterested supervision of the code some plan involving code supervision by industry mass meetings or the like would not only act as a check on progress but would inevitably lead to chaos and to bitter feelings between various groups.

Lastly, as to denying consideration to any new product because it is not anticipated by current code rules or because it is in conflict with the specific letter of certain code rules, where would the wiring industry be to-day had that practice been adopted and followed from the beginning? We would probably still be using so-called "Underwriters' wire" and staples, or possibly the old brass-armored paper tube. The writer can remember no class of material now in common use which was anticipated by the code when it was first brought out or which was not in conflict with the letter of various code rules during the first few years or months it was in process of being introduced.

NEW PRODUCTS HAVE RIGHT TO TRIAL

The manufacturer of existing products is most certainly entitled to all reasonable protection, but it would not seem that he should be permitted to close the code and prevent even field trial of a new product because he fears the possible effect on his business. Invariably, too, his fears are greatly magnified. Gloomy predictions of code standards wrecked, the jobbing industry ruined and contractors wiped out of business have always accompanied the introduction of any new wiring material, but such materials as have finally received code recognition have soon found their particular niche and have caused little or no disturbance.

The manufacturers in the present instance seem to forget that for the first time in the history of the industry the presence of the new development committee allows certain rules and certain standards to be established which definitely govern the trial period of any new product which the committee is convinced is safe and sane. This fact in itself offers them far better protection than was possible under old methods of introduction. In a word, then, let us decide whether we are to support the competent, orderly method offered us for the introduction, or at least the trial, of new products, or whether we are to adopt a course which it would seem must either lead to no further progress or to a gradual return to the so-called "bootleg" methods under which practically all of our present classes of wiring material were originally introduced.

Small Quantity Buyers Need Improved Wholesale Sources

THERE is a growing tendency among retailers to increase their rate of turnover through buying in smaller quantities that is likely to require more convenient wholesale sources of supply to facilitate prompt deliveries, in the opinion of the domestic distribution department of the United States Chamber of Commerce.

Some of the obvious elements which might bring about economies in merchandising through a study of the subject are: (1) Amount of capital investment for the maintenance of private warehouses. (2) Bare operating costs of storage under public and private warehousing methods comparatively. (3) Publicity value of private warehouses. (4) Intangible value of specialized services offered by public warehouses. (5) Possibilities of reducing the costs of distribution within a given area or of increasing the area without increasing the costs. (6) Relative costs of additional warehouses to supply a given area. (7) Consideration of negotiable warehouse receipts as a means for enlarging the volume of business.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

IT HAS been an uneventful week in the electrical trade throughout the country. Business continues strong and the recovery from summer quiet which has been in process is well sustained. There has been an absence of price changing or other spectacular movements, however, other than the fact that the pulse of buying in preparation for the holiday market has been reported from the Chicago district. Also, the abrupt transition from daylight saving time to standard time has brought a bit of activity into the lighting field wherever it has gone into effect. There has been an improved demand for better lighting in offices and factories evidenced by increased demand for lamps and reflectors.

Manufacturers of appliances have begun to unlimber their national and local advertising campaigns. Cleaners, washers, heaters and lamps are all being supported, and confidence is indicated by the fact that larger appropriations are being planned than were spent last year. Meter and instrument manufacturers report a considerable demand from school and industrial laboratories. Opening of the schools is leading to the installation of considerable of this equipment.

The buying of finishing materials for use in building construction now nearing completion continues. The pole industry reports business a little easier in the Southwest as a result of a reduction in freight rates particularly affecting Arkansas, Oklahoma and Texas. The strongest demand for poles at the present time is coming from Ohio, Illinois, Indiana and Pennsylvania. An interesting situation appears to exist in the radio market. Stocks are fair, but buying is improving. The manufacturers, therefore, hold prices and stocks pretty much in their own hands with prospects of a very large seasonal demand not far ahead.

Economizer Business Improving; Increasing Use of Steel Tubes

SALES of steel-tube economizers are steadily increasing. It has been the general opinion apparently that few installations of this equipment were being made within the central-station industry. Growing interest is being shown by the utilities of the larger cities of the United States, however, and orders and installations during the last six months have exceeded the expectations of the manufacturers. Some of the more important installations have been made by the Detroit Edison Company, at its Trenton Channel plant; the American Gas & Electric Company, at the Twin Branch station; the West Penn Power Company, at Springdale, Pa.; the Los Angeles Gas & Electric Company, at Los Angeles; the Middle West Utilities, at Tulsa, Okla., and the Edison Electric Illuminating Company of Boston, at the Weymouth station.

An interesting trend has been taking place in the development of this economizer equipment. From the standpoint of corrosion, cast iron was looked upon until recently as the only metal that would give a satisfactory length of life, according to the makers, and for the pressures in common use cast-iron economizers proved satisfactory. With the coming of higher boiler pressures, however, doubts of the ability of cast-iron construction to withstand such pressures and the possibility of adverse legislation against the use of this metal in economizers above certain working pressures, as in the case of boilers, led engineers to turn to other economizer material. Wrought-steel construction, because of safety and ability to withstand high pressures, or steel tube with a cast-iron outer jacket, naturally received first consideration. The increased tendency toward corrosion of wrought steel as compared with cast iron in economizer construction was appreciated, but it was felt that the increased safety of steel more than offset this tendency and warranted its use, provided that corrosion could be obviated or minimized through the use of any reasonable methods of prevention.

Cast-iron economizers, it is said, will continue to be used in many plants, but the steel economizers are being generally adopted in high-pressure power-plant work. A number of installations of steel-tube economizers have been made where low-feed temperatures are used and air elimination is not attempted. In such cases the interior economizer surfaces have had non-corrosive protection. This method has been tried with greater or less success, it is said, but is not so reliable as the elimination of air from the feed water.

Careful merchandising policies are being carried out by the steel-tube economizer firms in order to hold the confidence of the whole central-station field in this equipment. Where the feed water is not of sufficient temperature, manufacturers are actually refusing to make installations unless the prospective purchasers will at the same time install corrective equipment also.

Raw-material prices continue firm; they have been on the same levels during six months. Steel plates to the boiler manufacturers are selling at from $2.35 to $2.50, the latter price being that of the Steel Corporation. Labor in the Ohio and Pennsylvania works is being hired at about 50 cents an hour, which is several cents above the regular rate for such labor. Deliveries as a whole are much improved, boiler orders running at eleven to twelve weeks, and economizers and special work in reasonably satisfactory time.

Washing-Machine Makers Look for Record-Breaking Sales

WITH washing-machine sales for the spring and summer months of this year averaging 50 per cent better than they did during those periods of 1922, washing-machine makers expect a new sales record to be made in the next two months. One reason for this is that while sales for the first half of the year have been very good, the distribution among manufacturers has been uneven. Another reason is that the September and October sales for 1922 were respectively 113 and 120 per cent better than those for the same months of 1921.

Since June 1 washing-machine sales have been more uniformly distributed among manufacturers since they have not been spotted as formerly. This is probably explained by increased sales efforts and better organization. The feeling is constantly increasing throughout the ranks of the manufacturers that this business is available, if properly worked for.

All of the 1923 monthly sales for all types of washers have averaged considerably above those of 1922. For electrical washing machine sales this percentage has been even greater. The sales for the month of June fell just a little under those obtained in May, but there was a gain of 6 per cent in July over June. August sales are said to have improved over July, although no definite figures are available at this time.

From a manufacturing standpoint the problem of producing washing machines is no longer a question of obtaining the proper balance of raw material and labor, but is becoming a question of sales and a problem of keeping the sales cost down in order to show a profit. Labor is available in ample quantities, although at high prices. With raw materials still high, the solace of the manufacturer lies in an increasing volume of business. No price changes are contemplated, since it is felt that the price of labor is at its peak and that further raw-material advances can be absorbed through an increased volume of sales.

Considerable thought is being given the question of sales on a time-payment basis. There is a feeling that this industry should not be allowed to degenerate into one where too long terms are made, with serious detriment to dealers and distributors. Present opinion seems to be that a payment of 10 per cent down with the balance payable within one year should be ample. This system, which was formerly done on fifteen to eighteen months' long-term contracts, will materially help the dealer, who was required formerly to serve as a buffer for delinquent accounts.

Another point that the manufac-

turers are desirous of stressing is that they are selling washing service and not a piece of machinery which, to the ordinary housewife, means nothing more than a collection of gears and mechanism. The pioneering stage has been passed, so that a manufacturer's guarantee means that the equipment must render service. This is a reversal of the old idea of "Caveat emptor" (Let the buyer beware). This also may account for the increasing sales rate.

Farm-Plant Firms in Distress, but Confident of Future

FARM light and power plant interests are disappointed with the unsatisfactory turn of their market, which again has been demoralized as the result of bad financial conditions in the agricultural sections. The manufacturers are of the opinion that their business for 1923 will be no larger than it was last year. Although large crops of fruit in the South and Middle West are recorded, such low prices are being received by the farmers that it seems almost useless for them to expect any fair profit after freight and basket expenses are accounted for. The same situation prevails in the corn belt, where values are held so low that much of the crop is being fed to the live stock, for which quotations are also low.

Salesmen of long standing in this field, however, believe implicity in the future market. They remember that there are now 5,500,000 prospective buyers in this country alone, and they realize that the next profitable year for the farmers will return large dividends to them for their patient waiting and intensive sales efforts. It is felt also that the manufacturers of farm plants are making the greatest merchandising effort that has ever been made in the electrical industry to gain large business in the agricultural sections of this country. It is a difficult market to develop, however. Entering into the difficulties of the salesmen are, first of all, low-paying crops, heavy expenses of demonstration cars from farm to farm, muddy and destroyed roads, ignorant "prospects" and slow collections.

The bulk of this year's business has been with the people who own summer homes, hotels, small moving-picture houses and garages. One maker controlling English patents has made many installations in large clubs and lodges of the Northeastern summer resort sections. Foreign demand has fallen off considerably because of financial and industrial conditions in England and Germany, more than 1,500,000 persons being unemployed in England alone.

Bearing on the buying tendencies of the farmers of this country, it is their practice as well as that of the people in the cities to buy automobiles and radio outfits before household necessities. Farm-plant salesmen are watching the sales of the autombile dealers in their territories and are inclined to feel that the farmer's next step will be to purchase electric light and power plants. Agents of electric flatirons, cleaners and other labor-saving devices should come along next in order that they may participate in a share of the farmers' earnings.

The farm-plant business at the present is shifting to a small number of manufacturers. Those who are making other lines of electrical commodities seem to be best able to hold out to await the large business of the future that can come only when economic conditions are improved. One of the best known manufacturers of the Middle West is said to be losing thousands of dollars monthly in the attempt to hold his corner in the agricultural sections.

Another maker believes it will take until 1926 to put his farm-plant business on a profitable basis. It is estimated that central-station power cannot be expected to reach half of these 5,500,000 prospective buyers of farm plants for at least twenty years.

Electrical Exports Increased $1,430,276 in August

TOTAL exports of electrical machinery, apparatus and appurtenances for August were $6,183,186, an increase of $1,430,276 over August, 1922, when the total amounted to $4,752,910. In July, 1923, total electrical exports amounted to $6,754,858. The accompanying figures are supplied by the Bureau of Foreign and Domestic Commerce.

Switch Boxes Lower on West Coast; Report Poor Fan Season

A BRISK little war on solid single-switch boxes has resulted in sharp price decreases. Lamp-cord stocks are rather high and sharp increases in silk-covered wires are expected because of the reaction of the Japanese catastrophe on the silk trade. Pole-line-hardware business is good, with a recent carload order of braces reported for a local manufacturer. The final report on the fan season is unfavorable owing principally to the unseasonably cold weather. Intercommunicating telephone business is very good. A recent order for three carloads of fiber conduit is reported.

Construction is steadily and slowly improving from its July and August slump, and the rather high stocks of midsummer show favorable decreases. Despite the cautious buying, recent statistics show a ten-year industrial business increase as follows: Oakland, 315 per cent; Los Angeles, 146 per cent, and San Francisco, 82 per cent.

Eastern Jobbers Report Excellent Demand for Wiring Supplies

LITTLE reflection of the somewhat spotty general business is apparent in the Eastern electrical trade. Jobbers report an excellent demand for wiring supplies and line material, the latter in-

ELECTRICAL EXPORTS FOR AUGUST, 1923, COMPARED WITH CORRESPONDING MONTH A YEAR AGO

	Value August 1922	Value August 1923
Mechanical-drive turbines	$286,535	$70,922
Generators:		
Direct-current:		
Under 500 kw	45,670	39,912
500 kw. and over	280,402	57,300
Alternating-current:		
Under 2,000 kva	1,339	5,838
2,000 kva. and over	86,430	120,357
Accessories and parts for generators	15,836	84,102
Self-contained lighting units	52,622	49,005
Primary batteries	81,649	105,505
Storage batteries	122,799	176,041
Power transformers	334,931	80,643
Other transformers	25,777	83,951
Rectifiers, condensers, double-current and motor-generators, dynamotors, synchronous and other converters	283,916	54,974
Switchboard panels, except telephone	222,222	282,953
Switches and circuit breaker above 10 amp	212,886	69,265
Fuses and fuse blocks	11,315	28,324
Watt-hour and other measuring meters	23,916	37,854
Volt, watt and ampere meters and other recording, indicating and testing apparatus	55,008	92,062
Lightning arresters, choke coils, reactors and other protective devices	69,665	43,727
Motors under 1 hp	62,238	135,523
Stationary motors, 1 to 200 hp	114,223	322,349
Stationary motors over 200 hp	24,253	102,989
Railway motors	33,405	7,960
Railway locomotives	......	317,098
Mining and industrial locomotives	10,462	3,959
Other motors	29,938	10,092
Rheostats, controllers and other starting and controlling equipment	89,626	194,663
Accessories and parts for motors	88,248	134,872
Electric fans	36,036	63,034
Incandescent carbon-filament lamps	1,959	9,714
Incandescent metal-filament lamps	80,367	87,566
Other electric lamps	11,702	12,390
Flashlights	17,568	48,575
Searchlights and projectors	8,660	34,540
Motor-driven household devices	38,963	87,945
Domestic heating and cooking devices	30,164	92,253
Industrial electric furnaces and ovens	25,714	51,174
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries	43,981	86,104
Radio and wireless apparatus	188,670	307,127
Telegraph apparatus	20,839	21,669
Magneto telephones	(*)	9,983
Other telephones	261,385	19,866
Magneto switchboards	(*)	47,351
Other telephone switchboards	(*)	4,387
Railway signals, switches and attachments	20,274	100,077
Bells, buzzers, annunciators and alarms	6,258	13,851
Spark plugs, magnetos and other ignition apparatus	92,732	194,749
Insulating materials	54,478	147,600
Metal conduit, outlets and switchboxes	26,579	49,120
Sockets, receptacles and lighting switches	51,338	78,865
Other wiring supplies and fixtures	105,091	150,322
Other electrical apparatus	428,550	676,021
Globes and shades for lighting fixtures	34,084	42,990
Electrical glassware except for lighting	14,051	11,312
Electrical porcelain	87,171	123,814
Electrical carbons, carbon brushes and electrodes	130,802	202,216
Insulated wire and cable, iron and steel	27,508	75,693
Other manufactures of aluminum	105,411	204,493
Copper wire, bare	99,423	172,967
Insulated copper wire and cable	117,841	243,178
Total	$4,752,910	$6,183,186

* Not separately stated prior to Jan. 1, 1923.

dicating well-sustained central-station activity in new business fields. Stocks are comfortably meeting current requirements, barring occasional slight gaps in rigid conduit sizes which are ordinarily filled by a little "shopping around." Appliance retailers are unusually busy, and the growing tendency toward installing more convenience outlets is having some effect on sales of the lighter socket devices. Industrial electric truck sales are quieter for the moment, but there is a fair demand for motors of various sizes. Prices are steady as the week starts. Some comment is heard among jobbers as to their narrow margin of profit on this year's excellent volume of orders.

General trade in New England is marked by wholesome activity in retail circles, a good volume of sales in the metal-working industries, fairly active business in paper production and continued large transactions in the building industry. The outlook in textiles and also in leather is somewhat improved.

Southern Trade Enjoying Best Business Since 1917

GENERAL conditions in the Southeast continue to improve, and electrical jobbers report their business the best since 1917. Industrial expansion is pushing ahead, and this includes extensions to enterprises already established as well as new industries that are coming to this section. Conditions in the rural districts are much improved and are reflected in considerably increased sales.

Georgia's 1922 peach crop was the second largest in the state's history, and as a result the orchard owners have been able to liquidate their outstanding accounts and in some instances have a surplus on hand. This has tended to boost sales of electrical materials in the territory in question. However, all jobbers report sales throughout the Southeast as very satisfactory and considerably in excess of last year. It is expected that the marketing of the cotton crop will still further stimulate this movement. Stocks at present are satisfactory, but deliveries are lengthening, and one jobber states that he will have difficulty in filling orders unless good shipments are received within the next thirty days.

Jobbing Supplies Moving Upward in Chicago

ALTHOUGH a rather warm week in the Chicago district has reduced sales of open-air heaters, which had started out so well earlier in the month, the majority of jobbers are reporting a well-balanced market with a greater volume of finishing material for new construction. The conduit situation is improving along with the increased shipments from manufacturers, but prices are steady. In the flexible armored conductor market No. 14 two-conductor size has advanced 5 per cent. Most jobbers attribute this to the previous sluggish sales of this material.

Jobbers covering territories outside of Chicago have noticed the start of the stocking-up movement of appliances for holiday trade. In Chicago proper appliances are also starting up after the summer sluggishness. Both radio and lamps are selling better, which is due to seasonable activity. Jobbers generally are reporting greater activity of business, which they feel will create a better year than 1922.

The Metal Market

COPPER is quiet with only a fair volume both of foreign and domestic sales. Prices generally are unchanged. The foreign buyers seem to be waiting before they make further commitments for some announcement from France regarding what she is going to require from Germany for reparations. William A. Willis, manager of the Copper & Brass Research Association, states that his association received requests from representatives of the Japanese government last week for full information on the use of copper in building construction. These representatives have assured the association that they expect to use large tonnages of copper in rehabilitating the areas devastated by the recent earthquakes.

NEW YORK METAL MARKET PRICES

	Sept. 26, 1923 Cents per Pound	Oct. 3, 1923 Cents per Pound
Copper, electrolytic	13.50	13.37½
Lead, Am. S. & R. price	6.85	6.85
Antimony	7.50	7.75
Nickel, ingot	27.00 to 32.00	27.00 to 32.00
Zinc, spot	6.50	6.40
Tin, Straits	42.00	41.75
Aluminum, 98 to 99 per cent	26.00 to 27.00	25.00 to 27.00

The official contract price of the American Smelting & Refining Company continues at 6.85 cents per pound, New York. The lead market has been quiet this last week, but the undertone is decidedly firm. Though quotations do not reflect so high an average price for New York deliveries as last week, this is merely because less prompt metal at premium prices is sold; the quoted prices are certainly no lower, and for delivery before the end of October anywhere from 6.90 to 7.12½ cents would have to be paid. Consumers seem now to be pretty well provided with immediate requirements, however, and most of the sales have been made for late October shipment on the smelting company's price basis.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Starts Largest Appliance "Ad" Campaign Seen in New York

The largest local advertising campaign reported by any national appliance manufacturer selling in the metropolitan territory is to be started during the coming week by the New York City office of the Edison Electric Appliance Company, Chicago.

It is estimated that the expenditure for this advertising will reach $25,000 by January, 1924, and $50,000 if continued until June, 1924. Twelve experts will start work this Monday to dress the windows of the Manhattan dealers.

Brass Manufacturers Say Improvement Is in Sight

Improved business in the great brass and copper industries of the Naugatuck Valley are in sight, according to officials of these concerns. F. S. Chase, president Chase Companies, Inc., says: "We believe the underlying conditions are sound in this country and improving abroad and that the settlement which seems imminent between France and Germany is going to have a marked effect on business. Business in the spring was distinctly above normal. It was natural that it should drop off in the summer as is generally the case through hot weather and the vacation period.

"The prices of copper and spelter, considering today's costs, are not unreasonable. Our customers, as far as we know, have not stocked up. They can use more material and we expect them to order it. We do not anticipate as strong a demand as earlier in the year, but do anticipate normal, healthy business this fall and winter."

About the same opinion is obtained from officials of the American Brass Company in that section. They forecast improved conditions during the months to come, saying that business conditions seem to warrant this expectation.

Irving Iron Works Holds Three-Day Sales Convention

The Irving Iron Works Company, Long Island City, manufacturer of "Irving subway grating" and "Safstops," held a three-day sales convention Sept. 12, 13 and 14.

About forty salesmen, divided into four groups, visited the company's plant at Long Island City, and the manufacturing of the product was shown from the raw-material stage to completion. While inspection was in progress a buffet luncheon was served in the sales department.

On Thursday an inspection trip was made to the Hell Gate power plant of the United Gas & Electric Company, New York City.

International Western Electric Rebuilding Japanese Buildings

The International Western Electric Company has received a cable reporting satisfactory progress of wrecking operations on several buildings of its associated company, the Nippon Electric of Tokyo, which were destroyed during the earthquake. The cable says that manufacturing will probably be resumed in three months. Despite the extent of the disaster, the Nippon company is actually transacting business. Philip K. Condict of New York, vice-president of the International Western Electric Company, who was in Japan at the time of the disaster, is remaining on the scene during the critical restoration period, or about six weeks.

Black & Decker Announce Changes in Sales Personnel

Of the more important changes to be made in the sales force of the Black & Decker Manufacturing Company, Baltimore, are the following:

Robert D. Black, branch manager for Black & Decker, in charge of the Philadelphia territory, will return to headquarters about the middle of November to take up his new duties as advertising manager for the company. Mr. Black succeeds Mr. Brogan as advertising manager, effective Jan. 1, 1924, at which time Mr. Brogan will take up his new work in connection with G. W. Brogan, Inc., which concern will handle the advertising of the Black & Decker Manufacturing Company, the Manley Manufacturing Company, the Dieffenbach-Westendorf Manufacturing Company and one other organization whose name has not yet been announced.

H. G. Smith, at present resident salesman for Pittsburgh and western Pennsylvania, will succeed Robert D. Black as branch manager in charge of the Philadelphia territory, including all of Pennsylvania, Delaware and New Jersey from Trenton south.

Bethlehem Steel Orders Reversing Mill Equipment

The Bethlehem Steel Company has ordered from the Westinghouse Electric & Manufacturing Company electrical equipment to replace a steam drive for a 30-in. x 48-in. universal plate mill in its Lackawanna plant, Buffalo, N. Y. The value of the order is about a quarter of a million dollars.

This is the second reversing-mill equipment ordered from the Westinghouse company for the Lackawanna plant and is part of an extensive electrification program which was undertaken when the plant was acquired by the Bethlehem company a short time ago. It is expected that this equipment will be installed in the early part of 1924. The apparatus in the order includes one direct-current reversing-mill motor operating at 75 r.p.m. to 150 r.p.m. in either direction; one flywheel motor-generator set consisting of one 4,000-hp. wound-rotor induction motor; two 21,000-kw., 700-volt direct-current generators and one 100,000-lb. cast steel flywheel; auxiliary equipment consisting of a three-unit exciter set to supply excitation for the reversing-mill motor and the generator of the flywheel set; ventilating apparatus for ventilating the main equipment; switchboard and complete automatic control equipment.

Electric Heating Apparatus Firm Opens Chicago Office

The Electric Heating Apparatus Company, 18 Nesbitt Street, Newark, N. J., manufacturer of electric industrial furnaces, announces the opening of its Chicago office in the Marquette Building, 140 South Dearborn Street. F. A. Hansen, who for a number of years was with the Westinghouse Electric & Manufacturing Company as an industrial heating engineer, is the district manager in charge of the new office.

Announcement is also made that the company has canceled its contract with Westinghouse. This contract existed during the past two years and specified that Westinghouse had exclusive rights to "Hevi-Duty" industrial furnaces manufactured by the Electric Heating Apparatus Company.

New York City Jobber Holding Lamp and Heater Campaigns

With advertisements of Edison "Mazda" lamps appearing in fifty-five daily newspapers of New York, Connecticut and New Jersey, the Sibley-Pitman Electric Corporation, New York City, a General Electric distributor, has started its second large sales contest of the season. The other, instituted for its agents, is the "Hotpoint" heater campaign, following the recent contest held by the Edison Electric Appliance Company, in which 20,000 "Hedlite" heaters were sold.

The lamp campaign started shortly after resumption of standard time in New York, Sept. 30, when people turned on their lamps an hour sooner.

The Savage Arms Corporation, Utica, N. Y., is arranging for expansion at its local plant for the manufacture of electric washing machines. The present output averages 1,200 machines a month, and it is purposed to advance this to 2,000 machines monthly by the close of the year. The company is also developing plans for the manufacture of electric refrigerators on a large scale.

O. H. Nickerson, electrical manufacturers' representative, announces the removal of his offices to the Leader-New Building, Cleveland. Among the companies which Mr. Nickerson represents are the All Steel Equipment Company, Aurora, Ill.; the Connecticut Telephone & Electric Company, Meriden, Conn.; the Federal Porcelain Company, Carey, Ohio, and the Schwartze Electric Company, Adrian, Mich.

The H. T. Electric Company, North Capitol Avenue, Indianapolis, manufacturer of electrical supplies, etc., is completing plans and will soon take bids for the construction of a one-story-and-basement addition to its plant, to cost about $32,000.

The Reliance Electric Company, Moorman Street, Chicago, has awarded a contract to the Stoddard Peterson Company, 60 West Washington Street, for the construction of a two-story-and-basement addition to its plant, to cost about $50,000. Edward Leiss is president.

Landers, Frary & Clark, Stanley Street, New Britain, Conn., manufacturers of electric heating and cooking appliances, etc., have commenced the construction of a new addition to cost about $30,000.

M. D. Goodman, who for ten years was connected with the Electric Controller & Manufacturing Company and lately with Stephen Hall & Company, has opened his own business at 185 Bigelow Street, Newark, N. J., to buy and sell new and used electrical equipment.

The Reinforced Switch & Manufacturing Company, Inc., 400 East North Avenue, Pittsburgh, has appointed B. J. Mockenhaupt & Company, 217 North Des Plaines Street, Chicago, as its representative in the Chicago district.

The American Batteries, Inc., New York City, has been incorporated with capital stock of $1,500,000 to manufacture batteries. Its plant is in Waco, Tex., and is now in operation.

The Eden Washer Corporation, Paterson, N. J., incorporated with capital stock of $325,000, will manufacture washing machines. The Robbins & Myers Company, Springfield, Ohio, will build the machines by contract. All machinery belonging to the new company is being moved and production will begin about Nov. 1. Paul V. D. Brokaw is president.

The International Lamp Corporation, 736 West Monroe Street, Chicago, contemplates the erection of a new plant on four acres recently acquired in Cicero, Ill.

The Western Electric Company has opened the new season for its industrial night school at its Hawthorne (Ill.) works, which is by far the largest school of instruction of this character in the Chicago district. It is designed to accommodate the 34,000 operatives now employed at the plant. The instruction classes are divided into seventeen different courses, covering practically every phase of operation at the works, from technical instruction to bookkeeping. There are thirteen technical courses in the prescribed 1923-24 curriculum, the latest additions being call-indicator-equipment engineering and blueprint reading. The first noted includes a comprehensive study of the operation and performance of automatic dial telephones, now being produced in large numbers at the Hawthorne plant.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Constantinople, Turkey (No. 7,849), of electrical radiators, heaters, irons, water heaters, small motors, small refrigerators, hot-water accumulators and radiators.

Agency is desired in Amsterdam, Netherland (No. 7,851), for household appliances, novelties and radio.

Purchase is desired in Lapas, Bolivia (No. 7,843), of radio apparatus for broadcasting station.

Purchase is desired in Antwerp, Belgium (No. 7,850), of radio apparatus.

INDO-CHINA IMPROVEMENTS AUTHORIZED.—Authority has been obtained by the Societe Indo-Chine d'Electricité of Haiphong, Indo-China, to add 1,500 kw. capacity to its present plant, according to cable advices from Consul Smith of Saigon. The improvements will cost 2,500,000 francs.

RUSSIAN-FRENCH RADIO AGREEMENT RATIFIED.—Ratification has been made of the contract between the French Compagnie Générale de Télégraphie sans Fil and the Russian Radio Electric Trust, which provides for the installation of wireless stations and manufacture of apparatus in Russia.

ROME-NAPLES ELECTRIC TRAM LINE UNDER CONSTRUCTION. — For some time work has been proceeding upon a direct express electric tram line between Rome and Naples, which will reduce the running time considerably. It is announced that 39,000,000 lire ($1,950,000) is available for the completion of this project, which, it is calculated, will take about ten months longer.

ROME RAILWAY REPAIRS TRANSFERRED TO SOUTH ITALY. — Premier Mussolini has decided that all repairs to railway equipment in the Rome department will henceforth be done in the south of Italy and not in the north. This is intended to relieve somewhat the employment situation and to further aid the factories and works of Naples.

New Apparatus and Publications

PORTABLE ELECTRIC TOOLS. — The Hisey-Wolf Machine Company, Cincinnati, has issued catalog No. 3027, describing the complete line of "Hisey" products.

DIESEL ENGINES.—The Busch-Sulzer Bros., Diesel Engine Company, St. Louis, has issued a bulletin showing the record of 186 central stations operating 263 Diesel engines during twenty years.

POLYPHASE INDUCTION MOTORS.—The Allis-Chalmers Manufacturing Company, Milwaukee, has issued bulletin No. 1118-B, entitled "Polyphase Induction Motors, Type 'AR' Squirrel Cage."

FINE MATERIAL AND PORCELAIN INSULATORS.—The Westinghouse Electric & Manufacturing Company has issued a new catalog covering line material and porcelain insulators. The catalog is supplementary to the company's large supply catalog and has been issued for the convenience of purchasers of these two allied lines of materials.

PORTABLE OSCILLOGRAPH. — The Westinghouse Electric & Manufacturing Company has brought out a new portable oscillograph.

HIGH - VOLTAGE DETECTORS. — Schweitzer & Conrad, Inc., 4435 Ravenswood Avenue, Chicago, are issuing bulletin No. 214 describing their high voltage detectors.

ELECTRIC INDUSTRIAL TRUCKS AND TRACTORS.—The Crescent Truck Company, Lebanon, Pa., is issuing a catalog describing its complete line of electric industrial trucks and tractors.

STRAINERS. — The Elliott Company, Jeannette, Pa., is issuing catalog No. A-2, covering the "Twin Strainer," "Twin Oil Strainer" and the "Single Strainer."

RACK RAKE. — The Newport News Shipbuilding & Dry Dock Company, Newport News, Va., has issued Bulletin No. 1, describing its power-operated rack rake for cleaning trash rakes or screens installed in connection with water-power flumes and canals, condenser intakes, water-supply intakes, etc.

STRIP HEATERS.—Edwin L. Wiegand Company, 422 First Avenue, Pittsburgh, is manufacturing heating elements in convenient strips for commercial and domestic heating.

CONTROLLER VALVE. — The Bristol Company, Waterbury, Conn., is issuing bulletin No. 319, describing its new "Bristol-Fuller Controller Valve."

X-RAY EQUIPMENT.—The Acme-International X-Ray Company, 341 West Chicago Avenue, Chicago, has issued Bulletins Nos. 9, 10, 11, 12, 13, 15, 16, 18, 19, 20, 21, 22 and 23, describing its X-ray equipment.

ELECTRIC RANGE. — The Electrahot Appliances, Inc., 307 Fifth Avenue, Minneapolis, Minn., is manufacturing a new type of range, No. B-57.

EARTH DRILL.—The Hubron Company, Somerville, N. J., is manufacturing a gasoline-engine-driven drill which digs in earth, clay, shale and hardpan for telegraph and telephone poles, fence posts, etc.

ANALYZER.—G. Roth, Grande Rue, Paris, France, has brought out a new CO_2 analyzer called "Positif."

TREE WIRE. — The Simplex Wire & Cable Company, New York City, has issued a folder describing its "Fibrex" tree wire.

ANNUNCIATORS.—The Patrick & Wilkins Company, 51 North Seventh Street, Philadelphia, is issuing bulletin No. 60, describing its complete line of annunciators.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

RUTLAND, VT.—The Vermont Hydro-Electric Corporation has sold a block of first mortgage bonds, a portion of the proceeds to be used for extensions and improvements.

BOSTON, MASS. — Superstructure work will be commenced on an addition to the power plant of the Boston Elevated Railway Company at 696 East First Street, to be 76 ft. x 80 ft., estimated to cost $200,000, with equipment.

CHESTER, CONN.—The Central Connecticut Power & Light Company has secured permission to acquire the Essex Light & Power Company for a consideration of about $600,000. Extensions and improvements are planned in connection with a consolidation of the property.

MIDDLETOWN, CONN.—The Connecticut Power Company plans for extensions in its local generating plant, with the installation of additional equipment. A new substation will be erected on the Cromwell Road. The company has arranged an appropriation of about $500,000 for expansion during the present year, including the work noted, additional transmission lines, etc.

TORRINGTON, CONN.—The Torrington Electric Company has purchased property in the Winchester section approximating 100 acres of land and contemplates additions in its hydro-electric generating plant and system.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by the Quartermaster Section, New York General Intermediate Depot, until Oct. 11 for electrical supplies, including electric fans, etc. (Circular 24-48.)

BUFFALO, N. Y.—The Ford Motor Company, Highland Park, Mich., plans for the construction of a power house at its proposed local plant on a site for which negotiations are under way. It is estimated to cost in excess of $500,000.

BUFFALO, N. Y.—The Buffalo General Electric Company will commence the construction of a new generating station at Childs Street and the Hamburg Turnpike, to cost about $65,000.

CANANDAIGUA, N. Y.—Plans are under consideration for the construction of a municipal electric power plant and the installation of electrically operated pumping machinery for waterworks service. Henry A. Beeman, president Board of Public Works, is in charge.

GOUVERNEUR, N. Y.—Plans are under consideration for the construction of a municipal electric power plant and the installation of electrically operated pumping machinery at the city waterworks.

NORTH TONAWANDA, N. Y. — The Tonawanda Power Company has purchased property at Main and Sommer Streets for the construction of a substation.

TULLY, N. Y.—The Syracuse Lighting Company has acquired the local municipal electric plant, and plans for extensions in its transmission system for service in this section, with substation.

CHATHAM, N. J.—The Central Jersey Power & Light Company plans for the construction of a transmission line on Main Street in connection with an extension in its system to furnish service at Madison.

JERSEY CITY, N. J.—The Public Service Corporation has filed plans for the construction of a new plant addition at 190-94 Morgan Street, estimated to cost $71,000.

NEWARK, N. J. — The Public Service Electric Company will commence the construction of a one-story substation, 60 ft. x 160 ft., on Passaic Street.

ATHENS, PA.—O. L. Haverly, Athens, and associates have organized the Smithfield, Sheshequin and Ulster Township Electric companies to install and operate transmission lines in the respective territories named.

GRANTVILLE, PA. — The Grantville Electric Company, recently organized, contemplates the construction of a transmission line for local service. The company will be operated in conjunction with the East Hanover Electric Company and the Cold Spring Electric Company, lately formed, which will also construct systems in their respective districts. S. S. Seyfert, Bethlehem, Pa., and J. G. Rich, Bethel, Pa., are heads.

HARRISBURG, PA.—The Board of Education will build a power house at the vocational shops, William Penn High School, to cost about $65,000.

NEW VERNON, PA.—The New Vernon Electric Company, recently organized, plans for the installation of a transmission line in this section. The Mill Creek Electric Company, an affiliated organization, formed at the same time, will also install a system. F. A. Conner, Greenville, Pa., is treasurer of both companies.

LEBANON, PA.—The Metropolitan Edison Company has acquired the plant and system of the Weimer Electric Light & Power Company and contemplates extensions and improvements in connection with consolidation. Officials of the purchasing company have organized the Metropolitan-Royalton Electric Company, to install and operate a light and power system at Royalton, Pa., and vicinity.

MEADVILLE, PA. — A fund is being raised for the installation of an ornamental lighting system. The Chamber of Commerce is interested in the improvement.

PITTSBURGH, PA. — The Keystone Power Corporation has issued preferred stock for $300,000, the fund to be used for extensions and improvements.

PITTSBURGH, PA. — The West Penn Power Company will issue stock for $1,500,000, the entire fund to be used for extensions in generating plants and system.

SILVER BROOK, PA.—The Candlemas Coal Company contemplates the installation of electric power equipment at its properties.

STEELTON, PA.—An ordinance has been approved for the installation of an electric street-lighting system on South Front Street consisting of 250-cp. and 100-cp. units.

YARDLEY, PA.—The Bureau of Water, Philadelphia, contemplates the installation of a power plant and electrically operated pumping plant on the Delaware River, with capacity of 600,000 gal. per day. An appropriation of $6,000,000 has been granted, the proceeds to be used for extensions and improvements, including the installation of electric pumping machinery in existing plants.

SEAFORD, DEL.—Plans are under consideration for extensions in the municipal street-lighting system. It is also contemplated to make improvements in the waterworks, to include the installation of electric pumping equipment.

OAKLAND, MD. — The Victory Mining Company, recently organized with a capital of $500,000, plans for the installation of electric power equipment at its local coal properties. G. S. Hamill heads the company.

NORFOLK, VA.—The Virginia Fuel Corporation, Portsmouth, Va., recently organized, contemplates the construction of a power house at its proposed local fuel-

briquette manufacturing plant. S. W. Williamson is general manager.

CLARKSBURG, W. VA.—Plans are under way by the C. F. Cuningham Company, Goff Building, for the installation of a street-lighting system on a tract of 150 acres of land, near Clarksburg, to be developed.

FAIRMONT, W. VA.—Plans are being perfected by the Monongah Glass Company for the installation of electric power equipment at its local plant in connection with the construction of additional units and for the purchase of similar machinery at its coal-mining properties in this same section. A fund of $500,000 is available for the expansion. H. L. Heintzelman is president.

WASHINGTON, D. C.—Bids will be received by the Chief of Engineers, Room 2825, Munitions Building, until Oct. 16 for twenty-five ventilating blowers, complete with motors, starting regulators, etc. (Advertisement No. 24-120).

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Oct. 11 for 1,400 ft. of wire messenger strand; 1,000 ft. of wire, type W-62; 3,000 ft. type W-20; 200 connecting cords; 500 ft. two-conductor wire; 1,500 ft. wire, type W-21; 1,000 ft. wire, type W-22; 40,000 ft. wire, type W-35; 1,000 ft. wire, type W-13; forty-eight cords 1,000-ft. high-tension wire. (Circular PR 15263-1CP.)

North Central States

LANSING, MICH.—The Reo Motor Car Company has commenced the construction of an addition to its power plant to double approximately the present output.

PHILO, OHIO.—The Ohio Power Company has issued bonds for $6,000,000, the proceeds to be used for its proposed local generating plant, with capacity of 70,000 kw. and transmission system.

DAWSON SPRINGS, KY.—The Dawson Daylight Coal Company, Louisville, recently organized, plans for the installation of electric power equipment and mining machinery at its local properties. K. U. Mequire is head.

FLEMINSBURG, KY.—The M. & F. Light & Power Company will construct a transmission line to Maysville to operate at 13,200 volts; extensions and improvements will be made in the local distributing system recently acquired from the Flemingsburg Light & Ice Company. Power will be secured from the Maysville Gas & Electric Company.

MOGG, KY.—The Drakesboro Coal Company, recently formed with a capital of $400,000, contemplates the installation of electric power and mining equipment at its local properties. Claude Nichols is head.

MISHAWAKA, IND.—The La Salle Paper Company, South Bend, will build a power house in connection with its proposed local paper mill, estimated to cost about $110,000. Freyermuth & Maurer, Farmers' Trust Building, South Bend, are architects. C. N. Nicely is president.

INDIANAPOLIS, IND.—The E. C. Atkins Company, manufacturer of saws, has filed plans for the construction of a one-story power house addition at its plant on South Illinois Street.

OTTAWA, ILL.—The National Plate Glass Company, Detroit, Mich., contemplates the construction of a power house in connection with additions at its local plant, estimated to cost more than $5,000,000, on which work is being commenced.

COLD SPRING, MINN.—The St. Cloud Public Service Company is planning for the rebuilding of its local transformer station, recently destroyed by fire.

MASON CITY, IOWA.—The Webster Brothers Manufacturing Company, Waucoma, Iowa, will install electric power equipment at its proposed box-manufacturing plant, on local site, estimated to cost $75,000. N. A. Webster is president.

WASHINGTON, IOWA.—Contract has been awarded to the Iowa Gas & Electric Company for street-lighting for a period of ten years. The company will also build a line and furnish power for the operation of a municipal pumping plant.

WATERLOO, IOWA.—New bids will be asked in the near future for the installation of a street-lighting system. Bids recently received have been rejected. Charles MacKay is city clerk.

DES MOINES, IOWA.—The Eagle Iron Works, 301 East Court Street, will install electric power equipment at its proposed plant at Halcomb Avenue and the Belt Line Railroad, consisting of a number of buildings, estimated to cost $125,000. Wilfred D. Holtzman, 406 Flynn Building, is architect.

GALLATIN, MO.—Plans are under way for the installation of additional equipment at the municipal electric plant.

MOBERLY, MO.—Plans are being perfected for the installation of an ornamental street-lighting system on Coates Street.

THAYER, MO.—Plans are under consideration for the installation of electrically operated pumping machinery in connection with a proposed waterworks, estimated to cost $50,000.

RIDGEWAY, MO.—Plans are being arranged for the installation of electric pumping and power equipment in connection with a new waterworks system, estimated to cost $45,000.

INMAN, NEB.—The O'Neill Light & Power Company plans for the construction of a transmission line here and the installation of a local system. Negotiations are under way with the council.

WYNOT, NEB.—Plans are under way for the construction of a transmission line to Gayville, S. D., to connect with the system of the Tri-State Utilities Company, for local service.

APPLETON, WIS.—Electric power equipment will be installed in the new local mill of the Riverside Paper Fibre Company, estimated to cost $150,000, for which foundation work is in progress. Orbison & Orbison, 312 College Avenue, are architects.

LEAVENWORTH, KAN.—The Kansas Electric Power Company has issued bonds for $1,000,000, the entire fund to be used for extensions and improvements in power plant and system.

Southern States

ASHEVILLE, N. C.—The Gennett Lumber Company contemplates the construction of a power house at its proposed mill in Madison County. Andrew and N. W. Gennett are heads.

SALISBURY, N. C.—Plans are under consideration for the installation of electrically operated pumping machinery in connection with extensions in the waterworks plant to cost about $35,000.

ELIZABETH CITY, N. C.—The Chesson Manufacturing Company contemplates the rebuilding of the portion of its power house on Knobbs Creek, recently destroyed by fire.

ROCKINGHAM, N. C.—The Rockingham Paper Company, recently organized, plans for the construction of a power house at its proposed local paper mill. H. C. Wall is president.

GOLDSBORO, N. C.—Plans are under way for the installation of electrically operated pumping machinery at the municipal waterworks in connection with proposed extension, to cost about $60,000.

GREENSBORO, N. C.—Bonds have been approved for $30,000 for the installation of a fire-alarm system.

PARIS ISLAND, S. C.—Bids will be received by the Quartermaster, United States Marine Barracks, until Oct. 10 for a quantity of miscellaneous electrical supplies.

COLUMBUS, GA.—The Columbus Brick & Tile Company contemplates the installation of electric power equipment at its plant.

HOMESTEAD, FLA.—The Redlands Grove Homes Company, recently organized with capital of $350,000, plans for the installation of a light and power system on a local tract of 150 acres of land. W. H. Price, Miami, Fla., is president.

STUART, FLA.—The Florida Food Products, Inc., P. O. Box 96, recently organized, plans for the installation of a power plant for electric service at its proposed local factory.

WHITE SPRINGS, FLA.—Plans are being perfected for the installation of electrically operated pumping machinery in connection with a proposed waterworks plant to cost about $30,000.

HAZLEHURST, MISS.—Plans are under consideration for the construction of a municipal electric plant for light and power service.

ALBERTVILLE, ALA.—The Alabama Power Company is concluding negotiations for the purchase of the local lighting plant and system and will extend its transmission line here. The plant will be remodeled for a substation. The company will also acquire the power plant at Boaz, in this same district, and will build a transmission line for local service.

ATTALLA, ALA.—The Gadsden Ice & Fuel Company, Gadsden, Ala., plans for the installation of additional electric power equipment at its local ice-manufacturing plant, recently acquired.

BIRMINGHAM, ALA.—The Birmingham Water Works Company plans for the installation of electrically operated pumping machinery in connection with extensions and improvements in its plant.

GADSDEN, ALA.—The Gadsden Cooperage Company contemplates the rebuilding of the portion of its power house and plant recently destroyed by fire with loss of about $45,000.

HUNTSVILLE, ALA.—The Alabama Power Company will make extensions and improvements in its local transmission and distributing system, including substation equipment installation, estimated to cost about $200,000.

KNOXVILLE, TENN.—Plans are being arranged for the construction of an electric lighting plant by the Swan-Land Country Club on tract of land about 8 miles from the city. J. W. Leek is manager.

CARROLLTON, LA.—The Citizens' Light & Power Company will make extensions in its local power plant, including the installation of new prime movers and auxiliary equipment.

GED, LA.—The Orange Light Company, Orange, Tex., plans for the construction of a transmission line here for service in the local oil fields.

NEW ORLEANS, LA.—The Great Southern Lumber Company, Bogalusa, La., contemplates the construction of a power house in connection with its proposed local pulp mill, estimated to cost more than $400,000.

ENID, OKLA.—Electric pumping machinery will be installed in connection with extensions and improvements in the waterworks system. J. D. Bomford & Company, Masonic Temple Building, are consulting engineers.

PRYOR, OKLA.—The Public Service Company of Oklahoma has acquired the local power plant and system. A transmission line will be constructed from Vinita, Okla., and the plant converted to a substation. The line will be extended to Adair and Big Cabin, Okla., for service in this district.

TULSA, OKLA.—A power house is planned at the proposed local mill of the Tulsa Cotton Mills Company, recently organized, estimated to cost $225,000. The Southwest Engineering Company, Tulsa, is engineer. Daniel Hunt is president.

COWETA, OKLA.—The Oklahoma Public Service Company has acquired the local municipal electric plant and will build a transmission line to this point.

DRUMRIGHT, OKLA.—The Canadian Valley Utilities Company has increased its capital to $150,000 and contemplates extensions and improvements.

BELLEVUE, TEX.—The Wichita Falls Electric Company has work in progress on a new transmission line from Wichita Falls, with extension to Bowie, Tex. Installation of lines for commercial service will be made in seven towns in this vicinity.

CORSICANA, TEX.—The Corsicana Power & Light Company will install a light and power system, including street lighting, in the Oak Lawn addition.

DALLAS, TEX.—The Dallas Power & Light Company has called a meeting of stockholders to arrange for an increase in capital from $3,500,000 $4,500,000, a portion of the proceeds to be used in connection with additions to power plants and system.

DESDEMONA, TEX.—The Desdemona Electric Company plans for the installation of additional equipment at its local power plant, including engine, generator, switchboard, etc.

FRISCO, TEX.—Plans are under consideration for the installation of electric pumping machinery and auxiliary equipment in connection with improvements in the municipal waterworks, to cost approximately $40,000.

KENEDY, TEX.—Electric pumping machinery, air compressors and other equipment will be installed in connection with extensions and improvements in the waterworks, to cost about $30,000.

McALLEN, TEX.—The Valley Ice & Electric Company plans for the installation of electric pumping machinery at its local waterworks.

NEW BRAUNFELS, TEX.—The Planters & Merchants' Mills, Inc., operating a local cotton mill, plan for a hydro-electric development for mill service.

SNYDER, TEX.—The Snyder Utilities Company will install electric power equipment at its proposed cold-storage plant, on local site, estimated to cost about $100,000.

HOUSTON, TEX.—The Texas Packing Company, 110 Milan Street, contemplates the construction of a power house and refrigerating plant at its proposed local meat-packing plant, estimated to cost $100,000. M. P. Burt, 206 Falls Building, Memphis, Tenn., is engineer.

Pacific and Mountain States

CHINO, CAL.—Bids will be received by the Board of City Trustees, M. L. Birinie, city clerk, until Oct. 16 for the installation of an ornamental street lighting system on portions of D and Sixth Streets and Riverside Drive, including iron conduit, ornamental light posts, complete with bases and other appurtenances. Paul E. Kressly, 732 H. W. Hellman Building, Los Angeles, is consulting engineer.

SACRAMENTO, CAL.—Bids will be called at once for the installation of a fire-alarm system.

SAN FRANCISCO, CAL.—Bids will be received by the Bureau of Supplies and Accounts, Washington, D. C., until Oct. 23 for 4,000 ft. of electric wire, for use at the Mare Island Navy Yard. (Schedule 1357.)

BERKELEY, CAL.—Surveys will be made of the municipal lighting system for the preparation of plans for extensions and improvements. Frank B. Rae, electrical engineer, is in charge.

CARMICHAEL, CAL.—The Carmichael Irrigation District is perfecting plans for the establishment of a public utility district, to install power lines and furnish service in this section.

KINGSBURG, CAL.—The E. Y. Foley Grape Products Company contemplates the rebuilding of the portion of its power house and plant, recently destroyed by fire with loss of about $50,000.

PITTSBURG, CAL.—The Pacific Gas & Electric Company has contracted to furnish service at the local plant of the Columbia Steel Company for a period of five years. It is said that the contract will aggregate more than $200,000 per year. The company has also secured an agreement for power service at the plant of the Calaveras Copper Company, to total about $31,000 per annum. Extensions and improvements will be made to accommodate the service.

PLACERVILLE, CAL.—S. G. Beach & Son contemplate the installation of additional electric power equipment at their local box-manufacturing plant in connection with extensions estimated at $35,000.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has issued bonds for $10,000,000, a portion of the proceeds to be used for extensions and improvements. Foundations will soon be laid for a new steam-operated power plant on Stevenson Street, estimated to cost $250,000.

AZUSA, CAL.—The Paramount Motors Company plans for the construction of a substation at its proposed local plant, estimated to cost $100,000, for which negotiations are now in progress with the city officials.

EVANSTON, WYO.—The State Board of Charities and Reform will build a power house at the local state hospital for the insane.

CLARKSTON, WASH.—Plans are under way for the installation of electric pumping machinery in connection with waterworks system, to cost about $300,000.

EVERETT, WASH.—The Weyerhaeuser Timber Company contemplates the construction of a power house at its proposed new local mill, estimated to cost about $250,000.

SEATTLE, WASH.—An appropriation of $50,000 has been approved for extensions in the municipal steam-operated electric power plant, used for emergency service, including the installation of additional equipment.

SEATTLE, WASH.—Electric power equipment will be installed in the two-story plant to be constructed by the Seattle Ice Cream Company, to cost about $165,000.

SEATTLE, WASH.—The Washington Iron Works will build a one-story power house at its plant, Sixth Avenue, South, 30 ft. x 110 ft.

SPOKANE, WASH.—The Mount Spokane Power Company will construct an addition to its transmission system in the northern part of Spokane County, where franchise has been granted, estimated to cost $50,000.

SPOKANE, WASH.—The Washington Water Power Company will commence the construction of an addition to its hydro-electric power plant at Similkameen Falls, formerly the property of the Okanogan Valley Power Company, recently acquired. A new 2,500-hp. unit will be installed and extension made in transmission lines.

Central America

GUATEMALA CITY, GUATEMALA, C. A.—The Guatemala Oil Corporation, recently organized with a capital of $5,000,000, plans for the installation of electric power equipment at its properties.

Electrical Patents

Announced by U. S. Patent Office

(Issued Sept. 11, 1923)

1,467,959. Amusement Device; H. Stoehrer and M. Stoehrer, Methuen, Mass. App. filed March 27, 1920. Electrically driven chair energized from overhead wire.

1,467,966. Means for Replenishing Storage Batteries with Water; H. Watzman, Washington, D. C. App. filed Nov. 12, 1921. Automatically maintaining proper level.

1,467,973. Induction Coil; J. H. Hunt and W. A. Chryst, Dayton, Ohio. App. filed Dec. 22, 1917. For ignition system of airplane engines.

1,467,974. Circuit-Breaker Indicating Device; J. H. Hunt, Dayton, Ohio. App. filed Aug. 13, 1919. Electromagnetic device.

1,467,988. High-Frequency Signaling System; C. A. Hoxie, Schenectady, N. Y. App. filed March 16, 1922. Radio receiving apparatus.

(Issued Sept. 18, 1923)

1,467,993. Automobile Signal; J. B. Blair, Decatur, Ill. App. filed Aug. 28, 1919. Direction signal.

1,468,006. Regulating System for Electric Generators; A. E. Doman, Elbridge, N. Y. App. filed Nov. 21, 1919. For three-brush-type generators for automobiles.

1,468,007. Regulating System for Electric Generators; A. E. Doman, Elbridge, N. Y. App. filed Nov. 21, 1919. Three-brush type used in automobiles.

1,468,024. Apparatus for Regulating the Voltage of Dynamos; A. J. Jullin, St. Cloud, France. App. filed May 20, 1920. Generators for lighting railway trains and motor cars.

1,468,042. Column Strain Insulator; L. Steinberger, Brooklyn, N. Y. App. filed Dec. 6, 1918. Rod type the terminals of which are ventilated.

1,468,043. Insulator-Supporting Pin; L. Steinberger, Brooklyn, N. Y. App. filed March 11, 1919. Arrangement for cooling the inside of insulator.

1,468,044. Line Insulator; L. Steinberger, Brooklyn, N. Y. App. filed March 11, 1919. Pin type.

1,468,049. System for Receiving Radio Signals; A. H. Taylor, Grand Forks, N. D. App. filed Oct. 9, 1918. Method of eliminating static interference.

1,468,051. Storage Battery; H. C. Thompson, Jr., St. Louis, Mo. App. filed Aug. 26, 1921. Method of constructing.

1,468,056. Starting and Generating System; W. A. Turbayne, Niagara Falls, N. Y. App. filed Feb. 25, 1918. Motor-generator for automobiles.

1,468,059 to 1,468,062. Method and Apparatus for Radio Signaling; R. A. Weagant, Douglas Manor, N. Y. App. filed Feb. 7, 1919. Method and apparatus for eliminating static interference.

1,468,078. Automatic Telephone System; A. J. Ray and W. A. Chapin, Chicago, Ill. App. filed Sept. 3, 1920. For large commercial and manufacturing plants.

1,468,084. Device for Incandescent Lamps; F. W. Salz, Cleveland, Ohio. App. filed Jan. 18, 1919. Holder for chemical that absorbs tungsten gas.

1,468,095. Calling Device; W. L. Whidden, Spreckels, Cal. App. filed April 7, 1921. For small telephone exchanges.

1,468,096. Storage-Battery Circuits; R. L. Young, East Orange, N. J. App. filed April 9, 1920. Charging batteries in sections.

1,468,101. Testing Circuits; A. B. Clark, Brooklyn, N. Y. App. filed Dec. 26, 1919. For telephone lines having repeaters.

1,468,103. Electrode Protector; W. Dryssen, New York, N. Y. App. filed Nov. 15, 1921. To prevent oxidizing action caused by heat in electric furnace.

1,468,106. Electric Heater; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed May 23, 1917. Heating element combined with high-pressure steam tube for electric irons, etc.

1,468,116. Method of and Means for Amplifying Potential Variations; I. Langmuir, Schenectady, N. Y. App. filed Dec. 10, 1914. Current-limiting device for wireless receiving system.

1,468,150. Electric Motor; J. Goodman, Chicago, Ill. App. filed Aug. 16, 1920.

1,468,154 to 1,468,158. Arc-Welding Apparatus; J. A. Holifield, Mobile, Ala. App. filed May 9, 1921. Twin-field type of self-regulating generator.

1,468,179. Combined Thermostat and Time Control; F. M. Sutton, Vallejo, Cal. App. filed Feb. 26, 1920. For electric ovens.

1,468,180. Time Brush; E. W. Turner, Kokomo, Ind. App. filed May 16, 1921. For timers of ignition systems.

1,468,217. Measured-Service System; F. M. Slough, Rochester, N. Y. App. filed June 11, 1917. Selective indication and selective registration of telephone calls.

1,468,234. Depolarizer and Process of Preparing the Same; G. W. Heise, Elmhurst, N. Y. App. filed Dec. 14, 1921. Sulphur-containing copper oxide, including an ammoniacal ingredient.

1,468,249. Automatic Telephone System; W. T. Powell, Rochester, N. Y. App. filed Oct. 25, 1919. Control for machine switches.

1,468,250. Transmitter for Wireless Telephony; S. O. E. T. Trost, London, England. App. filed June 21, 1921. Employs two or more sets of oscillations.

1,468,259. Storage-Battery Practice; C. C. Carpenter, Niagara Falls, N. Y. App. filed Sept. 8, 1917. Method of shipping batteries in charged condition.

1,468,264. Incandescent Lamp; D. Gordon, New York, N. Y. App. filed Oct. 23, 1919. Second filament automatically lighted when first burns out.

1,468,265. Trolley Pole; G. B. Hamric, Widen, W. Va. App. filed Feb. 7, 1923. For mine locomotives.

1,468,296. Stand for Electric Irons; W. Hodgson, Gisborne, New Zealand. App. filed July 28, 1921. Current broken when iron is placed on stand.

1,468,305. Sender Diaphragm for Submarine Sound Signals; W. Kunze, Bremen, Germany. App. filed Aug. 16, 1921. Diaphragm with fixed ring and freely vibrating center.

1,468,307. Electric Motor; G. C. Marx, Elizabeth, N. J. App. filed Aug. 24, 1917. Direct-connected sewing-machine motor.

1,468,321. Electric Control System; J. F. Newsom, Palo Alto, Cal. App. filed Sept. 28, 1921. Means for opening room-lighting circuit when door is locked.

1,468,330. Synchronous Transmission System; E. A. Sperry, Brooklyn, N. Y. App. filed Dec. 5, 1919. Supervisory control system.

1,468,341. Battery Rejuvenator; R. E. Carter, Champaign, Ill. App. filed Oct. 10, 1921. For renewing storage batteries.

1,468,385. Electrically Heated Utensil; J. F. Lamb, New Britain, Conn. App. filed June 11, 1919. Grill plate.

1,468,408. Electric Pocket Lamp; H. Studer, Zurich, Switzerland. App. filed May 10, 1922.

1,468,419. Electric Coffee Roaster; M. T. Seymour, Stowe, N. Y. App. filed March 28, 1922.

1,468,430. Starting and Lighting Device for Internal-Combustion Engines; R. H. Whisler, Halfway, and S. G. Baits, Detroit, Mich. App. filed Oct. 5, 1921. Double-unit motor-generator.

1,468,441. Protective Device for Electric Distribution Systems; A. S. FitzGerald, London, England. App. filed Sept. 9, 1922. Differential relay.

1,468,444. Vibrator Horn; M. F. Fitzgerald, Winsted, Conn. App. filed Aug. 24, 1920. Electrically operated type.

1,468,456. Thermo-Electric Couple; W. H. Bristol, Waterbury, Conn. App. filed Sept. 14, 1922. Extension portion for compound type.

1,468,490. Electromagnetically Operated Counter; H. L. Merrick, Passaic, N. J. App. filed July 18, 1917.

1,468,500. Magneto; P. W. Fuller, Washington, D. C. App. filed Oct. 12, 1921. Usual revolving coils eliminated.

1,468,503. Trolley Wheel; J. D. Kimmel, Dayton, Ohio. App. filed June 18, 1923. Sliding contact for forward motion; rotates for backward motion.

1,468,542. Copying Telegraph; M. H. Petersen, Christiania, Norway. App. filed June 8, 1921. By means of oscillograph at the receiving station.

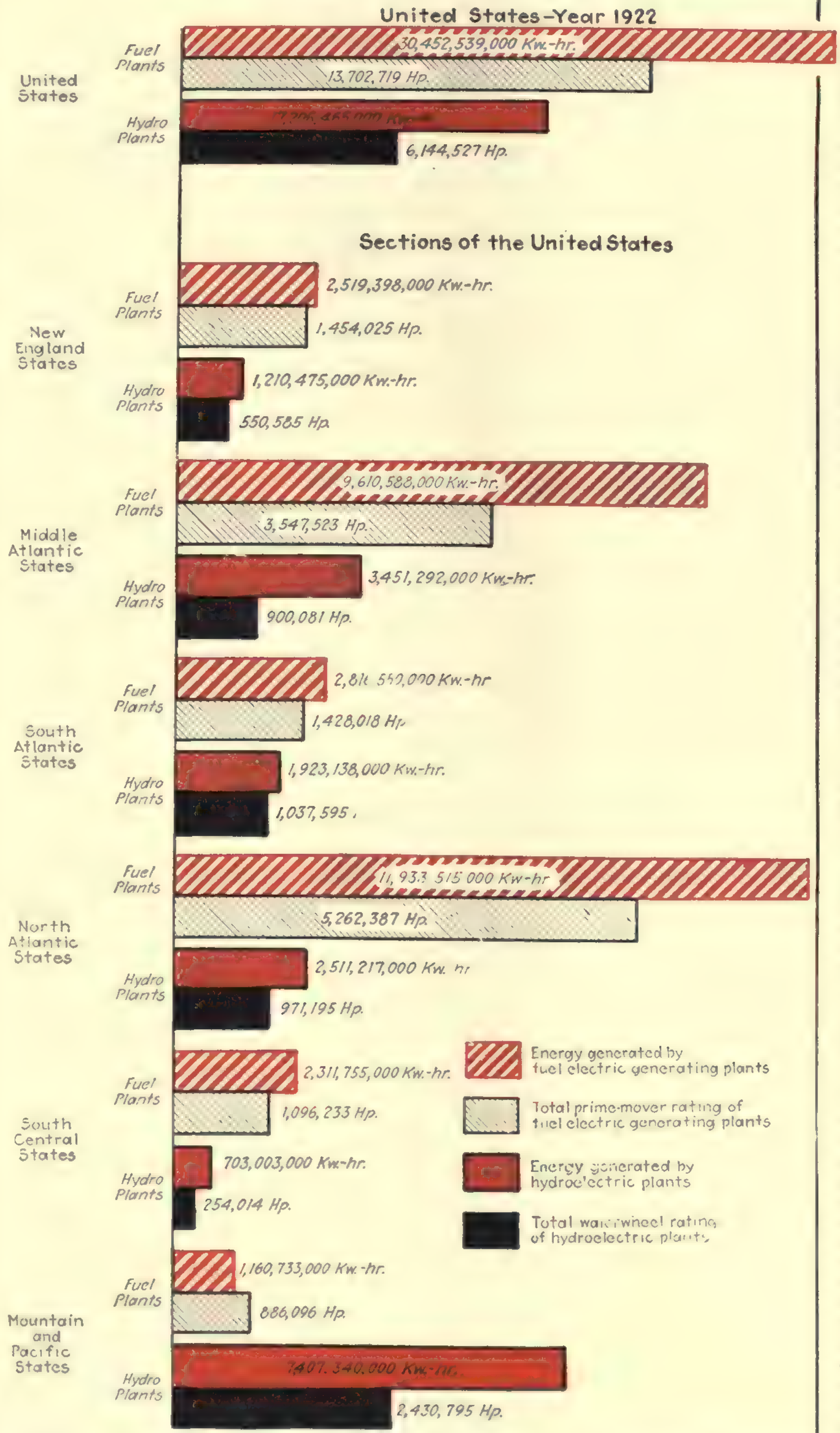
1,468,574. Voltaic Cell; F. R. Parker, Chicago, Ill. App. filed May 8, 1916. Improved method of construction.

1,468,577. Electrical Double-Pole Switching Plug; H. C. Sanders, Newport, England. App. filed April 23, 1921. Plug and receptacle for flexible cords.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Water Power Now Generates More than One-Third of Central Station Energy



National Interconnection Must Come

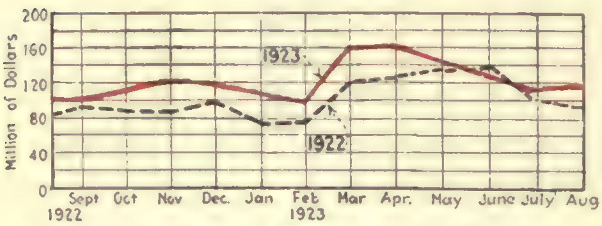
OF THE domestic problems which are today pressing for solution, few will have a greater influence on the future prosperity of the American nation than the conservation of the natural resources. The phantom which hovers over international discussion of the present day is not one of quantity of the earth's surface, but of quality—the potential presence of coal, oil, metals and water power. National leaders recognize the fact that in nature's bosom lies the power of future national predominance.

As the fastest growing of American industries, and an industry the very basis of which is the conversion of certain natural resources into electrical energy, the central station becomes a prime factor in the conservation or the conservative use of the nation's coal, oil and water power.

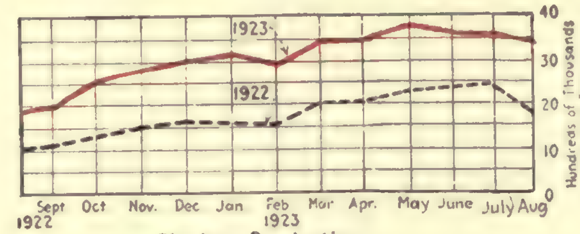
The electrical industry has made great strides toward conservation, both in greatly increased efficiency in the utilization of fuel to produce electricity and also in the development of water power at as rapid a pace as practicable. But even with all this, the demands for electric service and electric power have kept the industry busy building steam plants. Last year approximately thirty-eight million tons of coal and its equivalent in other fuels were consumed in central station generating plants and indications are that a consumption of 125,000,000 tons per annum will probably have been reached by 1935. This means about 25 per cent of the present annual bituminous coal production. Increased efficiency in fuel utilization may lower this figure, but at best the central station is bound to cut deeper and deeper into the fuel supply of the country.

One of the most effective checks on increasing fuel consumption is increased water power development. As indicated in the accompanying diagram, only a little over one-third of central station energy, as reported by the U. S. Geological Survey, is now supplied by water power. In order to prevent proportionately greater demands on coal, interconnection on a constantly increasing scale must be resorted to in order to permit development of water power. That is, superpower production, interconnection, and ultimately a country-wide network with maximum transmission of hydroelectric energy will be the greatest contribution the electrical industry can make toward the most economical fuel utilization and conservation of natural resources.

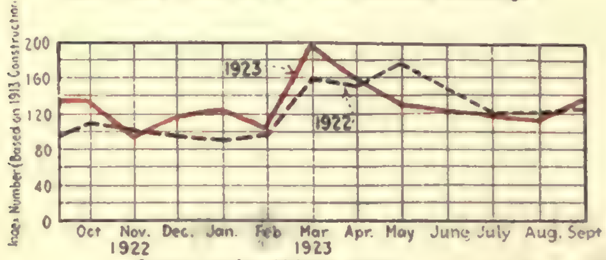
How the Primary Industries Are Trending



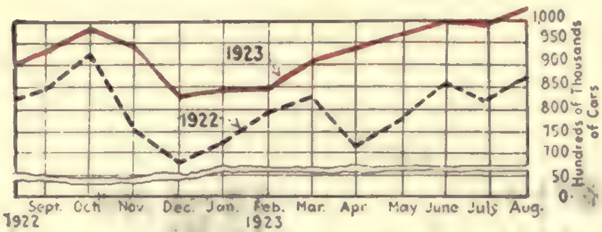
Contracts Awarded for Residential Buildings



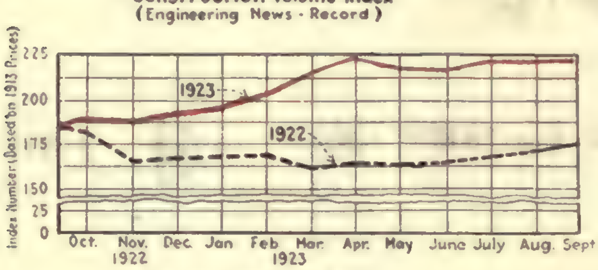
Pig-Iron Production



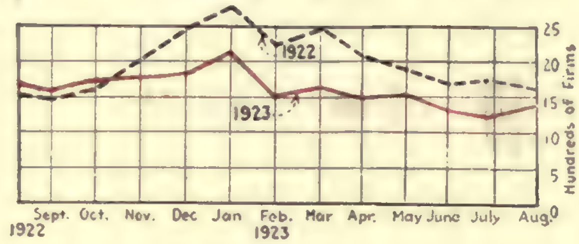
Construction Volume Index
(Engineering News - Record)



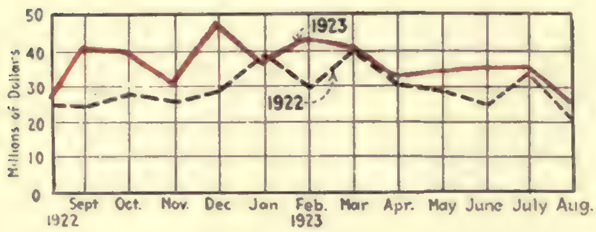
Total Average Weekly Freight-Car Loadings



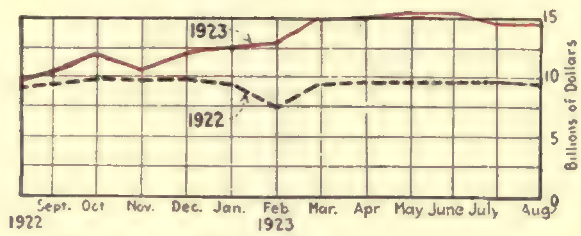
Construction Cost Index
(Engineering News-Record)



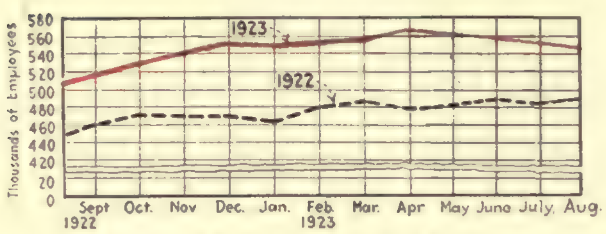
Business Failures



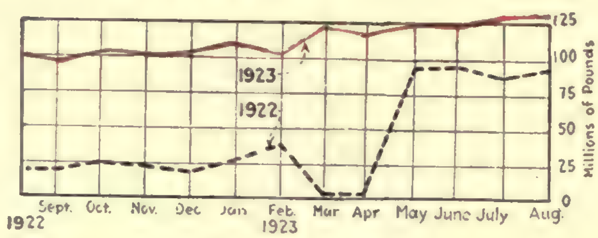
Fire Losses



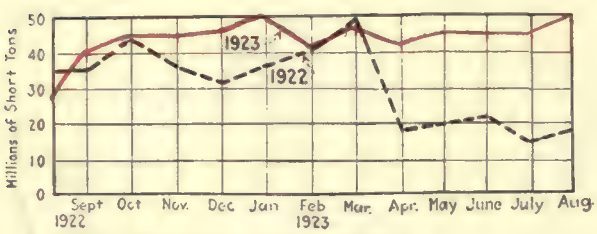
Bank Clearings
(Outside of New York City)



Employees in Factories of New York State



Copper Production



Bituminous Coal Production

Record Freight Movement During August

AUGUST witnessed the greatest freight car loadings ever reported by the railways of the country, with a weekly average of 1,039,570 cars, or 19.2 per cent above the freight movement of August, 1922. A more exact indication of healthy national industrial activity could hardly be found. Another outstanding figure was that of 129,377,401 lb. of copper produced, a record also for that industry.

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Another Result of Misinformation

NO OTHER reason than that it is a result of misguided judgment caused by misinformation can be ascribed for the resolution passed on Oct. 5, at Portland, Ore., by the American Federation of Labor favoring federal and state ownership and control of all hydro-electric systems. The action of the same body on Monday, Oct. 8, in removing from its ranks a man whose principles were un-American adds to confidence in the purposes and sincerity of the federation as an institution of well-intentioned American citizens.

Yet these men profess to believe that they and the country at large would be better off with government-owned hydro-electric systems, and their expressed opinion is not a pretense, but a conviction based on misinformation. This is an added indication that the electrical industry collectively, and the companies which compose it individually, have still a great task to perform in educating the public to grasp the facts in the case. There are always those whose selfish purposes will lead them to be on hand to give misinformation.

Experience has shown that a stable utility industry is the public's best assurance of a dependable service at reasonable cost. Experience has also shown that waterpower cannot be considered alone—it is not the only element in assuring an adequate supply of electrical energy. Steam power will always play an important if not the major rôle in that regard. The practical problems of interconnection and of operation must all be considered. And the inter-relation of these various factors are most important in the consideration of what agency is best fitted to conduct the electrical supply business. A large amount of interconnection has already been effected by the utilities to gain economies and give better service. It is facts such as these that must be brought home to the public in order that the public will take intelligent action. Resolutions of the kind reported, while in themselves not directly potent to do damage, do indicate an existing tendency in some quarters and serve to set precedents which may later produce a serious problem for the entire electrical industry—central stations, manufacturers, jobbers or others—as well as for the consumer and the public at large.

It is an industry-wide problem. Among central-station men it has been discussed and its seriousness appreciated, and action has started in some places. Affiliated interests, such as manufacturers, jobbers, contractors and dealers, do not seem to comprehend the situation so well. It is important that they be shown that every component part of the industry owes it to itself, to the industry and to the public to bring these problems before its national organization in such a way that concerted action can be taken. Utility information bureaus are doing excellent work, but they cannot succeed alone. Their activities must be supplemented by the action of companies locally, and above all by every utility employee.

The desire of every one is the same—to insure an adequate electrical development, to bring dependable service to all at reasonable cost. The problem is a huge one. Many groups which themselves have no first-hand information are studying it and acting on it. The question of moment is to see that they are correctly informed and that they do not act on misinformation.

Howard Saunders Warren

A telephone engineer who has been largely responsible for the development of loading and repeating coils and in addition ranks as an expert in inductive co-ordination work.

IT SPEAKS well for the co-operative spirit that exists in the electrical engineering profession to find that many expert telephone engineers find time to work cordially with other engineers in the industry to bring about a greater degree of co-ordination in those aspects of commercial development which involve controversial engineering and commercial elements.

Howard Saunders Warren became an expert on "loaded" circuits with the telephone industry. He designed the loading coils, superintended their manufacture and did the engineering of the first commercially successful installations both on cables and on open-wire circuits. He invented the very useful "terminal taper" device whereby reflection losses between loaded and non-loaded circuits may be overcome. The design and construction of successful phantom repeating coils formed another notable contribution from Mr. Warren.

Since 1907, however, Mr. Warren's time has been largely taken up with problems of electrical protection and inductive co-ordination. From 1912 to 1915 he was very active in the California investigations of inductive phenomena. The inductive-co-ordination features associated with the electrification of the New Haven, Pennsylvania, Norfolk & Western and other roads were handled by Mr. Warren, and his activities along these lines have been continued through his active participation in the work of the joint general committee on inductive co-ordination.

Born March 3, 1873, at Oldtown, Me., Mr. Warren attended the public schools at Dedham, Me., and the East Maine Conference Seminary at Bucksport, after which he took the engineering course at Leland Stanford University. After receiving his degree in 1898 he worked successively as electrician with the United States Fur Seal Commission, engineer with the Standard Electric Company, engineer with the California State Board of Harbor Commissioners and engineer with the Nevada County Electric Power Company.

With this varied experience behind him, Mr. Warren entered the employ of the American Bell Telephone Company and has retained his connection with that company and its successor since September, 1899. His contribution to the commercial and engineering developments of the company and his ability as an administrator caused him to be placed in charge of the sub-department of transmission in the engineering department in 1903, and in 1905, when H. V. Hayes became chief engineer, Mr. Warren succeeded to Mr. Hayes' former position, in charge of equipment.

Editorial Comment

Electrical World, October 13, 1923

Volume 82 Number 15

How to Approach the Public School

THE public schools offer a very great opportunity for the education of the general public to a greater knowledge of electricity and what it means in the world today. But lamentably small progress seems to be made from year to year in the development of this ever-present and promising contact. What can be done by the central-station company actually to get the schools throughout the country properly equipped and more liberally minded toward the teaching of this very practical subject of electricity in daily living?

At a recent gathering of electrical men a guest, an advertising man, rose during the discussion and said that he was on the school board of an Eastern city and that the trouble was largely a matter of approach. The electrical industry, he said, has merely tried to sell light and power to a school. It has failed to look at the problem from the school board's viewpoint. In his opinion, a complete and definite proposition should be put up to the school board of every city, showing what part electrical applications have in education and what should be done for the electrical equipment of domestic science and physics classrooms.

The opportunity, of course, is larger than the mere sale of energy. Here are gathered the plastic minds of our youths, from whom will come the next generation of the consumers of central-station service. Public relations a few years hence will be vitally concerned with these youngsters now in the school. If it could so be that in the natural course of their education they could become familiar with the electric meter and the figuring of rates and bills and appreciate the functions of the modern public utility in our social and civic structure, it would prevent many of the misunderstandings and antipathies that now hamper electrical market development. If also they should learn the use and value of all kinds of household electrical equipment, the influence upon them and their parents would be great.

Higher Pressures May Reduce Obsolescence

ONE ELEMENT introduced by the adoption of high-pressure boilers and turbines in connection with existing stations is that this practice offers encouragement for postponing the time when many low-pressure stations will become obsolete. The use of the new high-pressure units in such a way as to superimpose them on existing moderate-pressure equipment will increase the station capacity without greatly increasing the investment and in addition will add greatly to the thermal efficiencies of the stations. If the new developments prove successful, it seems very probable that many stations, now rapidly becoming obsolete because of low thermal economy resulting from the use of low pressures, will gain a new lease of life at a minimum of expense.

A still further use of this principle of superimposing high-pressure systems on low-pressure stations is suggested by the Benson system of generating steam at about 3,200 pounds. This scheme is simple in principle in that water is raised to the desired pressure and is then heated as it flows through a steel coil of small diameter. After passing through a superheater it then is throttled and exhausted as slightly superheated steam at a pressure of about 1,500 pounds per square inch. It then goes through a superheater and to a high-pressure turbine and can be exhausted at a moderate pressure to operate in conjunction with the steam produced in the main boiler plant.

The history of the development of central-station power production includes records of many changes of method and equipment and shows case after case of obsolescence due to improvement in the art. The accounting and financial problems thus introduced have not been minor ones. It will surely be a sincerely welcomed condition if future improvements in central-station power production are all in the direction of superimposing the new equipment on existing plants, thereby extending indefinitely their useful life.

Increase Net Revenue by Intense Cultivation of Old Fields

THE opportunity of the central-station company for growth lies not only in the new fields for electrical energy but also in the many old fields that have not become saturated. For example, in a recent report to the National Electric Light Association, M. Luckiesh presents an extensive analysis of the residence lighting field which shows that the average wired home, in order to enjoy the full convenience and comfort of adequate lighting, needs 250 per cent more convenience outlets, 400 per cent more portable lamps, 250 per cent more wall brackets, 120 per cent more wattage of lamps and 50 per cent more electrical energy for lighting. The seventeen million homes that are not yet wired need all this plus about twice what the nine million homes already have. This total figured conservatively means billions of dollars' worth of business in permanent lighting equipment and about one billion dollars per year in additional revenue to central-station companies for electrical energy consumed in the proper lighting of homes. Certainly, the central station must eventually supply this 50 per cent increase in energy to the average wired home, and the resultant net revenue is an interesting subject for speculation.

A manager of an electric light and power company recently asserted that the average residence, consuming 350 kw.-hr. per annum at an 8-cent rate, was a source of a net profit per year of $2.50. After taking into consideration all charges, he found that an additional 100 kw.-hr. meant an additional net profit of $4.56, or a total of $7.06 instead of the original total of $2.50. Accepting both the statement mentioned above, that the average home should consume 50 per cent more electrical energy than at present in order to enjoy adequate

utilitarian lighting, and the foregoing computation of additional revenue, it is seen that the total net profit per annum from each home enjoying satisfactory utilitarian lighting would be $10.50 instead of $2.50.

The central-station company that does not interest itself in lighting the home adequately is neglecting not only the householder but its own prosperity as well. If these computations are borne out in practice, 50 per cent increase in electrical energy consumed will result in more than 300 per cent increase in net revenue. Of course, there would be readjustments in rates, but fortunately they would be of the character that meet with popular approval.

Interconnection and Droughts

IT IS too early to estimate the value of interconnections this year to electric light and power companies in areas suffering from almost unprecedented drought, but when the totals for 1923 come in covering energy sales by steam plants to hydro-electric networks and vice versa one may safely look for record-breaking economies in the use of fuel, remarkable savings in the use of capital and extraordinary benefits to the public. The popularity of intersystem tie lines developed with immense rapidity during the war, and the ability of adjoining and adjacent systems to meet fluctuating demands for power during the early post-war period through interconnection was also a factor potent for public welfare. Steady increase in interchanged energy has now reached a volume of intercompany service that has done yeoman duty in overcoming the difficulties arising from such a drought as New England in particular has been obliged to face since early summer.

In so-called normal years the diversity of flow between different watersheds renders the interconnection of hydro-electric plants of much value. This is the year of the steam plant in the Northeast, however, and during the current dry spell its interconnection with both steam and water-power systems signifies service of fundamental importance. In some parts of New England the output of the steam-driven central station has risen 50 to 100 per cent above that of a year ago, and in some localities a very large part of this increase is due to sales to other utilities at present severely handicapped by low water at their hydro-electric stations. The drought has stimulated engineering advance along the line of increased reservoir construction, but more immediate relief has come from the larger steam stations.

The cost of this power is a pretty substantial total in the hydro-electric companies' 1923 operating expenses. But, first and foremost, the demands of the public have very generally been met without curtailment of service, and, second, this regional service has undoubtedly been rendered as a whole with marked savings in total cost as compared with the expense incurred in former days by trying to meet such situations with the equipment and methods of isolated systems. The multiplication of small and inefficient steam plants has been virtually stopped; existing plant and line resources have been worked with a keen eye to changing and far-flung load requirements, and, in a word, fuel, labor and capital have been conserved on a large scale. Nothing within the past decade has accomplished more than interconnection to improve the control exercised by the operating engineer over the load supply of wide areas for the mutual benefit of the public and the utilities serving it.

The Code Advances— Give Its Changes Official Status

ONE of the features of the published National Electrical Code to which there has been some objection in past years was the form in which the code was presented—it was difficult to find rules on some things and one could never be sure he had found all the rules governing any one matter. In the issue of the revised code, recently made available, the publishing committee has made some very commendable changes to increase the "usability" of the code. A better and more complete index is included. Paragraphing, titling and general arrangement of text are improved. These welcome changes will materially assist those who use it as a daily procedure.

In any discussion of the code and its present status there is one fact of which sight should not be lost. It was referred to in these pages in the April 7 issue, page 788, and again in the Sept. 22 issue, page 571. That is that steps should be taken to give the code, in its revised form, the status of an American standard through regular action of the A. E. S. C. As a matter of fact, once the code was made an American standard in its earlier form, better procedure would have been to have used A. E. S. C. machinery in the recent modifications.

The need for revision was insistent, however, and the time element involved in A. E. S. C. procedure, with no section then formed to consider it, would have delayed a revision for some months at least, so that it seemed best to the electrical committee that it should proceed on its own initiative with this revision, and it did so.

The situation now confronting the industry with reference to the code is this: The old code is an American standard; certain most necessary and advisable changes have been made by the electrical committee, the former responsible party; the revised code will be in a much stronger position, strategically, if made an American standard; the electrical committee can, with some modification, form an excellent nucleus of the A. E. S. C. section on the code; steps should be immediately taken to put the revised code through the necessary procedure to make it an American standard; and finally, no future code changes should be contemplated without first being sure that they will be made according to A. E. S. C. procedure.

It may not be at once apparent why so much insistence is placed on this line of argument. The reasons, however, are sufficient and are an outgrowth of long experience. First and foremost, the code is the property of no one group but belongs to the industry and affects every branch. The American Engineering Standards Committee was created to meet such conditions generally and to provide a mechanism which would assure a voice to every group legitimately interested in the formation of any particular standard. Such procedure produces best results and inspires greatest confidence. Second, greater moral strength is given to the code. As a result, the code is in a better strategical position to be used to the interests of the industry in its relations to the public if it is an American standard.

These comments are not made to point to past shortcomings. Rather are they directed to conditions as they are and to urging the electrical industry to see both its opportunity and its duty in its future handling

of the code situation. The A. E. S. C. itself cannot take the initiative—it must wait for the matter to be brought to its attention. Some organization in the industry should take formal action to bring the matter forcibly before the officials of the Standards Committee.

Supervisory Control and Remote Indication

AUTOMATIC operation of substations and small isolated generating stations seems quite definitely to be finding a logical and economical field of application. In connection with the operation of entire systems supervisory control and remote indication of position or condition of various apparatus will likewise find a definite field of application as pioneering in this line becomes more extensive and the results more widely known. Already several companies in the power field have adopted this relatively new system in full or in part, the most striking examples being installations made by the Malden (Mass.) Electric Company, the New York & Queens Electric Light & Power Company, the Interstate Public Service Company and the New York Edison Company. On the first three systems, where it is used to indicate the position of remotely situated switches as well as to control them, supervisory control has been in operation for various lengths of time. On the New York Edison system the supervisory indication feature has been used since 1913 to indicate at a central point the position of all of the generating station switches.

The various forms of supervisory control do not involve new and untried apparatus since they have been used in slightly different form for train dispatching, printing telegraph, telephone and similar purposes for several years. The question is how much inspection and maintenance will be required to assure reliability for the new application? The distributor type of supervisory control has given a very good account of itself on the Malden system, which had the distinction of being one of those able to restore service most quickly after the New England sleet storm of two years ago had created so much havoc. On the New York Edison network the original system was satisfactory except for maintenance, but this objection has been largely removed by incorporating newer types of apparatus. These changes, of course, improved the reliability of operation as well. Good reports have also been heard regarding the other systems, but sufficient details of experience have not been made available up to the present time.

So far it looks as if the logical field for combined remote control and indication were on average and small-sized systems, especially for substation work. Large companies recognize the advantages of remote indication, but some doubt whether the supervisory control feature as distinguished from remote indication can be utilized to advantage by them. For example, in case of trouble in a large generating station two operators have all they can do to take care of the situation, and, incidentally, the operators in generating stations tied to the one in trouble are extremely busy at the same time. Hence it would seem impracticable to control large systems from a central point. However, some engineers believe that it might be possible to control all substations from a central point, leaving generating stations to be controlled individually as at present. It has been pointed out that in an extensive system the large number of feeders involved would be analogous to the telephone boards in an exchange, and the possibilities of "wrong feeders" would be just as great in existing telephone systems.

It must not be inferred that any method of remote control could do away with the load dispatcher's board. It would be impossible to simulate a load dispatcher's board in a remote-control system by mimic buses, lines and so forth. The load dispatcher must have before him the complete system layout with reference to physical location. None the less, the supervisory indication should enable a load dispatcher to work with less likelihood of error than where the condition of switches must be reported by telephone.

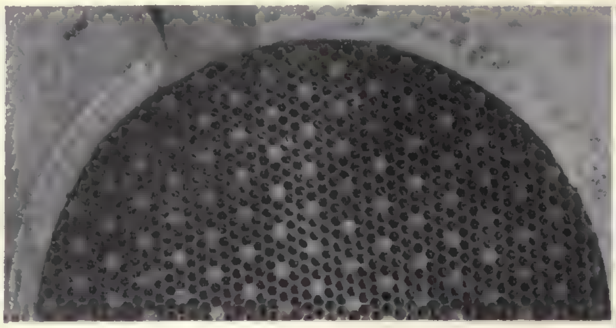
Despite the limitations which may be conjured up, supervisory control and indication have their logical and economical field of application. Before they can be definitely prescribed, however, more installations must be made and there must be frank discussion in order that any weaknesses which may be found shall be eliminated. Pioneers who are willing to make the trial are needed. Progress isn't made by companies which sit back and wait for the others to determine the practicability and reliability of new ideas.

Expansion of Alternating-Current Distributing Networks

IT TAKES some brains and experience to run a single grocery store, but to operate successfully a chain of say one hundred identical grocery stores involves many more difficult problems unknown to a single establishment. In the same way a spread of distributing networks over large city areas, with several interconnected power plants, with numerous substations, and with customers whose individual demands run into hundreds and thousands of kilowatts, has called the attention of operating engineers to new and difficult problems. Moreover, these problems cannot wait until some future time "when we are not so busy," but must be handled rather promptly under the penalty of intolerable interruptions of the supply and heavy expenses for damaged apparatus.

The simplicity and the "abusability" of the large 220-volt direct-current underground distributing networks for a time perhaps closed the eyes of engineers and executives to quite different properties of the more recent alternating-current networks. Now, however, professional pride is at stake to make them just as dependable as direct-current networks. No engineer wants to admit to the general public that because of the additional link in the shape of transformers the furnished voltage must at times be equal to zero.

It is possible that some day an ingenious "jigger" will solve the problem of parallel operation of distributing transformers, of automatic disconnection of damaged alternating-current feeders at both ends, etc., but in the meanwhile every distribution engineer can study carefully each district of his network and apply partial remedies so as to reduce the probability of interruptions. In one case it may be a different spacing of the transformers, in another the use of much higher internal impedances, in still another the application of relay-operated switches. Since there is no general solution, if each engineer learns how to treat his own individual patients, the general problem will lose much of its acute importance and data will be obtained which will help in some future general plan.



Hartford's Pioneer Mercury Turbine

ORIGINALLY designed to deliver 1,800 kw. at the mercury turbo-generator and 28,000 lb. of steam per hour at 200 lb. pressure and 100 deg. superheat, yielding about 2,300 kw. in steam-generated energy, this pioneer turbine, carrying its first commercial load Sept. 7, 1923, has already delivered 3,500 kw. to the system, at the Dutch Point Station, 1,400 kw. of which was produced in the mercury turbine. Mercury vapor at about 35 lb. per square inch (above atmosphere) and 850 deg. F. drives this turbine. As the mercury condenses it imparts heat to generate steam, which is delivered to the steam main. Modern welding processes appear to have solved the problem of tight joints. About 7 lb. of mercury per kilowatt are required to charge the Hartford boiler, but future designing will undoubtedly reduce this by at least 50 per cent. Present results indicate a remarkably low fuel rate, perhaps only one-half the previous record at Dutch Point. The apparatus was built by the General Electric Company under the design and direction of W. L. R. Emmet.

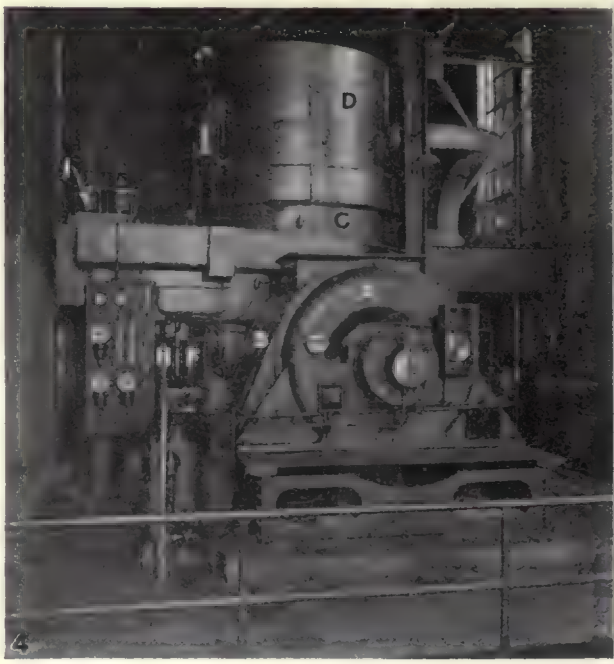
No. 1.—Bottom of mercury boiler from bottom of furnace, showing hexagonal cross-section of lower end of the tubes. The tubes are slightly conical and one in seven is omitted to permit circulation of the mercury.

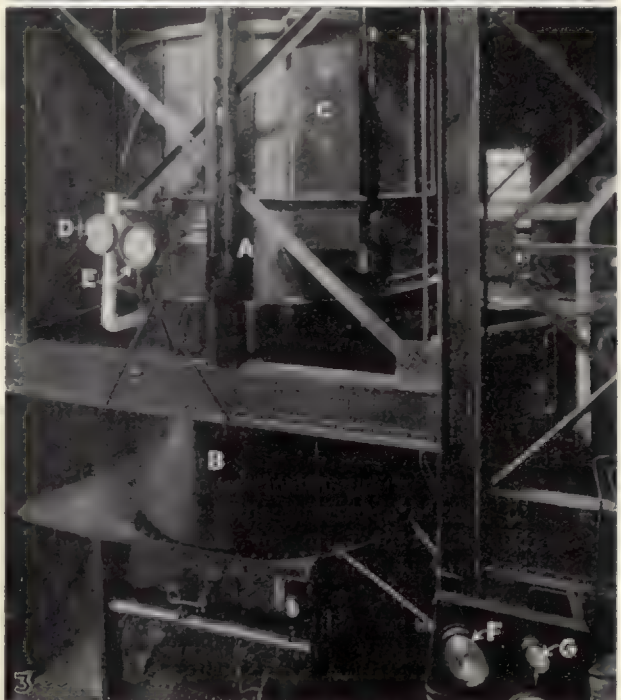
No. 2.—Blading of turbine runner.

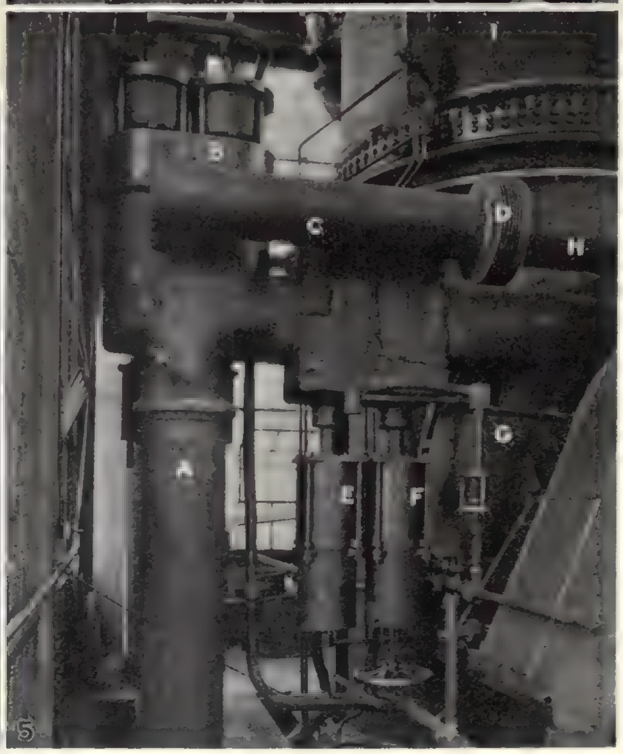
No. 3.—Mercury boiler. *A*, boiler; *B*, furnace casing; *C*, flue casing, inclosing vapor pipe; *D*, mercury-level gage; *E*, mercury-pressure gage; *F*, steam-pressure gage; *G*, vacuum gage.

No. 4.—Mercury turbo-generator set, condenser and condenser boiler. *A*, generator; *B*, turbine; *C*, mercury condenser; *D*, condenser steam boiler; *E*, flyball governor; *F*, electrically controlled governing valve and throttle; *H*, electrically controlled emergency valve; *I*, mercury safety valve.

No. 5.—Safety, emergency and governing valves. *A*, Vapor pipe from boiler; *B*, safety valve; *C*, by-pass from safety valve direct into condenser; *D*, accordion expansion joint; *E*, electrically controlled emergency valve; *F*, electrically controlled governing valve; *G*, turbine; *H*, condenser; *I*, condenser steam boiler.







Steam Plant Auxiliaries

Discussion of Methods of Switching and Grouping Auxiliaries—Arrangements for Insuring Continuity of Service—Typical Installations—Choice of Voltage and House Service Supply

By C. D. GRAY and M. M. SAMUELS
The J. G. White Engineering Corporation

THE method of grouping and switching the various auxiliaries should be one of the most important considerations in the design of the electrical portion of a large steam plant of superpower proportions. Whereas the scheme of connections for the main circuits generally leaves very little choice, the main circuits being practically determined in each case by the particular operating method for which the plant is designed, the number of possible schemes of grouping and connecting auxiliaries is almost unlimited. Even in outlying plants where the continuity of operation of the main units is not so important as in large city plants, it is very desirable to maintain almost absolute continuity on the auxiliary circuits, particularly those circuits supplying motors which drive boiler-house auxiliaries. A thorough study of the problem of auxiliaries leading to a systematic design of the auxiliary buses, switch groups, etc., is therefore of prime importance in the design of a large steam plant.

In virtually all large steam plants of recent design the auxiliaries are not supplied from the main buses nor controlled from the main control board. A separate house-service bus is generally established, controlled from a separate control switchboard, independent of the main board. Energy is furnished to the main house-service bus either from separate house turbines or from the main bus through transformers or from the main bus through motor-generator balancer sets. In most cases all three, or at least two, of these sources of energy for house service are made available. Heat-balance problems will in each case determine the sizes and number of house turbines as well as the advisability of providing motor-generator balancer sets. The latest developments seem to indicate that the need for house turbines will gradually decrease by further development of means for "bleeding" the main units, but for the present the majority of large plants find it opportune to provide house turbines. Whether or not it is advisable to provide balancer sets is still an open question, and before deciding to use them a thorough investigation of the operating conditions should be made to determine if the benefits derived from balancer sets will not be more than offset by the additional complications which such sets must introduce in the switching and relay system. Even if it is found to be theoretically economical to provide balancer sets, the further question should be looked into as to whether or not the operators will in practice pay sufficient attention to these sets even to approach the theoretical economy.

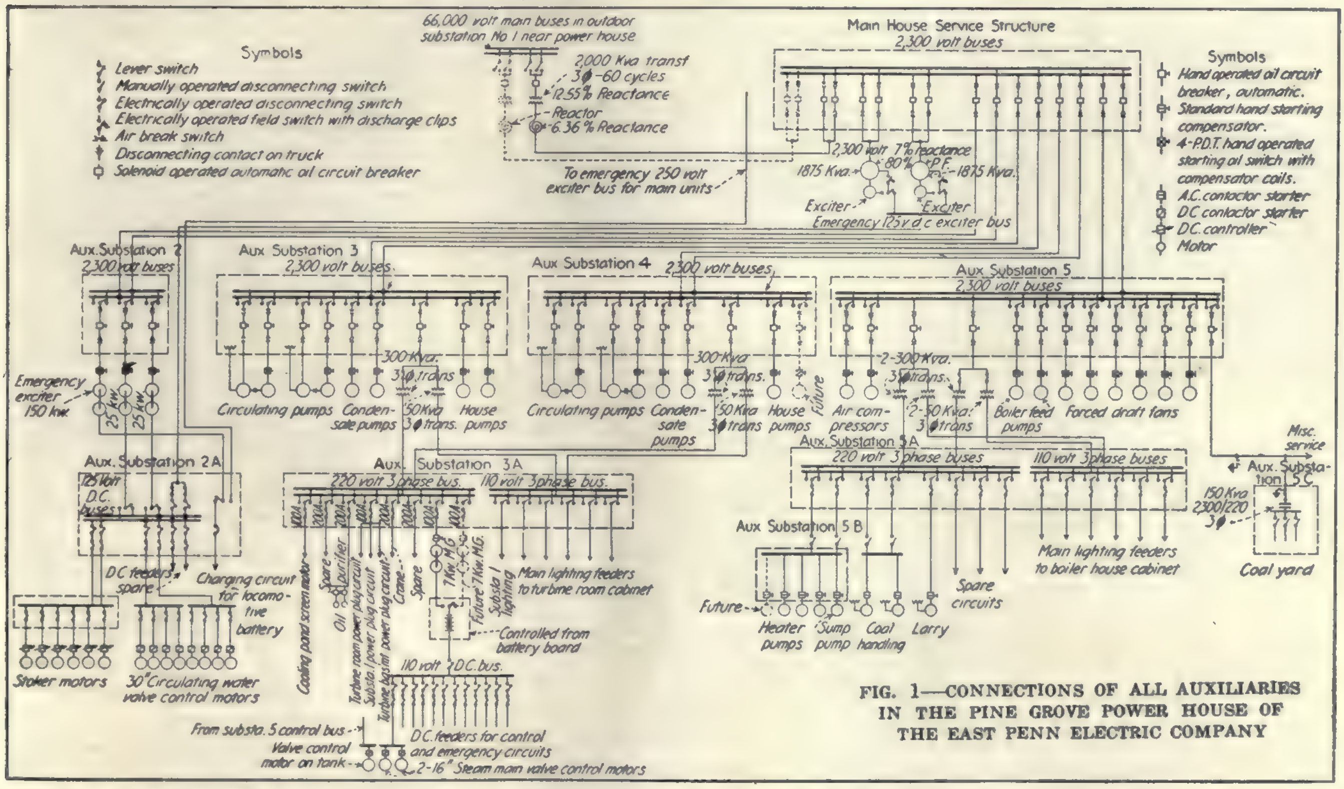


FIG. 1—CONNECTIONS OF ALL AUXILIARIES IN THE PINE GROVE POWER HOUSE OF THE EAST PENN ELECTRIC COMPANY

The introduction of ties through transformers from the main bus to the house-service bus should also be handled with a great deal of care, and suitable switching and relay protection, and possibly reactors, should be provided to make sure that troubles on any of the lines supplied from the main buses will not interfere

with the operation of the auxiliary circuits. Therefore, even if it is found that house turbines are not required for heat-balance purposes, it will in most cases still be advisable to provide this independent source of energy for the house service and to provide switching on the tie transformer which will open in case of any trouble on the main bus or the main units before such trouble is continued onto the house bus.

Even in power houses having only one set of main buses, it is advisable to provide two sets of main house-service buses, only one of which is to operate at one time, the other being always available for inspection or repair. For the main house-service buses truck-type switches will be found the most convenient and most economical, the two sets of switches being arranged in two rows, each row having its bus self-contained in a steel housing, and an aisle provided between the two rows having a monorail over it, so that a truck can be moved out of its place and easily and quickly carried on the monorail to a suitable working space for repair.

The question of rupturing capacity of the main house-service breakers will generally be a difficult one to answer, for the same reason that the required rupturing capacity of the main breakers is very difficult to estimate, since it is not known to what capacity the power house may grow in the future. However, since it is absolutely necessary to plan for future extension, the best method is to make as reasonable an assumption as it is possible to make as to the últimate capacity of the auxiliary bus, and then to arrange the system in such a way that when in the future the capacity of the bus grows beyond the rupturing capacity of the circuit breakers a new bus can be started. Thus, in the case of the Pine Grove power house of the East Penn Electric Company, which has a present installed main capacity of 33,500 kva. and an estimated ultimate capacity of 300,000 kva., it was considered expedient to limit the rupturing capacity of the breakers on the main house service to two house turbines, each rated at 1,875 kva., and two house transformers, each rated at 2,000 kva., the transformers being equipped with external reactance, making the total reactance of the transformer circuit 20 per cent. This will take care of the auxiliaries of a station having a total capacity of 150,000 kva. in main units, and when the station grows beyond this capacity a new main house-service bus will have to be started.

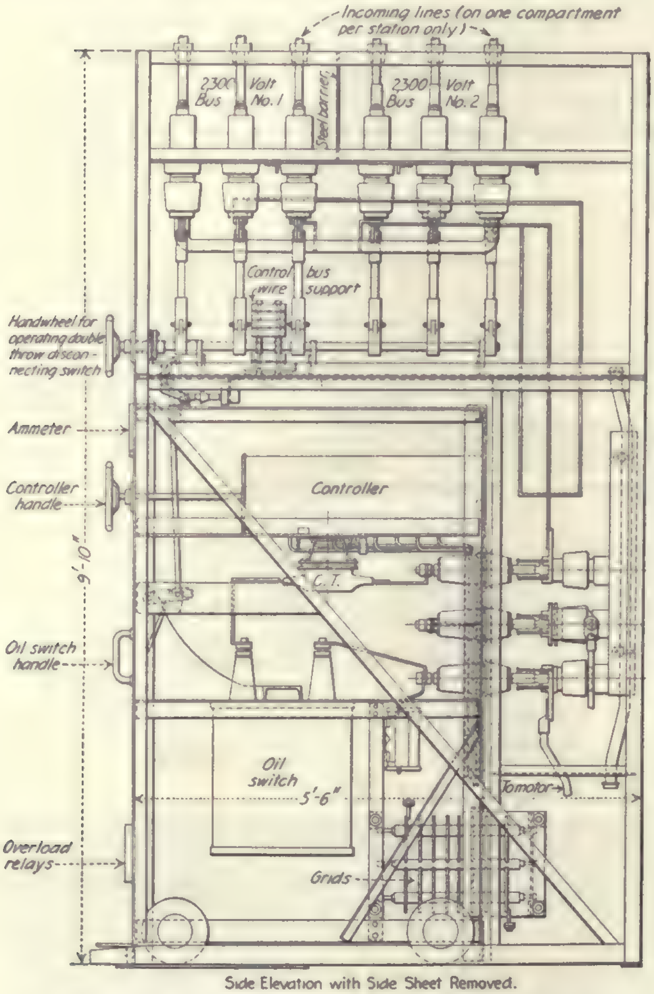


FIG. 2—TYPICAL STEEL COMPARTMENT CONTROLLING LARGE 2,300-VOLT SLIP-RING MOTOR FROM TWO SETS OF BUSES

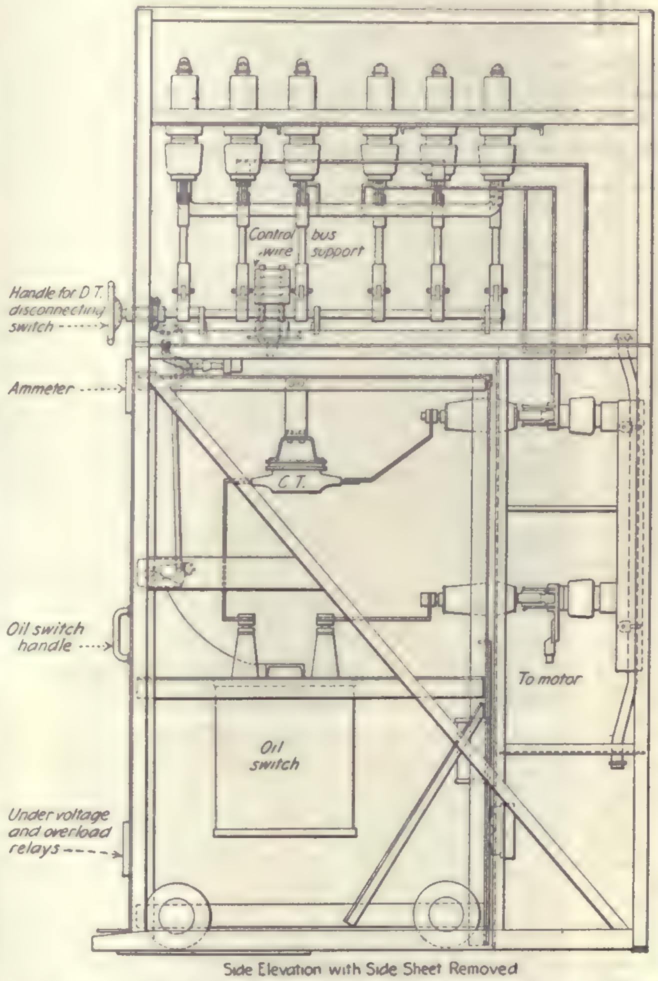


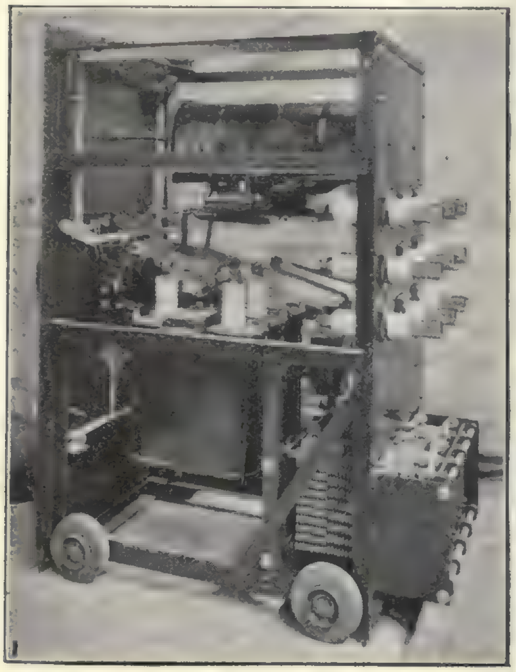
FIG. 3—TYPICAL STEEL COMPARTMENT CONTROLLING LARGE 2,300-VOLT SQUIRREL-CAGE MOTOR OR TRANSFORMER

The voltage to be chosen is another very important consideration. Four hundred and forty volts seems to be in very general use for auxiliaries, which may have for its reason the fact that most operators grew up in small power houses having only a small number of auxiliary electrical drives. When a power house grows to superpower proportions, and with the modern tendency to make practically all auxiliaries electrically driven, the auxiliary load grows to thousands of kilowatts, and low-

voltage motors will require a great amount of very heavy conduit and cable, making the station extremely complicated and requiring, in addition, a great number of heavy-capacity circuit breakers and cumbersome heavy copper bus work. In most cases 440 volts is not so safe as either 2,300 volts or 220 volts. An operator will generally be careful with 2,300 volts to avoid accident, and 220 volts is not fatal; but, although 440 volts is almost as dangerous as 2,300 volts, operators will consider it low voltage and may be careless with it. The apparatus available for 2,300 volts is safer than that available for 440 volts and less expensive for the same kva. because of the low amperage. Statistics seem to indicate that the most balanced system, therefore, seems to be one using 2,300 volts on all large motors and 220 volts on smaller motors which are not built for 2,300 volts or where the cost of 2,300-volt starters would be too high.

The choice of the types of motors to be used on the various auxiliaries is the next consideration of importance. Where constant-speed motors are required, the only question to be settled is one of slip ring versus squirrel cage, a question which will find its own answer in each individual case according to the starting conditions. In large plants it will generally not be necessary to use synchronous motors at all, and even in cases where it would seem offhand that they would offer some advantages, they will introduce complications in the switching and wiring and should therefore not be used unless absolutely necessary. Simplicity should be the most important feature in the design of all auxiliary installations.

Where variable-speed motors are required, as for fan or stoker drive, an attempt has been made recently, with more or less success, to use brush-shifting alternating-current motors. However, there are a number of serious objections to this type of motor which must be overcome before they can be considered very satisfactory for use on power-house auxiliaries. They are, first of all, very costly; they require a great amount of care in installation, and they call for a great number of delicate control and switching devices which are very difficult to install, take up altogether too much space and have to be continually looked after. The brush-shifting motor no doubt has great possibilities in the larger sizes, but before the above objections are overcome, even the very progressive engineer will prefer direct-current drive for variable-speed operation. A motor-generator of suitable capacity can be provided for the purpose, which, in cases where the voltage regulation is done on the main generator fields and the exciter voltage kept constant, can also be used as an emergency exciter. At the Pine Grove power house it was considered preferable to have constant-speed drives for the fans. The only variable-speed motors required, therefore, are those for the stokers, which are 125-volt direct-current, supplied from either of two 25-kw. motor-generators, each of which can likewise serve as an emergency exciter for the house turbines.



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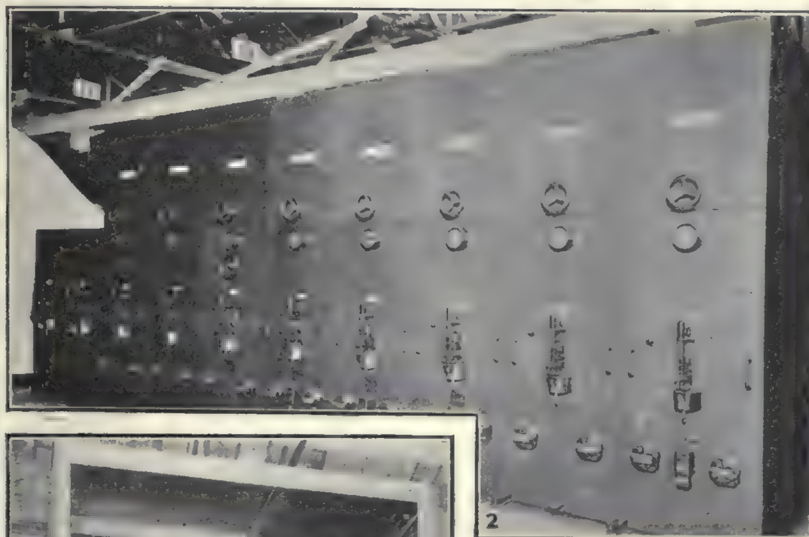

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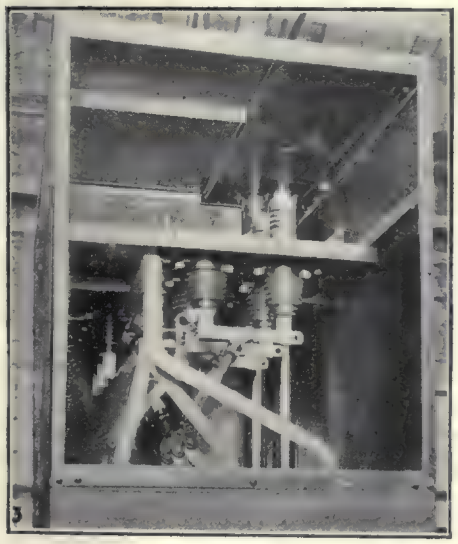

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AUXILIARY CONTROL APPARATUS OF THE PINE GROVE STATION

No. 1. Side view of the slip-ring motor-truck type switchboard. This switchboard contains the oil breaker, grids and controller for a slip-ring induction motor.

No. 2. Control board for auxiliary substation No. 3 (shown in detail in Fig. 1). This board is composed of truck-type compartments containing slip-ring controllers and disconnecting switches.

No. 3. The upper compartment is used to contain the double-throw disconnecting switches so that either auxiliary bus may be used. An interlock is provided, making it impossible to close the oil switch breaker when the disconnecting switch is open on both sides.

Each of the centrifugal pumps is directly connected to both a 200-hp. slip-ring motor and a 75-hp. squirrel-cage motor, the larger motor being used when it is necessary to operate the cooling-pond sprays and the smaller motor in cold weather when the sprays can be dispensed with.

The method of starting the various alternating-current motors is becoming more and more of a problem. In smaller power houses of the older type ordinary hand compensators with suitable overload and low-voltage protection were considered satisfactory, but the matter has recently been subjected to a careful study by the manufacturers and the conclusion reached by them that the usual type of standard starting compensator is not suitable for large power houses, even if it be used as a non-automatic starter and an automatic

oil circuit breaker installed in series with it. Manufacturers should be urged to design compensators suitable for heavy power-plant service, but until such compensators are available other means of starting auxiliary motors will have to be employed.

The tendency now is to develop motors which can be thrown on full voltage without starting apparatus. In some cases it is possible to do so now, and there are self-starting motors on the market, so it is hoped that in the near future it will be possible to eliminate all starting equipments for auxiliaries and merely provide an automatic oil switch for throwing the motor directly on full voltage, equipped with short-circuit and low-

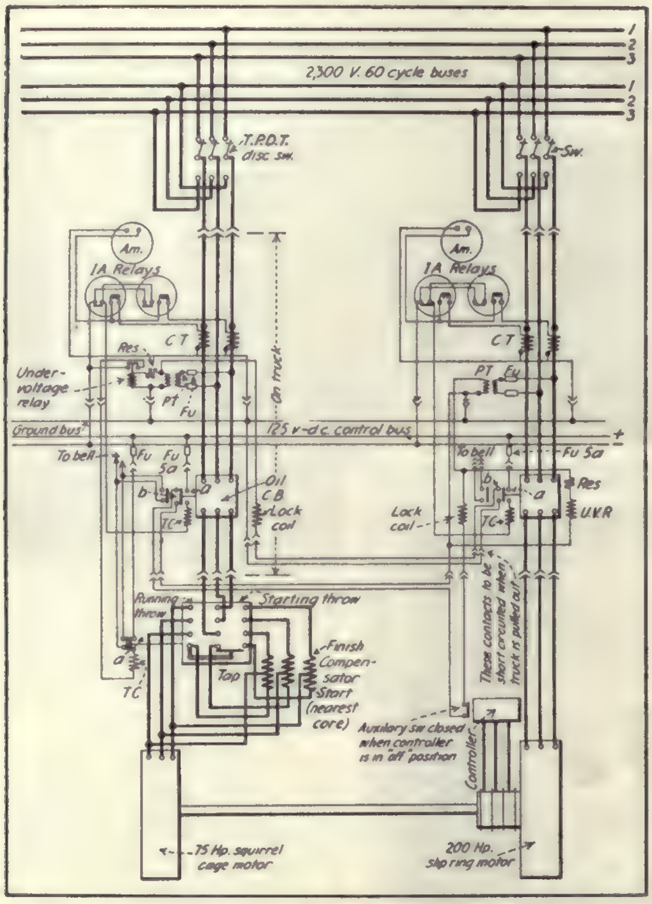


FIG. 4 — CONNECTIONS (IN FULL) FOR CONTROLLING ONE 200-HP. SLIP-RING MOTOR AND ONE 75-HP. SQUIRREL-CAGE MOTOR DRIVING THE SAME CIRCULATING PUMP

voltage protection, since ordinary overload protection is of very little importance in such cases.

In some large power plants a starting bus is provided by taking a 50 per cent tap out of the main house transformers or providing a starting transformer of two-to-one ratio supplied from the main house-service bus, supplying a main starting bus from which starting feeders are run to the various groups of motors in the same manner as the main feeders are run from the main house-service bus, and at each motor there is then provided a double-throw oil circuit breaker, non-automatic on the starting throw and automatic on the running throw. There are a number of objections to this scheme, the principal one being the necessity of providing four sets of buses and practically four throw switches at each motor, since two sets of running buses are a very desirable feature and two sets of starting transformers, with the resultant two sets of starting buses, would have to be provided, an arrangement which becomes very complicated. If only one set of running buses and one set of starting buses are satisfactory, the scheme shown in Fig. 5 is preferable where the starting bus is supplied from the running bus through an auto-transformer which is normally disconnected on both sides. A solenoid-operated single-throw non-automatic oil switch is provided on each side of the starting transformer, and a hand-operated double-throw oil switch is provided on each motor, non-automatic on the starting throw and automatic on the running throw, and equipped with auxiliary switches, so that when the manually operated oil switch on any motor is closed on the starting side the auxiliary switch will close the two solenoid-operated breakers of the starting transformer, thus starting the motor, and when the manually operated oil circuit breaker is thrown over to running side, thus throwing the motor on the running bus, the other auxiliary switch will trip the solenoid-operated circuit breakers and disconnect the starting transformer. This scheme has, of course, the same disadvantages as the previous one, and both have the further disadvantage of requiring double-throw switches of heavy rupturing capacity.

A much better arrangement is the one used on the auxiliaries of the Pine Grove power house. Here two sets of running buses are provided for each group of motors. A single-throw oil circuit breaker of the required rupturing capacity is provided for each large motor and equipped with a double-throw mechanically operated disconnecting switch. The oil circuit breaker is of the truck type, and the disconnecting-switch operating handwheel is mounted on a steel panel above the truck and an interlock provided, making it impossible to close the oil circuit breaker when the disconnecting switch is open on both sides. The two sets of buses are arranged in steel housings above the truck in such a way that it is possible to remove the steel covering of either of them and inspect or repair it without the possibility of accidental contact with the other bus, which may be operating. For slip-ring motors the controller and grids are arranged on the same truck with the oil circuit breaker, but for squirrel-cage motors a short feeder is provided from the oil circuit breaker to a small steel housing near the motor, which contains a non-automatic double-throw oil circuit breaker of low rupturing capacity, but of sufficient momentary carrying capacity, and an open-type core and coil compensator for starting purposes. No energized parts have to be exposed even for throwing over the disconnecting switches from one bus to the other.

ASSEMBLY OF EQUIPMENT

Perhaps the most important problem is to arrange and group the equipment in such a way as to provide the smallest amount of conduit and cable and so to centralize the equipment as to make it easily accessible for operation and supervision. The scattering of individual switches, starters, switch boxes and fuse boxes throughout the plant makes it almost impossible to supervise them properly and inspect them regularly.

The arrangement provided at Pine Grove proceeds logically along the lines followed for operating a customer's load. The basic idea of this system is to establish an "auxiliary substation" in a load center and to supply a group of motors from this substation, thus reducing the amount of cable to a minimum and making it possible to add motors on such an auxiliary substation

whenever required without going back to the main switching.

The majority of auxiliary substations at Pine Grove are 2,300-volt, and they in turn supply energy to the small transformers feeding 220-volt auxiliaries as well as to lighting transformers. To avoid the necessity of carrying long runs of heavy low-tension copper, the distribution system is made 2,300-volt and transformers are provided whenever low-tension energy is required. Thus separate 220-volt power transformers as well as separate lighting transformers are provided for the turbine room and for the boiler house. Each of these auxiliary transformers again supplies energy to a bus, likewise called an auxiliary substation. As may be seen from Fig. 1, on page 749, there are altogether four principal auxiliary substations and five subordinate auxiliary substations. Principal auxiliary substation 2 supplies the emergency motor exciters and is installed near the exciters on the main floor, together with subordinate auxiliary substation 2A, which takes care of the direct-current side of these motor-generators as well as the direct-current feeders. Each of the principal auxiliary substations 3 and 4 take care of a number of pumps belonging to a unit and are installed centrally near these pumps. When one of the units is shut down the respective auxiliary substation can likewise be de-energized. Each of these two substations feeds a 300-kva., 220-volt power transformer as well as a 50-kva. lighting transformer, each of which respectively supplies energy to one of the two sets of 220-volt power buses and to one of the two sets of the 110-volt, three-phase lighting buses, both 220-volt and 110-volt buses being for the turbine room only and with the respective switching making up the subordinate auxiliary substation 3A.

Principal auxiliary substation 5 is for boiler-house auxiliaries. It supplies 2,300 volts directly to all the 2,300-volt motors which are considered boiler-house auxiliaries, and through transformers supplies energy to subsidiary auxiliary substation 5A, 5B and 5C, which take care of the 220-volt boiler-house power loads and the 110-volt boiler-house lighting.

Not only is a minimum of cable required for this system, because of the elimination of practically all heavy low-tension runs, but it also allows for very easy supervision and facilitates the locating of any trouble which may arise. The panels of all the auxiliary substations are so numbered that the panel number at once identifies the substation to which it belongs. Thus, the panels belonging to auxiliary substation 2 are numbered 200, 201, etc., those belonging to substation 5 are numbered 500, 501, etc. It is for this reason that there is no auxiliary substation 1, since numbers 1 to 199 are used up for the main control boards and the house-service control board. The conduits running from any panel are marked with the respective panel number, so that if, for instance, a conduit marked 503-D is found any place in the power house, it is at once known that the cable in this conduit is controlled from panel No. 503 in auxiliary substation 5.

The question of space for auxiliary starting and switching equipment looms up very important in large power houses. In small plants where standard compensators are used this question can be virtually neglected in the general layout of the power house and in the determination of the required floor space, since compensators can readily be accommodated on walls or columns near the motors. In large power plants requiring

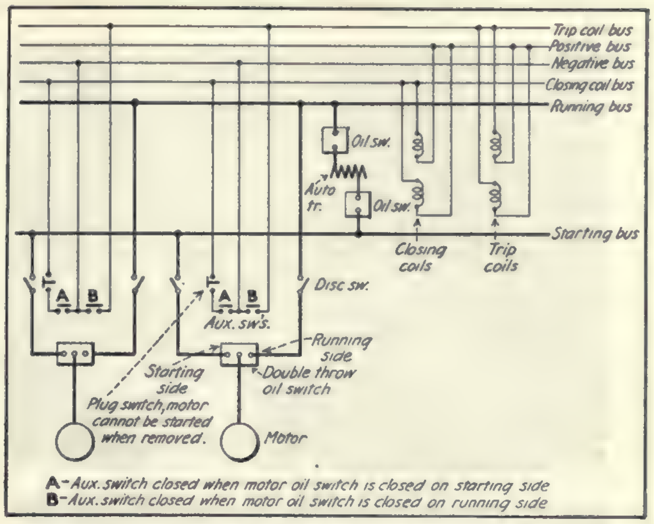


FIG. 5—CONNECTIONS FOR STARTING A GROUP OF MOTORS FROM SAME STARTING TRANSFORMERS

elaborate auxiliary switching, on the other hand, careful attention must be given to the space required for such equipment. Many of the existing large power plants have very unsystematic arrangements of auxiliary equipment, obviously caused by the fact that when the general arrangement of apparatus was determined upon insufficient attention was given to the question of how much space would be required for auxiliary equipment, and hence after the building construction was well under way it was necessary to place such equipment, not in the space in which it logically belonged, but in such free space as happened to be available.

Virtually all of the electric equipment for Pine Grove was furnished by the General Electric Company. The main house-service circuit breakers are solenoid-operated K-32-A, the main circuit breakers on the auxiliary substations are manually operated K-32-A, and the double-throw starting switches are K-5.

The Pine Grove power house, which is on the Swatara Creek at Pine Grove, Pa., was designed and constructed by the J. G. White Engineering Corporation.

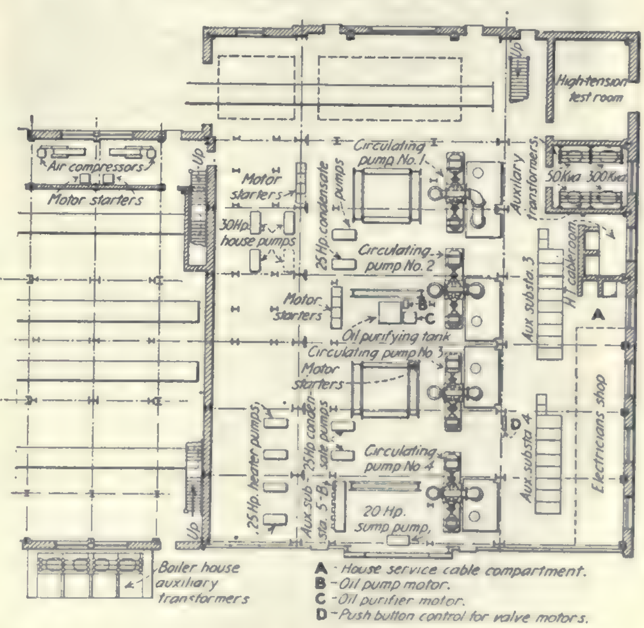
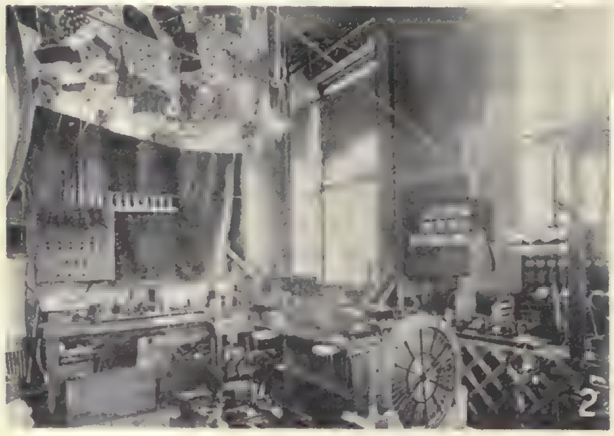
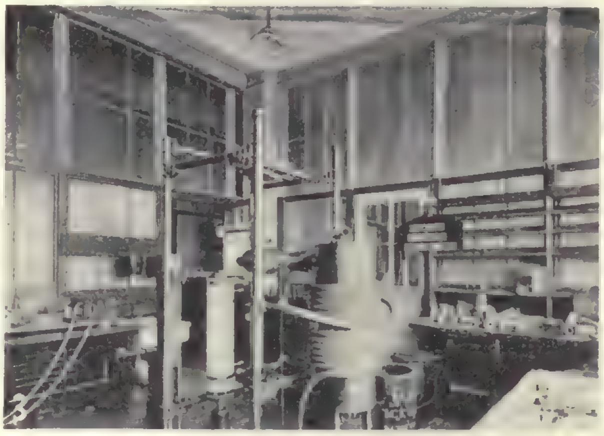


FIG. 6—BASEMENT PLAN OF TURBINE ROOM AND PART OF BOILER HOUSE, SHOWING LOGICAL LOCATION OF AUXILIARY SUBSTATIONS





Research Laboratories Aid Industry

AN IMPORTANT development of the last few years has been that of industrial research. For many years the colleges offered the only facilities for scientific research, but with the growth of the electrical industry there arrived a condition where industrial research laboratories became necessary to it. Most of these laboratories do both pure and applied research, and their work has resulted in many practical and theoretical developments. The growth of the research idea first developed by the electrical industry has extended to all the industries and is rapidly becoming recognized as a necessary adjunct to successful commercial operations.

Figs. 1, 2 and 3—Views of the Research Laboratory of the General Electric Company at Schenectady.

1. One of the rooms devoted to the developments of X-ray apparatus, including oil-immersed outfits and high-voltage tubes.

2. Special room devoted to the study of electrodynamics, showing equipment used in developing loud speakers, etc.

3. Room devoted to study of high-voltage vacuum tubes for power purposes; view of a 1,000-kw. tube.

Fig. 4.—Part of Underwriters' Laboratories in New York.

Most of the work of the electrical department of the laboratories is not exactly "research" work, although it all partakes more or less of that character. One work at present in progress is a special investigation of heater cord intended to develop especially appropriate methods of testing to show durability and service value of the different kinds of cords. Other subjects illustrating the work done are investigations of special hazard X-ray apparatus; studies of inclosed switches, construction and performance, and routine of special tests on cartridge-inclosed fuses, both the renewable and non-renewable types. Another important part of

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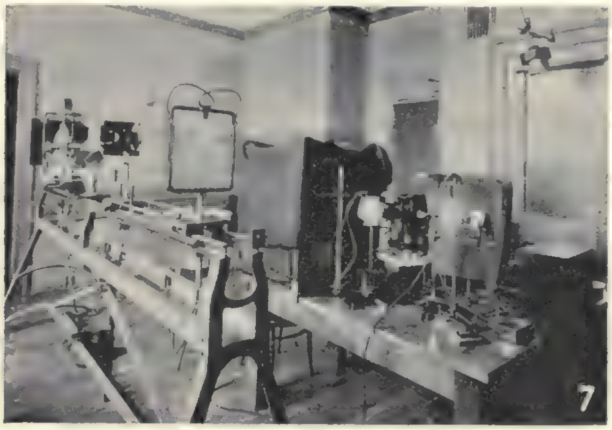

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the work is special investigations and tests on a large variety of fire-alarm signaling devices and systems, including automatic thermostats, manual systems and sprinkler supervisory systems. Aside from these there are the constant investigations of a wide variety of wiring devices both of standard and special forms, and also of domestic and industrial appliances of all service utilizing electricity for a wide range of purposes.

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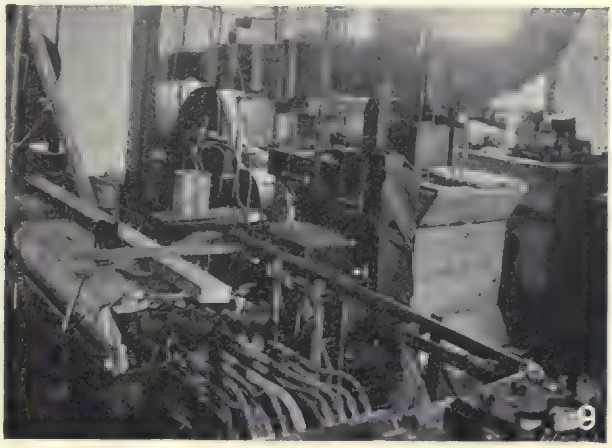
Fig. 5 — Communication Research Laboratory at Yale. Signal Corps officers of the army have done important researches in this laboratory. Many other universities have developed splendid research laboratories in their engineering departments.

Fig. 6—View of Western Electric Research Laboratories in New York. This laboratory has made many valuable research contributions to the art of communication. Dr. Clinton Davisson and Dr. C. H. Kunsman are seen inspecting their apparatus for studying the structure of atoms as revealed by the action of electrons.

Figs. 7 and 8—Views of the Nela Research Laboratory of the National Lamp Works.

7. Apparatus for the photometric and spectrophotometric study of lamps and new light sources.

8. Apparatus for studying the emission from oxides heated to high temperatures.



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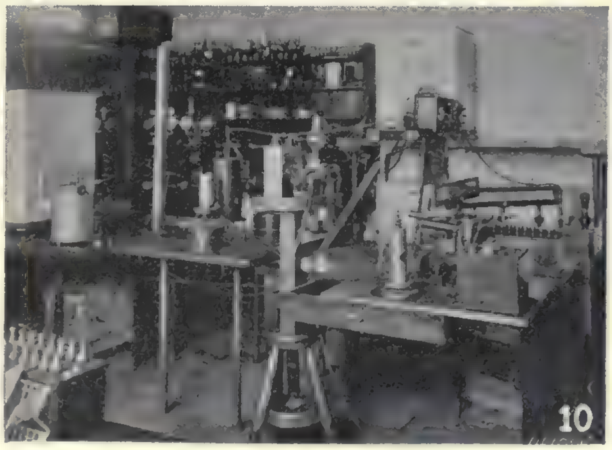
Figs. 9 and 10—Views of the research laboratory of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa.

In addition to the tests depicted in the pictures, major researches now in progress include (1) magnetic material, (2) heat-conduction dissipation as applied to electrical machines, (3) radio researches, (4) ceramic researches, (5) metallurgical researches, (6) high-tension researches, (7) general researches on insulating materials, (8) physical properties of materials as applied to electrical machines, (9) transformer oil, and (10) electrochemical researches.

9. Durability of Insulation Tests. Left—Temperature tests on high-voltage generator insulations. Right —Dissipation of heat from high-voltage generator windings.



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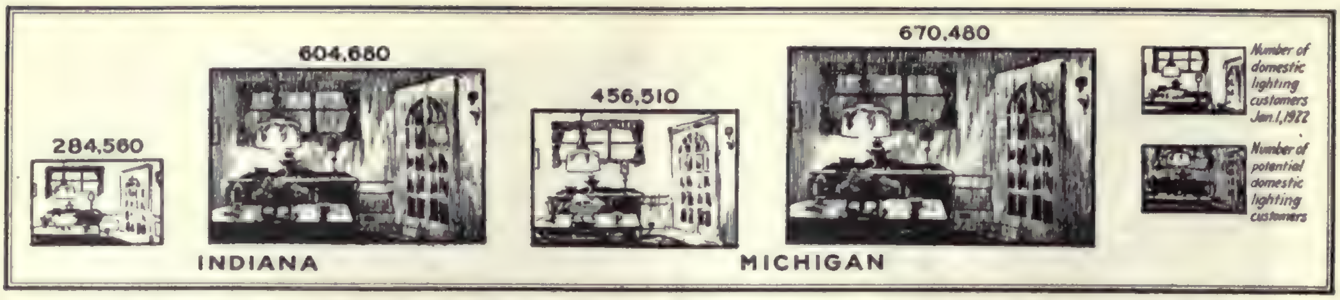
10. Durability of Insulation Tests. Front tables—Set-up for watt loss and power-factor determinations. Rear tables—Ovens and physical testing machines used in the study of effects of long-continued heating, under different conditions, on the life of various types of insulating materials.



THE DOMESTIC LIGHTING FIELD IN INDIANA AND MICHIGAN COMBINED IS ABOUT 58 PER CENT DEVELOPED

1,500,000 Potential Customers

"Electrical World" Estimate by Counties of Present and Possible Future Consumers of Electricity in Indiana and Michigan

INDIANA and Michigan present fruitful fields for the growth of the central station. In Indiana 56.5 per cent of the population live in cities and towns, and in Michigan almost exactly two-thirds of the citizens live in urban communities. A study just completed indicates, however, that the domestic lighting field of the central stations in Indiana has been only about 47 per cent developed and the same field in Michigan about 68 per cent developed. The indications are that there are more than half a million homes in these two states combined which form a field for future electrification.

Continuing its study of the distribution of present and potential central-station customers in the counties of the various states, the ELECTRICAL WORLD presents in the tables on pages 757 and 758 its estimate of the consumers in Indiana and Michigan. Studies have been made in previous issues of the ELECTRICAL WORLD for New England and the Atlantic States and also for Ohio and Illinois. Similar data for other states in the Union will appear in early issues.

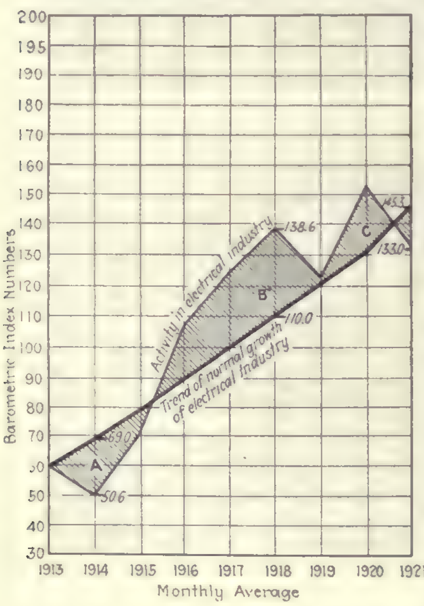
This study is based upon reports which have been received by the ELECTRICAL WORLD from operating companies representing about 70 per cent of the entire generator rating of the country, supplemented by data on population and industrial power issued by the United States Census Bureau. The data obtained in this way were referred to a representative company operating in the county concerned, with the request that an opinion be given as to whether they represented with a fair degree of accuracy conditions existent in that county.

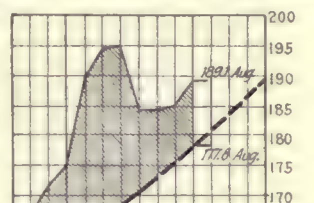
In the few cases where the operating companies to which the figures were sent indicated that the ELECTRICAL WORLD figures were at variance with conditions in the county a new study was made, and the data were corrected accordingly. The figures for the various counties, although estimates, are believed to indicate very clearly the present and future potentialities of these counties as ultimate purchasers of electrical apparatus, appliances and supplies.

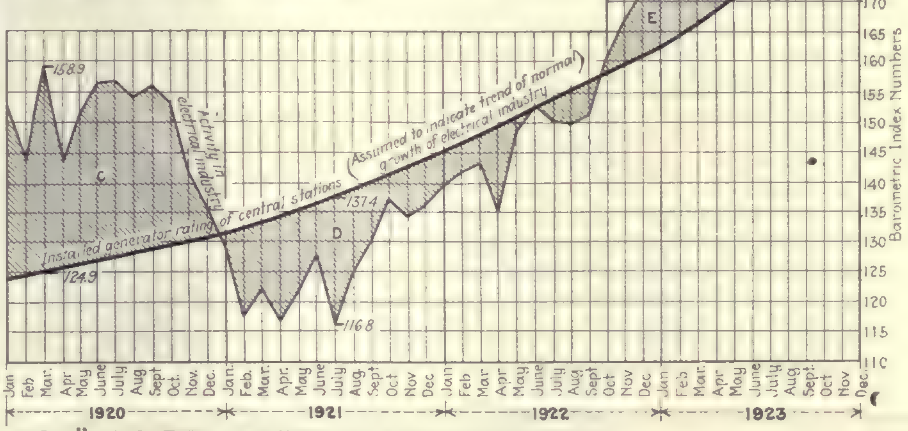
Increased Activity Indicated During August

INDEX figures upon which the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" is based indicate that activities within the industry took an upward turn during August. Some of the basic industries, such as pig-iron production, reported decreased operations, but other industries entering into the ELECTRICAL WORLD'S index of activity in the electrical industry increased their operations above those of July.

The basic data upon which the "ELECTRICAL WORLD Barometer" is based indicate an increase of four points on the barometer scale, as compared with July activities. During this interval the industry has grown two points, leaving a net increase in activity of two points on the barometer scale as compared with July. The electrical industry as a whole was operating in August at 11.3 points or per cent above what would have been the point of seasonal demand if growth in the industry had been normal. In July it was operating at 9.3 points or per cent above the point of normal demand.







"ELECTRICAL WORLD" BAROMETER OF ELECTRICAL BUSINESS CONDITIONS

Present and Potential Central-Station Customers in Indiana by Counties

State and County	Population (Census of 1920) Total	Urban*	Rural	Domestic Lighting Customers Total (Jan. 1, 1922)	Total Potential (Including Present Customers)	Commercial Lighting Customers Total (Jan. 1, 1922)	Total Potential (Including Present Customers)	Industrial Power Customers Total (Jan. 1, 1922)	Total Potential (Including Present Customers)
INDIANA	2,930,390	1,654,750	1,275,640	284,560	604,680	46,160	99,670	14,900	35,900
Adams	20,503	6,299	14,204	1,130	3,330	200	590	50	250
Allen	114,303	87,786	26,517	10,030	24,050	2,180	5,230	1,330	1,800
Bartholomew	23,887	10,173	13,714	1,580	4,560	240	690	40	200
Benton	12,206	1,442	10,762	690	2,070	180	540	10	70
Blackford	14,084	8,480	5,604	1,140	2,910	210	540	20	100
Boone	23,575	7,689	15,886	1,520	4,460	230	680	50	230
Brown	7,019	0	7,019	180	820	10	50	10	30
Carroll	16,315	3,528	12,787	1,030	3,090	150	450	30	130
Cass	38,333	21,626	16,707	3,060	7,850	640	1,640	310	470
Clark	29,381	12,420	16,961	1,780	4,990	310	870	120	280
Clay	29,447	12,519	16,928	2,000	5,520	350	970	50	230
Clinton	27,737	11,585	16,152	2,130	5,720	440	1,180	250	300
Crawford	11,201	0	11,201	420	1,560	50	190	20	100
Daviess	26,856	8,743	18,113	1,530	4,460	270	790	50	260
De Kalb	25,600	12,363	13,237	1,930	5,250	320	870	40	190
Dearborn	20,033	7,765	12,268	1,700	3,540	190	560	40	190
Decatur	17,813	5,345	12,468	1,070	3,290	150	460	40	190
Delaware	56,377	39,071	17,306	1[illegible],000	17,000	1,200	1,500	680	910
Dubois	19,915	5,800	14,115	940	2,910	160	500	60	290
Elkhart	56,384	48,480	7,904	6,140	14,160	1,230	2,840	560	1,360
Fayette	17,142	9,901	7,241	2,680	4,000	400	500	110	150
Floyd	30,661	22,992	7,669	2,840	6,940	550	1,340	130	520
Fountain	18,823	4,972	13,851	1,140	3,440	160	480	40	190
Franklin	14,806	2,220	12,586	660	2,270	80	280	40	190
Fulton	16,478	3,720	12,758	990	2,990	140	420	50	230
Gibson	29,201	11,980	17,221	1,810	5,190	300	860	50	230
Grant	51,353	31,502	19,851	7,530	11,470	1,370	2,100	410	830
Greene	36,770	14,042	22,728	2,320	6,570	400	1,130	40	190
Hamilton	24,222	7,579	16,643	1,670	4,790	250	720	40	190
Hancock	17,210	5,381	11,829	1,300	3,640	200	560	30	130
Harrison	18,656	1,785	16,871	600	2,450	40	70	30	50
Hendricks	20,291	4,165	16,126	1,120	3,510	160	500	30	130
Henry	34,682	17,649	17,033	2,660	7,070	460	1,220	80	440
Howard	43,965	31,230	12,735	3,920	9,620	770	1,890	160	750
Huntington	31,671	16,591	15,080	5,000	6,490	800	1,140	260	460
Jackson	24,228	10,033	14,195	1,500	4,320	250	720	50	230
Jasper	13,961	3,956	10,005	690	2,180	100	310	10	70
Jay	23,318	9,723	13,595	1,680	4,690	270	750	40	190
Jefferson	20,709	6,711	13,998	1,400	3,600	350	600	110	200
Jennings	13,280	3,084	10,196	650	2,140	80	260	20	100
Johnson	20,739	9,192	11,547	1,470	4,110	240	670	30	160
Knox	46,195	25,845	20,350	6,280	8,810	1,250	1,750	280	830
Kosciusko	27,120	7,667	19,453	2,200	5,100	300	770	100	320
La Porte	50,443	34,615	15,828	4,280	10,520	880	2,160	240	710
Lagrange	14,009	1,610	12,399	770	2,430	100	320	10	70
Lake	159,957	153,871	6,086	14,940	33,720	3,730	8,420	310	1,380
Lawrence	28,228	12,101	16,127	1,810	5,110	310	880	40	190
Madison	69,151	48,053	21,098	6,170	15,220	1,190	2,940	350	1,170
Marion	348,061	318,363	29,698	58,410	85,750	6,960	10,210	3,600	6,250
Marshall	23,744	9,872	13,872	2,290	4,630	350	750	70	230
Martin	11,865	3,367	8,498	530	2,120	80	320	20	100
Miami	28,668	13,459	15,209	2,500	5,920	380	1,010	170	360
Monroe	24,519	11,595	12,924	1,680	4,630	290	800	100	310
Montgomery	28,490	11,149	17,341	2,220	5,980	370	1,000	220	530
Morgan	20,010	6,676	13,334	1,220	3,640	180	540	30	160
Newton	10,144	3,467	6,677	640	1,840	110	320	10	70
Noble	22,470	8,452	14,018	1,560	4,410	240	680	40	190
Ohio	4,024	1,411	2,613	250	750	10	20	10	30
Orange	16,974	4,908	12,066	850	2,730	120	390	30	130
Owen	12,760	2,066	10,694	610	2,040	70	230	20	105
Parke	18,875	3,146	15,729	860	2,970	100	350	30	130
Perry	16,692	6,094	10,594	890	2,640	160	480	30	160
Pike	18,684	3,507	15,177	1,150	2,700	180	290	30	70
Porter	20,256	8,122	12,134	1,270	3,650	210	580	30	160
Posey	19,334	6,410	12,924	1,200	3,470	200	580	30	130
Pulaski	12,385	1,684	10,701	570	1,890	80	270	10	70
Putnam	19,880	3,780	16,100	2,900	3,460	190	450	40	130
Randolph	26,484	8,469	18,015	1,400	5,210	270	1,010	50	230
Ripley	18,694	3,454	15,240	1,350	3,600	110	370	50	400
Rush	19,241	5,498	13,743	1,200	3,610	170	510	30	130
St. Joseph	103,304	87,209	16,095	20,920	33.950	3,290	4,840	810	1,210
Scott	7,424	1,609	5,815	430	1,150	70	140	10	70
Shelby	25,982	9,701	16,281	1,610	4.820	230	680	100	180
Spencer	18,400	2,581	15,819	820	2,770	110	370	30	130
Starke	10,278	2,766	7,512	550	1,710	80	250	10	30
Steuben	13,360	2,650	10,710	880	2,650	110	330	30	160
Sullivan	31,630	10,722	20,908	1,700	5,250	260	800	30	130
Switzerland	9,311	1,175	8,136	360	1,420	30	120	10	30
Tippecanoe	42,813	26,316	16,497	4,700	4,700	670	670	210	210
Tipton	16,152	4,506	11,646	1,060	3,010	170	480	30	130
Union	6,021	1,292	4,729	310	1,060	30	100	20	100
Vanderburg	92,293	86,688	5,605	9,000	20,000	2,500	4,500	750	1,500
Vermilion	27,625	13,833	13,792	1,760	4,630	340	900	70	220
Vigo	100,212	70,393	29,819	10,000	21,320	1,550	4,250	470	1,560
Wabash	27,231	12,583	14,648	2,070	5,600	350	950	50	260
Warren	9,699	1,088	8,611	440	1,560	50	180	10	30
Warrick	19,862	5,746	14,116	1,300	3,150	200	450	40	130
Washington	16,645	2,836	13,809	720	2,520	80	280	20	100
Wayne	48,136	29,966	18,170	4,210	10,590	770	1,940	570	1,320
Wells	20,509	5,391	15,118	1,150	3,540	170	520	30	190
White	17,351	3,893	13,458	1,140	3,230	180	510	30	130
Whitley	15,660	3,573	12,087	1,300	4.480	250	350	70	130

*Cities and towns of over 1,000 population.

Present and Potential Central-Station Customers in Michigan by Counties

State and County	Population (Census of 1920)			Domestic Lighting Customers		Commercial Lighting Customers		Industrial Power Customers	
	Total	Urban*	Rural	Total (Jan. 1, 1922)	Total Potential (Including Present Customers)	Total (Jan. 1, 1922)	Total Potential (Including Present Customers)	Total (Jan. 1, 1922)	Total Potential (Including Present Customers)
MICHIGAN	3,668,412	2,445,226	1,223,186	456,510	670,480	78,015	115,749	18,246	29,260
Alcona	5,912	0	5,912	110	410	10	40	10	30
Alger	9,983	5,037	4,946	470	1,110	120	280	10	30
Allegan	37,540	8,854	28,686	1,780	4,740	240	640	30	140
Alpena	17,869	11,101	6,768	1,800	3,800	270	300	20	40
Antrim	11,543	1,214	10,329	590	1,510	90	230	10	30
Arenac	9,460	0	9,460	190	650	20	70	10	30
Baraga	7,662	1,013	6,649	230	620	40	110	10	50
Barry	21,383	6,508	14,875	1,230	3,130	160	410	20	80
Bay	69,548	49,092	20,456	11,000	15,000	1,060	1,500	180	430
Benzie	6,947	1,244	5,703	430	1,060	70	170	10	30
Berrien	62,653	32,417	30,236	4,930	11,390	770	1,780	290	490
Branch	23,997	9,880	14,117	3,200	3,890	200	300	150	200
Calhoun	72,918	49,864	23,054	8,600	14,770	1,450	2,280	460	680
Cass	20,395	6,825	13,570	1,290	3,180	180	440	10	50
Charlevoix	15,788	8,930	6,858	1,850	2,540	340	470	24	50
Cheboygan	13,991	5,642	8,349	1,200	2,150	250	500	50	150
Chippewa	24,818	12,096	12,722	2,720	3,000	500	600	170	200
Clare	8,250	1,462	6,788	210	480	40	170	10	30
Clinton	23,110	4,992	18,118	970	2,700	120	330	10	50
Crawford	4,049	2,450	1,599	400	680	50	90	10	30
Delta	30,909	19,605	11,304	3,900	4,780	620	750	110	160
Dickinson	19,456	15,030	4,426	1,560	3,410	330	720	10	50
Eaton	29,377	11,583	17,794	2,200	4,500	500	650	50	70
Emmet	15,639	6,664	8,975	1,900	2,560	190	440	60	100
Genesee	125,668	97,705	27,963	20,000	28,000	2,800	5,000	400	500
Gladwin	8,827	1,225	7,602	260	400	100	120	10	20
Gogebic	33,225	25,372	7,853	2,350	5,160	550	1,200	40	150
Grand Traverse	19,518	10,985	8,533	2,300	3,300	500	700	210	350
Gratiot	33,914	12,507	21,407	1,870	4,700	280	710	20	80
Hillsdale	28,161	7,786	20,375	1,640	4,200	210	540	20	80
Houghton	71,930	54,673	17,257	5,480	12,050	1,170	2,570	35	160
Huron	32,786	5,513	27,273	1,040	3,020	150	440	10	50
Ingham	81,554	63,244	18,310	7,920	17,300	1,370	2,990	750	970
Ionia	33,087	13,991	19,096	2,240	5,380	330	890	20	110
Iosco	8,199	3,538	4,661	520	1,240	50	210	10	30
Iron	22,107	11,165	10,942	1,220	2,840	250	580	20	80
Isabella	22,610	4,819	17,781	850	2,360	120	330	10	50
Jackson	72,539	48,374	24,165	6,500	14,470	1,090	2,420	870	980
Kalamazoo	71,225	50,199	21,026	6,650	14,880	1,100	2,460	240	800
Kalkaska	5,577	0	5,577	240	650	90	125	12	30
Kent	183,041	143,029	40,012	17,430	37,100	3,050	6,480	1,100	3,010
Keweenau	6,322	2,351	3,971	320	770	70	170	10	30
Lake	4,437	0	4,437	60	300	10	50	10	50
Lapeer	25,782	5,934	19,848	1,310	3,340	200	510	10	50
Leelanau	9,061	0	9,061	270	800	40	120	10	30
Lenawee	47,767	20,377	27,390	5,760	8,190	1,020	1,170	170	250
Livingston	17,522	4,008	13,514	2,930	3,500	830	1,200	130	200
Luce	6,149	2,172	3,977	200	510	50	130	10	30
Mackinac	8,026	1,852	6,174	310	830	50	134	10	30
Macomb	38,103	12,893	25,210	5,910	7,000	1,200	1,400	320	400
Manistee	20,899	9,694	11,205	1,360	3,220	230	550	20	80
Marquette	45,786	32,665	13,121	4,800	7,470	970	1,510	220	390
Mason	19,831	9,855	9,976	3,000	4,000	350	500	130	150
Mecosta	17,765	4,558	13,207	860	2,270	120	320	10	50
Menominee	23,778	11,464	12,314	1,340	3,140	270	630	20	80
Midland	17,237	5,483	11,754	830	2,130	130	330	10	30
Missaukee	9,004	0	9,004	180	630	10	40	10	30
Monroe	37,115	12,681	24,434	4,500	4,900	800	950	110	290
Montcalm	30,441	4,304	26,137	1,500	4,000	200	530	20	80
Montmorency	4,089	0	4,089	80	290	10	40	10	30
Muskegon	62,362	47,314	15,048	5,770	12,640	1,030	2,260	640	910
Newaygo	17,328	3,340	14,038	700	1,940	90	250	10	50
Oakland	90,050	53,807	36,243	11,990	15,540	1,320	1,700	500	580
Oceana	15,601	2,878	12,723	850	2,120	130	320	10	50
Ogemaw	7,786	1,105	6,681	250	750	30	90	10	30
Ontonagon	12,428	1,406	11,022	220	760	30	100	10	30
Osceola	15,221	3,129	12,092	520	1,530	70	210	10	30
Oscoda	1,783	0	1,783	20	100	10	20	0	10
Otsego	6,043	1,701	4,342	260	670	40	100	10	30
Ottawa	47,660	23,663	23,997	3,170	7,430	540	1,270	190	530
Presque Isle	12,131	4,898	7,233	540	1,340	100	250	10	30
Roscommon	2,032	0	2,032	60	190	10	30	0	10
Saginaw	100,286	70,759	29,527	8,610	19,020	1,540	3,410	540	950
St. Clair	58,009	35,405	22,604	8,430	10,540	1,565	1,950	300	490
St. Joseph	26,818	12,481	14,337	2,310	5,300	340	780	20	110
Sanilac	31,237	1,678	29,559	860	2,730	100	320	10	50
Schoolcraft	9,977	6,380	3,597	900	1,520	200	340	50	70
Shiawassee	35,924	16,818	19,106	3,820	5,270	760	960	170	330
Tuscola	33,320	5,385	27,935	1,280	3,580	210	590	10	50
Van Buren	30,715	10,332	20,383	1,750	4,500	230	590	30	140
Washtenaw	49,520	31,106	18,414	9,630	11,000	1,810	2,100	490	600
Wayne	1,177,645	1,135,972	41,673	226,000	252,040	40,000	46,000	8,400	10,900
Wexford	18,207	9,750	8,457	1,800	3,140	440	790	80	150

* Cities and towns of over 1,000 population.

Regulation of High-Voltage Lines

Typical Cases Involving the Action of Different Types of Regulators Are Discussed to Indicate Factors in Handling the Problem of Voltage, Power Factor and Load Regulation

By E. F. GEHRKENS

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WHEN investigating the advisability of providing regulation on high-voltage lines, due attention must be given to the connection and use of such lines as well as to the selection of the proper type of regulator and its location. Among the line arrangements which must be considered are: (1) A single line used as a feeder only; (2) two feeder lines supplied from a common bus and also connected together at some point beyond the bus, constituting a parallel connection or a loop system; (3) a single line connecting two or more generating stations, and (4) two or more parallel lines connecting two generating stations. Of the various means for obtaining regulation there are the induction regulator (both single-phase and polyphase), the series synchronous booster, a transformer with taps and dial switches, a combination of a transformer with taps and dial switches and an induction regulator, and the synchronous condenser. The object of a regulator may be to compensate for the voltage drop in a line, to control the power factor of the load delivered to a distributing or power system by one or more of several generating stations, or to control the load carried by two or more parallel connected lines.*

In handling the problem of regulation certain elementary theory must be clearly kept in mind. For example, the voltage drop in a line is due to the ohmic and the reactance of the line. The voltage drop due to the former is in phase with and that due to the latter at right angles to the current. Therefore the angular phase displacement of the voltage drop to the generator voltage at any point on the line depends on the relation of the resistance of the line to its reactance, and it is further modified by the angular relation of the line current to the line voltage, i.e., by the power factor of the load.

The phase displacement of the line voltage drop with respect to the generator voltage has no particular significance when considering a single line, but it must be taken into account if two or more lines are operated in parallel. Two parallel lines of unlike characteristics or carrying loads of different power factors are analogous to two parallel-operated, unequally loaded and unequally excited generators. The generator which is leading in phase supplies a greater amount of power to the line and the higher-excited generator supplies a leading wattless current to the lower-excited one until the voltages at their terminals are equal.

Since the voltage drop in a line due to resistance is in phase with the line current, an unequal drop in two parallel lines, before the lines are connected in parallel, would cause a wattless current to flow from the higher-voltage line to the lower-voltage one when the connection is made, this current being of such a value as to equalize the voltages. In like manner, the reactance voltage drop being at right angles to the current flow, an unequal resistance of the two lines corresponds to a phase displacement of the two parallel generators considered and causes a power current to flow from the line the voltage of which is in advance to the other line. In other words, the distribution of a load over parallel lines depends on the constants of the lines, on the nature of the load and on the location of the load along the lines.

SIGNIFICANCE OF PHASE DISPLACEMENT BY REGULATORS

The induced voltage of a transformer with taps combined with a voltage-regulating switch, as well as that of a single-phase induction regulator, is practically in phase with the line voltage, whereas the voltage of a synchronous motor-generator or that of a polyphase regulator may be out of phase. This out-of-phase voltage corresponds to the phase displacement of parallel-connected alternators when such regulators are used in parallel lines. The phase displacement in the motor-generator set is due to the armature reactance of both motor and generator and also to the lag of the motor under load, whereas that introduced by the polyphase regulator is due to the mechanical displacement of the primary and secondary windings as the armature is rotated.

In considering the voltage regulation of a single line, any phase displacement which may be introduced by the regulator has no more significance than the phase displacement caused by the line voltage drop except that with the synchronous booster a compensation must be provided for the phase displacement of its own voltage under load either by a sufficient over-ratio or by a phase adjustment. Any design or type of regulator may therefore be used.

The employment of a regulator on a single line used as a feeder only is for the control of the voltage of the line, whereas if the line is used as an interconnection between two generating stations, the object of the regulator is to control the power factor of one of the generating stations and influence the load carried by the line. In the latter case any phase shift which may be introduced by the line voltage drop or by the regulator is compensated for by a corresponding phase shift of the connected generators, so that each generator will deliver its proportion of the load as determined by the adjustments of the governors of the prime movers. Therefore, for the case considered, the adjustment of any type of regulator results eventually only in a change in the value of the voltage and hence controls only the wattless current flowing in the line.

The interconnection of more than two generating stations may be by means of a single line, as for example, a T-connection of three generating stations, or by means of a loop or ring bus.

The first arrangement is similar to the interconnection of two generating stations by means of a single line,

*For a more detailed and comprehensive discussion of this subject the reader is referred to the author's handbook entitled "The Induction Voltage Regulator," recently published by the General Electric Company.

whereas the second constitutes a parallel line connection between the generating stations in that the current flow from any station may be through either side of the loop. However, in either case the control of the power factor of the load delivered to the interconnected system by each of the generating stations requires the voltage control of the individual feeders supplying the system.

The voltage adjustment for the control of power factor may be beneficial or detrimental to the voltage regulation requirements of the line, depending on the location of the regulator, the distribution of the load and the direction of the flow of power.

Relative Merits of Regulators

From the preceding comments it is apparent that the most economical operation of parallel lines becomes somewhat complicated. If the lines have identical characteristics and are equally loaded, it is advantageous to control both with the same regulator, but if the lines have different characteristics or it is desired to load them unequally, each line should be controlled by its own regulator. For the latter case the use of single-phase regulators or a transformer with taps and dial switches does not give the best results, even though the resultant voltage is in phase with the impressed voltage, for the reason that they do not compensate for the line drop in both value and direction. A single polyphase regulator in each line is more objectionable in that the regulator itself introduces a phase displacement. Proper and correct voltage compensation can, however, be obtained by the use of two polyphase regulators connected in series with each line, as with this arrangement and by an independent adjustment of each regulator the line drop in both value and direction can be compensated for or the load may be divided as desired.† The synchronous booster set is also applicable, provided the stationary members of the set are relatively adjustable so as to compensate for the phase displacement required. However, the impedance of a regulator, referred to the line voltage, is relatively small—probably about 1 per cent. Hence, with unlimited power and with sustained voltage any regulator under a line short circuit may be subjected to enormous overloads even up to 100 per cent. Under this condition the synchronous set is not so safe as the induction regulator which has no rotating parts.

With the exception of the transformer with a variable ratio, no design of voltage regulator can economically be wound for a voltage exceeding 15,000. Hence, when regulators are required to control high-voltage lines it is necessary to provide an exciting or step-down transformer for the primary winding of the regulator and a series or insulating transformer for the secondary or series winding. The secondary of the regulator is connected directly to the primary of the series transformer and the secondary of the series transformer is connected in series with the line to be regulated. With this arrangement it is necessary to arrange the windings of the transformers and of the regulator so as not to introduce a phase displacement due to the connections; that is, with the regulator in a maximum boosting or lowering position, the resultant induced voltage of the regulating outfit must be in phase with the bus or line voltage. Both transformers must also have a slightly higher kva. capacity than the regulator itself. The exciting transformer must have a capacity equal to that of the regulator including its over-ratio and must also supply the losses in the regulator and series transformer. The series transformer must have a kva. capacity equal to that of the regulator including its over-ratio.

†This particular phase of the subject was presented and fully discussed and illustrated on page 140 of the *Electrician* (London) of Nov. 6, 1914.

The transformer with a variable voltage winding is the most economical regulator and can be used directly in higher voltage circuits than any other means of voltage regulation. The voltage regulation, however, is in steps; consequently, since it is generally desired to make voltage adjustments under load, it is necessary to use a somewhat complicated switching mechanism.

The synchronous booster set requires an exciting and a series transformer, as does also the regulator. Furthermore, the synchronous motor and the booster must each have a kva. capacity equal to the voltage regulation required. That is, the regulating equipment must have a total kva. capacity four times the regulation required; hence the losses are high.

The induction regulator with its exciting and series transformers has a kva. capacity three times the voltage regulation required. The voltage regulation is gradual, no switching of line current is required, and as the regulator has no continuously rotating parts it is somewhat safer under line short circuits.

The combination of a transformer with taps and an induction regulator has the advantage of low losses and a gradual voltage change, but the arrangement is somewhat more complicated than the transformer with taps and switches only.

The synchronous condenser, when used on a high-voltage line, also requires a step-down transformer.

Function of Synchronous Condenser

Although the function of the synchronous condenser is primarily to supply a wattless current to the load, thereby increasing the capacity of the generating, transforming and transmission equipment or reducing the losses therein, it may properly be classed as a voltage regulator, although the regulation of voltage is only incidental and depends on the line and load constants and the lowering of the voltage can only be obtained by loading the line with a wattless current. The function and the action of the synchronous condenser have, however, previously been presented from various angles and viewpoints and hence require no further comment.

From the preceding it will be observed that the control of high-voltage lines is expensive owing both to the initial cost of the apparatus and to the losses. However, instances have occurred—and they will continue to occur in increasing numbers as the paralleling of lines and interconnections increases—in which this control is economical or even essential because the lines cannot be operated without the use of feeder regulators.

Location of the regulator is also an important factor. The adjustable-voltage transformer is generally installed in the generating station, although it is frequently installed at the tie-in point of an interconnected system. The induction regulator should be installed in the station from which the power supplied to the line is obtained so as to avoid carrying the exciting and, in the boosting position, the primary current of the regulator, which loads the line with an additional current, thereby increasing the line load and hence the voltage drop as well as decreasing the power factor of the load carried by the line. The synchronous set may be installed at any desired point, and advantage may be taken of the fact that the synchronous motor may in part be used as a condenser. The synchronous condenser is preferably installed at the load.

Central-Station Utilization of Byproduct Power from Steel Plants

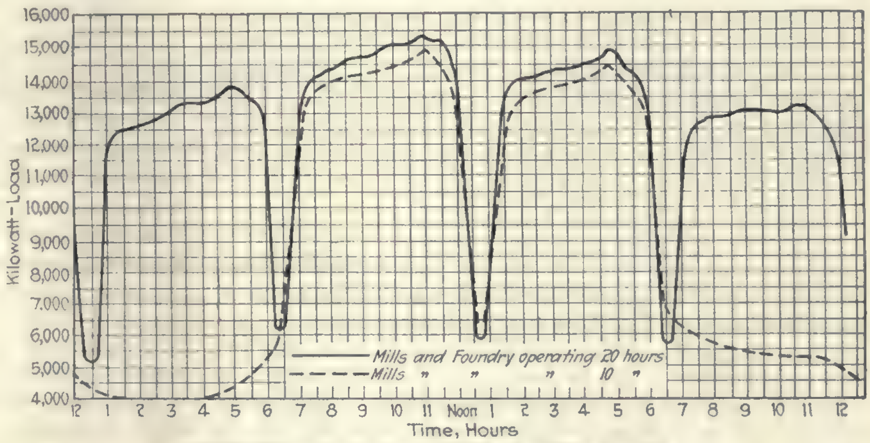
Opportunity for an Economical Interchange of Electrical Energy and the Conservation of Waste Heat Developed in the Steel Industry—What the Data from a Fully Electrified Plant Show

By L. B. BREEDLOVE
Consulting Engineer Chicago Trust Company, Chicago

WHILE gas companies have, whenever the opportunity offered, co-operated with the steel industry in the conservation and sale of gas from coke-oven plants, little if any progress has been made by electric power companies toward utilizing the waste energy product at steel mills and blast furnaces. This has been due largely to the fact that the conversion of waste heat into salable electrical energy involves a more complicated process than the mere distribution of byproduct gas. There exists, however, the possibility of very real economies for both the steel mill and the central station in the combining of their respective resources to utilize the energy which is now being absolutely thrown away.

The steel industry requires large quantities of electrical power and produces large amounts of byproduct energy suitable for the generation of power. The amount of energy consumed and the byproducts produced depend upon the number of departments and the volume of production. Practically all the byproducts suitable for power generation excepting waste heat are produced in the blast furnace and byproduct coke departments, while these departments consume about 15 per cent of the energy required in the manufacture of rolled-steel shapes from the raw materials. The rolling department is the largest consumer of power among the departments and takes about 70 per cent of the manufacturing total and produces no byproducts. The open-hearth department requires about 5 per cent of the manufacturing total and produces considerable waste heat suitable for utilization. Thus a plant producing pig iron as a product would consist of blast furnace and byproduct coke departments having large quantities of products for the generation of power which will produce far in excess of their energy consumption. A plant producing rolled-steel products but not manufacturing its own cast iron would have the opposite power conditions. In a plant having the full complement of departments proper utilization of the byproducts will produce all the power required for the plant's operation and in addition a surplus.

The most economical arrangement theoretically between an industrial plant utilizing available byproducts for power generation and a central station is a connection for interchange of power. Ignoring all other possible economies, the saving in the investment for reserve capacity would alone warrant this interconnection, even if no power were normally transmitted in either direction over the tie lines. If the isolated power plant can be linked with an interconnected superpower system, the idea is more attractive. This would require a co-ordination of the operation of both stations, which would practically mean the operation of the isolated station by the central-station organization. This may be generally hard to arrange, however, and probably the best way would be to work out the engineering economies without regard to the rate question of either power or byproducts and to have a joint committee study the cost relations. Where the industry is of sufficient magnitude, as in the case of the large steel plants, a subsidiary operating company, whose stock would be controlled by the two interested corporations, could be formed.



EXPECTED DAILY LOAD CURVE OF STEEL PLANT

This method would provide a flexible means of adjusting rates for byproducts and power to give to both organizations a fair profit on the investment. It would also decrease the amount of investment required from either organization under any present plans, remove certain commercial and personal elements, bring central-station operating methods to the steel industry and add another source of power to the central-station system at a moderate capital outlay with low production costs for energy. This would surely be a distinct step in advancing the industrial development of this country and in the conservation of national resources.

In localities where several steel plants are situated considerable saving in the total investment can be made by grouping the blast furnaces, coke plants and power plant together. In localities where several companies are operating the future may see the blast furnaces, coke plants and central station grouped together near a waterway, while the other departments may be located some distance away.

The operation of a power plant by steel mills is secondary to the production of steel and is therefore seriously handicapped in its technical staff and methods. The foremost attention of the engineers attached to the steel industry is directed principally to the application of electric power to the industrial operations. The production of power has become a separate industry requiring highly specialized operators. This fact is being more appreciated each year by the steel industry. The load curves of steel plants are becoming more and more desirable for central stations, and the peak-load periods do not ordinarily coincide with the peak-load hours for central stations.

Central stations have not in the past been able to contract for a large part of the electrical requirements of the steel industry. This has been due to the lack of knowledge of the plant operations and the factors connected with the availability of the several byproducts. The principal interest of the steel engineers is devoted to power application in the operation, rather more as it relates to increase in production than to power cost saving. Thus power generation from the byproducts as produced has not had the attention it deserves from steel men or central stations. A study of the possibilities requires an engineer having full and practical experience in each department of the steel industry combined with central-station experience. In all the conferences attended by the author neither central-station organizations nor steel-plant executives appreciated the mutual benefits which may be obtained by a successful commercial plan.

A Typical Power Plant

In order to indicate in a general manner some of the important economic considerations certain assumptions have been made. The data used are taken from detailed study of a modern, fully electrified steel plant having the full complement of departments for the manufacture of cast-iron castings and rolled-steel products. This plant consists of five 500-ton blast furnaces, two of which supply the foundry and the others the open-hearth department. The foundry is equipped with complete mechanical equipment for large-volume production of small castings. The byproduct coke plant consists of 240 16-ton regenerative coke ovens with complete recovery apparatus for the production of benzol, tar and ammonia sulphate. The mills consist of one 40-in. blooming mill, one 24-in. continuous mill and two 18-in. continuous mills.

The annual production assumed for these mills is 600,000 tons per year of 1½-in. x 1½-in. minimum bar blanks or any weight of sheet bar. Operation schedule of the mills and foundry calls for 310 days per year. The accompanying diagram shows the expected electrical load curve for this plant. The motors throughout the plant were carefully chosen to avoid oversizing. The energy consumption from ore to finished steel per ton is around 67 kw.-hr., and from ore to finished castings at the foundry the energy consumption is 32.5 kw.-hr. The yearly consumption is 58,000,000 kw.-hr. Generating capacity consists of three 12,500-kva. turbo-generator units. Six turbo-blowers capable of delivering 45,000 cu.ft. of free air per minute against 17 lb. gage pressure are installed for blowing the furnaces.

Each 500-ton, or so-called standard, blast furnace will produce, when operating at a rating in excess of the gas necessary to heat the blast, around 2,000,000 cu.ft. of blast-furnace gas per hour, except during the periods of casting, or about two hours per day. This gas with the dry hot method of cleaning comes to the boiler at about 300 deg. F. and contains about 98 B.t.u. per cubic foot. In the wet cold method of removing the dust from the gas the sensible heat of the gas, or about 5 per cent of the total, is lost. This heat loss is a considerable item, and for that reason dry hot cleaning is recommended. With gas containing 0.2 (or less) grains dust per cubic foot at standard conditions (0.2 grains or less dust content is the usual requirement), the maximum boiler load which can be carried with one tube blowing per day shift is about 190 per cent. Our standard furnace will supply continuously, except at casting times, about 3,600 boiler-horsepower, which at 155 per cent rating calls for 2,300 hp. units. These large units, fired by blast-furnace gas and pulverized coal, permit a lower investment than separately fired boilers and a wide range of capacity in the firing, with lower labor costs and good economy. Tar, coal, coke and coke-oven gas may be fired in the same boiler installations with good economy in addition to the other fuel. This the author has tried over a period of five months in a temporary boiler installation with good success. It is probably an indication of future developments.

In the plant assumed the blast-furnace gas will produce continuously 9,000 kw. During the heavy load period of the day 100,000 kw.-hr. must be produced in addition by other fuel, and this is in addition to generating the steam necessary for blowing each furnace and the plant steam supply over the amount produced at the open-hearth plant. No exact balance between the electrical demand and the supply of furnace gas is possible. The byproducts available in excess of all plant requirements each day in this plant, and which may be stored to some extent for use at the power plant as desired, are as follows: 30,000 gal. tar (18,000 B.t.u. per gal.); 570 tons coke (domestic and breeze); 5,000,000 cu.ft. coke-oven gas (550 B.t.u. per cu.ft.).

Assuming 23,000 B.t.u. per kilowatt-hour produced and a factor of availability of 50 per cent, which is low enough certainly, these byproducts represent 270,000 kw.-hr., leaving approximately 150,000 kw.-hr. which may be sold outside of the plant each day. During periods when the rolling mills are not in operation surplus power will exceed this figure materially. The market value of these byproducts on a B.t.u. basis is lower than that of coal and the most profitable sale is in the form of electrical energy.

Opportunity for Profitable Business

The estimated cost of the power station for this plant is about $5,000,000 complete. The sale of this surplus power alone would bring in a gross income around $1,200 per day, somewhat over 6 per cent on the investment. By improving the load factor and utilizing more fully the byproducts this becomes very profitable business. By supplementing these fuels with pulverized coal a flexible and efficient method is provided for handling load fluctuations. Such a station operating on byproducts and pulverized coal can be made a very important generating station of any connected system and can be operated in such a manner that further economies may be made. In case the mills and foundry do not exist or are not in operation, the tar is increased to 41,000 gal. and the coke-oven gas to 27,000,000 cu.ft. per day. Any successful plan of obtaining the electrical loads of the steel industry should be of great value to central-station organizations.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Electric Overhead Distribution Maps for Central Stations

MAPS of overhead systems must be readily intelligible to every one who has occasion to use them, according to a paper presented by H. S. Chartier of the Fulton County Gas & Electric Company (Gloversville, N. Y.) before the convention of the Empire State Gas and Electric Association at Utica, N. Y., in May. The maps must be easily made and not difficult to maintain and must be in easily accessible places and protected from dust and exposure.

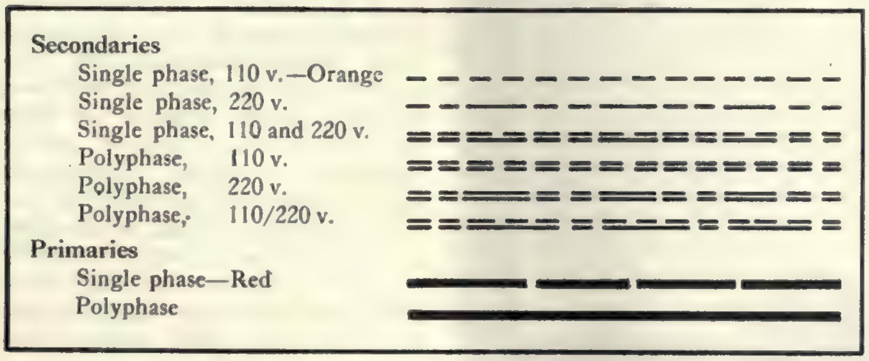


FIG. 1—METHOD OF MARKING SECONDARIES AND PRIMARIES ON DISTRIBUTION MAPS

Plain paper prints are not sufficiently durable. Paper with a cloth back is not suitable because the ink will penetrate the paper, and when erasures are made a hole results which allows the ink to smear over the cloth. The maps should preferably be blue-line prints on cloth. These prints are extremely durable, do not crack, stand erasing and do not smear when ink has been applied over an erasure.

The making of these prints is somewhat expensive as it is necessary to prepare a tracing and a Van Dyke. However, streets do not change frequently, and it is seldom necessary to remake a tracing or Van Dyke, but merely to have additional prints made when the maps are worn out or the electric information on the distribution maps becomes obsolete.

There are many ways of mounting maps, and where there are a large number to display they will presumably be mounted on rollers similar to the ones used for window shades or flat on some composition board. The first-mentioned plan has the advantage of being very cheap and of holding a considerable number of maps in a comparatively small space. The rolls can be supported in a cabinet with a swinging door so as to keep them free from dirt. This method has a few disadvantages, however, that are not present in the other. When the maps are rolled there is a tendency to break the surface and thus reduce the life to a considerable extent. This method does not allow the use of marking tacks.

The second style of mounting is considerably more expensive but is at the same time much more satisfactory. The supporting frame may consist of a vertical standard to which are hinged the composition-board sheets in a light metal frame so that they swing as sheets in a book, or they can be mounted in thin drawers in a cabinet which allows them to be pulled out. The frames should be at least 36 in. x 48 in. and may be as large as 42 in. x 60 in. The larger sizes are particularly desirable as they allow the ordinary village of one or two thousand inhabitants to be shown on one page with a scale of 100 ft. to the inch. A city of ten to forty thousand requires about eight or ten pages on the same scale. Ten to forty maps can be supported on the ordinary commercial frames.

The scale of 100 ft. to the inch will probably be found most desirable for ordinary construction. Very light construction can be shown on a scale of 200 ft. to the inch, and in extremely congested districts the

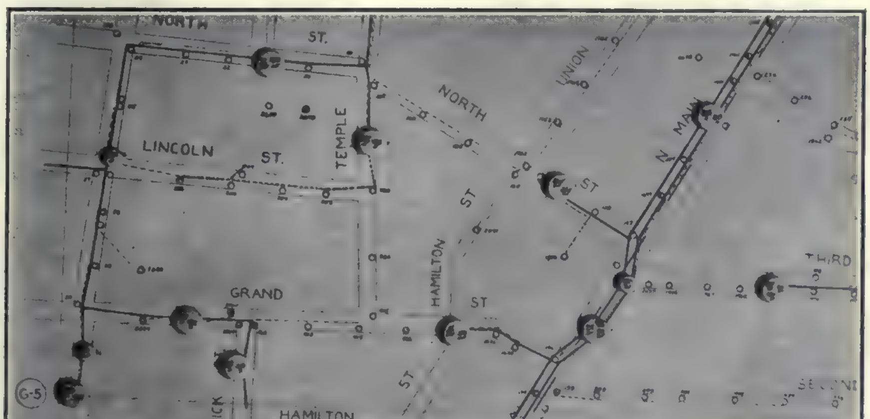


FIG. 2—DISTRIBUTION MAPS MUST BE EASILY MADE AND NOT DIFFICULT TO MAINTAIN

scale of 50 ft. to the inch should be ample in most cases. The 100 ft. scale allows for more than half a square mile on one map of the large size. The blue-line print is somewhat more desirable than the black as it allows the electrical construction to show more prominently, and incidentally it is about 10 per cent cheaper.

As regards the various parts of the distribution work, the supporting structures are the first essential in building a line. For poles a rubber stamp with a ⅛-in. (inside diameter) circle will facilitate marking the location. A black pad can be used for poles owned by the company and red or purple for poles of foreign companies. Presumably most companies are blessed with joint poles, and probably the easiest way of showing this is to fill in one-half the circle. By dividing the circle vertically and coloring either the right or left half the electric company makes provision for two different joint relationships, and by dividing it horizontally for two more. The fully colored circle would denote a three-party ownership, and as that is usually the ultimate condition the coloring is progressive and erasing is not required. Pole numbers can be put on the map in ink as they are of a nearly permanent nature.

Lines are the greatest variable and require the most frequent changing. The scheme should be such that in the change a minimum of erasing will be required. Primaries are the first essential, but as the system grows it is the secondaries that are most frequently extended. When they become loaded they are changed over to primaries and extensions again made. Using orange for secondaries and red for primaries allows for this logical method of growth without erasing. This is shown in Fig. 1.

The very important step of the connection between primary and secondary has not as yet been considered. This is probably the cause of destroying more perfectly good maps than any other thing, for transformers are the floating population of the electrical industry. With maps on rollers there is little that can be done other than to draw a circle or mark an X by the pole supporting the transformers and print the capacity and companies' numbers. The flat mounting allows the use of celluloid-covered tacks. White with black figures is the most satisfactory. The ⅜-in. tack is large enough for one transformer and the ⅝-in. for two or three. These are very inexpensive and provide an extremely flexible method of showing the location of transformers without destroying the maps.

Sectionalizing switches, lightning arresters and other apparatus can be shown on colored tacks which have a flat surface for convenient lettering.

Maps properly made on cloth and mounted flat should have a life of at least ten years so far as the electrical record is concerned, and a draftsman should be able to fill in the construction on one page in one or two days. This is particularly desirable as extensive rebuilding might make a section obsolete, and it would be simpler to make a new one than to attempt to correct the old.

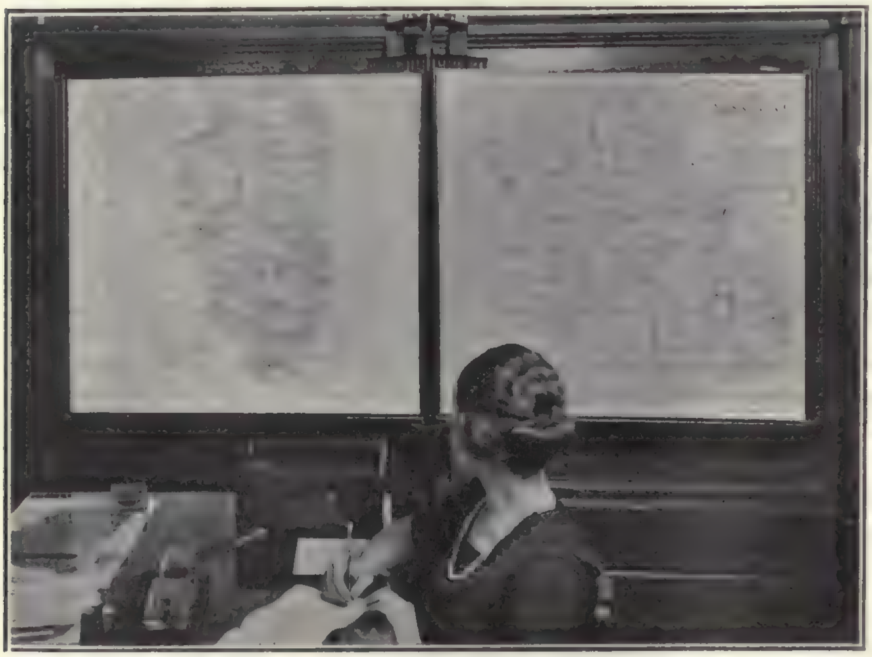


FIG. 3—HINGED SUPPORTING FRAMES FOR MAPS WHILE SOMEWHAT EXPENSIVE GIVE THE MOST SATISFACTION

Cost of Automatic Hydro Plant at Searsburg

DETAILED costs of the recently completed hydro-electric plant of the New England Power Company at Searsburg, Vt., were filed with the Massachusetts Department of Public Utilities by President H. I. Harriman a short time ago. This station is an automatic installation and was described in the ELECTRICAL WORLD for May 19, on page 1143, by E. B. Collins. The construction involved a dam, 4 miles of wooden-stave conduit, penstocks and generating plant on the Deerfield River, with an installed capacity of 4,500 kw. using a head of 245 ft., the installation of control circuits, an auto-transformer, quarters for required attendance, land, surge tank, outdoor substation, right-of-way for 18,413 ft. of conduit line, headworks, flowage and riparian rights for pond area along both sides of the Upper Deerfield for 23,000 ft., aggregating 380 acres. The total cost, subdivided in the accompanying table, was $1,939,689, or $431 per kilowatt of capacity installed.

COST DATA FOR 4,500-KW. HYDRO ELECTRIC PLANT

Local and general camp operation, field engineering, etc.	$109,737
Construction plant	115,858
Preliminary surveys, test pits, roads, etc.	62,501
Dam and appurtenances	163,316
Conduit, 96-in. wooden stave with concrete cradles	481,537
Surge tank, steel, 50 ft. x 35½ ft.	30,878
Penstock, steel, length 550 ft., diameter 8 ft.	21,388
Power-plant building, steel, concrete and brick, 33 ft. x 40 ft.	48,579
One 6,200-hp. I. P. Morris turbine	53,478
Miscellaneous equipment	2,483
One 5,000-kva. G. E. generator, exciter, etc.	76,394
Testing and starting	1,870
Auto-transformer, for stepping up 22-kv. energy at Mount Mills	8,334
Property for operator's quarters, as needed	3,658
Control circuit for automatic operation of plant	3 386
Sub-total	$1,183,403
Contractor's and engineering expense	183,427
Contract payment for dam and pipe line construction	24,000
Land for plant, surge tank, penstocks, outdoor substation, conduit right-of-way, flowage and riparian rights	520,000
Interest during construction at 6 per cent	31,333
Credit on removal of 165 telephone poles	2,475
Total Searsburg plant	$1,939,689

Combined Local and General Lighting Best for Machine Shops

By J. J. McLaughlin
Illumination Bureau, Westinghouse Lamp Company, New York.

Frequently when fairly good general lighting is installed in a plant there is a tendency on the part of the executives to believe that the lighting problem is entirely solved. While it is true that in the general run of work of shops, such as machine shops, overhead illumination of the proper type will provide sufficient illumination, there is none the less generally some very fine bench and machine work that requires local lighting of high intensity. This might make it seem that lighting of an entirely local nature would be preferable, but this leaves dark spaces and corners between machines that are extremely dangerous. With a well-balanced system, it is often possible to reduce the general illumination, allowing a sufficient intensity for ordinary work and installing local lighting units for fine work, thereby providing better illumination at a lower cost.

An ideal machine-shop installation, upon which numerous tests have been made, has recently been completed by the Westinghouse Lamp Company in its Bloomfield (N. J.) plant. This shop consists of twenty-six 20-ft. x 20-ft. bays with 12-ft. ceilings. The ceiling and walls to a distance of 5 ft. above the floor are painted white, while the rest of the wall is painted a buff color. The overhead illumination consists of 150-watt gas-filled lamps, bowl-enameled, with "RLM" reflectors spaced 10 ft. apart and mounted 9 ft. 6 in. from the floor. This makes an average of four units to a bay. The four units are controlled by a ceiling pull switch in the center of each group, thus permitting a flexible and economical control.

The local lighting consists of 50-watt "Mazda" lamps with Westinghouse standard bowl reflectors and adjustable arm brackets. These units are mounted on the back edge of the benches in a position that permits the arm bracket to be adjusted in any position that the workman may desire or require. The overhead system provides an average intensity of 10 foot-candles throughout the room, which is sufficient for ordinary work. When local lighting is used with general lighting from 40 foot-candles to 50 foot-candles is thrown on the plane of work.

Indiana Utility Uses Hard-Drawn Wire

By J. W. Walker
Operating Superintendent Traction, Light & Power Company, Anderson, Ind.

After several years of experience with hard-drawn wire for use in rural transmission, the Traction, Light & Power Company, Anderson, Ind., is now using this type of wire on all its new construction work. Some of the primary advantages in the use of hard-drawn copper over the softer grades are: (1) The appearance of the line is better; (2) the line will stay up with the same sag it had when being pulled, and (3) there is but little difference in the initial cost of hard and of soft wire.

The only objections to this grade of wire are voiced by the linemen, who claim that it is harder to work with. Undoubtedly more care must

FOUR VIEWS SHOWING (TOP LEFT) DAYLIGHT, (TOP RIGHT) GENERAL, (BOTTOM LEFT) GENERAL AND LOCAL, AND (BOTTOM RIGHT) LOCAL ILLUMINATION IN MACHINE SHOP

Notice in Fig. 2 the even distribution of light throughout the room. In Fig. 3, where general and local lighting is in use, the effective illumination is practically the same as the good daylight illumination shown in Fig. 1. Fig. 4 represents the same part of room with the general lighting units turned off. This leaves dark spaces and dangerous corners between machines and benches.

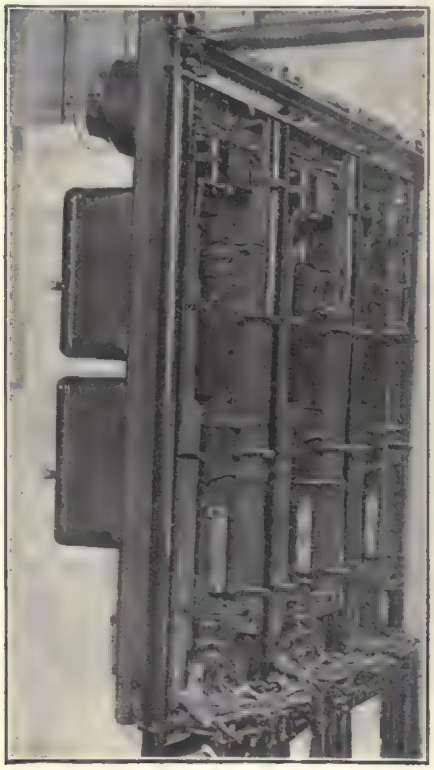
be given it to prevent kicking, but a little patience will go far in making the linemen realize that a line well strung during the time of construction will mean less time wasted later on in repulling.

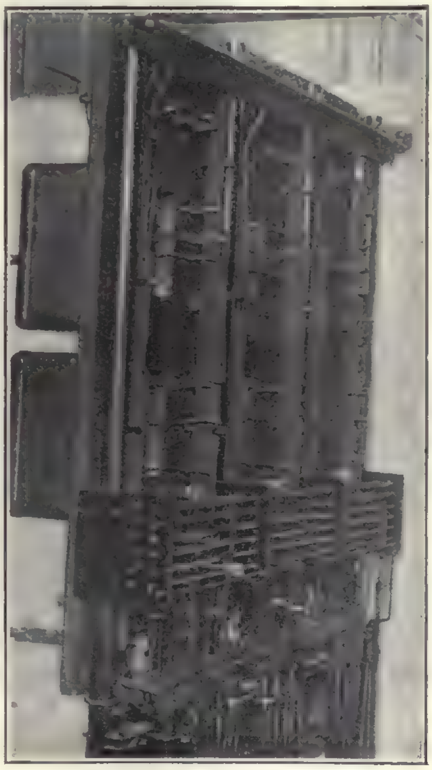
An argument against the use of this grade of wire which relates to the danger of it snapping during sleet and snow storms can be refuted by testing the tension on the line with a dynamometer. With this precaution there need be little fear of going beyond the safe margin of the rupturing strain. A word of caution might be given to linemen not to exceed this limit despite their desire to build a line with only a slight perceptible sag.

Crowding of Switchboard Wiring Avoided

By D. D. Clarke
Electrical Engineer Kansas City Power & Light Company, Kansas City, Mo.

THE usual method of bunching wires as they come from conduits at the back of a switchboard panel, as shown in Fig. 1, makes trouble hunting a difficult job. To get away from this, the "open-bus" wiring method shown in Fig. 2 is used by the Kansas City Power & Light Company. This is used for all connections from the conduits that are joined to more than one point on the switchboard. Connections are readily traced, and time of repair men as well as time out of service for the switchboard itself is saved by the open arrangement. The appearance is also much neater.





FIGS. 1 AND 2—EXAMPLES OF IMPROPER AND PROPER SWITCHBOARD WIRING

Distribution by Aerial Cables Increasing

By F. A. Westbrook,
Formerly Field Engineer Habirshaw Electric Cable Company, Yonkers, N. Y.

EXTENSIVE inquiries have indicated that aërial cables for power transmission and distribution have been used sporadically over a wide range of territory. This practice until very recently has been more in the nature of a means of getting around some specific and peculiar difficulty under exceptional conditions than a standard method of construction. Recently, however, the realization that aërial cables can be regularly used in localities where open-wire construction is too hazardous or otherwise impracticable and where underground conduit is too expensive has been gaining ground.

For instance, the Westchester Lighting Company, which two years ago had only a small amount of aërial cable in service, now has several miles and is planning the installation of a good deal more. This cable has been adopted as one of the standard methods of construction of this company.

One of the principal forces which have given impetus to this method of construction has been the problem of serving the large single consumers of power which have arisen during the recent rapid progress of industrial electrification. It has been desirable to distribute at high voltages, but open-wire circuits within congested areas have been too dangerous, and the density of consumption of power along the route frequently too low for an underground system, so that aërial cables are being resorted to more and more. Then the concentration of generating machinery in large central stations with many substations scattered over a wide area of thickly settled suburban territory has also made the use of aërial cables desirable for high-voltage feeders to substations, on account of the danger of open wires, the greater assurance of continuity of service with cables, and the question of tree trimming.

Aërial Cable Gives Satisfaction

So far as is known, aërial cables have always given satisfaction to those who have had occasion to use them, but it is also true that the practice is not yet general or even considered by a great many central-station companies even among the largest in the country. This was shown at the annual meeting of the Pennsylvania Electric Association at Pittsburgh, where a paper on this subject was read and discussed. The discussion so far as the central-station companies were concerned was mainly in the nature of asking questions. Most of those present had had no experience in this line. The single exception was the Duquesne Light Company of Pittsburgh, which is probably the largest and most consistent user of aërial cables in the country. There are many miles of such cable in Pittsburgh, and the practice has been standard with the company for several years wherever the conditions indicated the advantage of its extensive use.

Some large industrial plants, such as steel mills, where considerations of safety and continuity of service make high-tension open wires particularly objectionable, are also making use of three-conductor aërial cables, and the faith and enthusiasm of the engineers responsible for the supply of electrical power bid fair

to bring about their general use in the near future within the confines of plants covering a large area.

The meeting in Pittsburgh was significant from two points of view —the fact that the question of the use of aërial cables was considered of such importance as to give it first place on the program of the session and the fact that, although it excited a lively interest, there were none present, with the exception of the Duquesne Light Company's representatives and the manufacturers, who could contribute anything to the subject.

Extracts from an Operating Code*

Operation of Turbines that Are Under Load

INSPECTION of apparatus and tabulations of all necessary readings are the most important features to consider under the routine procedure for operating a turbine room. Detailed instructions covering inspection of all apparatus and a tabulation of the readings to be taken are given below.

1. The running engineer or assistant running engineer must make routine inspection of turbines or engines carrying load. Inspect the oiling system, noting temperature, to see that the bearings are not being overheated, that water is flowing to the water-cooled bearings and that proper pressure is being maintained on step bearings.

2. Inspect and adjust the steam seals to maintain maximum vacuum.

3. Oil, at stated intervals of time, any movable parts not automatically oiled.

4. Observe all instructions stated on machines.

5. Inspect the governor on each machine—see that there is no excessive vibration and that the guides of the governor rods are not binding.

6. Enter on the proper log sheet the following: (1) Hourly readings of vacuum, condenser discharge temperature, wet pump discharge temperature, all bearing temperatures, steam pressure, steam temperature, injection temperature, boiler-feed temperature and barometer reading. (2) Daily mechanical test readings at two load conditions, one at approximate maximum load, the other at approximate average load, as follows: Load in kilowatts, steam pressure, vacuum in condenser, step pressure, first-stage pressure, exhaust-steam pressure, number of by-passes open, hot-well or wet-pump discharge temperature and condenser discharge temperature. (3) The hours operation of stoker turbine and steam exciter.

7. Enter on the proper log sheet the following: (1) Designating numbers and hours of operation of circulating pumps, air pumps, wet pumps, boiler-feed pumps, accumulator pumps, heaters and heater pumps, air compressors, river-water pumps, house pumps, vacuum-heating-system pumps, evaporators and pumps and miscellaneous. (2) Readings of integrating meters.

8. At midnight (or other specified time) change the recording-instrument charts.

9. Enter, under "Engine Room Report," any other items pertaining to the day's operation which are worthy of permanent record.

10. The assistant running engineer or oiler on the pump-room floor must make periodic inspection of all auxiliary apparatus, noting (a) on turbine-driven pumps all operations stated for main turbines, in so far as they apply; (b) on pumps the condition of bearings, to see that oil is circulating and that water is being supplied to water-cooled bearings, and (c) on boiler-feed pumps the condition of regulators, to see that the proper differential is being maintained between boiler-feed pressure and steam pressure.

11. The assistant running engineer or oiler must assist the running engineer to get together the readings for entry upon the log sheets.

12. Spray lines on boiler-feed pumps are to be used only when the pumps are becoming steam-bound.

13. Inspect the reduction gears for vibration and see that oil is circulating.

14. Note, at frequent intervals, the discharge pressure on circulating pumps and keep this within operating limits.

15. Inspect heaters to see that proper temperature and water level are maintained and that all automatic valves are functioning freely.

16. On surface condensers note, at frequent intervals, the temperature rise of injection water.

17. On engine-driven auxiliaries lubricate all moving parts not self-oiled and inspect the valve governor mechanism to see that it is in operation.

20. In operating Corliss engines note that the latching of the valve-lifting mechanism is positive. At light loads it may be necessary partially to close the throttle to prevent nipping of the latch plates.

21. To give full instructions for operation and care of machinery under load would cover a vast field as the conditions vary at different stations; therefore what should be done under extraordinary conditions is left to the judgment of the men in charge.

Relay and Oil Switch Trip Test

THE following test should be made every two weeks on each relay and oil-switch trip in generating stations and once a month in substations. The load dispatcher should be consulted as to the time of day at which the test should be made. The test is made to determine whether a relay will operate the oil switch under a heavy current, but it gives no indication of how much current is required or of the time. It does not take the place of the regular calibration test. Following are the rules for conducting this test:

1. The line or circuit whose relays are to be tested must either have its load entirely removed or be in parallel with another, so that its dropping out will not cause an interruption to the service.

2. Close the main oil switch on the line or circuit to be tested, if it is not already closed.

3. Open the relay test switch.

4. Connect the primary side of the relay test box to the proper source of power.

5. Connect one lead of the secondary of the relay test box to ground and the other to the current lead of the relay.

6. Energize the relay test box; this will cause current to flow through the windings of the relay and operate it. Where the relay is of the reverse-energy type, it may be necessary to reverse the primary leads of the test box to operate the relay.

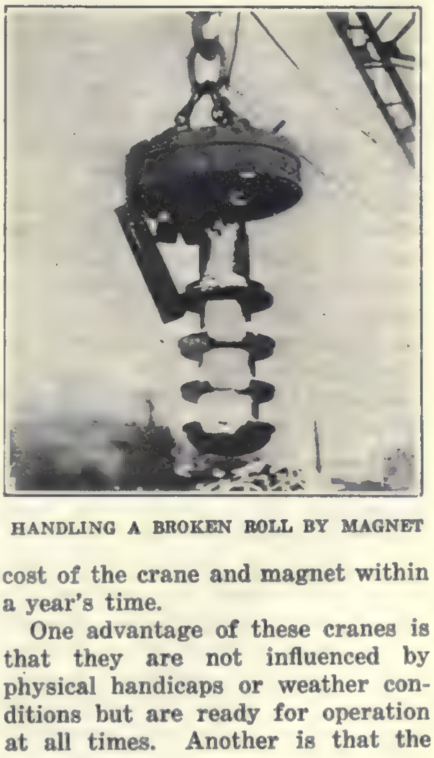
7. Observe the operation of the relay and see that it causes the oil switch to trip and the drop signal or bell alarm to operate.

8. Test the relay on each phase.

*Abstract from the operating code of the Philadelphia Electric Company.

Saving $40 Daily by Use of Lifting Magnets

BY THE installation of a 45-in. lifting magnet mounted on a locomotive crane a metal-scrap dealer in Cleveland reduced his operating force from twenty to four laborers without lowering his daily output of 300 tons. His operating costs with twenty men were $64 per day, while his expenses with the magnet and crane, including depreciation, repairs, crane operator and supplies, were only $24 a day. This saving per day of $40, or $12,000 yearly, was almost enough to pay the entire cost of the crane and magnet within a year's time.



HANDLING A BROKEN ROLL BY MAGNET

One advantage of these cranes is that they are not influenced by physical handicaps or weather conditions but are ready for operation at all times. Another is that the control is very simple.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Educational Value of Electric Appliances in High Schools

Progressive Central-Station Policy Yields Good Results—Company Directs Instruction—Testimony of School Authorities Proves Very Encouraging

BY I. R. CARLSON
Sales Manager Houghton (Mich.) County Electric Light Company

EVEN in these enlightened times the reluctance of the experienced housewife to change her methods of performing domestic routine is one of the chief obstacles to the more rapid electrification of the home. Much of this inertia has been overcome, but there yet remain a vast number of worthy housekeepers apparently bent on "getting along" with what they have.

Advertising has proved to be one of the greatest mediums for educating the housewife to make use of electric labor-saving devices, but it does not always accomplish its purpose. Sometimes the housewife fails to read the announcements, or if she does, is not fully convinced. There are, however, many potential housewives—millions of them in fact—who have not yet become confirmed victims of household drudgery.

The schoolgirl of today is the housewife of tomorrow, and we can teach her with comparatively little effort. If we now educate her to appreciate the convenience and advantages of electricity in the home, she will undoubtedly demand them in her own home, and we shall have "put across" for tomorrow the lesson we are spending so much to drive home to our present customers.

Moreover, the chances are that if the girl in the home is educated and convinced, she will reach her mother in a way we cannot, and we shall accomplish in a measure at least what we are striving for.

The home economics departments of our high schools are organized to train their pupils in the management and administration of a modern home. The modern home is an electrical home. Hence we have a common aim with the home economics department in teaching high-school students the use of electrical appliances. They should be teaching our lesson because it is their lesson also. The chances are that they are not doing it. In many cases they have not proper appliance equipment. Probably it will also be found that the teachers themselves do not appreciate the possibilities of electricity.

The Houghton (Mich.) County Electric Light Company, a Stone & Webster utility which serves the "copper country" of northern Michigan, has recently done some work along these lines with convincing results. The high schools of the district are all progressive and up to date with good home economics departments, but they were pitifully short of appliance equipment and no attempts were being made to teach anything about it.

In the fall of 1922 this company offered to equip the domestic science rooms of four of the high schools of the district with practically every electrical appliance that should be in common use in the home. The list includes flatirons, sewing-machine motors, percolators, toasters, table stoves, electric ranges, washing machines, vacuum cleaners, vibrators, curling irons, heat pads, mixers and many other appliances. The school boards were not bound to do anything at all in return; there were no "strings" to the offer.

In addition, the company offered the services of a man to demonstrate the appliances to the teachers and to the pupils. The gifts were accepted and the appliances installed, and the company representative gave one demonstration a week in each school in the regular classes until the course was completed.

Company Directs Instruction

In no case was the manufacturer's name mentioned in connection with the demonstration. The course was purely educational, and any marks of commercialism in the schoolroom would have met with the disapproval of the instructors and would have ended disastrously for the company.

ONE ROOM OF HIGH SCHOOL HOME ECONOMICS DEPARTMENT, SHOWING PART OF ELECTRIC APPLIANCE EQUIPMENT

At the close of the school year the company was invited to assist in preparing an examination for the classes on the subject of the uses of electrical appliances as applied to domestic science, and all questions submitted by the company were accepted. Our representative prepared the questions to emphasize the use of electric appliances in the home and the costs of operation.

The first question had to deal with the reading of an electric meter. Then the students were asked to compute the cost of operating the various appliances for a month with a specified time for the use of each appliance. Other questions were: "What appliances would you buy if you were going to equip a home for yourself?" "Why?" "In what way does electricity help a city to progress?" "Name five uses of electricity in Houghton County," and "What do you think of the idea of placing electric appliances in the high schools?"

The examination brought forth a large number of highly interesting answers which showed conclusively that the average student of the domestic science course had been impressed with the accomplishments of electricity in conducting the affairs of the household and with the economy of its use.

The results of this program, which was attempted at a considerable cost to the company, were watched closely, and in order to check the results of the schoolwork, an exhaustive survey of the communities in which the classes were conducted was made. Surprising reports were received in most instances.

LOCAL SALES BECAME GREATER

One contractor and retailer of electrical appliances in one of the communities wrote the company that his sales have shown a marked increase. Of the recent sales of electric washing machines, more than 70 per cent were made to parents of pupils who attended the classes where the washing machine had been demonstrated.

Other similar reports were received from dealers in electrical appliances, and after an experiment of several months the superintendents of all of the schools are in favor of continuing the course. One superintendent expressed his opinion as follows: "The appliances have been given a fair try-out, and I consider that they constitute a very valuable addition to our school equipment. Electrical aid for the housekeeper is the one progressive step that has been made in home economics in the last generation, and we consider ourselves fortunate to have such splendid equipment available for the instruction of our girls."

We do not hesitate to spend large sums for special campaigns or daily advertising, but it has paid in this case to inspect the schoolrooms and place at the disposal of teachers and pupils electrical appliances which they will welcome and which will bring a greater return upon the investment.

Alabama Power Exhibits at Chemical Exposition

THE opportunities which Alabama offers capital were presented in striking form by the Alabama Power Company at the ninth Exposition of Chemical Industries, held at the Grand Central Palace, New York City, last month, through an exhibit which afforded definite data on the state's natural resources and facilities.

A master map of the state, 8 ft. x 5 ft., portrayed the location of all mineral deposits which have commercial possibilities, sites of all chemical industries, electric generating plants, power transmission lines, substations, towns and cities served with hydro-electric power, transportation facilities, etc. Industrial possibilities were elaborated in detail in a series of smaller charts and maps. In the theater on the exposition floor three motion pictures of the Alabama Power Company, "King Cotton," "Electricity at Work" and "Minerals and Metals," were shown.

The Alabama Power Company has found that participation in industrial expositions of this nature has been very productive of results in bringing new industries into its territory. Plans have been completed by the company to have a booth with several representatives at the International Textile Exposition in Boston and also at the Power Show in New York, both of which will be held later this year.

Hints for Obtaining Electric Heating Load

SOME industrial engineers have yet to be convinced of the superior economy of electrically heated ovens and furnaces for industrial processes. If central-station power salesmen give careful attention to certain well-thought-out suggestions, declares John D. Noyes, Detroit Edison Company, they will be able to present this subject in a more convincing manner.

For example:

1. See that some one person or concern is responsible for and stands back of the oven design and installation.
2. Insist on a guaranteed performance in pounds of metal per kilowatt-hour and see that this figure is in line with the best modern practice. This will require that the electric oven be properly heat-insulated after erection and not merely assembled out of standard parts.
3. Do not discuss industrial heat applications merely on comparative B.t.u. costs of heat supplied. In electric heating a large part of the heat supplied goes into the work; in the combustion process 80 to 90 per cent of the heat in the fuel goes up the stack.
4. The oven should be properly laid out for the work required so that it will not have to operate at partial loads a large part of the time. If an oven is designed for 4,000 lb. of metal per hour, but operated at 2,000 lb. under normal conditions, its efficiency is greatly reduced, since radiation and ventilation losses are more or less constant. It is better that the oven be a little small. Put on a night run when necessary in rush times.
5. In any comparison of costs see that all expenses are covered. This will include fixed charges in the excess investment of the fuel-fired installation, incidental electric power for auxiliary motors, carrying costs of fuel in storage, etc.
6. The combustion process requires careful attention to keep it up to its highest efficiency. Temperature control is automatic, provided that the furnace and all of its auxiliary apparatus are in first-class condition. It appears doubtful that such an oven can be run without higher maintenance expense and more expert supervision than is required by the electric outfit.
7. The depreciation of high-temperature fuel-fired furnaces is high—20 to 25 per cent annually is about the rate of well-established installations and should apply here.

Broader Duties for the Power Engineer

PLACING a new power customer on the "closed business list" soon after connecting him to the central station's system is simply inviting misunderstandings and complaints against the service, warned H. E. Duren, chairman New England Division, N. E. L. A., Power Bureau, at the recent Swampscott (Mass.) convention of the division. Central-station executives should encourage their power engineers to develop closer relations with large customers in order that causes of complaints may be minimized before they assume serious proportions, as is likely to happen under a different policy.

The real work of the power sales department has barely begun with the closing of the contract. It should be the duty of some one in this department to become well acquainted with the engineering force as well as with the executives of the new customer. In many cases where a manufacturing concern has become "electrified" the rank and file of the engineering force, such as the stationary engineers, master mechanics and so forth, have not been consulted, and

often they are antagonistic to the central station for the simple reason that they believe the coming of purchased power means the loss of their positions or curtailment of their importance.

In a typical case an excellent stationary engineer occupied the post of chief engineer of a large New England cotton mill. The officials of the mill decided to purchase power to a large extent, shutting down a portion of their engine plant. The chief engineer immediately started out to obtain another position and finally got one in an engine-driven mill in another city. Within two years this second mill purchased a portion of its power and the engineer moved to a third city, although he remained chief engineer of the second mill for some time after it was partly electrified before he could find a new location. During this time there was hardly a month that there was not a dispute between the power company and the textile company over some item in the bill or the service.

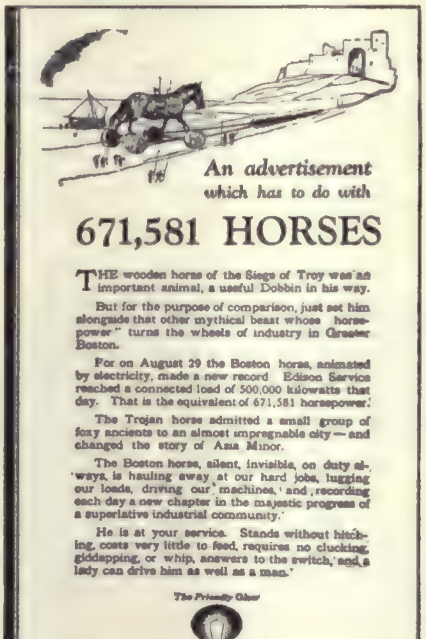
When the third mill also began to purchase part of its power the engineer gave up in disgust and for the first time in his life really attempted to learn something of the details of electric drive. In this he was assisted in every way possible by the power sales department of the central station and he is now an enthusiastic supporter of central-station service.

A little hard work with the men who are actually taking care of installations and are responsible for the successful operation of the machinery in customers' plants will prevent many of the minor troubles which might cause complaint being brought to the attention of the utility executives in much exaggerated form. It is the duty of the power sales department to see that the customer is obtaining the best results from the purchased power. Often in a business depression certain departments of a manufacturing concern will be nearly closed down, but, owing to ignorance on the part of the customer's operating force, these departments will be operated with motors much too large, and hence the amount of power consumed in these departments will not be in proportion to the output.

If some member of the power sales force of the central station will visit the plant frequently he can keep posted as to business conditions and often can show the customer how, by a slight rearrangement of his work or of his motor equipment, a very material saving can be made in his power consumption. This reduces to a degree the revenue of the central station during the period of curtailment, but it is during this period of slack work that the dollars look large to the manufacturer, and the loss in revenue to the central station at this time will be more than made up when business conditions improve.

To accomplish these results it should not be necessary to do anything except rearrange the work of the power sales departments. The more competent men should be relieved of a mass of detail which they are now required to thresh out, thus giving them more time among the customers.

Capitalizing a 500,000-Kw. Connected Load



A WHIMSICAL but effective advertisement calling attention to the recent attainment of a 500,000-kw. connected load was run in the Boston press a few days ago by the Edison Electric Illuminating Company. The inserted matter emphasized the contrast between the Trojan horse of mythology and the horsepower of modern electric service. A company celebration of this event in its load development was scheduled for Sept. 12, with a nighttime baseball game and other illumination features at the general service buildings of the company.

What Other Companies Are Doing

Dedham, Mass.—Eleven washers and two electric ranges were among the early sales at the Boston Edison Company's intercommunity electrical exposition last week, the first of a series to be held in its territory throughout the coming months. A $3,600 electric player piano was also sold at Community House, where the exposition took place. The company and local contractor-dealers co-operated actively in the displays and a new radio broadcasting station, "WTAT, Edison Light—the Friendly Glow," was opened at Dedham for general publicity purposes, this being the company's first popular broadcasting venture.

Atlanta, Ga.—The first part of October will witness the beginning of construction on a six-story addition to the present general office building of the Georgia Railway & Power Company. Changes to be made in the present building will provide for the installation of a cafeteria and club room in the basement for the benefit of the company employees. The new building will give 14,000 sq.ft. of additional office space, besides an assembly room, 60 x 40 ft., on the top floor and a substation in the basement. This basement is designed to house a 10,000-kw. substation, but 5,000 kw. will be the initial installation.

Wisconsin.—The Bloomfield Farmers' Club invited representatives of the Southern Wisconsin Electric Company to talk to the club recently on accident prevention in electric operation. O. B. Connor spoke and Merle H. Clapper demonstrated the prone-pressure method of resuscitation. In commenting on the instruction given, the chairman of the club complimented the company on its excellent service and the interest it had shown in promoting a wider knowledge of safety rules and methods of procedure in emergency.

Providence, R. I.—Instead of utilizing a new home to demonstrate the convenience and attractiveness of electric service to the public, the Rhode Island Electrical League has opened this fall its second electrical home in a remodeled residence. The house will be open afternoons and evenings from Sept. 29 to Oct. 20 on weekdays. H. E. Dawson, 501 Turks Head Building, Providence, is secretary.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Hydro-Electric Development and Steam Equipment

Devices to Reduce Leaving Losses in Steam Turbines.—I. R. Cox.—In the design of large turbines for operation at high speeds the limit of output is almost always determined by the allowable leaving losses at the low-pressure end of the turbine. Consequently, the problem of providing adequate leaving area becomes increasingly difficult at high rotational speeds. The methods of procuring adequate leaving area are dealt with in detail.—*Beama (England)*, September, 1923.

Surge Tanks. — F. JOHNSTONE-TAYLOR.—The laws governing the hydraulic conditions in relation to the speed control of hydraulic turbines are now well formulated, and one of the practical solutions for what has hitherto proved an intricate problem is the surge tank, which consists of a tank connected to the pipe line and placed in such a position as to allow the water to surge therein and by so doing to prevent dangerous rise of pressure in the pipe line consequent upon the closing of the governor gates. General characteristics of both the simple and differential types of surge tanks, and the operation of each, are considered. — *Electrical Times (England)*, Sept. 6, 1923.

Constructing Mitchell Dam on the Coosa River.—L. V. BRANCH.—The construction of this dam and of the power plant, which is to have an ultimate capacity of 120,000 hp., is described in detail. Railroad connections, plant layout, yard and plant railroad, cofferdam and steam control, quarry operations, crushing plant, concrete forms and permanent plant erection are considered. — *Engineering News-Record*, Sept. 27, 1923.

Operation of Hydro-Electric Stations. — RALPH BROWN. — Two conditions under which hydro-electric plants are operated to obtain the greatest output are where there is a limited amount of water and where there is an excess of water. Each of these two cases is considered.—*Power*, Sept. 4, 1923.

Generation, Control, Switching and Protection

Progress in the Design of Steam Turbo-Generators.—R. POHL.—More or less well-known details of the latest developments of steam turbo-generator sets of large capacity which have been previously published in this and other German papers are summarized in this paper. The last chapter, however, contains valuable suggestions as to future possibilities for the more economic and reliable operation of these machines. The author foresees a great future for the totally inclosed generator, cooled by a circulating gas, which is used over and over again without external replenishment. At a suitable point in the wake of the cooling gas, preferably under the generator, a system of water-cooling coils is interposed which absorbs the heat. By utilizing the heated water for boiler-feed purposes the effective efficiency of the generator may be raised from 95 per cent to 96 per cent, which may mean a great saving in fuel on a large machine. It is further pointed out that air, commonly used as gaseous cooling medium, is by no means the most suitable gas for that purpose. Carbon dioxide is too heavy, hydrogen is hard on the packing system, but nitrogen, and particularly helium, would give excellent results. It is claimed that the cooling action of the latter gas would be 25 per cent better than that of air. As neither of these two gases maintains combustion, the generator would be fireproof. — *Elektrotechnische Zeitschrift*, Aug. 9, 1923.

Generator Voltage Regulators.—J. H. ASHBAUGH.—The question as to why direct-current generator voltage regulators cannot be used to control the voltage of an alternating-current generator is explained. The operation of two types of voltage regulators for alternators is described. These regulators must have incorporated in them some feature that will prevent hunting. In one device described this is accomplished by directly utilizing the action of the exciter, while in another the inherent characteristic of a vibrating magnet is used.—*Power*, Sept. 25, 1923.

Transmission, Substations and Distribution

Automatic Alternating-Current Network Protector.—G. G. GRISSINGER.—An automatic alternating-current network protector has been developed for use on single-phase three-wire, two-phase three-wire and three-phase four-wire systems. It consists essentially of an electrically closed and tripped carbon circuit breaker and a group of relays. The principal object of this protector is to disconnect completely any faulty feeder from a distribution system.—*Electric Journal*, August, 1923.

Calculation of Condenser Bushings. —A. SCHWAIGER.—As this paper was written in the high-voltage laboratory of a university it is apparently not backed up by actual manufacturing experience. For this reason the results may or may not check up with those obtained from calculating methods familiar to American designers, which use this type of high-voltage bushing quite frequently. After developing the theory of series-connected condensers, coaxially arranged between a conductor and ground, two sets of curves are given, from which the number and individual height of the condensers may be determined for certain puncture and flashover voltages. The two curves will give a different number of foil layers for puncture and for flashover. In practice, of course, only one number can be used, so that it will be found impossible to fulfill simultaneously equal voltage distribution in a radial as well as in an axial direction of the bushing. A compromise will therefore always mean that a bushing of this type can never be designed with the smallest theoretically possible dimensions. It is of interest to note that the author's method obviates entirely any kind of capacity calculation. As a practical example the design of a bushing for 350,000-volt test voltage is shown.—*Elektrische Betrieb*, Aug. 29, 1923.

General Consideration of T-Type and Pi-Type Artificial Electric Lines.—H. NUKIYAMA and K. OKABE.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. summer convention, July 7, 1923, page 18.—*Journal of the A. I. E. E.*, September, 1923.

Units, Measurements and Instruments

Testing Electric Motors for Open and Short Circuits.—C. SYLVESTER. — The author explains how the ordinary measuring instruments can be used for locating open and short circuits in electric motors. — *Electrical Times (England)*, Aug. 30, 1923.

Determination of Chimney Sizes.—ALFRED COTTON.—The author presents a simple and orderly system, based on accepted characteristics, for determining the sizes of chimneys. He has found that certain essential relations exist between capacity, draft, diameter and height, when connected in the manner he outlines. Charts that are given show the static draft and maximum capacity of chimneys up to 500-ft. height and 25-ft. diameter, from which the working draft and capacity are found by means of the fundamental curve. Other charts give factors for various atmospheric temperatures, for altitudes and for approximate work based on boiler-horsepower. A problem is worked out to illustrate the use of the chart.—*Mechanical Engineering*, September, 1922.

Illumination

Lighting the Silk Industry with Incandescent Lamps.—H. W. DESAIX.—This paper is based on observations, investigations and experiments conducted by the author to secure for the silk industry a practical system of illumination to replace the present inadequate and impracticable methods. Each process in the manufacture of silk fabrics presents a problem in itself and each has to be so treated. A 250-word abstract of this paper as presented before a local meeting of the I. E. S., may be found in the May 19, 1923, issue of the ELECTRICAL WORLD, page 1168.—*Transactions of I. E. S.*, September, 1923.

Disappearance of Gas in the Electric Discharge.—Experiments that were carried out with evacuated incandescent tungsten lamps indicated that the disappearance or "clean up" of the residual gases by phosphorus is due to the adhesion of the gas to a solid film deposited by the discharge on the walls of the container. Other substances behave similarly to phosporus. The inactive gases are more difficult to eliminate than gases such as oxygen or CO_2, and a possible explanation to account for this difference is suggested. —*Paper presented before the American Electrochemical Society at Dayton, Ohio*, Sept. 27-29, 1923.

Motors and Control

Electric Textile Drives. — W. MÜHLENS. — Specialists in electric textile drives will find a great deal of information on well-established and late developments of European practice in this branch of exacting power drive. The article goes with considerable detail into the mechanical requirements of the drive of all the various machines needed for spinning, weaving and printing of wool and cotton goods. The special characteristics required for each drive are explained from tachometer records taken during perfect operation of the machine under consideration. It is shown when individual drive and when group drive gives the best result. In some cases the same machine is shown with the old steam drive and after electrification. The paper contains a great many photographs and a complete data reference.—*Elektrotechnische Zeitschrift*, Aug. 30 and Sept. 6, 1923.

Checking up Motor-Winding Diagrams.—A. C. ROE.—The author describes the developed type of diagram which shows every coil side and end connection as well as all stubs and jumpers. He then explains the simple single-line diagram and tells how a developed diagram may be changed to the single-line type. This is the first of a series of articles on laying out diagrams and procedure in connecting induction motors.—*Industrial Engineer*, September, 1923.

Heat Applications and Material Handling

Application of Electric Welding to Large Tank Construction.—E. J. RIGBY. An interesting account is given of the application of electric welding in repairing and constructing some of the Melbourne & Metropolitan Gas Company's gas holders. So satisfactory has the company's experience with this method of welding been that all classes of work possible are being welded.—*Journal of American Welding Society*, August, 1923.

Intra-Plant Haulage.—M. W. POTTS. —Various types of tractors and trailing cars that are being used at the present time extensively are described. Some of the advantages obtained from the use of the tractor-trailer system of industrial transportation are a reduced number of men on the payroll, cheaper operating costs, quicker and better deliveries of materials between operations, complete co-operation between departments, increased production, reduction of the amount of materials lost and damaged in transit, etc.—*Industrial Management*, September, 1923.

Electrophysics, Electrochemistry and Batteries

Production of Nitric Oxides and Ozone by High-Voltage Electric Discharges. — K. B. MCEACHRON. — This paper is a résumé of a bulletin of the engineering experiment station of Purdue University, setting forth the results of a series of tests made on a number of different discharge tubes. The design of tubes was such that the action of glow, sparks and glow, and sparks alone, could be studied separately. Tests were made with inclosed volumes of dry air and with moving air at different flow rates. The effect of pressure was also investigated. A new type of ozonizer was developed which produced high concentrations of ozone with only small yields of nitric oxides. The use of a mixed high-voltage discharge produces, under favorable conditions, the higher oxides of nitrogen, which is desirable from the standpoint of absorption. — *Paper presented before the American Electrochemical Society at Dayton, Ohio*, Sept. 27-29, 1923.

Extraordinary Diffraction of X-Rays. —L. W. MCKEEHAN.—The author considers the directed emission of characteristic X-rays from the atoms of a crystal placed in a narrow beam of X-rays containing short wave lengths. The theory presented was developed in attempting to explain the occurrence on photographs taken for the crystal analysis of iron, nickel and copper of spots at places and in positions quite inexplicable by the ordinary theory of X-ray diffraction in crystals.—*Bulletin B*-21-1, *Western Electric Company.*

Traction

Explosion on an Electric Locomotive. —On one of the single-phase Gotthard locomotives there occurred recently a violent explosion. Investigations disclosed the accident to have beyond any doubt been due to the following peculiar circumstances: A few days before the accident the core and coils of the locomotive transformer were taken out of the tank for inspection. It is assumed that in replacing them in the tank the winding became damaged or else some foreign metallic part dropped into the transformer which, on the day of the trouble, was responsible for a heavy internal short circuit. The arc of this "short" generated a large amount of so-called "oil gases," consisting mainly of hydrogen and methane gas, which escaped from the transformer tank, mixed with air and formed an explosive gas. This gas found its way to the contactors, located next to the transformer, where it was ignited. To forestall similar accidents in the future, a gas relief pipe, which will carry the gases through the roof into the air, is being installed on all locomotive transformers. A further precaution is an airtight seal between transformer and contactor compartments on all the locomotives. — *Elektrotechnische Zeitschrift*, Aug. 23, 1923.

Electrification of Foreign Railways. —S. PARKER SMITH.—In a former article the author considered the railways of Switzerland, and in this issue he discusses the Italian railway systems, which contain some of the earliest examples of main-line electrification in Europe. In the beginning most of the important Italian developments adopted the three-phase system, high-tension direct-current systems not being at the time perfected and the series alternating-current motor being in its infancy. The author considers in detail the large three-phase, 3,000-volt, 15-cycle to 17-cycle lines in Italy, with some observations upon the different types of locomotives developed for this service. There also exist in Italy direct-current lines at 650 volts and 4,000 volts, single-phase lines at 45 cycles and the newest development of the Rome-Tivoli line, three-phase, 45 cycles at a potential of 10,000 volts.—*Beama (England)*, September, 1923.

Energy Consumption Reduced in St. Louis. — B. F. THOMAS, JR. — Energy consumption tests made on United Railways of St. Louis have resulted in the installation of meters on 1,420 cars. The initial test procedure and results are described. One of the most important features in the campaign for reduction of energy consumption was the education of car operators. The complete installation resulted in peak load as well as over-all energy reduction.—*Electric Railway Journal*, Sept. 1, 1923.

Telegraphy, Telephony, Radio and Signals

Electrical Loud Speakers.—A. NYMAN.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. summer convention, July 7, 1923, on page 21.—*Journal of A. I. E. E.*, September, 1923.

Line Radio Communication.—A publication giving an introduction to the subject of line radio communication has been prepared under the direction of the Chief Signal Officer of the army with the co-operation of the Bureau of Standards. This pamphlet gives an explanation of how messages are carried to distant points by radio-frequency currents directed over ordinary telephone or power wires.—*Signal Corps Radio Communication Pamphlet No.* 41.

Mercury Arc as an Audio-Frequency Oscillator. — Y. WATANABE. — Investigating the problem of the oscillations produced by means of vacuum valves, such as mercury-arc rectifier tube or a tungar rectifier bulb, which are so soft as to permit ionization by collision, the author found that, besides the pure electrical oscillation, an oscillation could be produced on account of the pure mechanical oscillation of ions, positive or negative, in the arc vapor stream. — *Technology Reports of the Tohoku Imperial University (Sendai, Japan)*, Vol. III, No. 2.

New Books

Reviews of the Latest Contributions to Technical, Industrial and Commercial Literature of Particular Interest to Members of the Electrical Industry

Die Theorie Moderner Hochspannungs-Anlagen

By Dr. Ing. A. Buch. Munich and Berlin: R. Oldenbourg. 368 pp., illustrated.

The outstanding feature of this text is the attention given to electrostatic effects. The author holds that technical literature has thus far given insufficient consideration to methods of computation dealing with the insulation. An extended discussion is, therefore, justified, with recourse to all available mathematical methods, though as a matter of fact the mathematical demands on the reader are not at all severe. Even vector diagrams are used but sparingly and complex quantities not at all. Graphical methods, on the other hand, are introduced to good advantage, notably for working out the potential gradients in bushings, pin and suspension insulators, whose complicated shape renders analytical treatment practically impossible. Here interesting application is made of the idea of refraction of electrostatic lines of force at the bounding surfaces of media differing as to their dielectric constants. The mode of procedure is illustrated by concrete examples using data from current European practice. Though apparently somewhat tedious, as any solution by successive approximation is likely to be, it seems to get results.

The treatment of dielectric stresses in bushings and insulators, the data on the electrostatic capacity and power losses of various types, the suggestion of a definition for the efficiency of these devices, and the outlining of a mode of procedure for determining the conditions for minimum weight of material to meet specified requirements, are certainly timely. When the evidence is thus gathered in one volume, it is quite surprising to note the progress that has been made during the past few years in attacking analytically the host of problems relating to the behavior of solid, liquid and gaseous dielectrics. Results of American studies on corona are included.

As to cables, the operating voltages mentioned are impressive. Data are given on 30,000-volt, three-phase cables delivered in 1910, with test voltages of 75,000 applied for twenty-four hours and 90,000 momentarily; on a single-conductor cable for 60,000 volts, and mention is made of more recent practice running to 80,000 volts.

A discussion of transients is followed by one dealing with protection against their effects. Computations are shown for the inductance to be used in grounding the neutral of a line, as suggested by Petersen. It is reported that in this way the short-circuit current caused by the grounding of one phase is only from 4 to 15 per cent of the normal charging current.

The book brings together in textbook form a number of topics which well repay unified treatment. It is a valuable contribution to transmission literature.

G. F. WITTIG.

A Manual of Artificial Respiration

By Capt. G. R. G. Fisher. Boston: The Stratford Company. 80 pages, illustrated.

Captain Fisher's instructions are not based on theory or particular knowledge of the reasons for recovery, founded upon medical learning, but upon facts culled from a wide experience with the American Red Cross overseas during the war, from his connection with the British Army Medical Corps and from wide research. The Schaefer or prone-pressure method of resuscitation, which he selects as the most perfect, seems unquestionably to be adopted by all the authorities on artificial respiration. In connection with this method Captain Fisher, in Chapter XIII, dwells particularly on the importance of "counter-shock." His statements and experiences are most instructive. In one case he cites "a lineman was hit by 6,600 volts and fell thirty feet. Even though his left hand was burned off and the arm charred to the shoulder, still his mates actually revived him." This case is identical in nature with one that came under the reviewer's notice and that was reported in the ELECTRICAL WORLD for Feb. 26, 1916. A few further facts in connection with counter-shock and its value may not be out of place here, more particularly as a medical authority has recently taken active steps to have reference to counter-shock eliminated from instructions in connection with the prone-pressure method.

On Nov. 6, 1920, in the ELECTRICAL WORLD, were described in detail two cases occurring six weeks apart, both caused through contact, while the victim was on a pole, with 2,200-volt circuit to ground, the shock being through both hands. In each case the victim's name was shouted in his ear and he was struck on the point of the jaw, recovery being made right on the pole. In all, nine such cases have come under the reviewer's notice. Numerous other instances are on record. Without this evidence Captain Fisher has proved his case. He states on authority that every year a thousand lives are lost from electric shock. The reviewer does not know of any recovery without the aid of a fall or counter-shock, and if seven-tenths of these lives, as is asserted, can be thus saved, is not counter-shock worth while?

W. P. STRICKLAND.

La Radiotéléphonie

By Carlo Toche. Paris: Gauthier-Villars et Cie. 98 pages, illustrated.

In this little book of less than one hundred pages the author finds space for ten photographs of apparatus which add little to its value. Since the book is limited in size the material included could not be fully developed. Nevertheless it is interesting and readable. It is elementary and non-mathematical in character and is intended primarily to give a survey of this phase of radio without attempting to supply detailed information for the experimenter. For example, in the first chapter the author discusses the microphone, the effect of the voice waves on the current, the function of the permanent magnets in the telephone receiver systems of transmission including ordinary wire, carrier current and radio, and the necessity of undamped waves and how they are produced. Within the limits of twenty-three pages a detailed discussion of the various elements is impossible. However, the question of the production of undamped waves is somewhat amplified in the thirteen pages devoted to the arc and the high-frequency alternator, including some historical references and numerous diagrams showing how modulation may be obtained, and in the twenty pages on the use of vacuum tubes in radio telephony, including the characteristics and construction of the vacuum tube, the production of undamped waves, high and low frequency modulation and so forth. The remainder of the book takes up reception and the application of radio telephony. The treatment is logical and concise and makes one wish the author had expanded his subject. H. M. TURNER.

Books Received

Electrical Vibration Instruments. By A. E. Kennelly. New York: Macmillan Company. 450 pages, illustrated.

English for Engineers. By S. A. Harbarger. New York: McGraw-Hill Book Company, Inc. 266 pages.

Principles of Direct-Current Machines. By Alexander S. Langsdorf. New York: McGraw-Hill Book Company. 470 pages, illustrated.

Practical Electroplating. Fifth edition. Revised and enlarged. By W. L. D. Bedell. 407 pages, illustrated.

The Elementary Principles of Lighting and Photometry. By John W. T Walsh. New York: E. P. Dutton & Company. 220 pages, illustrated.

A Textbook of Intermediate Physics. By A. Moore. New York: E. P. Dutton & Company. 824 pages, illustrated.

Alternating Currents, Their Theory, Generation and Transformation. By Alfred Hay. London: Harper & Brothers. New York: D. Van Nostrand Company. 420 pages, illustrated.

Kent's Mechanical Engineers' Handbook. Robert T. Kent, editor-in-chief Tenth edition, 1923. New York: John Wiley & Sons. 2,247 pages, illustrated.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Hoover Takes Up Superpower

Secretary of Commerce Invites Heads of New England and Middle Atlantic State Commissions to Confer on This Subject in New York

CHAIRMAN of public service commissions in the Northeastern States, on invitation of Secretary of Commerce Hoover and with the approval of President Coolidge, are to meet in New York today (Saturday, Oct. 13), in the United Engineering Societies Building, for a preliminary discussion of steps that may be taken properly by federal and state authorities in the promotion of superpower development in the New England and Middle Atlantic States to meet the "growing, insatiable and general need for power." Members of the federal Superpower Survey that investigated the subject two years ago will also attend the meeting.

The aim of the conference, as officially announced, is to discuss steps toward a more effective co-ordinated power production between public authorities and industries in the interest of the public, to the end that the widest possible use may be given to the advances made in the development of electric power and to achieve the highest possible national economy in power production and distribution through interconnection of power supplies between existing great utility systems and in common action for the erection of large units of production at advantageous points for the mutual supply of two or more of the present systems and in the national development of great water-power resources.

TEN STATES TO BE REPRESENTED

Among those who will attend the conference are William A. Prendergast, chairman New York State Public Service Commission; Commissioner E. E. Stone, Massachusetts Department of Public Utilities; William C. Bliss, chairman Rhode Island Public Utilities Commission; Walter A. Dutton, chairman Vermont Public Service Commission; Richard T. Higgins, chairman Connecticut Public Utilities Commission; Harry V. Osborne, chairman New Jersey Board of Public Utility Commissioners; W. D. B. Ainey, chairman Pennsylvania Public Service Commission; Ezra B. Whitman, Maryland Public Service Commission; Charles E. Gurney, chairman Maine Public Utilities Commission; William T. Gunnison, chairman New Hampshire Public Service Commission; William S. Murray and E. S. Buckland of the Federal Superpower Survey of 1919; M. H. Aylesworth, executive manager of the National Electric Light Association, and O. C. Merrill, executive secretary of the Federal Power Commission.

Jewett Eulogizes Millikan

Speaking for Presentation of Edison Medal, He Describes Physicist's Main Achievements

THE Edison medal for especially meritorious achievement in the field of electricity was presented at the Pacific Coast convention of the American Institute of Electrical Engineers, held at Del Monte, Cal., last week, to Prof. Robert Andrews Millikan of the California Institute of Technology.

R. A. MILLIKAN

This award is the highest which the electrical engineers of America can pay. The presentation was made by Dr. F. B. Jewett, who spoke from New York over the transcontinental line of the Bell System. Dr. Jewett was president of the A. I. E. E. at the time the award was voted. A "public address system" installed in the convention hall made his words audible to every one present.

Dr. Jewett said, in part:

"Probably the best known and most noteworthy of Millikan's works are his so-called 'oil-drop' experiments, which were undertaken for the purpose of making precise measurements of *e*, that is, of the fundamental electrical quantity. These experiments proved conclusively that all electrons are alike, and the results obtained by Millikan have been of inestimable value in the calculation of physical constants.

"Second only to the oil-drop experiments is Millikan's work on photo-electric effect and his measurement of the so-called *h* constant. This is a universal constant of fundamental importance in the structure of the atom and in the relations between matter and radiation. Its meaning is doubtless not yet fully clear. By identifying and measuring this constant in his experiments on photo-electric phenomena Millikan made a very important contribution to modern physics.

"More recently Millikan's work has tended toward a definite bridging of the gap between light and X-ray phenomena. By this work he has pushed the ultra-violet spectrum down about two octaves, or nearly, if not quite, to the long-wave-length X-rays."

Dr. Jewett characterized Professor Millikan as being "in the first rank of physicists as a great consolidator and experimenter." He went on to say:

"Reference should also be made to the *Physical Review* papers of 1923 on the coefficient of slip, the reflection of molecules, and the complete law of fall of a particle through a gas at all densities. These 1923 papers establish both theoretically and experimentally the complete solution of the law of motion of particles through a gas.

"Among minor contributions may be named the establishment of the non-dependence of the photo-electric effect upon temperature, the experimental proof of the fact that a light wave may impart an energy to a free electron of the metal, the relation between the contact potential of a metal and the photo-electric work function, the determination of the law of Brownian movements in gases, the conditions for the detachment of two electrons from a single atom by the impact of an alpha or a beta particle against it, the non-existence of an intense penetrating radiation in the upper air, the extraction of electrons from metals by intense applied fields.

"All of Millikan's important contributions to experimental physics have been in the region which is particularly important to electrical engineers."

Dr. Jewett referred also to Professor Millikan's work during the war and in the formation of the National Research Council and to his influence as a producer of men.

Interconnection Study of New York State

Empire State Gas and Electric Association Discusses Possible Supersystem, State Regulation, Rural Lines, Rates, Accounting Systems and Inductive Co-ordination

MORE than two hundred representatives of New York electric and gas utilities gathered at Lake Placid on Oct. 8 and 9 at the annual meeting of the Empire State Gas and Electric Association to discuss problems of major interest facing the utilities. Much constructive work was done and a splendid group of papers and addresses was presented.

President M. J. Brayton in his address said that the utilities were never more prosperous and wisely administered or dedicated so truly to the ideal of public service. He predicted a greater use of hydro-electric power and asserted that a few years should see the power generated in the state all poured into one big pool so as to give better service. He stated that such a growth as is now taking place could not prevail if the industry were not built on a sound basis, yet a certain amount of loose talk affects credit and postpones or makes more difficult the rendering of still better service to the public. The association and the member utilities should take action to prevent detrimental legislation, he said, even though they have been accustomed to staying out of politics. The utilities are obligated to give the public the facts of their business in the light of intimate knowledge and experience.

Rural Line Extension

After encouraging reports from the secretary and treasurer, Bert H. Shepard gave the report of the rural-lines committee, which incorporated recommended practices and a rate-schedule formula. The idea presented of rural-line practice in construction was to obtain a line that would involve the minimum annual cost, and the rate schedule approved was one which would add to urban rate schedules a charge to take care of the excess cost of service involved, such as physical investment and cost of line and transformer losses. No direct relation exists between the rate and the amount of energy usage, load factor or diversity factor, the committee said, but if the urban rate schedules consider these elements, the rural user should be charged on the same basis.

W. C. Fisher criticised the report with respect to its general application and stated that usage and the location of customers with respect to power lines were factors that must be considered and that the complicated accounting system involved in determining charges and refunds was an objectionable feature of the recommendations. C. R. Vanneman, chief engineer of the Public Service Commission, thought that the rural question should be faced and some tentative agreement reached by the utilities as to the method of handling the business. He said the report was of a type to permit the commission to consider the question rather definitely as existing practices in respect to handling rural services were extremely variable. The utilities should consider carefully the building up of rural loads. For example, a farmer having a gasoline tractor should not be urged to buy a motor to apply to the same work. E. H. Rosenquest said that capital expenditures could not be standardized unless the method of securing a return was standardized. He thought local conditions faced by each company made it almost impossible to adopt standardized practices for rural services. The report was referred to the executive committee for action.

Intrastate Interconnection

An extremely valuable and timely report on the value of interconnection in the state and the immediate and future economies possible through this means was presented for the transmission-lines committee by the chairman, E. P. Peck.

The committee found that interconnection in New York State to an extent which is entirely practicable would, if lines and equipment were installed, permit the immediate release of 60,000 kw. of present capacity, representing the release of $7,875,000 of capital invested. By 1933 the saving in installed capacity would amount to 237,000 kw., representing a plant investment of $37,125,000.

Outside of the so-called metropolitan district, including New York City, Westchester and Long Island, there are 257 operating companies in the state. Of this number, 194 are dependent wholly or partly on water power, either directly through ownership of power sites or indirectly through the purchase of hydro-electric energy.

Eliminating the Niagara and St. Lawrence plants, it was estimated that the energy generated by hydro-electric plants in 1923 would amount to 1,250,000,000 kw.-hr.; also that an additional 250,000,000 kw.-hr. could be developed by existing hydro-electric plants and used to supply the rapidly increasing load.

Eliminating the plants in the metropolitan district, it was estimated that 500,000,000 kw.-hr. would be generated by steam during the year, and that of this amount 100,000,000 kw.-hr. would be produced from plants of comparatively low efficiency or from plants operating at low load factors.

Assuming that the additional 250,000,000 kw.-hr. which could be produced by the hydro-electric plants is salable at 0.5 cent per kilowatt-hour, and that the 100,000,000 kw.-hr. steam energy at low efficiency would cost 0.5 cent less per kilowatt-hour if generated in high-efficiency plants operating at high load factor, there resulted a total of 350,000,000 kw.-hr. at 0.5 cent, making $1,750,000 which could have been saved or earned during the present year by interconnection and efficient use of existing plants, without considering the Niagara, St. Lawrence and metropolitan groups. This amount capitalized at 10 per cent would justify an investment of $17,500,000. Saving in coal would amount to 137,000 tons, which, at $6 per ton delivered, would be $822,000. This was based on the estimate that an average of 2¾ lb. of coal is consumed per kilowatt-hour in these plants under present conditions.

On the basis of the capital released—$7,875,000, as shown—and capitalized operating savings of $17,500,000 an investment of $25,375,000 would be justified, while all the more important interconnections necessary to effect this saving could be made for less than half this amount, probably not more than $10,000,000.

The latest study, the committee said, showed a diversity in peaks in the up-state section of New York of approximately 29 per cent and a combined generating capacity greater than the simultaneous peak by 63 per cent. This figure of 63 per cent, however, included a large amount of steam equipment installed to carry the load during low-water periods, and it did not represent correctly the capacity which would be available for interconnected loads during the low-water periods.

The steam stations in the metropolitan district, the committee went on, have a large reserve capacity, except during their lighting peaks. This excess capacity could be made available to other companies in the state for the greater part of the time that the up-state companies require steam capacity. The low-water period in the hydro-electric plants does not normally come at the time of the year when the metropolitan lighting peak is on, and even at the season of the metropolitan peak the actual duration of the peak load is not a large proportion of the total time. Therefore the metropolitan steam stations could supply a very appreciable part of the steam power requirements of the up-state companies. By means of load displacement in the interconnected system very appreciable amounts of power may be transmitted over long distances without excessive loss. This plan of operation would permit the metropolitan companies to dispose of off-peak energy and would give an improved load factor. Owing to the high economy of these steam stations, a large saving in total cost would be made.

Requisites of Operating Agreements

In order to obtain all of the advantages of interconnection as previously outlined, it is necessary that the flow of power be determined almost entirely by the physical requirements and the available sources of power. Operating agreements between different companies should be such that these agreements would not prevent the operating departments from obtaining power freely from other companies when required for load or to obtain economies. One

way of accomplishing this, as has been done in some instances, is by making agreements covering interconnections and exchange of power in which the charges for energy are such that the delivering company neither makes nor loses any money by the transaction.

The committee recommended that future towers and substations be erected to accommodate lines operated at 132,000 volts, the initial installation to be insulated for and operated at a lower voltage of either 66,000 or 110,000, which will take care of the requirements in the near future; that 60 cycles be adopted as a standard frequency for future construction, and that systems operating at other frequencies change to 60 cycles if or when the change is practicable.

SAVINGS BANKS AND UTILITIES

The sentiments of savings banks toward the purchase of utility securities were voiced by George E. Stevenson of Hartford, Conn. He said that savings bank officials were coming to realize that they must not only protect the capital intrusted to them but also help build up the communities in which they reside. He could see no serious legal obstacles preventing savings banks from buying utility securities. M. S. Sloan urged all member companies to work in their respective communities to get savings banks to invest in gilt-edged utility securities.

A thoughtful and constructive address on hydro-electric development was given by O. C. Merrill, executive secretary Federal Power Commission. He accented the necessity for a national viewpoint in developing water-power resources and the necessity for formulating permanent state policies. He thought that the backwardness of New York in developing its water-power resources was due to the state not having any definite water-power policy.

On Tuesday H. O. Palmer reported for the accounting committee that the Public Service Commission would soon get out an order adopting the standardized classification of accounts and would give member companies the option of starting the new system on Jan. 1 of next year.

F. B. Steele reported for the advisory rate committee that demand rates had been studied but no definite conclusions reached. More than 147 different demand rates were found in use, with the greatest differences occurring in the width of the demand. The committee recommended the rural rate proposed by the rural rate committee.

J. O. Parker reported progress for the inductive co-ordination committee.

The New York State Committee on Public Utility Information, according to the report of the chairman, M. S. Sloan, is doing a very valuable work. Newspapers are using information compiled by the committee, the speakers' bureau is doing splendid work, and the industry advertising campaign has had a cordial reception.

"The Municipal Regulation Fallacy" was the subject of an able address by Carl D. Jackson. He said this question was settled in all states excepting New York and that New York needed to know all the facts about the utility business in order to prevent local regulation being established. He dwelt on the discriminatory rates that would result from local control, asserting that the opponents of state regulation were local politicians, those who wanted government ownership and those who advocated socialism and communism.

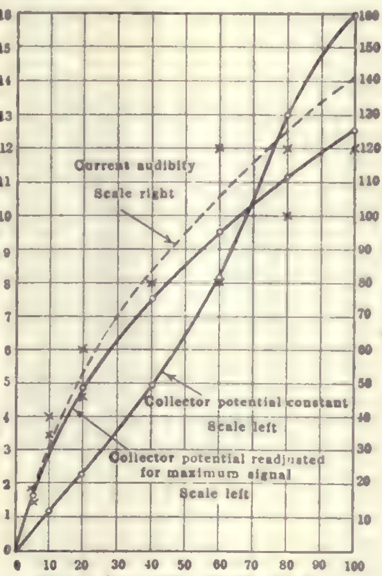
Dr. Murray Bartlett, president Hobart College, gave an inspiring address on the psychology of leadership and enumerated the moral and mental qualities necessary to real leaders.

Officers elected for the next year were: President, S. J. McGee, Ithaca; first vice-president, M. S. Sloan; second vice-president, E. G. Scobell. The executive committee will be M. J. Brayton, F. W. Smith, H. L. Mann and H. M. Brundage. Next year's meeting will be held on Monday and Tuesday in the first week in October at Lake Placid.

Progress in Wireless

New Applications of "Sodion" Radio-Detector Tube Are Described Before Radio Institute

APPLICATIONS of the new type of radio-detector tube which depends upon the ionization of metallic atoms for its operation were described by H. P. Donle, chief engineer of the Connecticut Telephone & Electric Company, Meriden, Conn., before the Institute of Radio Engineers in New York City on Wednesday of this week. The operating characteristics of this tube are very similar to those of the tube described by Mr. Donle last December (see ELECTRICAL WORLD for Dec. 23, 1922, page 1406). The present form differs in that no liquid sodium electrode is used. The outstanding features claimed for the "sodion" tube, as it is called, are high sensitiveness (about two stages greater than the hard-grid tube detector), pure quality of tone reproduction, stability in operation and absence of all interference-producing squeals and whistles as the tube cannot be made to oscillate or regenerate in itself.



NEW RADIO TUBE SHOULD PROVE INVALUABLE FOR MEASURING AUDIBILITY OF WEAK SIGNALS

Like the previous type, this tube has no grid but utilizes a tough-shaped piece of nickel, partially surrounding the filament and open toward the anode, as its control electrode. A glass shell contains the anode or plate, the filament and the collutor or control electrode. A heater is wrapped non-magnetically around the outside of the tube and a second external glass shell is placed over all elements for protection and to conserve heat. The tube is pumped to the highest possible vacuum and internally treated with an alkali metal (sodium) to provide the stable ionizing material that plays an important part in its sensitiveness.

The characteristic curves—anode current and collector-circuit current with the anode circuit opened and with it closed—are very similar to the curves shown in the article referred to above. When the potentials are properly adjusted the currents build up automatically to an equilibrium value fixed by the voltage applied to the collector. This building up is composed of a number of successive increases of current in the collector and anode circuits and reaches its delicate balance point after a time which is long as compared with a radio-frequency period. Any sustained radio-electromotive force applied to the collector circuit produces a marked and yet proportional drop in the equilibrium current, causing a signal in the telephone.

CHANGE IN CURRENT PROPORTIONAL TO AUDIBILITY

This proportional drop in collector current is shown in the accompanying illustration, which shows the amount of current change produced by the reception of a uniformly modulated wave at varying intensities. The lower curve was taken without readjustment of the detector, and its general inferiority to the other solid line indicates the advisability of choosing the best collector potential for varying signal intensities. A comparison of the upper solid line with the dotted line brings out the interesting fact that the change in current produced by an incoming signal is proportional to its audibility. It is clear that the tube thus gives an apparatus for reading audibility of weak signals directly from a meter. The scattering of observed points of the dotted line, shown by the crosses, is characteristic of the ordinary audibility measurements, while the way in which the points lie directly on the other curves shows the high accuracy of the new method. Thus, aside from its radio receiving application, the tube should prove of great value in the laboratory for measuring very small currents.

The relation of input radio-frequency and output audio-frequency power for the tube is a straight-line ratio, which is a desirable relation for reproduction of high-quality reception.

A. E. R. A. Attracts 4,000

Commissioners from Five States Address Big Convention Held at Atlantic City

WITH more than four thousand in attendance at Atlantic City from Monday to Friday of this week, the American Electric Railway Association held a most successful convention, with a larger space devoted to exhibits than at any previous gathering. Assurance that the railways have really weathered their financial storm and that they are satisfactorily finding a solution to the bus problem by using the bus as an auxiliary was apparent from the discussion. Much of the post-war "shake-down" period is over and the future looks brighter.

These ideas were verified specifically by President C. D. Emmons in his address. He also spoke of how Detroit with its municipally owned railway had been unable to operate at a profit at low rates and was now in the same position as privately owned railways, namely, forced to higher fares by higher costs. As to the association's policy regarding municipal ownership, the railways, he said, are not afraid of losing property or profits, because many railways had had no profit for years.

President L. C. Datz of the Engineering Association made a plea against duplication of work by various engineering associations working independently on allied subjects. He urged greater support of the American Engineering Standards Committee, which, he said, is proving a powerful agency in encouraging associations to co-operate.

The valuation committee presented a long and carefully prepared report. It was directed principally toward finding means of valuation which will make unnecessary repeated inquisitions. In a sense this report indicated somewhat of a breaking away from the association's previous insistent stand on present-day-price reproduction cost and a tendency toward a stabilized valuation on some more substantial basis.

COMMISSIONERS GIVE VIEWS

At Wednesday's session five public service commissioners spoke. While addressing themselves primarily to the railroad and bus regulation problem, they all discussed commission practice and the record of regulation, and all made a plea that public opinion and utility opinion should regard commission work with sufficient respect to encourage men of ability, courage and knowledge to become commissioners. Courts can never adequately handle extra-legal economic problems with full satisfaction. Commissions must not seek to be courts and must not try to manage, but must regulate with wisdom and judgment. Some of the difficulties of regulation under inadequate laws which give only partial jurisdiction were also outlined, and the statement was made that most successful utility operation is had under full regulation with a competent board, allowing a fair return which will attract the necessary capital to allow the utility to expand.

Britton I. Budd, president of the Chicago, North Shore & Milwaukee Railroad, the Chicago Elevated Railways and the Public Service Company of Northern Illinois, was elected president of the association for the coming year.

Farm Electric Conference in Washington

A conference on electricity on the farm is to be held in Washington on Oct. 17 at which virtually all agencies interested in the problem of the relation of electricity to agriculture and the widespread development of rural electric service will be represented. The Secretary of Agriculture, the Secretary of Commerce and the Secretary of the Interior will be present at the conference, as will also the members of the joint committee on the relation of electricity to agriculture which represents the National Electric Light Association, the Farm Bureau Federation, the Department of Agriculture and the Society of Agricultural Engineers. The names of the members of this committee were printed in the ELECTRICAL WORLD for Sept. 15, page 553.

The purpose of next week's meeting is to acquaint the government officials with the research program to be carried out jointly for the benefit of the farmer. It will be recalled that the joint committee has already secured the services of E. A. White, who will be stationed at Chicago, to help work out a program of research looking toward an adequate solution of the problem of electricity supply to the farms. Next week's conference, in line with that program, will be directed toward bringing all agencies interested to co-operate to a common purpose.

San Francisco Companies Will Not Sell City Systems

President W. E. Creed of the Pacific Gas & Electric Company, replying to former Senator Phelan, who is chairman of the committee appointed by the city authorities to sound the local power companies with regard to the sale of their San Francisco distribution systems to the city for the purpose of marketing Hetch Hetchy power, has asserted positively that the company considers its San Francisco system an integral part of its whole power system and will not sell to the city. The Great Western Power Company has also refused to sell its San Francisco properties and the only recourse now left to the city is litigation or the financing of a new distribution system at an estimated cost of $45,000,000.

Appliance Distribution Methods a "Joke"

John F. Gilchrist So Characterizes Them at Washington Meeting of Electragists—General Squier Predicts Universal Radio Through "Wired Wireless"

DECLARING that somebody has got to "get up nerve enough" to tell the industry that the results derived from present methods of distributing electrical appliances are a "joke," John F. Gilchrist, vice-president of the Commonwealth Edison Company, Chicago, discussed merchandising policies with exceeding frankness before the twenty-third annual convention of the Association of Electragists International this week at the Hotel Washington, Washington, D. C. Mr. Gilchrist estimated that very conservatively it should be possible to sell $700 worth of appliances to the average residence consumer now on the central-station lines. The fact that companies that are doing the best selling today are only "edging in" at the rate of $10 a year means that it will be seventy years on the present basis before these homes will be equipped to this extent. Meanwhile houses are being built faster than electrical men are appliancing them and new appliances are being devised that broaden the line. Something must be done, Mr. Gilchrist said, to put the merchandising business on its feet, for at the present time those who are pushing it most energetically seem to be losing the most money. Central-station companies must continue to sell appliances, he believed, and to carry forward the work of pioneering, but they must maintain policies that will help build up the prosperity of the contractor-dealer and establish the widest possible local distribution.

The feature of the opening session of the convention was an address by General George O. Squier, Chief Signal Officer, U. S. A., on the subject of "Wired Wireless." General Squier predicted small compact radio sets as convenient and portable as a telephone in universal household use and described the opportunities for "wired-wireless" broadcasting service.

Miss Sarah M. Sheridan, vice-president Detroit Edison Company, presented an extremely interesting analysis of the work of women in the industry. About seven hundred women have come under her observation, and the records show an average business life of five years as compared with thirty-five years for men. This seven-to-one ratio reduces woman's chance to attain to executive positions. Femininity, she believes, itself is no disqualification, for all good feminine qualities win recognition and women qualify not as women but as workers and compensation should be based on service and responsibility.

An excellent program embracing two debates, one on the question of combining the contracting and merchandising businesses, and the other on a resolution declaring for higher quality in construction, was still in process at the time of going to press.

Institute Meetings in 1924

Midwinter in Philadelphia, Spring in Birmingham and Annual in Evanston

PHILADELPHIA has been chosen as the place for holding the midwinter convention of the American Institute of Electrical Engineers, which will take place on Feb. 4 to Feb. 8, 1924. The subject of railroad electrification will be emphasized, and it is planned that two sessions will be devoted to reviewing the present status of electrification and prospective plans for electrification as outlined by some of the foremost railroad men in the country. A feature promising special interest will be a celebration of the fortieth anniversary of the Institute. Reminiscences of the early days of the association will be given by founder members.

Plans are being made to hold the spring convention in Birmingham, Ala., during the week of April 7. Hydro-electric development and steel-mill and mining applications of electricity will be the topics.

Evanston, Ill., has been recommended as the meeting place for the annual convention, which will be held during the last week in June. The program has yet to be arranged.

Seek Lower Insurance Rates on Electric Trucks

During a luncheon of the Electric Motor Truck Club in New York City recently, H. P. Hood of the Edison Electric Illuminating Company of Boston told of the efforts being made by the insurance committee of the N. E. L. A. and the Electric Motor Truck Manufacturers' Association to have the fire insurance rate on electric vehicles reduced to the point where it will be the same as that on the buildings housing the cars. On the subject of insurance against theft Mr. Hood stated: "Experience has demonstrated that electric trucks are almost never stolen. If they are driven away by thieves, the contents are removed and the truck is generally recovered uninjured a few blocks from the scene of the theft. Reductions affecting a total yearly saving of $400,000, I believe, have already been granted, and we are convinced that further reductions in insurance rates for fire, collision and theft are in order."

Southern Power Cannot Build Unless Rates Go Up

The Southern Power Company cannot continue its building program under the present conditions, high costs of building material, equipment and labor, unless it receives a higher rate for its product. This was the substance of a talk made on Oct. 5 by W. S. Lee, vice-president of the Southern Power Company, before the Civitan Club of Charlotte, N. C. Mr. Lee declared that unless the Corporation Commission of North Carolina, composed of three men who, he said, "are the people's representatives on the board of directors of the Southern Power Company," allows the raising of the rates 10 per cent, it will be impossible for the power company to plan any further developments in that section. He declared that under present building costs the company could not pay dividends on new plants at the prevailing rate for power, and since it could not pay dividends it could not get the capital to finance new projects.

The State Corporation Commission took over the fixing of power rates two years ago. At that time the power company asked for a rate 20 per cent higher than the rate finally allowed, but accepted the rate as fixed.

Ontario Commission Accepts Cramp Turbines

The three high-capacity turbines built by the William Cramp & Sons Ship & Engine Building Company for the Hydro-Electric Power Commission of Ontario and just installed in the new Queenston-Chippawa station at Niagara Falls, Ontario, have been accepted by the commission after a test which showed a peak efficiency of 93.3 per cent and a very high average efficiency. These turbines are rated at 55,000 hp. each and operate under a head of 305 ft. The Cramp company is also installing in the plant of the Niagara Falls Power Company on the American side one 70,000-hp. turbine and is completing in its Philadelphia shops a second unit.

To the Pelton Water Wheel Company, which is owned by the Cramp company and has a manufacturing plant in San Francisco, a contract has just been awarded by the Pacific Gas & Electric Company for three 33,000-hp. vertical turbines for its Pit River No. 3 development, to operate under a head of 294 ft.

Governor Scrugham's Views on Colorado River Dispute

In a recent speech at San Francisco Gov. James G. Scrugham of Nevada, who is an engineer, said that pressure should be brought to bear upon the government for the creation of a Colorado River Basin power authority, having the same scope and power as the Port of New York authority which enables New York and New Jersey to expend federal appropriations for harbor and waterway improvements. This, he asserted, would preclude controversy between agriculture and commerce over priority rights and would automatically place all differences of great moment, such as the possible granting of power rights to Mexico, before the State Department at Washington.

In touching upon the site for the necessary dam between the upper and lower basins, Governor Scrugham said that neither the Boulder Canyon nor the Glenn Canyon site was satisfactory, according to recent tests made by geologists, but that drill holes in the Black Canyon, 300 miles from Los Angeles, had proved 100 per cent perfect. Here, he advised, engineers should study the problem of foundation with the view of erecting the dam when the pact has finally been ratified.

Public Utilities Representatives Discuss Safety

Of chief interest to the representatives of electric light and power companies who attended the Public Utilities Section meetings at the twelfth annual congress of the National Safety Council at the Statler Hotel, Buffalo, last week, was the comprehensive report of a special committee on accident causes and remedies, which was presented by C. J. Rutland, safety engineer Texas Power & Light Company, Dallas. The report emphasized two vital remedies for application by individual companies. The first of these was the exhaustive investigation of an accident, including the determination of the fundamental cause, fixing the responsibility, promulgating new rules, and the executive backing which is often essential and which carries great weight. The second was the accentuation of the foreman's responsibility, the scope of which, the committee held, might include the entire field of training the workmen and getting help in safety measures from them, the anticipation of accidents on the job, the issuing of special instructions for varying conditions and the enforcement of the rules in effect. Discussion on the report was led by H. W. Moses of the Edison Electric Illuminating Company of Boston and Harry Lucas of the Philadelphia Electric Company.

Attention was called to the rapid increase in radio accidents in a paper by H. J. Burton of the Consumers' Power Company, Jackson, Mich. He pointed to the dangers attending the use of the radio, particularly in the case of children, and explained what steps can be taken to eliminate these hazards. During discussion on this paper use of the indoor aërial was recommended as an important factor in reducing accidents.

J. A. P. Crisfield of the United Gas Improvement Contracting Company, Philadelphia, declared that 60 per cent of accidents during construction of plants are due directly to the man injured, 10 per cent are the fault of fellow-workmen and only one-half of 1 per cent are the fault of the employer.

Methods for eliminating the automobile hazard in connection with electric railway operation were discussed at the joint meetings of the Public Utilities Section and Electric Railway Section. James P. Barnes, president of the Louisville Railway Company, recommended more rigid enforcement of motor-vehicle laws.

These were elected officers of the Public Utilities Section: Chairman, H. W. Moses, Edison Electric Illuminating Company of Boston; vice-chairman, B. B. McCulloch, Bureau of Safety, Chicago; secretary, George Opp, Detroit Edison Company.

Supervisory Control

Representatives of Three Big Manufacturing Companies Tell of Its Development

UNUSUAL interest was excited at the meeting of the Connecticut Section, A. I. E. E., in New Haven on Oct. 4 by the discussion of "Supervisory Control"—particularly for power systems. The meeting was held in the Dunham Laboratory of Yale University, and the General Electric Company, Westinghouse Electric & Manufacturing Company and Western Electric Company had set up energized systems for demonstration purposes. The equipment was shown in operation by the speakers during their talks and afterward. C. E. Stewart described the General Electric Company's equipment and was followed by F. Zogbaum, who explained the functioning of the Western Electric Company's equipment, which is co-ordinated with that of the General Electric Company. The former described in detail the functioning of each portion of the equipment along the general lines of his joint article with J. C. Field appearing in the ELECTRICAL WORLD for Sept. 29, page 655 The safeguards that are provided to avoid failures and to insure intelligent functioning in case of failure were covered in the talk. The speaker showed slides exhibiting other types of equipment that had been developed for somewhat different forms of application. Mr. Zogbaum pointed out the fundamental principles of the mechanism and in general showed how the "start-stop" printing-telegraph device had been employed as a foundation for the supervisory control development. He also showed slides exhibiting structural and assembly features of this and other types of equipment.

Westinghouse Equipment

R. J. Wensley, representative of the Westinghouse Electric & Manufacturing Company, then described that company's type of equipment. He began by outlining the need created for such equipment by labor and economic situations arising first in connection with the ordinary attended substation and then later with the unattended substation. In the early stages automatic equipment had been more or less limited to the performance of a "canned" program. Occasionally it became necessary to vary that predetermined program, but it could only be done by motorcycle messenger or some similar means. The development of supervisory control has provided means of obtaining information which formerly only a messenger could get. It has proved economically feasible and partly so by reducing to a minimum losses incurred through mistaken operation of switches and similar equipment. The Westinghouse equipment is based upon automatic telephone mechanism, and in fact whole units exist exclusively of standardized machine switching relays, contacts, coils etc.

The electrical message consists in all cases of twenty-five line impulses, the code being obtained by the variation in location of two pauses in the sequence of these impulses. At the receiving end a scheme similar to the Clement selection principle is employed. This consists of a labyrinthine way of arranging devices so that only one electrical path is provided through them on receipt by the relays of the impulses and pauses. The speaker pointed out how the mechanism is safeguarded against failure and some of the supplementary functions that can be performed by this equipment.

When asked by the audience to give some indication of cost of such a system, Mr. Wensley said that costs vary considerably, but a system adequate for ten circuit breakers would cost slightly more or less than $2,000. He also mentioned a "flivver" set, as he described it, designed for small hydro-electric developments, which costs in the vicinity of $400.

Many of the one hundred in attendance were men in responsible charge of power systems, and the discussion became unusually active after Chester Lichtenberg of the General Electric Company's staff had pointed out that supervisory control really dated back to a more or less primitive system adopted by the New York Edison Company in 1902 and materially improved by that company about 1912. It was not until 1920 that Chambers of the Des Moines Railway urged the perfection of an adequate supervisory system, thus giving an impetus to the development.

Arizona Promotes Plan for 750,000-Hp. Development

Application for water and power from the Colorado River for the irrigation of 3,500,000 acres of land in Arizona has just been made in filings with the State Water Commissioner by the Arizona Highline Reclamation Association. The filings were based on the United States Supreme Court decision in the Colorado-Wyoming case, which, according to State Senator F. T. Colter, president of the association, "substantiated as between states the long-used, satisfactory and tested law of prior appropriations that has been established in almost all of the Western irrigation states."

The plan provides for tunnels through several mountains and flumes across rivers and the cost is put by an engineering committee at $280,000,000. While the power possible of development is said to be in excess of 1,000,000 hp., it is deemed advisable to recommend only the development of 750,000 hp. as a part of the initial construction. Assuming, the committee says, that this will be used for all commercial purposes as well as household use, and that it will be sold at not more than 1¼ cents per kilowatt-hour, the net earning from the power, if financed on a 4½ per cent basis, will pay off a construction bond issue of $340,000,000 in forty years.

Brief News Notes

Farmington, Iowa, to Sell Municipal Plant.—Voters of Farmington, Iowa, have authorized the sale of the municipal light plant to the Iowa Electric Company of Cedar Rapids.

Buffalo Electrified Foundry Exhibit Made Six or Seven Heats a Day.—In the news report of the convention of the Association of Iron and Steel Electrical Engineers at Buffalo, on page 672 of the Sept. 29 issue, an error was made in stating that two heats a day were made in the electrified foundry exhibit. The minimum number of heats produced by the electric furnace per day was six, the maximum number was seven.

Adirondack Company Expanding. — Improvements and extensions at its South Amsterdam generating plant to cost in the neighborhood of $3,000,000 have been approved by the board of directors of the Adirondack Power & Light Company. An additional steam turbine unit of 40,000 hp. is to be delivered in the spring. To accommodate it the Mohawk River power house is to be doubled. The new unit will bring the production of the Amsterdam plant of the company up to 80,000 hp.

Norman and Enid Renew Oklahoma Gas & Electric Company Franchises.—Citizens of Norman and Enid, Okla., have voted by large majorities to grant new twenty-five-year franchises to the Oklahoma Gas & Electric Company. In Norman, to which the company has been furnishing electricity for about nine years, the vote was 1,236 to 289, and in Enid, a city of 21,000 population, which has been supplied with electric light and power by the Oklahoma Gas & Electric Company and its predecessors for about twenty years, the vote was 1,269 to 533.

Relations of Trade Associations and the Federal Government.—This will be the subject of an address to be made by W. J. Durgin of the United States Department of Commerce at Providence. R. I., on Oct. 18, before a convention of the American Bottlers of Carbonated Beverages. Mr. Durgin is in charge of the government's program to standardize manufactured products in the United States and has presided at the conferences held by the various industries at the call of Secretary of Commerce Hoover. He will attend this convention as the personal representative of the Secretary.

Increased Voltage Benefits Seven Towns.—The Southern Minnesota Gas & Electric Company, which serves many northern Iowa towns with electrical energy, has just completed the work of raising the voltage on its main trans-

mission line between Winnebago and Elmore, Minn., from 13,000 to 23,000. This will materially improve the service in the towns of Ledyard, Lakota, Swea City, Bancroft, Titonka, Buffalo Center and Thompson, Iowa. A division office has been opened at Winnebago to bring the company closer in touch with the Iowa towns which it serves.

Electric Transportation News Bulletin.—The Electric Transportation Bureau of the N. E. L. A. has issued the first of a series of semi-monthly news letters on the progress of electric trucking. It directs attention to the importance of electric truck shows, specifying the one to be held as part of the New York Electrical and Industrial Exposition on Oct. 17-27, and to the advantages of electric vehicles in laundry collection and delivery service.

Radio Links Poland and United States.—The United States and Poland were brought into direct communication on Oct. 4 when officials of the Radio Corporation of America and the Polish government exchanged greetings by means of a commercial radio service inaugurated on that day. The completion of work on this circuit, which was undertaken by the Radio Corporation of America for the Polish government in August, 1921, further advances plans to make the United States the center of a world-wide radio communication system. The cost of the New York and Poland stations is placed at $2,000,000 and the work has been in progress nearly two years.

National Organizations Co-operate for Management Week.—Over a score of meetings for spreading the ideals of better management will be held in different parts of the United States during the week of Oct. 22 or near that time. Programs for these have been arranged under the direction of representatives of the American Society of Mechanical Engineers, the Taylor Society, the Society of Industrial Engineers, the American Management Association and the National Association of Cost Accountants, who are co-operating in this second observance of Management Week, which was instituted by the A. S. M. E. in 1922.

Low Water in Maine Hampers Production of Electricity.—Water in the Saco River in Maine is reported lower than it has been for some years at this season of the year. Only 500 sec.-ft. was on a recent date passing over the West Buxton dam, where the volume of water has sometimes ranged as high as 2,470 sec.-ft. Because of the low water the Cumberland County Power & Light Company has been obliged to substitute steam-manufactured power for water power to a large extent. Many small mills along the upper reaches of the Saco have been forced to close down temporarily, and hotels and residences which generally depend upon water power for the manufacture of their electricity have in some cases been driven to substitute some other form of lighting.

Federal Question Enters Grand River Situation.—The relation of the federal government to the proposal of the Grand River Hydro-Electric Company to construct three dams across the Grand River in Mayes and Wagoner Counties, Okla., may delay permission from the state engineer to construct these dams. The question hinges upon whether the United States government has ever included the Grand River in Oklahoma among navigable streams. The application of the Grand River Hydro-Electric Company calls for two dams 35 ft. high and one dam 30 ft. high, each to cost approximately $1,500,000. The applicants are prepared to finance the project and complete it within five years. Electrical energy totaling 100,000,000 kw.-hr. per year will be developed from each dam. No formal objection to the application has been filed.

South Carolina Utility Companies Contest Tax.—Contending that electric light and power and gas companies are "public utilities" and not "manufacturers" and accordingly have been illegally required to pay the manufacturers' tax levied by the State Tax Commission, the Columbia (S. C.) Railway, Gas & Electric Company has instituted suit against the State Tax Commission to recover the taxes paid under the act of one-tenth of 1 per cent upon their gross receipts. As a test case the suit will affect all manufacturers of gas and electricity in the state. The company's contention is that it is a "public utility," as defined in the act creating the enlarged State Railroad Commission, and not a "manufacturer." This distinction, it is claimed, has heretofore been recognized by the state taxing bodies and by the General Assembly itself.

Seven-Hundred-Mile Interconnection About Completed.—With the testing of the 60,000-volt transmission line between Centerville, S. D., and Hartington, Neb., one of the final steps was taken to form a 700-mile arc of high-tension line reaching from Eau Claire and Chippewa Falls in Wisconsin westward and southward through Minneapolis and St. Paul, Sioux Falls, S. D., and Sioux City, Iowa, to Omaha. The plan to connect up the power lines of different companies has been worked out to equalize the distribution of electric power through the northern section of the Middle West. The Centerville-Hartington line was built by the Minnesota Electric Distributing Company, and the 700-mile line is the result of co-operation between this company, the Tri-State Utilities Company, the Northern States Power Company, the Sioux City Gas & Electric Company and several other electric light and power concerns.

Associations and Societies

Charleston Electrical Contractors and Dealers' Association.—This body has prepared an electric show to be held at Charleston, S. C., Oct. 15 and 16. A number of displays by local concerns and nationally known fixture and equipment houses have been entered. T. A. Brookbanks is president of the association and J. P. Connelly secretary and treasurer.

Southern A. S. M. E. Men to Discuss Topics of Electrical Interest.—At the first regional meeting of the American Society of Mechanical Engineers to be held in the South, which will meet in Chattanooga, Tenn., on Oct. 23 and 24, R. D. Reed of the General Electric Company will discuss arc welding, J. A. Switzer and W. R. Woolrich the power development of the Southern Appalachian slope, and R. H. Lowndes the use of pulverized fuel as applied to the open-hearth furnace in small power plants.

Northwest Electric Light and Power Association.—The following executive committee chairmen have been appointed by President George L. Myers of the Northwest Electric Light & Power Association: Technical Section, John B. Fisken, Washington Water Power Company; Commercial Section, W. M. Shepard, California Oregon Power Company; Accounting Section, George F. Nevins, Pacific Power & Light Company; Public Relations Sections, Norwood W. Brockett, Puget Sound Power & Light Company. A. T. Schultz, vice-president of the Helena Light & Railway Company, has been named vice-president for Montana.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Frederick Hotel, Huntington, W. Va., Oct. 19-20. Herbert Smith, Robson-Prichard Bldg., Huntington.

Telephone Pioneers of America—Atlantic City, N. J., Oct. 19-20.

Arkansas Utilities Association, Pine Bluff, Nov. 15-16.

Electric Power Club—French Lick Springs, Ind., Nov. 19-22. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Southeastern Division, N. E. L. A.—Tampa, Fla., Nov. 19-22. Charles A. Collier, Georgia Railway & Power Company, Atlanta, Ga.

American Society of Mechanical Engineers—New York City, Dec. 3-6. C. W. Rice, 29 West 39th St., New York.

National Association of Railway and Utilities Commissioners—Miami, Fla., Dec. 4-7. J. B. Walker, New York Transit Commission, New York City.

American Institute of Electrical Engineers—Midwinter convention, Philadelphia, Feb. 4-8. F. L. Hutchinson, 33 West 39th St., New York.

Recent Court Decisions

Powers of Ohio Commission.—In Village of New Boston vs. Public Utilities Commission, the Supreme Court of Ohio has ruled that the inclusion in a contract adopted before the jurisdiction of the commission was established of a clause reading, "And to be thereafter subject to the provisions of the statutes in the State of Ohio in such case made and provided," did not reserve to the village the right to act in accordance with the statutes as they existed when the municipal ordinance was adopted. Gas rates prescribed by the commission, which are higher than those set in a new ordinance, were sustained by the court. (140 N. E. 607.)*

To Be "Unjust and Unreasonable" a Rate Need Not Be Confiscatory.—Affirming the legality of gas rates fixed for the city of Portsmouth by the Ohio Public Utilities Commission, suit having been brought by the former against the latter because the rates set by city ordinance were increased on complaint of the gas company, the Supreme Court of Ohio said: "It is the contention of the plaintiffs in error that if the rate fixed by the ordinance was not confiscatory, it then follows that the same was reasonable and just, the question being not what rate the commission might have made in the premises had it had the authority to fix the same in the first place, but, is the rate established by the council in its ordinance a confiscatory rate? We think there must be a clear line of demarcation between a rate that is confiscatory in character and one that must be fair and reasonable. It is not sufficient to say that because a rate is not confiscatory in character it must necessarily follow that it is fair and reasonable and just to both parties." (140 N. E. 604.)

Valuation of Utility Property by Commission Does Not Create Contract Impaired by Revaluation.—The United States District Court in Alabama has decreed, in Mobile Gas Company vs. Patterson, that under the public utility act giving the Public Service Commission power to fix rates for public utilities, and providing that it shall, after investigation, fix a valuation on the property of a utility which shall for all future rate-making purposes be the permanent basic valuation, and which valuation, if made at the request of a utility, shall be at its expense, such a valuation, made at the request of a gas company and for which it paid, did not create a contract between the company and the state which was impaired by an amendatory act authorizing a revaluation. While thus determining the right of the commission to proceed with a second valuation, the court sustained the company in its contention that a second examination of its books and records a few months after the original one would be an "unreasonable search" in violation of the state constitution. (290 Fed. 476.)

City Tax on Wires and Poles a License Fee. — The Delaware Supreme Court has supported the contention of the tax collector of the city of Wilmington that a statute which provided for the assessment of all electric power, street railway, telephone or telegraph poles and wires on public streets according to a certain rate on every $100 of their estimated value imposed merely a license fee for the privilege of using streets. In New York, Philadelphia & Norfolk Telegraph Company vs. Dolan the plaintiff contended that the assessment was a real estate tax and unconstitutional because no opportunity was given to the taxpayer for a hearing, and also that the tax was arbitrary and confiscatory. (128 At. 18.)

Doctrine of "Res Ipsa Loquitur" Does Not Apply Where "Act of God" Is Set Up by Defense. — During an extraordinarily severe storm in Toledo, Ohio, poles and electric wires belonging to the Toledo Railways & Light Company fell upon an automobile wherein one Loomis was riding, injuring him. He thereupon brought suit against the company, alleging that the poles were rotten and of insufficient strength and also setting up the doctrine of *res ipsa loquitur* (the thing speaks for itself). The Supreme Court of Ohio has upheld a verdict for the defendant, finding that, the storm being an "act of God," the doctrine invoked did not apply and the jury had the duty of deciding whether the defendant was negligent in maintaining the poles and wires as alleged or whether their falling was the result of a happening beyond the company's control. Its verdict must stand. (140 N. E. 639.)

Priority of Claim to Hiawassee Power Rights Sustained.—The Supreme Court of North Carolina has just sustained the claims of the Carolina-Tennessee Power Company to power rights on the Hiawassee River, in western North Carolina, against the contentions of the Hiawassee River Power Company. The case, which is of several years' standing, involved the titles to certain parcels of land along the river. The lower court awarded these lands to the Carolina-Tennessee company because of priority of claim, and the Supreme Court sustains this decision. The lands involved are in the possession of the Hiawassee company and the successful litigant must pay the loser the amount involved. The Hiawassee company resisted the claims of the Carolina-Tennessee company on the ground that it had lost its rights by reason of the statute of limitations, but an effort to have the Legislature revoke the latter company's charter failed. The charter question, however, will finally be decided by the Federal Supreme Court. The plaintiff claims that the special charter granted the Carolina-Tennessee company is in violation of the Fourteenth Amendment to the United States Constitution, and appeal already has been made to the federal court on this and other grounds.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Municipalities Must Obey Wisconsin Electrical Code.—Finding that the city of Barron has violated the Wisconsin Electrical Code by carrying its wires through trees, insulation being destroyed, the trees damaged and hazards set up, the Wisconsin Railroad Commission has ordered that the city increase the height of its poles and wires by 10 ft. or else remove the wires to a location where they will not encounter trees. The city must not, however, in so doing, discontinue service to existing consumers.

Price to Be Paid for Utility Immaterial Until Question of Capitalization or Rates Is Raised.—In granting authority to the Sunapee Electric Light & Power Company to absorb the Bradford Light & Power Company, the New Hampshire Public Service Commission refused to concern itself about the price paid, saying: "The price to be paid for this property is not material as the purchaser is not asking to issue securities against the property purchased. If and when the question of capitalization or of rates is raised, it will be necessary for the commission to determine the fair value of the property."

Apportioning Cost of Rural Transmission Line.—A dispute between five rural customers of twelve years' standing and the Portland Railway, Light & Power Company concerning the re-establishment of service discontinued because of the action of a land owner over whose property the transmission lines were carried in disconnecting the supply wires came before the Public Service Commission of Oregon for adjudication. The company claimed that to resume service an old privately owned supply line would have to be abolished and a new standard distribution system built at an expense of $90 each to the complainants. The commission, holding that new business along the line would repay the company for any necessary reconstruction of the old private line, ordered an assessment on the five complainants of only $18.85 each on condition that they relinquish their equity in the private line to the company and execute an agreement to take continuous service for not less than one year.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Samuel Insull, president of the Commonwealth Edison Company, Chicago, sailed from New York on Tuesday of this week for Europe for a short visit.

Clifford R. Beardsley, formerly electrical engineer with Fred L. Ley & Company of Springfield, Mass., is now superintendent of electrical construction for the Brooklyn Edison Company.

W. H. Cahoon, formerly associated with C. M. Read of Lansing, Mich., has recently associated himself with McClellan & Junkersfeld, consulting engineers of New York, as assistant electrical engineer.

W. M. States, formerly manager for the International General Electric Company, Shanghai, China, has been appointed assistant manager of the Edison Lamp Works of the General Electric Company, Chicago.

L. B. Breedlove has been appointed consulting engineer for the Chicago Trust Company to act in an advisory capacity for the analysis of public utility and industrial properties for the bond department of this company.

E. W. Oesterreich, formerly associated with William G. Woolfolk, consulting engineer of Chicago, is now connected with the Duquesne Light Company of Pittsburgh as superintendent of the underground cable division.

Ward H. Snook has joined the Snook-Hillhouse Company, consulting engineers, Columbus, Ohio, as president. Mr. Snook was previously inspector of power wires on the Public Utilities Commission of Ohio.

Sorab B. Damania, who was formerly construction engineer with the Andhra Valley Hydro-Electric Power Supply Company, Ltd., Bombay, India, is now engineer in charge of the Bombay Electrical Supply & Tramway Company's power house.

Robert B. Morton, recently associated with Tolz, King & Day, engineers, St. Paul, as electrical engineer in connection with the design and construction of a large steam-power plant, has severed his connection with that firm to become project engineer with Gibbs & Hill of New York.

Thomas M. Gibbes, formerly associated with the Appalachian Power Company, with operating territory in Virginia and West Virginia, has entered the sales department of the Puget Sound Power & Light Company. Mr. Gibbes is in charge of power sales.

F. R. Lack, an engineer of the International Western Electric Company, has had bestowed upon him by the Emperor of Japan the sixth class of the Imperial Order of the Rising Sun. The award is in recognition of his services in connection with the installation of the first printing telegraph in Japan. Mr. Lack has been associated with the Western Electric Company since 1911. His service with the company has been uninterrupted since except for a period spent in military service.

Norman Read President-Elect of Rocky Mountain Division

Norman Read, vice-president and general manager of the Colorado Power Company, has been elected to succeed to the presidency of the Rocky Mountain Geographic Division of the National Electric Light Association at the close of the present fiscal year on June 30, 1924. The election was held at the recent annual convention of the division in conjunction with the Colorado Public Service Association at Glenwood Springs, Col.

NORMAN READ

Although a native of England, Mr. Read received all his education in Colorado. He graduated from the University of Colorado as an electrical engineer in 1905, and the same year he entered the service of the old Denver Gas & Electric Company, where he remained for two years in the engineering department. For a short time he represented the Nernst Lamp Company in the Rocky Mountain territory. In 1908 he became a consulting engineer in Denver, specializing in hydraulic design and construction work, and he remained in an independent capacity until 1910, when he was appointed assistant superintendent of power of the Denver Tramway Company. Later, when serving as superintendent of power and electrical engineer for that company, he resigned to become assistant general manager in charge of operations of the Colorado Power Company. In November, 1916, he was elected to his present position of vice-president and general manager of the company.

Mr. Read is a past-president of the Colorado Public Service Association, past-chairman of the Denver Section of the A. I. E. E. and has served as vice-president of the Rocky Mountain Division of the N. E. L. A. for the last two years. He is now a member of the executive committee of the National Technical Section of that association.

W. L. Robinson, who has been assistant superintendent at Bath for the Central Maine Power Company for the last five years, has been transferred to Skowhegan as assistant district superintendent, succeeding the late Walter Wyman.

John R. Nichols, formerly chief engineer, Monks & Johnson, Boston, has opened a consulting engineering office in that city, where he will specialize in the design and construction of industrial plants and will handle miscellaneous problems in structural and construction engineering.

Col. William Kelly, chief engineer of the Federal Power Commission, is making a detailed inspection trip throughout the Rocky Mountain region. He expects to visit a number of projects. During the colonel's absence Major H. S. Bennion will act as chief engineer.

W. E. Douglass, who has been associated with the Westinghouse Electric & Manufacturing Company for ten years, recently severed his connection with that company to enter the service of the Wisconsin Valley Electric Company in the capacity of electrical engineer in charge of generating stations and transmission.

W. A. Lackaff, formerly district manager of the Pacific Power & Light Company at Toppenish, Wash., has been transferred to the head office at Portland, Ore., to succeed P. J. Kean as purchasing agent. G. L. Corey, formerly district manager at Seaside, Ore., has been selected to succeed Mr. Lackaff as manager of the Toppenish district. E. W. Rouleau is the new manager of the Seaside and Gearhart district.

Secor Cunningham, **D. W. Roper** and **B. G. Jamieson** of the Commonwealth Edison Company and **F. E. Goodenough** of the Public Service Company of Northern Illinois recently returned to this country from a four months' trip of inspection abroad. Samuel Insull, Jr., was one of the original party, which sailed from New York on May 19, but he was obliged to return home before the trip was completed. Ten different countries were visited, the trip covering more than 17,000 miles. It had for its object a study of European methods of generation and distribution of electricity with special reference to the use of high-tension cable, high-tension oil switches, rural uses for electricity and hydro-electric developments. As a result of this comprehensive journey three special reports are being prepared—on high-tension cable by Mr. Roper, on circuit breakers by Mr. Jamieson and on rural service by Mr. Insull.

A. L. Rohrer Retires

A. L. Rohrer, superintendent of light, heat and power at the Schenectady works of the General Electric Company, has retired after thirty-nine and one-half years' service with the company and is succeeded by O. A. Clark, who has been assistant superintendent since the department was organized in 1917. Mr. Rohrer entered the employ of the Thomson-Houston Company at Lynn early in 1884. When that company was merged into the General Electric Company in 1892 he went to Schenectady as technical adviser in charge of drafting and designing. In 1894 Mr. Rohrer was appointed electrical superintendent, and the following year, when G. E. Emmons became manager of the Schenectady works, Mr. Rohrer became one of his principal lieutenants. For twenty years he has been in charge of selecting college men for the General Electric test, and during this time he has visited nearly all the technical colleges and the universities of the country. Mr. Rohrer will remain with the company in an advisory capacity and will spend most of his time in Schenectady.

Mr. Clark, his successor, is a graduate of the University of Kansas, class of 1904. In 1905 he entered the General Electric Company's employ and in 1906 was transferred as assistant to the electrical superintendent, then Mr. Rohrer. In 1917, when the light, heat and power department was organized, Mr. Clark was made assistant superintendent.

E. Auger is now superintendent of district of the Minnesota Electric Light & Power Company, Bemidji, Minn., succeeding J. Cook.

L. Kreitinger is now president of the municipal electric light and water works at Springfield, Minn., succeeding H. Birkemeyer.

Charles Whitaker has succeeded A. Clark as engineer of power station of the municipal electric plant at Red Cloud, Neb.

E. B. Lamb, formerly associated with the Inland Steel Company, Indiana Harbor, Ind., is now associated with the Illinois Traction System in Peoria, Ill.

Joseph A. Brookman, formerly connected with the West Penn Power Company, Pittsburgh, is now associated with the Ohio Power Company at Steubenville.

Carl H. Hermance, who was formerly with the United Electric Light & Power Company, New York, is now with the Southern California Edison Company, Los Angeles.

William Ives has been placed in charge of the sub-office at Norfolk, Va., of the Westinghouse Electric & Manufacturing Company's Baltimore branch office.

Eugene Herzog, formerly connected with the test department of the United Electric Light & Power Company, New York, is now in the research department of the General Electric Company at Lynn, Mass.

R. E. Baird, general manager of the Oklahoma Gas & Electric Company at Poteau, has been transferred to Pauls Valley as general manager of that district. J. R. Werth, formerly commercial agent at Poteau, has been selected to succeed Mr. Baird.

Robert B. George, who has been recently connected with the Mississippi Agricultural and Mechanical College, has become professor of electrical engineering at the Oklahoma Agricultural and Mechanical College, Stillwater, Okla.

H. L. Moody has severed his connection with the Philadelphia office of the Westinghouse Electric & Manufacturing Company, where he was manager of the central-station division, to become associated with the U. G. I. Contracting Company, Philadelphia.

A. F. Torrey of New Haven, Conn., has recently been appointed new-business manager of the Trenton (Mo.) Gas & Electric Company, which property is under the management of the General Engineering & Management Corporation, New York.

Russell P. Wise, formerly assistant to the sales manager of the Simplex Electric Heating Company, Cambridge, Mass., has been appointed sales manager of the Spencer Thermostat Company, Cambridge. Mr. Wise assumed the duties of his new office Oct. 6.

L. W. Scott, manager of the municipal electric and water plant at Fairport, N. Y., for the past three years, has allied himself with the Hamburg (Pa.) Gas & Electric Company as assistant to the general superintendent. Mr. Scott was formerly district superintendent for the Empire Gas & Electric Company at Clyde, N. Y. He assumed his new duties Oct. 1.

W. L. Goodwin, assistant to the president of the Society for Electrical Development, and F. M. Feiker, formerly vice-president of the McGraw-Hill Company, Inc., who recently joined the staff of the society, were made operating vice-presidents of the society at a meeting of the executive committee held at staff headquarters.

T. L. Tynes, who for sixteen years has been electrical engineer for the Lackawanna Steel Company of Buffalo, now the Bethlehem Steel Company, has gone to the Buffalo plant of the American Radiator Company in the same capacity. For nine years before his connection with the Lackawanna company Mr. Tynes was erection engineer with the Westinghouse Electric & Manufacturing Company's Pittsburgh office.

Roy Worth, who has been associated with the Pacific States Electric Company, San Francisco, since 1914, was recently appointed assistant manager of the company. In 1914 Mr. Worth joined the sales force at Seattle, and since that time he has served as assistant treasurer, assistant district manager at Seattle, and for the past three and a half years as district manager of the Seattle branch. Mr. Worth has been in the electrical supply jobbing business for a number of years and has a wide circle of friends in the trade.

H. A. Rinker of Springfield, Ohio, has been named superintendent of the Marysville properties of the Ohio Edison Company.

N. B. Garden, formerly power engineer of the Ohio Power Company at Tiffin, Ohio, has been transferred to the engineering department of the company at Canton.

W. R. Ham, formerly connected with the engineering department of the Adirondack Power & Light Corporation, Amsterdam, N. Y., has been transferred to Saratoga Springs as electrical superintendent.

R. R. Jewell, formerly district superintendent of the Ohio Service Company at Newcomerstown, Ohio, has been transferred to New Philadelphia in the same capacity. J. W. Bodenheimer has succeeded Mr. Jewell at Newcomerstown.

C. E. Watson, formerly designing engineer with the G. & W. Electric Specialty Company, Chicago, is now in the electrical engineering department of the Duquesne Light Company.

J. L. Guthals has been appointed new-business manager of the San Angelo (Tex.) Water, Light & Power Company, succeeding R. A. Stroud, who has been transferred to the accounting department.

L. R. Jones, formerly research assistant at the Massachusetts Institute of Technology, has entered the transmission department of the Public Service Company of Northern Illinois in Chicago.

F. H. Ives, sales manager of the Adirondack Power & Light Corporation at Glens Falls, N. Y., has severed his connections with the company to become sales manager of the Service Appliance Company of that city. Mr. Ives was recently transferred to Glens Falls from the Schenectady office of the Adirondack company.

Obituary

Frederick C. Bates, for twenty-seven years employed by the General Electric Company, most of which time he was manager of the lighting department in the New York office, died Oct. 2 at his home in Brooklyn after a long illness. Mr. Bates, who was well known in the electric light industry, entered the employ of the Thomson-Houston Company, Lynn, Mass., in 1887 and was sent in 1894 to Berlin to supervise electrical installations with the Allgemeine Elektricitäts-Gesellschaft. He returned in 1896 and became connected with the New York office, where he was soon appointed manager of the lighting department. Mr. Bates was born in Danielson, Conn., in 1867. He was vice-president and treasurer of the Orange County Public Service Corporation and an officer in its affiliated companies. He was a member of the Machinery and Engineers' Clubs, New York, and a member of the A. I. E. E.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Work of Associated Lighting Industries

Some of the Reasoning Behind the "Notice the Lighting Equipment" Campaign and What It Means to the Industry at Large

By Herman Plaut

President of National Council Lighting Fixture Manufacturers

THERE are two aspects to the campaign of education now being conducted by the associated lighting industries throughout the country that it seems to me should have a particular interest to the electrical industry in general. This is the campaign which has been organized behind our slogan "Notice the lighting equipment." It is doing something very definite for the lighting-fixture people and it is contributing an influence of even greater benefit and value to the electrical industry at large.

Briefly speaking, the big problem before the lighting-equipment industry today is the lack of understanding on the part of the public in regard to the really vital importance of this equipment. People are considering it as something fixed and immutable like the laws of the Medes and Persians. Lighting fixtures handed down to them by their forefathers are apparently taken for granted and looked upon as unchangeable.

Will Promote Complete Equipment Idea

The word "fixture" itself has been an unfortunate selection. It seems to signify something immovable and people have accepted this interpretation. The result has been that the idea of refixturing a house has really never registered with the public. If extensive alterations and redecorations are in process, new fixtures naturally suggest themselves, but the average family never thinks of buying a better, more attractive and more artistic chandelier for the living room or library, although it would purchase a new rug or chair to take the place of an old one that was not satisfying without hesitation and as a matter of course.

All this of necessity means something to the electrical industry. It means first loss of business to the fixture manufacturer, jobber and dealer. It means also loss of work to the contractor who would be called upon to hang these fixtures or to install fixture receptacles, such as "elexits," as the homes of America adopt this new method of fixture attachment. But it will mean more than that to the industry at large. The mere effect of the establishing of this new mental attitude toward fixtures, the setting up of a receptive state of mind toward fixtures on the part of men and women generally, will inevitably influence their whole point of view toward electrical equipment. Light is the fundamental use of electricity in the household. Everybody looks on this today as the first necessity and the other applications follow. Ultimately we shall have complete electrical equipment in the average home.

It will come more quickly and more easily when people get away from the old idea that once the electric lights are in nothing more can be done about it. When we all of us begin to realize and accept in our household planning the fact that the lighting can be improved and made more convenient and enjoyable as time passes by, then will the spirit of getting the home equipped completely and in the most modern style take hold and the trick will be turned. The electrical industry will no longer have to fight to make people see that a house should be completely outfitted with electrical equipment any more than the hardware industry has to fight to make people see that a house should be completely equipped with hardware. They will do it as a matter of course, and the job will be then just one of selling quality as it is in the hardware field today.

The purpose of this campaign of ours is, of course, primarily to promote the sale of lighting equipment by making the public a little more "lighting-equipment conscious." But in reality the fixture associations will in the end be performing a far greater service to the electrical industry as a whole. And this is well.

We are all aware of the wonderful possibilities which modern lighting makes available for people in so many different ways, and we also know that the best effect of modern lighting cannot be obtained without proper lighting equipment. The problem before the industry as we see it is, therefore, to create a public consciousness of lighting equipment, make people realize what it can do for them and get them to "notice the lighting equipment." It was at the beginning of this year that the first announcement of this plan was brought to the attention of the entire industry. During the "Fixture Market" in January in Cleveland the publicity committee decided definitely upon a campaign built around this slogan, on which was to be expended not less than a hundred thousand dollars a year for at least three years. The financial canvass for raising this amount is making satisfactory progress but has not yet been completed.

Results of the Movement

In the meantime, however, the industry took hold of the idea spontaneously. Manufacturers and dealers started in to use the slogan and its use is very rapidly increasing in volume. We have at our office samples of printed matter and clippings from publications showing definitely that in the neighborhood of fifty million impressions of the slogan have already been made. This means that that many times people have already been called upon to "notice the lighting equipment." You will agree that this is a really remarkable showing for so brief a period and proof positive of the inherent value of the movement.

It was to be expected that the momentum already attained would make an impression. It has already

done so. No need to point out that lighting equipment used to be conspicuous by its absence in the advertising sections of publications. This condition was well summed up in an article published recently by the statement that "the largest seller advertised the least." But conditions are being changed. Advertisements of lighting equipment are becoming far more numerous and important. Leading publications which had up to now treated the subject with indifference bordering on contempt are opening their pages to authoritative articles on the importance of lighting and the selection of the proper lighting devices, through which alone it becomes available.

Importance to the Industry

We believe that all this will mean much for progress. It cannot but help the central stations of the country greatly. The most that manufacturers of lighting devices may expect as the result of this campaign is the increased sale of their products. But the central station will gain continuous revenue from more and more elaborate lighting equipment and a more generous use of light. When we recall the greatly increased volume of electricity which central stations have at their disposal through the recent construction of new generating plants and that the lighting load represents their most profitable business, it is merely stating the obvious when one says that this movement of the lighting-equipment industry is of far greater importance to these central stations than to the manufacturers of lighting devices who originated it.

Renaissance of Lighting

Naturally, it is highly important that electrical men themselves understand the scope and the significance of this campaign. It is not just a matter of a slogan or an advertising campaign to push a certain kind of goods. It is in effect the renaissance of an important branch of the electrical industry—important both in the volume of its sales and the nature of its product. If manufacturers and jobbers and retailers of other kinds of electrical equipment that looks to the American home for its market will see the value of this movement to them, as an influence for selling the electrical idea more fully to the public, they will support it in many ways. And indorsement of this kind will put a mighty impulse behind this work.

Impetus to Electric Cooking and Heating

What the Code Changes Will Mean in the Market—An Acknowledgment of Debt to the N. E. L. A. Wiring Committee

By Ralph J. Patterson
Walker & Pratt Manufacturing Company, Boston

The report of the N. E. L. A. wiring committee, of which R. S. Hale is chairman, is of more than passing interest in that some very radical changes in the Underwriters' rules governing residence wiring have been allowed, chief among which is the abolition of the 660-watt rule for branch circuits.

The changes noted are in brief as follows:

Solid Neutral Wire.—No fuses required or permitted on middle wire of three-wire circuits.

Fifteen-Ampere Fuses.—These are allowed on branch circuits in place of 10-amp. fuses—no wattage limitation specified.

Three-Wire Branch Circuits.—These are allowed for distribution instead of being limited to two wires as in the past.

Fuses Not Required.—No fuses are required on the grounded size of two-wire branch circuits where the neutral wire is grounded.

It does not require much imagination to see that these changes are more than likely to have a far-reaching effect in increasing the use of portable heating and cooking appliances. For instance, a branch circuit under the old rules, or code, limited the watts on a branch circuit to 660 and the fuse to 10 amp. The new code permits a three-wire branch (No. 14) wire with 15-amp. fuses, allowing the use of 3,000 watts on, let us say, the kitchen circuit. With 3,000 watts available any electric range can be properly demonstrated, and, of course, much larger portable cooking and heating appliances may be used than formerly.

This virtually eliminates all the argument about the cost of wiring, because in most cases the regular wiring, with a three-wire system, is sufficient (say 3,000 watts) for average requirements in the kitchen, especially if care is used in keeping the switches on low or medium points as much as possible.

A hot plate (with oven) or kitchenette range is at once a possibility in every home without the expense of special wiring, because 1,500 watts becomes available under the new rules on every two-wire circuit such as is at present installed in the kitchen of every wired home.

The difference between 660 watts and 1,500 watts in cooking, heating water and for radiators is practically the difference between a plaything and a useful appliance. Many appliances will not be affected by this change. Flatirons, toasters, percolators, etc., are very practical as they are now made, but a wider use of kitchen appliances is sure to be encouraged by the higher wattage permitted on all circuits in residences.

The importance of the new development in electric wiring can hardly be overestimated, and the world owes a debt to the N. E. L. A. and its wiring committee which has brought it about.

Electrical Labor in New York 1919-1923

According to the Industrial Commissioner of New York State, the adjustment of labor in the electrical manufacturing plants of that state from 1919 to 1923 to the general business conditions of the country occurred gradually because of the fact that so many different lines are represented. The net decrease in employment during this time was about 50 per cent, but the total decrease for the separate divisions was probably much greater as all of these did not suffer periods of depression together. Even two years after the decline began employment was approximately 30 per cent lower than at the peak.

The commissioner's office further states that the depression of 1920 to 1922 started with overstocking by retailers and the fear of a consumers' reaction against the high prices. The result was that industries producing goods for the retail trade were the first affected by the stoppage of orders and were the first to reduce production. They were usually the first also to show at least a partial recovery. Industries making machinery and other goods for industrial purposes rather than personal use maintained production longer in 1920, but were usually slower in recovering from the depression, as expenditures for new equipment are not ordinarily made until business conditions have improved sufficiently to make a prompt return from the investment appear probable.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

A DEGREE of caution has entered into this week's market, with jobbers and manufacturers in all sections apparently holding back to avoid movements which might destroy in any part the solid buying that has developed only during the last four weeks. Authorities in the trade well realize the dangers that come in pushing a reluctant market too fast and state that there is a slight tendency at the present to avoid campaigns in territories where there is little money to be spent. For this reason the jobbers and manufacturers are doing very little in the rural districts regarding farm-lighting plants, appliances, ranges, etc. They realize that they are to receive many millions of dollars from these now slow markets, and they wish to approach them carefully at the present period so as to secure as many orders as possible after thirty or sixty days' time.

Sales of lamps are increasing by leaps and bounds in all parts of the country, but stocks and production are supplying the demand easily. Orders for miniature lamps are said to be unusually heavy, which is due largely to the fact that most automobile owners are carrying extra kits of lamps for replacements on the roads, and also to the interesting development in Christmas lighting outfits, which are likely to be used in greater numbers during the holiday season to decorate the exterior of houses as well as the trees in the streets.

Wire, poles and cross-arms are moving very rapidly to the central-station companies, which are making many extensions to old lines and repairs to others. Conduit sales are increasing in most sections of the country. Appliances took on another spurt during the week.

Evolution of Lamp Making Machinery and Higher Costs

WITH the many installations of expensive machinery in the lamp works of the General Electric and Westinghouse companies in Ohio and New Jersey during the last year have come higher production costs, which apparently will not allow a lower price to the consumers for at least another two seasons. In the effort to give the people of the United States better illumination by single units of longer life, these companies have decided, so it seems, to give as much quality as possible before considering price decreases.

In the evolution of the lamp industry these new machines are making possible greater output and easier operation, which will result in lower production costs after they have paid for themselves in about three and one-half years' time. These installations are for "tipless" bulbs only, and as the companies have been able to employ many of them in production during the last six months lamps with tips are no longer manufactured.

Officials of these companies are of the opinion that several million lamps with tips are still in the hands of their agents. They point out that as it is necessary to supply the market with approximately 165,000,000 type "B" lamps, 40,000,000 type "C" and 95,000,000 miniature lamps during every twelve months, it is very necessary to hold stocks continually at the sixty-million mark. These authorities believe that it will be 1926 before the lamps with tips will be rarities in the sockets of the consumers.

More Data Needed to Promote Industrial Truck Business

FOLLOWING a decided revival in industrial electric truck sales, there appears to be a temporary condition of quiet, accompanied by more or less so-called "proposition work" on the part of prospective purchasers and manufacturers' agents, at least in Eastern factory areas. This class of equipment is going through a developmental stage as regards the design and production of new units to meet increasingly varied conditions of service, although the well-known flat-platform types of truck and tractor have become standardized sufficiently to be looked upon in many industries at least as a staple tool of mass production.

Available economic data on industrial truck performance are still scarce, and until more complete figures of field service are at the hand of the purchasing engineer the sale of such equipment is bound to proceed along conservative lines as to volume. Industrial-plant engineers and executives are well aware that extraordinary economies in the use of labor and in material handling are being realized in numerous installations, but in too many cases, it is believed, the analysis of local conditions could be speeded up by the presentation of more carefully prepared data based on parallel experience.

Central-station power engineers are still slow to inform themselves as to industrial truck and tractor opportunities, and much of the sales work in this field is still being done by manufacturers' agents, with little real co-operation from utility men, according to well-informed material-handling engineers. There is little that is experimental about the modern industrial truck, and while it is necessarily sold in channels where skilled technical analysis is a feature of distribution, it has become so important a factor in the flexible and intensive handling of materials that its larger recognition by the central station would unquestionably help in the electrification of services at present most inefficiently handled by manual means. A survey of the trend of sales development in this line indicates that the present substantial number of units in service can be greatly increased as the demands of greater production are felt, if the proper amount of technical orders in sight is sufficient to develop the industry.

Used-Machinery Men Seeking New Lines

AN INTERESTING situation has been developing in the used-machinery field. During the war period a tremendous impetus was given to this business. The inability to manufacture and make deliveries and the urgent need for such equipment in all directions placed used machinery at a premium and the dealers reaped a harvest. Moreover, the social standing of used machinery improved, the stigma of the old term "second-hand" was shaken off, and the business was placed on a very substantial basis.

The market for used machinery has been steadily dwindling, however, with the restoration of normal conditions in the manufacturing field, and the dealers have been experiencing a very bad season. The fundamental cause is not just due to the ending of their boom time, but also to the steadily changing conditions in the electrical industry. The small, independent central station and the fair-sized industrial power plant have been the mainstay of the used-machinery market, but the number of small, independent central stations today is rapidly diminishing. More and more of them are being gathered into the larger systems operated by holding companies. The number of industrial power plants also has been rapidly decreasing through the substitution of central stations. There still remain the steel mills, the paper mills and other industrial establishments where because of an inherent need for steam for other purposes the proprietors will continue to operate their own plants, but on the whole the situation has cut deeply into the used-machinery market.

The changing over of many small industrial plants to central-station service has brought a market for rotary converters in many cases, and the used-machinery dealer is selling a good number of them. Gradually, however, his operations are becoming more and more restricted to the sale of motors and to such turbine, generator, boiler and stoker business as he can pick up. This has brought an urgent necessity for the broadening of the line carried by the used-machinery dealer who has heretofore specialized in electrical machinery. A distinct trend has set in, therefore, toward the sale of contractors' equipment. Road machinery,

excavating machinery, concrete mixers and machine tools are being added to electrical apparatus to make a broader line and restore the used-machinery dealer to a better economic position.

General business among the used-machinery dealers has improved materially in the last few weeks after a very quiet summer, and there is a good outlook for a busy season. The necessity for adding new lines, however, is very clear to all dealers, and the movement is definitely under way.

Interesting Details of Electrical Imports Through New York

IMPORTS of electrical machinery, apparatus and supplies through the port of New York during September, 1923, amounted to $47,807. Germany led in the values of most of the commodities that are also sent in by her only important competitors, England and France. The totals for these countries during September are as follows: Germany, $18,732; England, $13,510, and France, $11,653. The highest value in the table of information just issued by the Department of Commerce was for carbons and electrodes imported into this country by France and amounting to $6,400. England sent $3,125 worth of carbons and electrodes, and Germany $5,467. Other countries sent none. Germany is the only country recorded as having sent any flashlamps to this country in September. These amounted to $4,546. Another interesting turn in the foreign field is the great number of advertising machines, $1,881 in value, sent by Germany. No values of these sent from other countries are recorded.

Included under classifications in the import list are many other interesting details: Germany sent $900 worth of hair driers, although there are no records to show that any other country tried to secure any of that business. England sent $6,300 worth of electric piano lamps, while the other countries shipped none. A great number of lighting fixtures were sent into this country during September—France sending a value of $4,603; Germany, $2,634, and Czechoslovakia, $2,945. Only $15 worth of vacuum cleaners, $10 of storage batteries and $97 of electric bells were sent from all the countries of the world during that month.

West Coast Sales More Even; Conduit Reduced

LAMPS along the West Coast are selling briskly in a market which is said by the jobbers to be even and normal throughout the district. The usual sales efforts of the lamp agents are strengthened by excellent publicity programs and other educational work.

The price of conduit has decreased approximately 10 per cent, the carload price for ½-in. black being about $6.50 per 100 ft. from local stocks. Galvanized is quoted at $7.10 in similar lots. The usual autumn business decline in flashlamps has been offset by the introduction of new aluminum styles which are now largely oversold. Standard dry cells also show a large increase in demand, which is partly attributed to the popularity of the new packing in lots of fifty. Great interest is being shown in complete sets of radio.

New York Market Continues Its Steady Increase; Fixtures Active

THE New York market continues its steady increase. Jobbers are buying in conservative amounts and most of them express optimism concerning the coming holiday season. Buying by the central stations shows decided improvement over the corresponding period of last year.

Poles and line hardware are selling very actively as much repair work and extensions are being undertaken by the power companies. Motors in the smaller sizes have a fair market. Radio business is reported even, and a gradual pick-up is expected before the end of the month.

All kinds of fixtures are selling steadily, with firm prices and heavy stocks. A softening in the price of flexible armored conductor is noted. Conduit stocks are somewhat lower than one month ago, owing to the heavy demands of the past two weeks.

Small-Motor Business Active in Boston Section

BUSINESS in the Boston section runs along without much change from week to week. Central-station outputs are gaining steadily, and a good deal of distribution system construction is being pushed this fall. Lamp sales are increasing fast, but enlarged factory facilities are meeting the demand with ease. Sales of small general-purpose motors are active, although not quite up to earlier totals this year. Interest in individual drive is increasing.

Wire, poles and crossarms are moving well, although margins of profit are reported narrow. Wiring contractors are very busy and building operations continue in large totals. Money is easy and electrical apparatus manufacturers are generally hard at work filling back orders and caring for a volume of new business that exceeds that of a year ago in many lines.

Jobbers' stocks are well rounded and deliveries excellent on practically all lines. Building operations reflect marked improvement in volume and prospects are good for next spring. New England department store sales are running about 10 per cent in money above last year, and appliance sales are active among electrical retailers.

St. Louis Business Gained Considerably Last Month

BUSINESS conditions in St. Louis during the past month have shown a considerable gain over the same period last year. New construction and extensions by public utility companies, combined with continued activity in the building industry, are the chief reasons for this increase. Manufacturers and jobbers show a disposition to be cautious and conservative.

Prices generally have been steady, except for a decline in the price of copper wire and wiring devices. Exceptionally cool weather has resulted in unusual demand for electrical heating devices, and the demand for radio sets, ornamental lamps and household appliances is splendid.

Chicago Trade Expecting Much Improvement

JOBBERS and manufacturers in the Chicago district are expecting greatly improved fall business. The trade has resumed its normal trend, with jobbers receiving a growing volume of orders. Pole-line hardware demand has been exceptionally good for the first part of October. Demand for conduit has also increased, with Chicago stocks somewhat depleted and prices firm. One conduit manufacturer states that he booked more tonnage during the first week in October than he did during the entire month of August.

Appliance sales have been good for this week, particularly heaters and appliances used for the chilly mornings. The only price revision reported this week was on flexible armored conductor, which went to $41, Pittsburgh, effective Sept. 28. Wire prices remain the same, although there is gossip of an impending increase in code wire.

Cable Deliveries Improving in Atlanta; Slower Retail Business

THERE have been no particular changes in the jobbing field since last week, with the exception that all jobbers report deliveries on steel wire and cable improving, although the lead variety is still hard to get. One jobber reports a reduction of 1 cent per pound on bare copper wire, effective last week. Apparatus ordinarily handled direct by the manufacturers has slowed up somewhat during the last thirty days, but a sharp pick-up in industrial equipment lines is expected before the first of the year.

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.0337	$0.0337	$0.0292
Cold finished shafting, per lb.	0.0433	0.0433	0.0378
Brass rods, per lb.	0.165	0.17	0.171
Solder (half and half), per lb.	0.262	0.276	0.2283
Cotton waste, per lb.	0.1225	0.1225	0.1458
Washers, cast iron (½-in.), per 100 lb.	4.66	4.66	4.33
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.08	3.08	2.96
Machine oil, per gal.	0.349	0.349	0.36
Belting, leather, medium, off list	37%	37%	44½%
Machine bolts, up to 1-in. x 30-in., off list	49½%	49½%	49%

The retail business in Atlanta slowed up noticeably during the past month, particularly in the lighting fixture lines. This is due to the fact that Sept. 1 is "moving day" in this locality and practically all new houses and apartments have to be ready for occupancy on that day. This September lull is usual, and retailers expect the general movement to improve about Nov. 1.

The Metal Market

MOST of the metals have been quiet during the last week, but prices have been well maintained except in the case of copper, which has declined to 13 cents, delivered, as a result of an almost total absence of inquiry. Conditions in the New York lead market are unchanged from last week. A fair volume of business has been done at 6.85 cents for November shipments.

Zinc business has been in fair volume and mostly for October shipment. Prices are substantially the same for November and December, but inquiry for forward delivery has been light. Most of the business has been at 6.30

NEW YORK METAL MARKET PRICES

	Oct. 3, 1923 Cents per Pound	Oct. 10, 1923 Cents per Pound
Copper, electrolytic.	13.37½	13.00
Lead, Am.S.& R.price	6.85	6.85
Antimony...........	7.75	7.75
Nickel, ingot.........	27.00 to 32.00	27.00 to 32.00
Zinc, spot...........	6.40	6.30
Tin, Straits..........	41.75	41.75
Aluminum, 98 to 99 per cent...........	25.00 to 27.00	26.00 to 27.00

cents, although a few second-hand lots were disposed of at 6.20 cents. Brass special has sold at 6.40 cents, and high-grade at from 8 cents to 8.50 cents delivered.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

"Delco" Refrigerator Sales Are Double Those for 1922

With the August, 1923, sales of the "Frigidaire" mechanical refrigerators of the Delco-Light Company, Dayton, Ohio, running about double last year's sales, an official of the company expects to make his year's quota of 5,000 shipments before Jan. 1. In August of this year the total was over 3,000, while in August, 1922, only 1,800 had been sold. This, according to Mr. Harlan, is the first year that the mechanical refrigerator has been pushed from a sales standpoint.

The company is now endeavoring to build up a sales organization, and more than two hundred salesmen were added during September. By 1924 more than one thousand salesmen will be employed exclusively in the sale of these mechanical refrigerators. On Oct. 15 all the salesmen will be brought into Dayton for a sales conference on refrigerators and Delco farm lights.

Anaconda Buys National Conduit & Cable Hastings Plant

The American Brass Company, an Anaconda Copper subsidiary, has purchased at receiver's sale the plant of the National Conduit & Cable Company for $3,000,000. Confirmation of this sale was made Oct. 4. The purchase price is the amount of bond issues standing against the property of National Conduit & Cable at Hastings-on-Hudson, N. Y., the bulk of which was bought up some time ago by Anaconda.

The present facilities of this property are operating at fair capacity upon export orders and others for Pacific Coast shipment. The rod and wire mill at Hastings has a capacity of 10,000,000 lb. per month and is in good condition, requiring only minor changes to make it highly efficient.

This new purchase by the Anaconda organization fortifies those wire mills so located as to cater economically not only to domestic but to world demand. One of the largest wire-mill units in the world is owned and operated by the Anaconda Company at Great Falls, Mont. This mill is used to serve the needs of the fast-growing Middle Western and Pacific Coast States. Plants at Ansonia and Waterbury, Conn., under the name of the American Brass Company, provide material for Eastern, Southern and Middle Western States. The Hastings plant is particularly well adapted to the exporting of copper rods and electric wires to continental Europe.

Westinghouse Orders in First Half of Year Gained 28 per Cent

The incoming orders of the Westinghouse Electric & Manufacturing Company for the first half of the fiscal year begun April 1, with September orders partly estimated, were $89,400,000, compared with $69,569,000 in the period for 1922, an improvement of more than 28 per cent. Bookings for the fiscal year ended March 31, 1923, were $152,300,000. September bookings were $10,600,000, against $11,500,000 in August.

Sales billed for the first half were around $74,900,000, with September billings estimated at $13,600,000, topping the previous month by about $600,000. Based on the first half, net earnings for the year are conservatively estimated at well over $8 a share on the $85,776,480 present outstanding common stock, or double dividend requirements. Differently stated, earnings for the present fiscal year will be at least as good as for the year ended March 31, 1923, despite an additional dividend disbursement of $1,197,002 required for the $14,962,500 new common offered in April.

While orders for the second quarter were between $4,000,000 and $5,000,000 under the previous quarter, officials expect an improvement in incoming business this fall, principally in small lines of electrical equipment. Lamp business began to pick up in September and will undoubtedly continue its improvement. Orders for central station equipment have slowed up somewhat.

Champion Switch to Use Jeffery-Dewitt Insulators

The Champion Switch Company, incorporated in Ohio, has been formed with the following officers: F. D. Stranahan, president; R. A. Stranahan, vice-president; R. W. Lillie, vice-president and general sales manager; J. F. Sinclair, treasurer and general manager; W. W. Hoffmann, secretary, W. L. Stinson, general superintendent.

The company has taken under lease property owned by the Ferguson Shipbuilding Company, 550 Abbott Road, Buffalo, and will enter into the manufacture of high-tension and low-tension indoor and outdoor switching equipment, bus supports, etc.

The engineers of the company have designed their apparatus to be mounted on and used with Jeffery-Dewitt insulators of the various designs now being produced by that company and additional designs which have been brought out for the particular purpose of use in connection with this class of apparatus. The new designs of insulators will have features not embodied in any other make, being in every sense of the word of unit type in that they can be readily replaced in case of necessity. These designs will offer higher electrical and mechanical values.

It is the belief of the company's engineers that the development of switching gear and apparatus as required by the rapid advancement of the art has heretofore been seriously retarded owing to the inability of switch manufacturers to control the design of porcelains for their particular requirements. The Champion Switch Company fortunately enjoys a relationship with the Jeffery-Dewitt Insulator Company that assures co-operation along these lines.

Irvington Company's Correction

A trade note appearing in the Sept. 15 issue of the ELECTRICAL WORLD to the effect that the Irvington Varnish & Insulator Company had taken over the selling agency of the output of the Harvey Wire Company of Newark, N. J., manufacturer of enameled wire, silk and cotton covered wire, etc., was in error as regards its headquarters, which are in Irvington, N. J., not in San Francisco.

Electric Truck Firms' Exhibit at New York Electrical Show

A feature of the Electrical and Industrial Exposition which will be held in the Grand Central Palace from Oct. 17 to 27 will be an exhibition of electric trucks on the north side of the second floor. Among the truck and accessory exhibitors will be Autocar, Commercial, O. B. Electric, Steinmetz, Walker, Walter, Baker, Edison Storage Battery, Electric Storage Battery, Philadelphia Storage Battery, Otto Sarvas, General Electric and Westinghouse.

Thursday, Oct. 18, has been designated as "Electric Truck Day." There will also be an electric truck luncheon during the show and a meeting of the Electric Truck Manufacturers' Association.

Habirshaw Case Postponed

The hearing in the case of the Habirshaw Electric Cable Company was postponed by Federal Judge Knox of the New York federal court last week to Oct. 20, at the request of both the creditors' reorganization committee and the stockholders' committee. The former committee asked for a week's postponement in which to prepare its papers, and the stockholders' committee moved that the hearing go over for two weeks to allow the attendance of counsel.

Since Malcolm D. Whitman, chairman of the reorganization committee, notified the creditors of the Habirshaw and subsidiary companies, the Electric Cable Company and the Bare Wire Company, Inc., that the reorganization plan had been declared operative, the committee of stockholders has renewed its efforts to have the case aired in court. The stockholders charge that certain interests among the large creditors of the failed concern would wipe out the stockholders if by so doing they could get control of the company for themselves.

Western Electric Acquires More Property for Hawthorne Works

For the third time within six months the management of the Hawthorne Works, Western Electric Company, in Chicago has been forced to go outside its own 216-acre area for more space to provide for continually growing manufacturing requirements. The latest expansion of the works has just been accomplished by the acquisition of a one-story building in the new Ashland industrial center at Seventy-fourth Street and Ashland Avenue. The lease for the new building, which will give the Western Electric 160,000 additional feet of space in Chicago, was closed Sept. 25.

The acquisition of new quarters at the southwest border of the city will enable the Hawthorne organization to draw new employees from an area it has never looked to for man power. Executives of the company estimate that by the time the new plant is in full running condition it will have been the means of adding at least one thousand men and two hundred and fifty women employees to the Western Electric forces. One hundred thousand square feet in the building will be used for manufacturing purposes and the other sixty thousand feet will be assigned to the merchandise department.

Benjamin Starts Jobber Window Display Campaign

In order to assist jobbers and dealers in the sale of the Benjamin two-way plug, the Benjamin Electric Manufacturing Company, 847 West Jackson Boulevard, Chicago, has announced a Hallowe'en window display contest starting the week of Oct. 24.

For the best window decorated with material obtained from the Benjamin Electric Company a first prize of $100 will be given. Other prizes range down from $75 to $10. The windows will be judged on the basis of the most attractive appearance from the outside view and for the best original use in creating sales value.

Wesco Supply Receives Large Stock of Electric Ranges

The Wesco Supply Company of St. Louis has recently authorized the concentration of a large supply of electric ranges in St. Louis. The Wesco Supply Company believes that the design it sells has become reasonably standard, and this large stock is to be kept in order that the company may be able to give a more dependable service for popular types of electric ranges. Initial shipments of this newly authorized stock have already been received.

The B. F. Sturtevant Company, Hyde Park, Boston, is buying considerable new machinery for installation in its plant in Racine County, Wis. The company is now employing one hundred operatives and expects to increase the number to three hundred by Jan. 1. The Sturtevant works have orders amounting to more than $500,000.

The H. T. Electric Company, 612 North Capital Avenue, Indianapolis, manufacturer of electrical equipment and supplies, is taking bids for a one-story-and-basement addition, estimated to cost $30,000.

The Pelton Water Wheel Company, Nineteenth and Florida Streets, San Francisco, will soon commence the erection of a two-story addition, estimated to cost $100,000, including machinery.

The Electric Furnace Construction Company is now in its new offices in the Jefferson Building, 1015 Chestnut Street, Philadelphia.

The Electric Heating Apparatus Company, Newark, N. J., manufacturer of heavy-duty furnaces, has opened a Chicago office at 140 South Dearborn Street, with F. A. Hansen as district manager. Mr. Hansen was formerly connected with the Westinghouse Electric & Manufacturing Company.

The Dayton Fan & Motor Company, Dayton, Ohio, has leased two buildings adjoining its plant, giving it an additional 20,000 sq.ft. of floor space.

The Union Electrical Company, Baltimore, has leased a three-story building at Charles Street and Lafayette Avenue for new local works. Immediate occupancy is being arranged.

The Standard Electric Stove Company, Toledo, Ohio, has leased a portion of the large plant of the Engman-Matthews Range Company, Goshen, Ind., and plans for the early establishment of a new plant at this location. It is purposed to remove the present Toledo works to the Goshen factory, with the installation of additional equipment.

The Mathews Brothers Company, 1661 West Washington Street, Los Angeles, manufacturer of batteries and other electric products, has acquired property at 1729 Santee Street and contemplates the erection of a new plant, for which plans will be drawn in the near future.

The Northeast Electric Company, Rochester, N. Y., is developing maximum capacity at its plant and has recently inaugurated an overtime schedule, giving employment to additional workers. It is expected to maintain the present basis of production for at least six months to come.

George Bender, 128 Center Street, New York City, agent for electrical machinery, has taken up the sale of the "Townsend" combination armature coil winder and puller. This is an adjustable-slot machine similar to other winding machines, but has attachments so that the operator after winding the coil pulls it into shape on the same machine. It is adjustable for any size from 1 hp. to 200 hp.

The Reinforced Switch & Manufacturing Company, Inc., 400 East North Avenue, Pittsburgh, announces that it has concluded arrangements whereby the W. O. Conley Electric Company of Philadelphia will sell its products in southern New Jersey and eastern Pennsylvania.

The B. B. T. Corporation of America, 810 Atlantic Building, Philadelphia, recently incorporated, will act as the American distributor for the products of Barbier, Benard & Turenne of Paris, France, manufacturers of electric lighting equipment. Material is at present being imported from the main factory in France, but plans are under way for manufacturing certain parts in this country. W. W. Kellett is secretary and treasurer.

Henry Newgard & Company, electrical contractors, 947 West Washington Boulevard, Chicago, are taking bids on a three-story factory, 75 ft. by 118 ft., at 125 South Morgan Street, Chicago, to cost $90,000.

The Reliance Electric Company, 1313 Moorman Street, Chicago, manufacturer of electrical equipment, has awarded a contract for a two-story-and-basement addition estimated to cost $55,000.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Vienna, Austria (No. 7,931), for air compressors with electric motors.

An agency is desired in Auckland, New Zealand (No. 7,936), for electric trucks; also for builders' cranes or hoists.

Purchase is desired in Marseilles, France (No. 7,898), for electric trucks.

Purchase and agency is desired in Christiania, Norway (No. 7,910), for electrolytic copper, cables, rods, etc.

An agency is desired in Johannesburg, South Africa (No. 7,916), for electrical household appliances.

Purchase is desired in Ahmedabad, India (No. 7,906), for electrical novelties, such as pocket torches, handlamps, refills, bulbs, bells, wires and accumulators.

Purchase is desired in Basse-Terre, Guadeloupe (No. 7,915), for radio receiving sets; also for turbine (110 volts) complete with switchboard and also for rheostat (No. 7,917).

FEEDER AND PILOT CABLES FOR SYDNEY, AUSTRALIA.—Tenders will be received by the City Council, Sydney, Australia, until Dec. 3 for high-tension feeder and pilot cables.

PROPOSED TELEPHONE LINES IN FRENCH INDO-CHINA.—Following an intensive campaign on the part of the Saigon Chamber of Commerce, according to *Commerce Reports*, the government has announced that the following telephone lines will be erected by the end of 1924: Mytho-Vinlong-Cantho; Cantho-Sectrang-Baclieu; Saigon-Ca St. Jacques, and two new Saigon-Pnompenh lines. The proposed new lines will cover a distance of more than 1,000 km.

PROPOSED HYDRO-ELECTRIC DEVELOPMENT ON CARUAO RIVER, VENEZUELA.—The construction of a hydro-electric plant on the Caruao River is contemplated by a Caracas syndicate, *Commerce Reports* states, to supply additional power to the city of Caracas. It is estimated that 3,000 hp. can be developed, which would be transmitted about 37 miles. It was originally intended to finance this project locally, but owing to the recent death of one of the proposed subscribers it is now hoped to obtain at least part of the funds abroad. American firms interested in this project can obtain names of the members of the above syndicate from the Electrical Equipment Division, Department of Commerce, Washington, D. C., or through any of the district offices of the bureau, by referring to file No. 105,419.

New Apparatus and Publications

ELECTRIC SOLDER POT.—A new electric solder pot with automatic heat control has been placed on the market by J. D. Wallace & Company, 1401 West Jackson Boulevard, Chicago.

MOTOR-DRIVEN CHAIN BLOCK.—The Motorbloc Corporation, Philadelphia, has issued bulletin No. S-801, describing and illustrating the application of the "Motorbloc" in several capacities.

PULVERIZED-FUEL EQUIPMENT.—The Combustion Engineering Corporation, New York City, has issued a catalog relative to its "Lopulco" fuel systems.

CARBON BRUSHES.—The Pure Carbon Company, Wellsville, N. Y., has issued catalog No. 4, covering proper recommendation of brush grades for various classes of service and the basis upon which recommendations are made. The catalog also illustrates and describes the various styles and designs of shunt connections.

OIL CIRCUIT BREAKERS.—The Metropolitan-Vickers Electrical Company, Ltd., Manchester, England, has issued leaflet 255 1-1, describing its type "K" oil circuit breaker.

SWITCHING EQUIPMENT.—"Automatic Switching Equipment for Waterwheel-Driven Alternators" is the title of instruction book 87,714A issued by the General Electric Company, Schenectady, N. Y. The company is also distributing a booklet covering its automatic station-control equipment.

FLUE-GAS FILTER.—The Uehling Instrument Company, Paterson, N. J., has brought out bulletin No. 116A, illustrating devices which it is said prevent fouling and corrosion of CO_2 equipment and the tubing which conveys the gas sample to the instrument continuously.

MOTORS.—The Hertner Electric Company, Cleveland, is issuing bulletin No. 10A, which describes its 40-deg. polyphase induction motors in sizes from ½ hp. to 50 hp.

MOTORS.—The Reliance Electric & Engineering Company, Cleveland, is issuing bulletin No. 2014, describing its type "Treliance" motors for direct-current circuits.

MOTORS.—The Burke Electric Company, Erie, Pa., is issuing bulletin No. 128, describing polyphase induction motors.

CIRCUIT BREAKERS.—The Roller-Smith Company, New York City, is issuing bulletin No. 560, describing its inclosed circuit breakers, types "P" and "E."

SWITCHBOARD INSTRUMENT.—The Roller-Smith Company, New York City, is issuing bulletin No. 450, describing its new switchboard instrument, type "Lida," for use in educational institutions or elsewhere, where a very large instrument whose indications are visible from a considerable distance is wanted.

SLUICEGATES.—Philips & Davies, Kenton, Ohio, are issuing leaflets which describe the caterpillar type sluicegates as manufactured by them under the Broome patents.

INSULATING MATERIALS.—The Mitchell-Rand Manufacturing Company, 18 Vesey Street, New York City, is issuing a handbook, "Everything in Insulation."

TRANSFORMERS.—The Pittsburgh Transformer Company, Pittsburgh, has issued bulletins Nos. 2023 and 2024, the first descriptive of its distributing transformer and the second showing various phases of the manufacture of its power transformers.

INDUSTRIAL ELECTRIC TRACTOR.—The Mercury Manufacturing Company, Chicago, has brought out the "Mercury" type H internal-gear electrically driven tractor for industrial use.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

CARIBOU, ME.—The board of directors of Cary Hospital will build a power house at its proposed hospital. H. W. Rhodes, 574-A Congress Street, Portland, is architect.

WOODLAND, ME.—The St. Croix Paper Company plans to enlarge its power plant, including the installation of additional equipment. Contract has been let for a 4,550-hp. turbine unit. Orders will be placed for other equipment at an early date.

PORTSMOUTH, N. H.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 23, for nine motors, spare parts and control appliances for the local navy yard. (Schedule 1397.)

BOSTON, MASS.—The Edison Electric Illuminating Company plans to issue $9,083,340 in capital stock, part of the proceeds to be used for extensions and improvements.

BOSTON, MASS.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 23, for armature machines for the Boston and Philadelphia Navy Yards. (Schedule 1401.)

MERIDEN, CONN.—The Connecticut Light & Power Company is preparing plans for the construction of a substation on Hanover Street.

Middle Atlantic States

AMSTERDAM, N. Y.—The Adirondack Power & Light Company contemplates increasing the output of its steam-driven electric plant on the Mohawk River to 80,000 hp. Contract for a turbo-generator has been awarded and orders for other equipment will soon be placed. Additional transmission lines will be built. The cost is estimated at $3,000,000.

BROOKLYN, N. Y.—Electric power equipment will be installed in the proposed ice-manufacturing plant to be erected on Lorimer Street by the Rubel Coal & Ice Corporation, 197 Glenmore Avenue, to cost about $500,000. E. M. Adelsohn, 1770 Pitkin Avenue, is architect.

BUFFALO, N. Y.—Plans have been approved for the installation of a street-lighting system on Richmond Avenue, from Colonial Circle to Forest Avenue, and on Peckham Street, from Jefferson Avenue to Sears Street.

FAR ROCKAWAY, N. Y.—The Queensborough Gas & Electric Company has issued $2,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

GENESEE, N. Y.—The Genesee Light & Power Company plans to erect a transmission line on Crittenden and Bloomingdale Roads. Lighting systems will be installed on both highways.

HUDSON, N. Y.—Electric power equipment will be installed by the Hoboken Paper Mill, Inc., 151 Fifth Avenue, New York, in connection with the rebuilding of its plant at Gould Station, recently destroyed by fire. The cost is estimated at about $200,000.

JEWETTSVILLE, N. Y.—Electric Power equipment will be installed by the Clay Products Company in connection with the rebuilding of its local plant, recently destroyed by fire. The cost is estimated at $100,000.

PERRY, N. Y.—The Perry Knitting Company plans to build a power plant at its mill.

PERRY, N. Y.—The Perry Electric Light Company plans to build an addition to its power plant. Work has started on a transmission line to Retsof, where connection will be made with the system of the Niagara Falls Power Company.

POTSDAM, N. Y.—The St. Lawrence County Utilities, Inc., recently organized, will take over the Potsdam Electric Light & Power Company, Massena Electric Light & Power Company, Ogdensburg Gas Company and the Ogdensburg Power & Light Company. Extensions and improvements are contemplated to the systems.

NEWARK, N. J.—The Public Service Electric Company will build a substation at its Point-No-Point power plant, to cost about $30,000.

SOUTH ORANGE, N. J.—Bids will be received by the Water Committee, Board of Trustees, until Oct. 19, for one motor-driven triplex pump of 225 gals. capacity per minute, with control equipment and auxiliary apparatus, for the local waterworks. Nicholas S. Hill, Jr., 112 East Nineteenth Street, New York, is consulting engineer.

BAIRD, PA.—The West Penn Power Company has applied for permission to erect a transmission line on steel towers across the Monongahela River, comprising six 132,000-volt lines, two 22,000-volt lines, two telephone lines and two ground wires.

CATASAQUA, PA.—The Bryden Horseshoe Company plans for the complete electrification of its works, replacing present steam-power equipment, in connection with extensions and improvements to cost more than $150,000.

ENOLA, PA.—The Pennsylvania Railroad Company is reported to be planning to equip its local yard for electrical operation.

EPHRATA, PA.—Plans are under consideration for improvements to the municipal electric plant, to cost about $50,000, for which bonds will be voted.

HARRISBURG, PA.—The Manada Electric Company, recently organized, represented by John E. Snyder, local attorney, plans to erect a transmission line in South Hanover Township.

HARTLETON, PA.—Leroy E. Yagel has applied to the Public Service Commission for permission to organize a company to install and operate an electric plant for commercial service in Hartleton and Hartley townships.

HARVEYS LAKE, PA.—The Harveys Lake Lighting Company has acquired the Noxen Electric Company, Kunkle's Electric Company and the Lehman Center Light Company, operating in adjoining districts. The properties will be consolidated and extensions made in transmission system.

JOHNSTOWN, PA.—Penn Public Service Company plans for a stock issue of $100,000, the proceeds to be used for extensions and improvements.

JOHNSTOWN, PA.—G. C. Savering, Johnstown, and associates have organized

the Kingsley, Hickory, Howe and Green Township Public Service Companies and the Forest Public Service Company, to install and operate transmission lines in the respective districts named.

OIL CITY, PA. — The Penn-American Refining Company plans to build an electric generating plant at its local refinery.

PARRYVILLE, PA. — The Lehighton Electric Light Company will install a local commercial system. Lines will also be extended to Weissport and in Mahoning Township for similar service.

PHILADELPHIA, PA.—The Philadelphia Electric Company has acquired a site on the Delaware River at the foot of Erie Avenue, for a new generating plant, on which work will be started early in 1924. The initial unit will have a capacity of about 40,000 kw. The cost is estimated at $5,000,000. Plans are also being prepared for a large distributing plant in this section.

PITTSBURGH, PA.—The Duquesne Light Company has awarded a contract for prime movers and other electrical machinery for its Colfax power plant. Orders for additional equipment will be placed at an early date. The cost of the work is estimated at $1,000,000.

BALTIMORE, MD.—Arrangements are being made for the construction of a 3,000-hp. power plant at the Johns Hopkins Hospital. Joseph E. Sperry, Calvert Building, is architect.

FAIRMONT, W. VA.—The Continental Coal Company, recently organized, contemplates the installation of electric power equipment and mining machinery at its property in Monongalia County.

FAIRMONT, W. VA.—Robert Talbott & Company plan for the installation of electric power equipment and mining machinery at their properties in Monongalia County.

KEYSER, W. VA.—The installation of electrically operated pumping machinery at the municipal waterworks is under consideration. J. N. Chester, Union Building, Pittsburgh, is engineer.

KILLARNEY, W. VA. — The Killarney Smokeless Coal Company, Lynchburg, Va., recently organized with a capital of $1,000,000, contemplates the installation of electric power and mining equipment at its local properties. James Gorman is president.

MORGANTOWN, W. VA.—The Monongahela West Penn Public Service Company has issued $1,500,000 in bonds, part of the proceeds to be used for extensions and improvements.

NEWPORT NEWS, VA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 23, for seventy-six radiant electric heaters. (Schedule 1395.)

WASHINGTON, D. C.—The Washington Railway & Electric Company is considering an issue of $2,496,500 in bonds, part of the proceeds to be used for extensions.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, until Oct. 27, for high-tension insulators and fittings, electric wire and cable, electric bells and fixtures, etc. (Circular 1564.)

North Central States

BATTLE CREEK, MICH.—Plans are being considered for the installation of a fire-alarm system, to cost about $10,000. E. U. Hunt, City Hall, is engineer.

DETROIT, MICH.—The Board of Education will build a power house, to cost about $30,000, in connection with a new school on Cameron Street. Malcomson, Higginbotham & Palmer, Industrial Building, are architects.

DETROIT, MICH.—The Ford Motor Company, Highland Park, has taken an option on a site on the Rifle River, near Omer, for a proposed hydro-electric plant. It will be the first of six plants to be built by the company in this section.

GRAND HAVEN, MICH.—Plans are being completed for the construction of a municipal electric plant on Water Street, to cost about $75,000. A. C. Clark, 1151 Columbus Avenue, is architect.

GRAND RAPIDS, MICH.—Electric power equipment will be installed in the new local cement-plaster manufacturing plant of the Certain-Teed Products Corporation, 100 East Forty-second Street, New York, on which work has been commenced. It will cost about $200,000.

JACKSON, MICH.—Preliminary plans are being prepared by the Consumers' Power Company for a hydro-electric power plant on the Manistee River, with initial output of 25,000 kw., to cost about $400,000. The Fargo Engineering Company, Citizen-Patriot Building, is engineer.

KALAMAZOO, MICH.—The Valley Paper Company, recently organized, will build a power plant at its proposed local mill, to cost $900,000. Billingham & Cobb, Press Building, are engineers.

PEWAMO, MICH. — The Community Power Company has acquired the local municipal electric system and will furnish service from its plant at Hubbardstown. It is planned to install systems at Fowler and Westphalia.

BARBERTON, OHIO—Tentative plans are under consideration for the installation of electrically operated pumping machinery in connection with extensions to the waterworks.

LIMA, OHIO—The Ohio Power Company is planning to build a transmission line from Fostoria, to cost about $550,000. A local substation will be built at a cost of about $215,000. A new switching station will be erected at Fostoria, to cost $115,000. Plans are also under way for the erection of a transmission line from the power plant at Philo to Canton, to cost about $1,000,000.

LORAIN, OHIO — Arrangements have been made by the Ohio Public Service Company for the erection of a transmission line along the right-of-way of the Baltimore & Ohio Railroad in this section.

ROCKY RIVER, OHIO—Plans are being arranged for the installation of electrically operated pumping machinery in connection with a new waterworks plant to be used jointly by the towns of Rocky River, Bay and Dover, to cost about $300,000. E. A. Arnold is engineer.

TOLEDO, OHIO.—The Toledo Edison Company is disposing of a bond issue of $900,000, part of the proceeds to be used for extensions.

YOUNGSTOWN, OHIO.—The Ohio River Edison Company, recently organized to construct a local generating plant, has arranged for an increase in capital stock of $9,000,000, part of the proceeds to be used for plant and transmission-line construction.

ASHLAND, KY.—The Kentucky Face Brick Corporation, recently organized, plans to build an electric plant at its proposed local works, to cost about $150,000.

WINAMAC, IND.—The Interstate Public Service Company will build a 13,200-volt transmission line from a point near Francisville, about 15 miles, for local service. The municipal power station will be closed.

ANNA, ILL.—A power plant will be installed at the proposed local cement plant to be built by A. A. Fasig, Anna, and associates, to cost about $750,000.

MASON, ILL.—The Illinois Coal Corporation, Old Colony Building, Chicago, contemplates the construction of a power plant at its local properties.

LAKEVILLE, MINN.—Plans are under consideration for the installation of electric pumping machinery in connection with a new waterworks system. Druer & Milinowski, Globe Building, St. Paul, are engineers.

ARMSTRONG, IOWA.—The Iowa Falls (Iowa) Electric Company has acquired the property of the Emmet County Light & Power Company. Extensions and improvements are contemplated to the system.

MOUNT VERNON, IOWA.—The Iowa Railway & Light Company, Cedar Rapids, has purchased the property of the Wapsie Power Company and will make improvements, including extensions in transmission lines.

LEXINGTON, MO. — The McGrew Coal Company contemplates rebuilding its power plant and machine shops, recently destroyed by fire. The loss is estimated at $90,000.

LINCOLN, NEB.—The Continental Gas & Electric Corporation has issued $1,000,000 in bonds, part of the proceeds to be used for extensions.

KANSAS CITY, KAN.—The Kaw Valley Drainage District, 719 Osage Street, plans to install twenty electrically operated pumping units, to cost about $185,000.

TECUMSEH, KAN.—Preliminary plans are being prepared by the Illinois Power & Light Corporation, Peoria, Ill., for a new 15,000-kw. steam-driven electric plant in this vicinity, to cost about $2,000,000, with transmission system.

Southern States

ANDREWS, N. C.—Bids will be received by the Board of Aldermen until Oct. 24 for the construction of a 1,250-kw. hydro-electric plant on the Hiawassee River, including hydraulic and electrical machinery and auxiliary equipment, power station, 11-mile transmission line and power dam 390 ft. long and 40 ft. high. The Ludlow Engineers, Inc., Winston-Salem, N. C., are engineers.

AHOSKIE, N. C.—The Wall Street Tobacco Company, 79 Wall Street, New York, will build a power house at its proposed local plant, to cost about $375,000.

BURLINGTON, N. C.—The Queen Anne Textile Company plans to build a power house at its proposed local cotton mill, to cost about $1,000,000.

CENTRAL FALLS, N. C.—The Central Falls Manufacturing Company plans to construct a hydro-electric plant for local service.

COLUMBIA, S. C.—The Columbia Railway & Navigation Company is planning to build a 40,000-hp. hydro-electric plant on the Cooper River. A transmission line will be erected to Georgetown, Orangeburg and vicinity. The project will cost about $1,000,000.

WESTMINSTER, S. C.—Plans are under consideration for the installation of electrically operated pumping machinery at the proposed municipal waterworks, to cost about $150,000.

DALTON, GA.—The American Thread Company, 260 West Broadway, New York City, plans to construct a 1,500-hp. power plant at its proposed local mill, to cost about $1,000,000. Lockwood, Greene & Company, Atlanta, are engineers.

CRESCENT CITY, FLA.—Bonds for $39,500 have been sold, part of the proceeds to be used for extensions to the municipal electric system.

TALLAHASSEE, FLA.—The West Florida Power Company has acquired the local municipal electric plant under lease for a period of years and will make extensions and improvements for increased service.

MEMPHIS, TENN.—The Southern Hotel Company will install an electric plant at its proposed Hotel Peabody on Union Avenue, to cost about $2,000,000, for which bids will be called early in November. The equipment will include three 200-kw. generators and auxiliary apparatus. W. W. Ahlschlaeger, Inc., 65 East Huron Street, Chicago, is architect.

GADSDEN, ALA.—The Alabama Power Company has applied for permissioin to build a hydro-electric plant on the Coosa River. The plans call for an ultimate capacity of 100,000 hp., to cost about $3,000,000.

GREENVILLE, ALA. — The Alabama Power Company, Birmingham, has acquired the property of the Electric & Manufacturing Corporation. Local service will be furnished from the proposed transmission line of the Alabama company from Montgomery.

TUSCALOOSA, ALA. — The Alabama Power Company is arranging for a bond issue of $4,000,000, the proceeds to be used in connection with the purchase of the property of the Tuscaloosa Railway & Utilities Company and proposed extensions.

JONESBORO, ARK.—The Jonesboro Cotton Mills, Inc., recently organized, plans to construct a power house at its proposed local textile mill, to cost about $400,000.

GIBSLAND, LA.—Plans are being prepared for extensions and improvements in the municipal electric system. E. T. Archer & Company, New England Building, Kansas City, Mo., are engineers.

LEESVILLE, LA.—Plans are under consideration for the installation of electrically operated pumping machinery at the proposed new waterworks plant, to cost about $150,000. E. T. Archer & Company, New England Building, Kansas City, Mo., are engineers.

ENID, OKLA.—The Oklahoma Gas & Electric Company has commenced the erection of a transmission line to Drumright via Covington. Substations and distributing systems will be installed at both places.

KIEFER, OKLA.—The Oklahoma Union Railway Company plans to construct a number of substations in connection with a new traction line to Okmulgee via Nuyaka, about 32 miles.

OKMULGEE, OKLA.—Electrically operated pumping machinery will be installed at the municipal waterworks in connection with extensions to cost about $1,000,000. Burns & McDonnell, Interstate Building, Kansas City, Mo., are engineers.

CALVERT, TEX.—The Madison Oil & Coal Company, Westheimer Building, Houston, plans to construct a power plant in connection with a new coal tipple at its local properties.

KENEDY, TEX.—Plans are under consideration for the installation of electrically

operated pumping machinery at the municipal waterworks.

SAN ANTONIO, TEX.—The installation of an ornamental lighting system on Broadway, between Tenth and Houston Streets, is under consideration.

Pacific and Mountain States

BELLINGHAM, WASH. — The Utah-Idaho Sugar Company, Salt Lake City, Utah, plans to construct a power plant at its proposed local sugar mill, to cost about $1,000,000.

TONO, WASH.—The North Coast Power Company has applied for a franchise in Thurston County to erect a transmission line from Bucoda to Tono to furnish electricity here.

WALLA WALLA, WASH.—Plans are being considered for the construction of a 4,000-hp. hydro-electric plant in connection with an irrigation project in this district, to cost about $1,500,000. Ernest B. Hussey, Alaska Building, Seattle, is engineer.

WINLOCK, WASH. — Electric power equipment will be installed in the proposed local ice-manufacturing plant to be erected by the City Transfer Company, Centralia.

HILLSBORO, ORE.—William Briot is considering plans for the construction of a power plant on Panther Creek, where a water right has been secured.

KLAMATH FALLS, ORE.—The California-Oregon Power Company is completing arrangements for the purchase of the Douglas County Light & Water Company, Roseburg, and will make extensions and improvements in plant and system. Bonds for $1,000,000 have been issued, a portion of the fund to be used for the expansion.

COLUSA, CAL.—Arrangements are being consummated for the purchase of the local power plant and distributing system of the Pacific Gas & Electric Company, to be operated in the future as municipal property. Extensions and improvements are planned.

CROCKETT, CAL.—The Great Western Power Company contemplates the rebuilding of the portion of its local power plant, destroyed by fire Sept. 21, with loss approximating $100,000, including equipment.

CUDAHY, CAL. — The National Paper Products Company, a subsidiary of the Zellerbach Paper Company, 534 Battery Street, San Francisco, plans to build a power plant at its proposed local paper mill, to cost about $2,000,000.

FRESNO, CAL.—The San Joaquin Light & Power Company has secured permission from the State Water Department to construct a hydro-electric plant on the San Joaquin River, Fresno County, to develop 6,700 hp.

FRESNO, CAL.—Arrangements are being made for the installation of ornamental lamps on portions of Broadway, North Broadway, Wishon, Olive and Forthcamp Avenues. The plans provide for 350 standards with underground conduit system. William Stranahan is city engineer.

LOS ANGELES, CAL.—The Department of Public Service, Bureau of Light, plans to build a substation at 3514 South Normandy Avenue.

LOS ANGELES, CAL.—The San Pedro Lumber Company, Wilmington district, will build a substation at its plant at Wilmington and San Pedro Roads.

LOS ANGELES, CAL.—Electric power equipment will be installed at the proposed plant of the Los Angeles Cotton Mills, Inc., 628 Metropolitan Building, on site near the city limits, estimated to cost about $150,000. M. H. Merrill & Company, 50 State Street, Boston, Mass., are engineers.

NEWPORT BEACH, CAL.—The installation of an ornamental lighting system in the Peninsula section, near Balboa, is under consideration. Paul E. Kressly, 732 H. W. Hellman Building, Los Angeles, is city engineer.

SACRAMENTO, CAL.—Ray L. Allin, Sacramento, and associates have applied to the State Water Department for permission to construct a series of hydro-electric plants on Clear Lake, Cache Creek, Tiegler Creek and Putah Creek, in Yolo, Lake and Napa Counties, with total output of 215,000 hp.

SAN FRANCISCO, CAL. — The Pacific Gas & Electric Company has secured permission from the State Reclamation Board to construct a substation on the Wadsworth Canal.

TWIN FALLS, IDA.—The board of directors of the Milner Canal System plans to construct a power plant to cost about $125,000 in connection with the canal project.

TUCSON, ARIZ.—The Tucson Gas, Electric Light & Power Company plans to erect a transmission line in the Sawtelle and Metz districts.

WILLIAMS, ARIZ. — Plans are under consideration for the installation of electric pumping machinery in connection with extensions and improvements in the municipal waterworks. The Burns & McDonnell Engineering Company, Marsh-Strong Building, Los Angeles, is engineer.

BUTTE, MONT.——Plans are being arranged for the installation of an ornamental lighting system in streets adjoining the business section, to cost about $24,000. The installation of ornamental lamps on Argyle and Phillips Streets is also under consideration.

Miscellaneous

PETERSBURG, ALASKA.—Plans are being arranged for a hydro-electric plant in Petersburg, for which bids will be received until about Nov. 1 by Hubbell & Walker, Alaska Building, Seattle, engineers. The equipment will include two water turbines of 500 hp. each, two generators of 500 hp. each, and auxiliary apparatus; also apparatus for a 15-mile transmission line. The project will cost about $100,000.

ANCHORAGE, ALASKA.—Bids will soon be called by the Constructing Quartermaster, United States Army, Fort Mason, Cal., for the construction of a power house in connection with a number of new buildings here for an army post, to cost about $700,000. An electric lighting system will also be installed.

Electrical Patents

Announced by U. S. Patent Office

(Issued Sept. 18, 1923)

1,468,593. AIR-HEATING UNIT; E. M. Erb, Jersey City, N. J. App. filed Aug. 26, 1922. Designed to heat air or gases passing through apparatus.

1,468,610. WRAPPING MACHINE; J. Scherner, Milwaukee, Wis. App. filed Aug. 4, 1922. Electrically driven tire-wrapping machine.

(Issued Sept. 25, 1923)

15,689 (reissue). CONDENSER; C. D. Tuska, Hartford, Conn. App. filed March 29, 1919. Adjustable condenser made of paper and metal foil.

1,468,649. PROCESS FOR ELECTRICALLY TREATING LIQUIDS; H. B. Rudd, Mansfield, Ohio. App. filed March 3, 1920. To destroy any bacteria therein.

1,468,653. CONDENSER; C. D. Tuska, Hartford, Conn. App. filed July 30, 1923. Made of tinfoil and paper.

1,468,660. SIGNALING SYSTEM; A. P. Davis, Brooklyn, N. Y. App. filed Dec. 30, 1919. Applied to fortifications and warships.

1,468,680. WHEEL MOUNT; E. Telleson, Binghamton, N. Y. App. filed April 26, 1919. For trolley poles.

1,468,687. TRANSMISSION REGULATION; H. A. Affel, Brooklyn, N. Y. App. filed May 4, 1922. For carrier current or radio telephone system.

1,468,701. SWITCH MECHANISM; V. R. Despard, Hinsdale, Ill. App. filed March 6, 1917. Chain switch for lamp sockets.

1,468,704. APPARATUS AND METHOD FOR MEASURING TRANSMISSION; H. S. Hamilton, New York, N. Y. App. filed Dec. 5, 1921. Of radio signals.

1,468,721. GARMENT IRONER; B. W. Macy, Jacksonville, Fla. App. filed Jan. 21, 1922. Heat generated is communicated to ironing surface by insulating liquid.

1,468,722. ELECTRICAL HEATING DEVICE; B. W. Macy, Jacksonville, Fla. App. filed May 6, 1922. Water heater.

1,468,723. ELECTRICALLY HEATED IRONING DEVICE; B. W. Macy, Jacksonville, Fla. App. filed May 6, 1922. Heating element immersed in liquid.

1,468,729. AUTOMATIC REGULATOR; J. S. O'Hara, Romney, W. Va. App. filed Sept. 3, 1920. To maintain constant temperature, speed, pressure, frequency, quantity or vacuum

1,468,756. DIMMER ATTACHMENT FOR VEHICLE SYSTEMS; G. J. Smith, Peoria, Ill. App. filed Feb. 20, 1922. Dimmer control button on steering wheel.

1,468,764. ELECTROPLATING APPARATUS; Van Winkle Todd, Millburn, N. J. App. filed Dec. 27, 1922. Continuous process.

1,468,789. ELECTRIC CONTACT OPERATING DEVICE; O. M. Leich, Genoa, Ill. App. filed April 24, 1918. For alternating-current rectifiers.

1,468,793. SWITCH FOR CONTROLLING IGNITION CIRCUITS; J. A. Bessey, Jr., Marcellus, N. Y. App. filed May 10, 1922. For preventing theft of vehicle.

1,468,830. SIGNAL FOR AUTOMOTIVE VEHICLES; A. S. Ouzoonian, New York, N. Y. App. filed May 17, 1922. Combined tail-light, direction indicator and device for holding and illuminating license plate.

1,468,838. CATHODE FOR THE ELECTROLYTIC REFINING OF METALS; C. H. Schuh, Brooklyn, N. Y. App. filed Sept. 22, 1922. For refining copper.

1,468,853. TELEPHONE EXCHANGE SYSTEM; A. H. Adams, Galion, Ohio. App. filed May 13, 1920. Machine switches employed for establishing connections.

1,468,871. METHOD AND APPARATUS FOR PASTEURIZING MILK; T. H. Anglim, Dunkirk, N. Y. App. filed Dec. 1, 1921. Milk is electrically heated.

1,468,882. DIMMING SWITCH FOR AUTOMOBILE LIGHTS; C. W. McKee, Harrisburg, and W. T. Taggart, Marietta, Pa. App. filed Nov. 18, 1922. Mounted on steering wheel.

1,468,883. DRIVING ATTACHMENT FOR MAGNETOS; A. Rosner, Springfield, Mass. App. filed Dec. 23, 1921.

1,468,946. RESISTANCE; A. J. Horton, New York, N. Y. App. filed July 28, 1920. Unit type.

1,468,957. COMPOSITION OF MATTER; L. E. Brownell, St. Paul, Minn. App. filed April 17, 1922. Salt, alum and glycerine added to sulphuric acid solution for storage-battery electrolyte.

1,468,982. DUPLEX TELEGRAPHIC SYSTEM; H. W. Sullivan, London, England. App. filed March 22, 1921. Special artificial line to balance actual line.

1,469,015. ELECTRIC BATTERY; L. L. Jones, New York, N. Y. App. filed April 1, 1921. Secondary battery of lead-cell type.

1,469,033. ELECTRIC FURNACE; W. F. Bleecker, Boulder, Col. App. filed July 8, 1920. For reducing tungstic oxides to metallic tungsten.

1,469,037. SOCKET AND SHELL CAP FASTENING; V. R. Despard, Hinsdale, Ill. App. filed July 21, 1917. Lamp socket.

1,469,038. LAMP SOCKET; L. Erikson, Malden, Mass. App. filed June 5, 1920. App. filed June 5, 1920. For use in showcase reflectors.

1,469,043. PROCESS FOR MAKING ELECTRICAL CONTACTS; C. A. Laise, Weehawken, N. J. App. filed May 2, 1921. Method of welding base metal to contact joint metal.

1,469,056. REMINDING DEVICE; G. I. Sullivan, Philadelphia, Pa. App. filed Oct. 18, 1922. Clock arrangement for ringing electrically operated bell.

1,469,075. ELECTRON-DISCHARGE APPARATUS; H. E. Dunham, Schenectady, N. Y. App. filed March 23, 1921. Producing and varying emission of secondary electrons from cold electrode.

1,469,078. SECTION INSULATOR; K. Fritsch, Murnau, Germany. App. filed Feb. 20, 1923. For overhead trolley-wire construction.

1,469,090. VEHICLE DIRECTION INDICATOR; C. R. Krone, Oakland, Cal. App. filed Sept. 21, 1920. Rear direction signal.

1,469,097. SUPPORTING DEVICE; S. S. Matthes, Mansfield, Ohio. App. filed Feb. 9, 1923. For supporting trolley conductors from overhead structure.

1,469,098. CONDUCTOR SUPPORT; S. S. Matthes, Mansfield, Ohio. App. filed May 28, 1923.

1,469,107. BINDING POST; C. Phillips, Jr., Philadelphia, Pa. App. filed March 31, 1922.

1,469,119. ELECTROLYTE GAS AND SPLASH ESCAPE; E. A. Stallings, Wirt, Okla. App. filed Nov. 22, 1921. For storage battery or other electrochemical apparatus.

1,469,127. PROTECTIVE DEVICE; E. B. Wedmore, Golder's Green, England. App. filed Dec. 10, 1919. Pilot-wire protection of transmission lines.

1,469,134. CONDUCTOR SUPPORT; A. C. Wood, Mansfield, Ohio. App. filed March 10, 1923. For suspending trolley wire from hanger.

1,469,186. ELECTRIC CONNECTOR; E. A. Kuen, Cincinnati, Ohio. App. filed May 24, 1920. For miniature-lamp bulb socket.

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Support Action with Action

TWO years ago last summer the Superpower Survey of the Northeast Atlantic Seaboard made its report. "Superpower" as a word, as an idea, as an inspiration, was widely heralded to the public. No particular conception of it registered, except a vague idea of the development of mammoth power stations and transmission lines and an era of more and cheaper electricity.

Meanwhile, the electrical industry has gone its way, steadily if slowly, making an interconnection here, building a huge station there, always with the ultimate aim in view, though in a hazy future. In other parts of the United States interconnection on an extensive scale has progressed more rapidly. But in all cases the public has failed to be impressed with the fact that it was experiencing a "superpower" development—and, as a matter of fact, the electrical industry itself knows that it is far from a complete accomplishment of what is practicable, feasible and highly desirable from an engineering and economic point of view.

HERBERT HOOVER, with characteristic directness and perception, has started to pave the way toward a consummation of many of these superpower plans for the Northeastern States which are known to be practicable and desirable. Recognizing that widespread reciprocal interconnection and a comprehensive development of water power can never be realized until the various states in the region can agree upon a program of co-operation in encouraging the development, he has appealed directly to that group of public representatives most intimately familiar with the situation and its problems to start something that will result in action. Some move had to be made. Secretary Hoover had the courage and foresight to take the initiative. Particularly in the region under discussion will superpower development be an aid to industry—which, of course, is the aim of the Department of Commerce under its present Secretary. Fortunately and wisely he has emphasized the fact that this whole plan has no element of politics in it, but is solely a matter for engineering, business and economic consideration.

IT IS extremely important that utilities co-operate in the work the Secretary has started not only with full sympathy but also with real constructive action. Mr. Hoover pointed out, and his conference with the commissioners further emphasized, that a common or uniform program of permissive legislation, or at least of non-inhibitory legislation, must be inaugurated by the various states. But he pointed out, too, that the utilities must also co-operate in working out the necessary intercorporate financial, legal, engineering and commercial problems necessary to a full consummation of the general plan.

The public vaguely wants "superpower." It wants hydro-electric development. It wants electrified industry. It wants electrified homes. Moreover, it wants to obtain all this as quickly and as economically as possible. The idea is practicable, as the electrical industry itself is fully aware and has announced. The promise has been held out and it is now time for action. The states concerned must act, the utilities must act, and it is not only an encouragement but a very practical move toward accomplishment that Secretary Hoover himself has acted and set up a program of definite constructive purpose.

Arthur B. West

A central-station executive who has exerted a tremendous influence in the economic developmen by hydro-electric power of southeastern California.

THE story of the part that hydro-electric power has played in the economic development of the great Imperial Valley, the citrus-fruit belt of southern California and the mining district of western Nevada and southeastern California is really the story of the career of Arthur B. West, president and general manager of the Southern Sierras Power Company. Born in Rochelle, Ill., in April, 1877, Mr. West was graduated from Stanford University in 1899, remaining there for two years for a post-graduate study of law. In 1906 he became junior member of the law firm of Potter & West, counsel for the Nevada-California Power Company at Denver. Thenceforth he was to become more and more closely identified with hydro-electric development on the Pacific Coast.

Back in the days of the Goldfield and Tonopah mining discoveries in Nevada, a group of Denver capitalists developed hydro-electric power on Bishop Creek in northwestern Inyo County to supply the urgent needs of the gold and silver camps across the Nevada line. This company, known as the Nevada-California Power Company, carried its line across the barren White Mountains at an altitude of 10,000 ft. and over other intervening ranges to the camps, mines and mills of the new Golconda which had grown up over night amid the sage brush and cacti. Seeking new and permanent markets for the power that could be developed on Bishop Creek and other streams in the vicinity, it was decided to extend the line south a distance of 239 miles, across the Mojave desert and over the San Bernardino range, to the prosperous citrus and agricultural districts of Riverside and San Bernardino Counties and to the Imperial Valley.

The project involved transmission of power over an unheard-of distance at twice the next highest voltage then known in California. The Southern Sierras Power Company was organized and the line built during 1911 and 1912. This line stands today as the world's longest transmission line—537 miles. At this time Mr. West was called from the legal to the executive branch of the business to become vice-president and assistant to President Delos A. Chappell. On Mr. Chappell's death, in 1916, Mr. West was made first vice-president and general manager, and since early this year he has been president and general manager. In addition he is general manager of the Nevada-California Power Company and the Holton Power Company, both subsidiaries of the Southern Sierras Power Company. He is an active and vigorous force in economic, civic and social betterment.

Editorial Comment

Electrical World, October 20, 1923
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Light as a Safeguard

CASUALTY statistics for many years were full of records concerning industrial accidents, machine-butchered hands and arms and feet, cuts and bruises from tools, broken limbs and heads from falls, and similar unpleasant items in the day's work. Fortunately the safety campaigns of various agencies, including notably the National Safety Council, have done much to reduce the number of such injuries. But they are still too many.

It is somewhat surprising that more emphasis has not been placed upon light as a most effective agency in the reduction of industrial accidents. The experimental proof of the increased accuracy and speed of vision with increased intensity of illumination points directly and with emphasis to the increase of lighting facilities as a safety measure. For when a man sees danger clearly and quickly he seldom intentionally walks into it.

There are few mechanical guards so effective for safety as good light. And, what is of further real value, light is the only guard which at the same time increases the efficiency of the workman.

The Antics of Modern Physical Theory

WHY should the exponent of the distance in the inverse-square law be exactly "two"? Thoughtful students of nature's laws have often wondered at their simplicity and have seen in this very simplicity the probability of their ultimate explanation in terms of some deeper fundamental phenomena. Careful electrostatic measurements have determined that the exponent "two" for electric forces is accurate to within one part in forty thousand, and for years there has been a general acceptance of the exact inverse-square relation between electric force and distance.

But the discovery of the electron and the study of its relation to the positive nucleus of the atom have shown clearly that the inverse-square law cannot hold for the minute distances involved in the dimensions of the atom. Some other law must obtain, if the forces within the atom are all electrical, as seems certain, and if the law is to explain even the most ordinary facts of chemistry and physics. And, strange to say, the new law must provide a change from attraction to repulsion between opposite charges as the minute distances between these minute charges vary. How then can there be a law involving an accurate inverse square of the distance for all direct tests of the law and which must yet be abandoned or changed when we descend to atomic dimensions? The answer is simple. The law is expressed by a series of terms having different exponents of the inverse distance. For ordinary distances within man's recognition the inverse-square relation far outweighs all the other terms, but for the minute distances between electrons within the atom other terms become preponderating, so that the actual relation of electric force and distance between charges passes through a process of change which reverses the direction of the force for the smallest distances. By assuming a law of force of this character Sir. J. J. Thomson has been able to explain on electrical grounds a large number of chemical and physical phenomena hitherto unrelated and obscure.

Another curious product of modern physics is the so called "quantum" hypothesis by which electrical radiation, generally supposed throughout the whole history of physics to be a continuous or uniform phenomenon, in reality takes place by pulses. These pulses are due to the shifting of electrons from one orbit of equilibrium to another within the atom. Apparently there are a series of concentric orbits about the central positive nucleus, in any one of which a number of electrons can be in equilibrium. But if by the collision of two atoms, or by radioactive or other stimulus, an electron is knocked out of one orbit, it immediately pitches into some other one, and this plunge from one orbit to another gives out by radiation a "quantum" of energy. This quantum is found to be a constant over a wide range of radiation phenomena. The question of the universal periodic property of radiated energy is as yet not completely explained, but the fundamental fact of energy pulses of definite amount as the basis of electromagnetic radiation seems to be established beyond doubt.

The Water-Power Situation in New York State

STRONG opposition to the constitutional amendment permitting the erection either by the state itself or by private promoters of electric power houses and transmission lines in the New York State Forest Preserve in the Adirondack district has manifested itself in that commonwealth, and the voters are being called upon both by a Committee to Prevent the Exploitation of the Adirondacks and by Governor Smith to defeat the proposed change in the fundamental law. The opposing arguments take two forms—one that the amendment would permit virtual private ownership in the form of fifty-year leases of the state's potential water powers without provision for due compensation to the people and that these water powers should continue to be vested absolutely in the state and any development of them made and operated by the government; the other that the amendment would lead to a destructive raid on the mountain parks by timber and power companies, defacing scenery, destroying forests and creating "highly artificial, unsightly and dangerous conditions." The opponents of the amendment also point to the way in which it was twice rushed through the Legislature in its closing hours as an

indication to their minds of something sinister and underhand in the whole proceedings.

On the other hand, the advocates of the amendment, denying the truth of such statements and insinuations, lay stress upon the crying need of more electrical energy for the industries and homes of the state, some claiming that a million horsepower—a metropolitan journal enlisted in their support makes it a hundred million!—can be made available on the adoption of the measure by the utilization of less than 2,500 acres out of 6,000,000, though the proposed amendment would permit up to 3 per cent of the preserves to be taken, or 180,000 acres. It is also pointed out that a short route would be furnished for transmitting power from the St. Lawrence River through the mountains to lower New York. According to these defenders, who number among them men of standing in public life as well as some prominent in electrical circles, the constitutional amendment is unequivocally in the public interest and its leading antagonists are a "small group of wealthy owners of private estates and preserves."

Thus there are presented the same conflicting points of view that are sure to be confronted whenever in any part of the country a question of the development of water power on public and scenic lands comes up. The voters, awake to the advantages of electricity both to turn the wheels of industry and to lighten household tasks and enhance domestic comfort, are at the same time jealous of private exploitation of public resources. To them from divers sources comes conflicting counsel. Public utilities in esse and in posse are eager to serve them, but naturally on the condition that the utilities themselves shall gain a reasonable profit on their investment and their enterprise. Devotees of public ownership, on the other hand, would cheerfully pile up a great public debt, as has been done just across Lake Ontario, to permit the retailing of electricity at a low price by the state. Tourists, campers, artists and nature lovers, whose motives are worthy of all respect, preach preservation as a matter of esthetic duty, putting beauty so far above utility that sometimes a single scar on the scenery outweighs in their minds the thought of vast material development. Proprietors of delightful estates—a very small fraction of the population—anxious lest their surroundings be marred by the despoiler, join the outcry—and finance it. On both sides of the question, too, are undoubtedly conscientious political leaders and representatives, as well as others swayed by interested or partisan motives. Sometimes the citizen finds it difficult clearly to distinguish between the two classes.

To steer a straight course through these cross-buffeting waves and against these contrary breezes, the electric light and power industry must study the situation impartially and unselfishly. Its is the responsibility for an adequate electrical development and service for any community. Sorely as it is needed, it would be better for water-power development in any state to be delayed than for it to be promoted with any suspicion of subterfuge or under enactments imperfectly protecting the state from possible injury and loss. The contradictory statements about the objects and the implications of the Ferris amendment need clearing up, and the electrical industry should be the first to insist upon this clarification. So far, in New York, the central-station companies with few exceptions have made no aggressive move either to learn or to tell what it is all about. Doubtless any clarification they may make will show definitely to the people that the proposed amendment is in public interest and should be supported. If the amendment shall be carried next month, the legislative enactments that will make it operative and the executive machinery set up to enforce it should embody that wise middle course between unbridled private responsibility and unduly obstructive legislation that nine times in ten is the best political wisdom. In the contest that will ensue between the respective advocates of public and of private development the latter could disarm suspicion only by making it as clear as day that they did not desire to capitalize "unearned increments" and were prepared to submit to all proper regulation. If the amendment shall be defeated, before another one is submitted to the people the matters in dispute should be thoroughly thrashed out at public hearings. The whole water-power situation in New York State, which has so important a bearing on interstate networks and nation-wide superpower, needs to be put on a stable and permanent foundation such as, after years of effort, was provided as regards our national parks and our navigable streams by the creation of the Federal Power Commission.

Building Distribution Systems with Prophetic Vision

NOT many years ago central-station business consisted largely of residence and street lighting. Possibly some industrial load was carried, but this was usually in a confined area served very readily by primary service at about 2,300 volts. Today all that is changed, and more and more it becomes evident that the conditions now affecting distribution of energy in large metropolitan areas cause much difficulty in rendering adequate service at an economical rate. One factor in this problem is the widely scattered and more numerous power customers served and another is the increase in both amount and density of both power and lighting load in the more congested districts.

The trend is toward more substations and higher distribution voltages as the way to meet the situation, but a rather chaotic situation is coming about on many systems as a result of somewhat haphazard methods. Some are finding that changing old circuits to three-phase, four-wire is merely a stop gap in the search for a means of getting greater capacity in the distribution system. Others attempt power distribution at voltages around 13,000 for power customers and a second lighting distribution based on three-phase, four-wire circuits. Still other combinations are found involving small automatic alternating-current substations, network transformer operation or a multiplicity of substations. Regulation methods are debated, and there are varying practices of regulation from substations, regulation at the pole, regulation on the customers' premises and separate regulation of residence circuits and power circuits. Some distribution lines have high-voltage and low-voltage power circuits, high-voltage and low-voltage residence lighting circuits, and in addition street-lighting circuits, all on the same poles. And even the practice of serving power customers is very much a matter of individual opinion and experience on the various properties, while power-factor corrective practice is still more individualistic in character.

Such a situation affords a fine opportunity for real engineering and economic analyses, but care must be exercised to make sure that all elements are considered. For example, the item of commercial rates is a very important factor. The customer may or may not purchase high-voltage service and equipment instead of low-voltage service and equipment, his decision depending upon rate differentials. Moreover, the amount of equipment or supervision afforded the customer for each class of service has an important bearing on the problem. Needless to say, the question of power factor largely reduces to a rate question, while local conditions greatly modify any general conclusions.

But, even though the problem introduces many more variables than those involved in the application of Kelvin's law or voltage drops, there is no real obstacle to a basic solution for both overhead and underground systems. It is certain that many properties would avoid unnecessary expenditures if such analyses were made from a perspective embracing all present elements and careful predictions of future conditions. It is also certain that the engineering forces of the various companies can never give really adequate attention to the problem unless and until company executives realize that it involves major financial expenditures, that it contains serious elements of future obsolescence if wrongly handled and that it directly affects the service rendered.

Co-operation Needed to Run Down Small Defects in Electrical Appliances

TO KEEP electrical appliances in use central-station companies have quite generally adopted a liberal policy of service and repair. In a measure this has retarded the elimination of many little imperfections of design and construction. Most appliance troubles can be remedied by a minor adjustment or repair, and usually it has been only in the case of an actually defective part that the manufacturer has been called upon to replace it. In E. S. Lincoln's analysis of the situation, on page 807, he emphasizes the fact that nearly all failures of electrical appliances are caused not so much by glaring faults in design or construction as by comparatively insignificant details. Yet from the standpoint of the customer the cause is not so important as the effect.

Actual use of the appliance in the customer's home is the only way that these small defects can be searched out and remedied. The faults could be corrected by the manufacturer with a little strengthening here and there or a slight change in design or construction. But in most cases the manufacturer does not learn of these troubles because the central-station company's service department makes the repair and forgets it, and so it goes on—the same weakness causing new trouble until the user lays aside the device or tries some other make, unless the central station continues to carry the maintenance burden.

The perfection of the automobile has been made possible only by the close watch which the manufacturer has maintained on cars in use. Year by year defects have been detected and eliminated. So it should be with electrical appliances. A little closer co-operation between the manufacturer and the retailer in searching out and correcting these small deficiencies that Mr. Lincoln talks about will materially reduce the amount of servicing now necessary and also raise the reputation of the electric device as a rugged and serviceable piece of apparatus which can be depended upon.

Local Trade Relations and the Contractors' Convention

THE annual convention of the contractor-dealers last week contributed further evidence of the increasing interest taken by electrical men in each other. John F. Gilchrist and Miss S. M. Sheridan, central-station vice-presidents from Chicago and Detroit, addressed the meeting, and there were a number of other utility men present. Through the addresses and the discussions also ran a note that seemed to show a recognition of the interdependence between the members of the local electrical family, particularly the need for common policies that will mutually protect and profit the contractor-dealer and the central-station company.

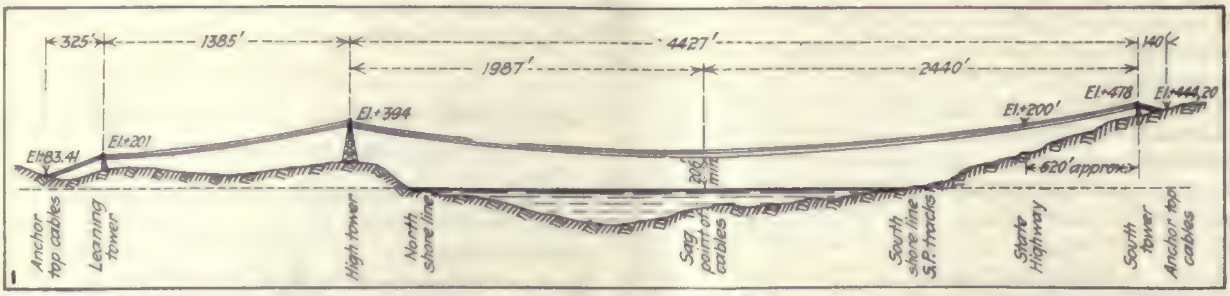
There was a time, not so long ago, when this spirit was not so conspicious in meetings of either group. Lack of local understanding was reflected in national gatherings and tinctured national plans. There was a subconscious attitude of belligerence between the two camps, because each felt that the other was antagonistic. Happily today the industry, bit by bit, is working out of this dank atmosphere into the sunshine of better feeling, as the men of each group are appreciating more fully that the greatest issue that confronts them all is the job of market development, and that in this work there is a common vital interest, an actual unity of purpose. The problem of local trade relations, the question of how to develop harmony among all the electrical men of each community, is steadily coming to the fore.

Laboring Under a "Technical" Handicap

TOO many people still picture the engineer in industry as a narrow technician who attacks every problem with a slide rule and an array of mathematical formulas. They grant him theoretical technical competency, but completely fail to visualize the type of engineer that is now in the majority—the operating manager of great physical properties involving the correct application of technical knowledge, business judgment and psychology. He seldom if ever uses a slide rule or a mathematical expression or indulges in fanciful theoretical analyses. Rather he busies himself with operating, directing and building a vast organism having facets reflecting every type and kind of human and mechanistic activity.

This type of engineer is really handicapped by the label "technical" and the name "engineer" when he encounters the general business or professional man on a plane which should merit recognition of his real place in industry. It is unfortunate that, unlike doctors, engineers have not carried their specialization to the point where a qualifying adjective illumines the general professional term.

Continuous and active work is needed throughout the country to convince the general public that all engineers are not alike and that a large number merit the title of big business men whose opinions on broad economic and social questions are predicated on a knowledge and an experience comparable to that of any banker, lawyer or executive.



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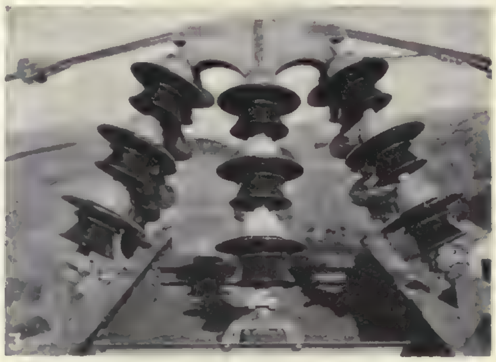
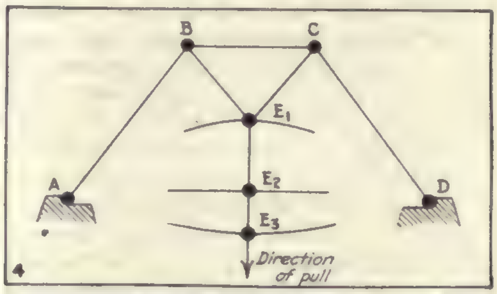


Design of 4,427-Ft. Span Over Carquinez Strait

A TWO-CIRCUIT 110,000-volt waterway crossing installation using insulating materials in compression is the unusual feature of the 4,427-ft. span across Carquinez Strait. An axle and sheave five-hinged anchor arrangement cares for unequal expansions with levers and pillars arranged to produce compression stresses only on the insulators. Hinges B, C and E_1 are free to shift, while A and D are fixed. The cable is attached at E_3.



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Del Monte A. I. E. E. Convention

Papers on Research, High-Voltage Equipment and Transmission, Waterwheel Problems and Carrier Radio Are Presented in a Symposium Form—Inspection Trips Prove a Drawing Feature

THE 1923 Pacific Coast convention of the American Institute of Electrical Engineers was held at the Del Monte Hotel, Del Monte, Cal., on Oct. 2 to 5 inclusive. The attendance was unusually good, the average at each of the sessions being in excess of 150 and the registration reaching 233. Thirty papers were presented during the three morning sessions and one afternoon session.

These papers covered a range of subjects from research to the design and operation of high-voltage transmission lines; practice concerning high-voltage switches, bushings, lightning arresters and busbars; waterwheel construction, operation and governing; carrier-current radio as applied to transmission lines, and telephone transmission over long distances.

Two inspection trips over the week end proved a drawing feature. One was to a large hydro-electric development in the High Sierras, the other to important substations in the San Francisco Bay region.

Investigation of Corona Loss

The opening session of the convention was presided over by Robert Sibley, convention chairman, who introduced Harris J. Ryan, president of the Institute. Following a brief address Professor Ryan presented his paper on "Researches Relating to High-Voltage Transmission." One of the purposes of the investigation and experiments which are being conducted, Professor Ryan said, is to determine the nature of corona and the laws which govern it. The experiments which are being conducted have been much facilitated by the development of a cathode-ray tube which will operate on moderate voltages. The boundary of the rectangular cathode-ray card is a measure of the corona loss.

Dr. Steinmetz in discussing this paper said that he considered the problem of insulation—the destruction of insulation—to be the most important one before electrical engineers today. "We are not up to the height of knowledge on this subject that we are in nearly every other field," he asserted. "We have so little knowledge to work with—so many factors which must be approximated—that we must have large factors of safety."

Transmission Line Practices on the Coast

Factors Affecting Electrical and Mechanical Construction of Transmission Lines Discussed—Snow and Ice a Source of Trouble in Many Regions

SEVERAL good papers were presented covering transmission-line construction and design as practiced by Pacific Coast engineers. W. Dryer of the Pacific Gas & Electric Company covered the practices of that company in his paper. He stated that design factors could be divided into two groups on the basis of those that affect the shape or the strength of the supporting structure. Factors affecting shape were listed as inside sag, clearance of phases and circuits, length and deflection of insulator string, type of tower and the clearance between conductors and tower members. Under those factors affecting strength are size and stress of conductor span and type of tower. Tests of the company showed 17,000 lb. per square inch for copper ranging from 250,000 circ.mil to 500,000 circ.mil to be the best value.

It is customary to consider more broken wires for double-circuit than for single-circuit towers. It is the practice of the company to assume three broken wires on standard double-circuit towers, all wires being on one side of the tower. This case will usually occur when the top wire breaks and drops across the two lower wires. Two wires are assumed broken with standard single-circuit towers.

Dead-end towers are designed to resist all wires broken at maximum stress in the conductor. This would occur under the condition of heaviest loading and with dead-end insulator strings.

For standard towers (designed for two or three wires broken) and for anchor towers (designed for all wires broken) no dead-end construction is permitted, the insulator string being suspended vertically. In this case when a wire breaks the insulator strings swing into the catenary, increase its length and therefore greatly reduce the tension in the span adjacent to the break. For standard 110-kv. double-circuit lines the resultant stress is 78 per cent, and for the 220-kv. double-circuit line it is 66 per cent of the maximum conductor stress. All towers of the Pacific Gas & Electric Company are tested to 50 per cent overload.

Transpositions on the 110-kv. lines are of the conventional "dead-end and jumper" type. Transpositions on the 220-kv. Pit River line are of the "rolling type"; that is, the wires are transposed without dead-ends or jumpers. The crossing wire of each circuit is pulled out of the vertical plane to an insulator suspended from the bridge, and the transposition is completed in two spans. The single-circuit transposition requires three spans for completion.

Where twin-tower lines traverse country that is not flat it is impossible to set the structures directly opposite each other. The amount of offset that will be permitted should be based on maintaining a minimum clearance between adjacent wires equal to the distance between phases on the flat-top, single-circuit towers. The horizontal projection of the catenary as deflected by wind furnishes the basis for the determination of allowable stagger. In designing the towers clearances are investigated under the assumption that the insulators are permitted to swing transversely to the line at some angle (usually between 30 deg. and 45 deg.) from the vertical.

Oak Grove Transmission Line

The Oak Grove transmission line of the Portland Railway, Light & Power Company was described by H. R. Wakeman and W. H. Lines. The line is 110 kv. and 54 miles in length. In the design of the line factors considered were voltage, conductor size and tension, loading, type of supporting structures and physical character of the country.

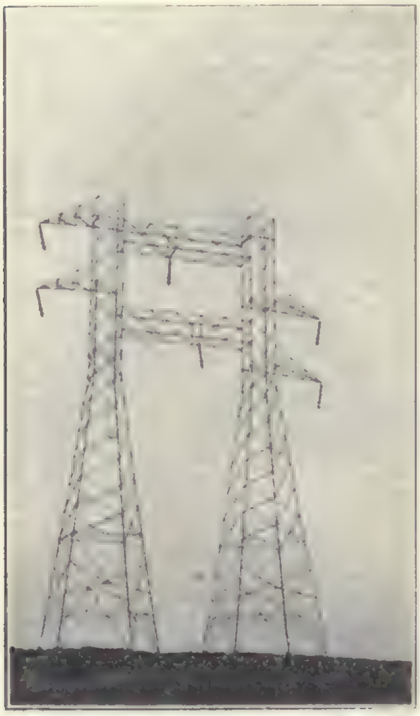
It was determined that for the ultimate development of 90,000 kva. two circuits each of 250,000-circ.mil hard-drawn, stranded copper, at 110 kv. grounded neutral, embodied respectively the economic number, size and voltage to employ.

The limitations imposed by the mechanical strength of available insulators and hardware were a considerable factor in the decision to use 4,000-lb. maximum conductor tension, equivalent to a stress of 20,000 lb. per square inch, or one-third of the ultimate strength of the conductors in this line.

After an investigation of the possible sleet, snow and wind conditions in the

country traversed, it was determined to use class B loading, namely, a maximum conductor tension equivalent to the load of the conductors plus ½ in. of ice and 8 lb. per square foot wind pressure on the ice-coated conductors at a temperature of 0 deg. F.

There were placed on the profile, to scale and by means of properly constructed sag templates, four types of



220,000-VOLT DOUBLE-CIRCUIT TRANSPOSITION TOWER OF PACIFIC GAS & ELECTRIC COMPANY

supporting structures designed for the assumed loading conditions and appropriate for the physical topography of the country. It was found that the maximum sag occurred on the line under summer loading conditions, at a temperature of 120 deg. F. The following are the four types of supporting structures which were considered:

1. Single wooden poles, average spans 300 ft., single-circuit capacity.

2. Double wooden poles (H frames), average spans 450 ft., single-circuit capacity.

3. Light steel towers (combination of flexible frames and anchor towers), average spans 500 ft., double-circuit capacity.

4. Heavy rigid towers, average spans 700 ft., double-circuit capacity.

Detailed estimates of material and labor were then prepared for each of the four types, and these resulted in favor of the fourth, namely, heavy rigid towers, average spans 700 ft.

From a study of the loading conditions imposed on the towers by the varying span lengths and the horizontal and vertical curves it was decided to provide three types of towers to meet all these loading conditions, as follows:

Type A Towers.—To be used on tangents up to 800-ft. spans, also on curves up to 10 deg. with spans not exceeding 500 ft.; suspension insulators to be used.

Type B Towers.—To be used on tangents up to 1,700-ft. spans, also on curves from 8 deg. to 30 deg. with spans not exceeding 800 ft. for the larger curves; suspension insulators to be used.

Type C Towers.—To be used at dead-ends and curves over 30 deg.

LOADING CONDITIONS ASSUMED FOR THREE TYPES OF OAK GROVE TOWERS

Loading Conditions	Type A	Type B	Type C
Number of conductors assumed broken	3	6	6
Maximum horizontal curve	10 deg.	30 deg.	60 deg.
Maximum span length when combined with curve	500	800	800
Vertical load—dead weights of conductor	6 at 1,800 lb.	6 at 1,200 lb.	6 at 1,200 lb.
Horizontal load in line component of conductor tension	3 at 4,000 lb.	6 at 3,500 lb.	6 at 5,200 lb.
Horizontal load across line component of conductor tension plus wind on conductor	6 at 1,400 lb.	6 at 2,200 lb.	6 at 3,700 lb.
Horizontal load across line, wind on tower	1 at 1,600 lb.	1 at 1,600 lb.	1 at 1,600 lb.
	32,800 lb.	43,000 lb.	62,000 lb.

The type A tower on tangents will accommodate spans to 800 ft.
The type B tower on tangents will accommodate spans to 2,400 ft.

PHYSICAL DIMENSIONS OF TOWERS

	Type A	Type B	Type C
Cage	4 ft. 6 in.	4 ft. 6 in.	4 ft. 6 in.
Length of cross-arm, cage to insulator support	7 ft. 0 in. and 9 ft. 0 in.	7 ft. 3 in. and 9 ft. 3 in.	7 ft. 3 in. and 9 ft. 3 in.
Horizontal separation of conductor at supports	18 ft. 6 in. and 22 ft. 6 in.	18 ft. 9 in. and 22 ft. 9 in.	18 ft. 9 in. and 22 ft. 9 in.
Vertical separation of conductor at supports	10 ft.	10 ft.	10 ft.
Height of lowest arm above ground	48 ft.	48 ft.	45 ft.
Over-all height above ground	72 ft.	72 ft.	69 ft.
Weight of tower exclusive of extension and footings	4,325 lb.	5,355 lb.	5,635 lb.
Weight of footings (all steel)	550 lb	1,820 lb.	2,780 lb.
Depth of footings in ground	7 ft. 6 in.	6 ft. 6 in.	7 ft. 6 in.
Area of footing at bottom	3 ft. x 3 ft.	4 ft. 8 in. x 4 ft. 8 in.	5 ft. 6 in. x 5 ft. 6 in.

The towers were designed to withstand maximum loading conditions embraced in each of the above classes, plus 50 per cent as an assumed margin of safety, without exceeding the elastic limit of the steel.

The design of the towers was also checked for maximum possible torsional load, namely, with three conductors broken on one side of the cage.

Special steel having a guaranteed elastic limit of 45,000 lb. per square inch and a minimum elongation of 22 per cent was used in the towers. Actual tests of samples which were taken from the tower stock showed yield points from 48,000 lb. to 53,000 lb. per square inch.

Insulators are attached to cross-arms by means of forged steel hooks with an elastic limit of 6,000 lb. It was thought best to limit the strength of this connecting member so that if any load greater than the assumed came on the conductors, the connection would fail rather than the tower.

LAGUNA BELL 220-KV. LINE

The transmission line from Laguna Bell substation to Eagle Rock substation of the Southern California Edison

DATA ON STANDARD TOWERS OF PACIFIC GAS & ELECTRIC COMPANY

	220-Kv. Tower Lines				110-Kv. Tower Lines			
	Single-Circuit Towers		Double-Circuit Towers		Single-Circuit Towers	Double-Circuit Towers		
Item	Type SA	Type SC	Type M	Type 0-98	Type S	Type AH	Type BH	Type CH
Height:								
Over all	55½ ft.	55½ ft.	97 ft.	98 ft.	49½ ft.	83 ft.	83 ft.	83 ft.
To lower cross-arm	51½ ft.	51½ ft.	62 ft.	63 ft.	48 ft.	58 ft.	58 ft.	58 ft.
Width:								
At base	20 ft. x 20 ft.	20 ft. x 20 ft.	20 ft.	20 ft.	14 ft. x 14 ft.	16 ft.	16 ft.	20 ft.
At cross-arm	4 ft. x 20 ft.	4 ft. x 20 ft.	6 ft.	6 ft.	2 ft. x 14 ft.	4½ ft.	4½ ft.	4½ ft.
Conductor separation:								
Between phases	19 ft.	19 ft.	15 ft.	15 ft.	13½ ft.	10 ft.	10 ft.	10 ft.
Between circuits	....	....	24 ft.	24 ft.	....	17½ ft.	17½ ft.	17½ ft.
Conductor:								
Maximum size (copper)	500,000 circ.mil	500,000 circ.mil	500,000 circ.mil	500,000 circ.mil	3-0	250,000 circ.mil	250,000 circ.mil	250,000 circ.mil
Loading	8 lb. wind ½-in. ice	8 lb. wind ½-in. ice	8 lb. wind no ice	8 lb. wind no ice	6 lb. wind 1½-in. snow	8 lb. wind no ice	8 lb. wind no ice	8 lb. wind no ice
Number broken	3	3	3	6	2	3	3	6
Span:								
Normal	500	500	800	800	400	800	800	800
With angles	...	1,000	...	800	...	...	800	800
Maximum on tangents	750	1,500	1,000	1,800	400	1,000	2,000	2,500
Maximum contributing weight	1,500	2,100	1,050	1,800	400	2,000	2,500	5,600
Maximum angle	None	22½ deg.	None	22½ deg.	None	None	15 deg.	45 deg.
Type of conductor support	Suspension	D. E. or susp.	Susp.	D. E. or susp.	D. E. or susp.	Susp.	D. E. or susp.	D. E. or susp.
Weight of tower	5,100 lb.	7,270 lb.	8,440 lb.	12,950 lb.	4,250 lb.	5,080 lb.	6,200 lb.	7,590 lb.
Foundations:								
Concrete	6.28 cu.yd.	11.8 cu.yd.	7.8 cu.yd.	15.2 cu.yd.	11.2 cu.yd.	6.72 cu.yd.	8.72 cu.yd.	12.9 cu.yd.
Excavation	18.1 cu.yd.	60.4 cu.yd.	25.5 cu.yd.	84.5 cu.yd.	32.5 cu.yd.	22.4 cu.yd.	31.2 cu.yd.	44.4 cu.yd.

Company was described by C. B. Carlson and W. R. Battey.

The design was started following a request from a committee assigned to investigate the electrical features of a line of this voltage. The questionnaire outlined investigation on the use of the following five sizes of conductors: 605,000-cir.mil steel-reinforced aluminum cable, 1,000,000-circ.mil steel-reinforced aluminum cable, 1,500,000-circ.-mil steel-reinforced aluminum cable, copper cables of equal conductivity to the last two sizes.

The first preliminary study eliminated from consideration the majority of the materials and limitations, and further study was requested on the use of cables of 666,600-circ.mil steel-reinforced aluminum, made up of seven strands of extra-high-strength steel and fifty-four strands of aluminum and having the following characteristics:

Diameter, 1 in.; ultimate tension, 24,430 lb.; elastic limit, 16,180 lb.; area, 0.59 sq.in.; weight, 0.86 lb. per foot. Analysis showed the most economical span to be between 1,150 ft. and 1,300 ft. and a 1,250-ft. span was selected. Tower designs were then based on 12,000-lb. cable tension, 6-ft. clearance, thirteen 10-in. disk insulators, with fifteen double-string on dead ends, aluminum shield rings, 10 deg. temperature range, 30 ft. ground clearance at 120 deg. F., and a wind pressure of 10 lb. per square foot on one and a half times the area of one face of tower and of 8 lb. on the projected area of conductor.

The committee having the features of the design of this line in hand required a factor of safety of three in the strength of the attachments of the cable to the towers. Owing to limitations of clearances this required the hardware to be made of cast steel. All hardware was designed and tested for loads three times the maximum tension.

The towers, except those in rather inaccessible places, which were assembled piece by piece, were erected by assembling the tower on the ground in two parts, dividing the face normal to the line and bolting with loose bolts each leg to the footing studs. Then, by means of two gin poles set aside the footings and a winch set on a truck and operated by its motor, the two halves were raised and connection made at the center gusset plates. The bridge of the tower was then hoisted in place.

The line stringing was also done by the use of the motor-operated winch.

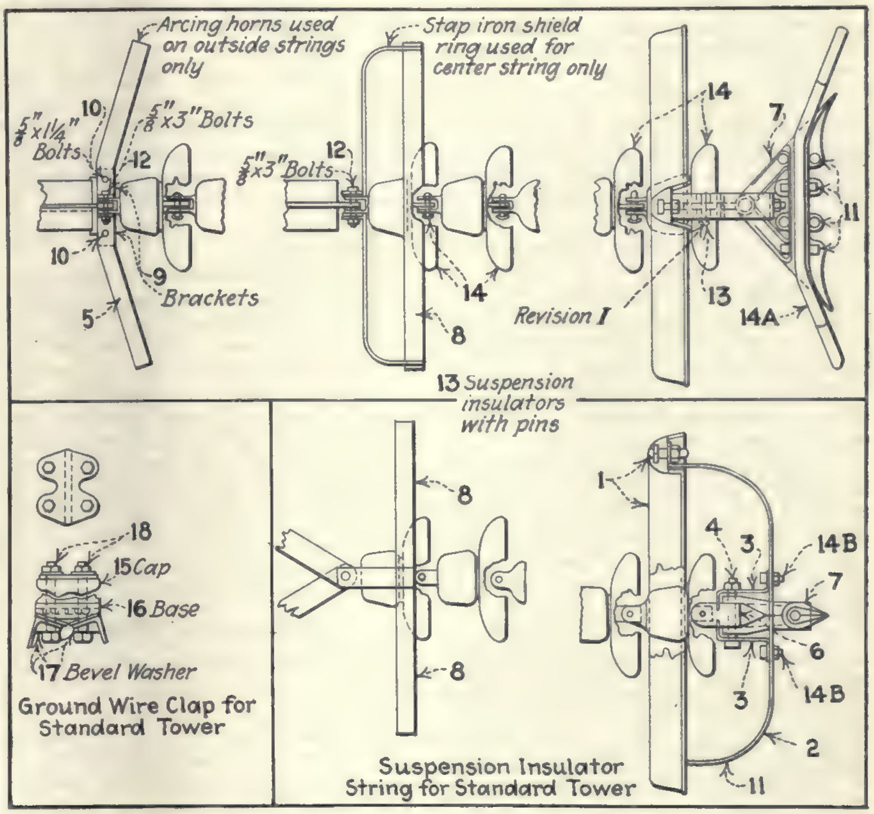
MOUNTAIN CONSTRUCTION PRACTICE

M. T. Crawford described a recent extension of the Puget Sound Power & Light Company consisting of a 120-mile, 110-kv. transmission line from the White River generating station to Wenatchee, Wash.

On account of the heavy snows and inaccessibility of sections of the line over the two mountain ranges additional mechanical strength was provided where the elevation exceeded 3,000 ft. Type SA 55-ft. steel towers were used for line supports, No. 4/0 B. & S. hard-drawn seven-strand copper cables for conductors, with O. B. No. 25620 cap-and-pin-type insulators, six-unit strings in suspension and seven-unit strings in strain. Spans were normally from 400 ft. to 700 ft., with conductors pulled to a tension which would stress the wire to its elastic limit of 4250 lb. at 0 deg. F., 8-lb. wind pressure and ½ in. of ice.

Conclusions reached involved a redesign through the exceptional loading area to provide:

1. A reduction in working tension on insulator strings.
2. A flexibility in wire supporting mechanism to allow some longitudinal movement of wires at all supports.
3. Additional strength in tower members near the base.



LINE HARDWARE ON LAGUNA BELL LINE

LIST OF MATERIAL FOR ONE COMPLETELY ASSEMBLED GROUND WIRE CLAMP FOR STANDARD TOWER ON THE LAGUNA BELL LINE

Item No.	No. Pieces Required	Description
15	1	Ground-wire clamp cap
16	1	Ground-wire clamp base
17	4	Ground-wire clamp bevel washer
18	4	⅝-in. square-head bolts, two hexagonal nuts and lock washer

LIST OF MATERIAL FOR ONE COMPLETELY ASSEMBLED SUSPENSION INSULATOR STRING FOR STANDARD TOWER

Item No.	No. Pieces Required	Description
1	1	Suspension shield ring with inset bolts
2	1	Supporting arm for shield ring
3	2	Suspension lugs
4	1	⅝-in. x 4½-in. bolt, hexagonal nut and washer
5	1	Arcing horn
6	1	Suspension-clamp clevis
7	2	Suspension-clamp-half
8	1	Strap insulator shield ring*
9	2	Arcing horn brackets
10	2	⅝-in. x 1¼-in. bolts with hexagonal nuts and lock washer
11	8	⅝-in. x 3½-in. car bolts, one hexagonal nut and lock washer
12	1	⅝-in. x 3-in. bolt, square-head hexagonal nut
13	1	Insulator pin
14	13	Suspension insulators with pins
14A	1	14 ft. length of .05 x .3 aluminum armor wire
14B	2	⅝-in. x 1½-in. bolts, hexagonal nuts

* Omit item No. 8, when arcing-horn items, Nos. 5, 9 and 10, are to be used. For each standard tower use item No. 8 for center insulator string and items Nos. 5, 9 and 10 for outside insulator strings.

The suspension form of support for dead-ends has taken care of the first two requirements. With this change the dead-end loading is largely shifted from porcelain to copper, reducing insulator tensions without increasing the number of insulators on the line. The suspension unit installed in places of former strain construction was made up of two strings of insulators in parallel with strain yokes at each end, which reduced the tension duty in the porcelain by half. This yoked double-string unit was installed to hang approximately in vertical suspension.

In replacing strain forms with suspension forms on long steep slopes where it is desired to have wire stresses unequal on each side of towers, it would be necessary to install additional tie-down strings on the up-hill side, offsetting by several feet the point of clamping the suspension and tie-down strings to wire. This provides for necessary clearances and gives some longitudinal flexibility. Had there been any sharp line angles in this section, the flexible construction could have been provided by installing additional towers so as to make a round turn with short spans, the suspension strings swinging out nearly horizontal. This form of corner construction has been successfully used on suspension insulator lines

along county roads and railroads where the right-of-way turns on a wide radius. It involves the use of bracket supports for inside insulator strings to obtain clearances.

Damage from snow to tower-leg members will be prevented by the installation of additional pieces of heavier angle stock alongside existing members, with the corner of the angle facing upward to form a roof effect and provide a cutting edge to break the snow.

DISCUSSION

In the discussion H. Michener said that weights instead of tie-down strings on the Big Creek 220,000-volt lines of the Southern California Edison Company required too much cast iron and therefore the tie-down construction is favored where there is a vertical upward strain on the conductors. R. J. C. Wood expressed the opinion that engineers may go too far in trying to eliminate dead-end strings. In the Big Creek lines of his company only two cases of trouble (flashover) have been experienced on dead-end strings.

In his paper W. Dryer suggested a possible economy in tower cost by stringing the conductors at lower tensions, but W. A. Hillebrand, San Francisco, in discussing the paper, questioned the economy of lower stringing tension.

R. J. C. Wood said the Southern California Edison Company had experienced trouble with conductors on a two-circuit steel-tower line, where the wires are in a vertical plane, because with the thawing of snow and ice a lower conductor may fly up into the one above.

According to J. P. Jollyman, the Pacific Gas & Electric Company received a report last winter that sleet had slid to the lowest point in a span, causing abnormal loading and sag. Horizontal configuration is used by this company in territory where there are heavy sleet storms to obviate this trouble. In the regions where sleet conditions are not so bad the company offsets the center conductor 3 ft., with 10-ft. vertical spacing of the wires. In light-sleet country it considers 20-ft. vertical spacing of conductors sufficient to avoid trouble in spans of 500 ft. or 600 ft. The experience of the Utah Power & Light Company with sleet and frozen moisture on its 130,000-volt vertical-conductor tower line has led it to offset the center wire by inserting another string of insulators and drawing the conductor in toward the tower, making a disalignment of 3 ft. as a precaution against further trouble. Discussion showed that most power companies of the West have had similar experiences, in some cases resulting in the failure of towers or conductors. The only remedy suggested was the offsetting of the conductors or horizontal configuration. Tests described by H. Michener which were made on one of his company's tower lines where the spans were loaded up with weights showed that with the center wire loaded and the bottom wire unloaded the center wire would hang down below the lower wire for three-eighths of the length of the span.

LONG-SPAN CONSTRUCTION

The problems of insulation design of anchors and tower supports and the importance of vibration in the 110,000-volt, 4,427-ft. span of the Pacific Gas & Electric Company over Carquinez Strait, were presented in a paper by L. J. Corbett.

In discussing this paper L. M. Klauber, San Diego, said that long spans require great engineering care in design whereas shorter spans may employ less expensive construction. His company recently built a 4,400-ft. span using wooden poles at no greater expense than for an equivalent in the adjoining line.

J. P. Jollyman pointed out that vibration is a serious factor in spans of great length and experience has shown that vibration will soon crystallize the conductors if some means be not provided to reinforce them. In redesigning the span in question great care has been taken to taper off the reinforcing wires by lapping. A few years ago a stiff reinforcing was used and within a few days the conductors crystallized and broke. The important feature of this span is that the insulators are worked under compression instead of tension.

Operating Problems

At the Friday morning session R. J. C. Wood presented a paper on "Theory and Practice in High-Voltage Operation." Mr. Wood told of the method of cutting over the 150,000-volt Big Creek transmission lines of the Southern California Edison Company to 220,000 volts. The big problem in increasing the voltage was to supply the large amount of charging current necessary to charge the 240-mile transmission lines. The transformers connected to each line supplied 16,000 lagging kva. and reduced the amount the generators had to supply by that amount. The first step in cutting over was to clear the West Big Creek line of all generators except the largest one at the Big Creek No. 8 power house. This machine was connected to the line and both were brought up to about 35 cycles together, at which point a 30,000-kva. synchronous condenser at the Eagle Rock receiving substation on the Los Angeles end of the line was disconnected from the 50-cycle system and allowed to coast down to the frequency of the line, at which point it was thrown in and the generator, line and synchronous condenser were then brought up to the normal system frequency of 50 cycles. A week later, when the second line was cut over, it was thrown in at full voltage without these precautions, and it went in without any trouble.

In operating the 220,000-volt system the company makes it a practice to keep sufficient generator capacity on the line at all times to take care of self-excitation of the generators by the charging current of the line in case of total loss of load. Switching on the lines has presented no difficulty. Long sections (100 miles) are switched in and out without any trouble. A proper proportion of synchronous-condenser capacity was made between the two terminal substations at the Los Angeles end of the line to obtain proper voltage regulation. These stations have been operating in parallel, but it is planned to operate them independently to give more latitude in the operation of the synchronous condensers installed. It has been found that there is less trouble in switching at the center of the transmission line, and in case of trouble the switches at the center are opened last and patrolmen work from the center each way.

J. E. Woodbridge, San Francisco, asked what the procedure is in case of the total loss of a line and the re-establishing of service. Mr. Wood replied that this condition has not occurred, but that if one line was lost the company would simply switch it in again. In case of flashovers the procedure is to lower the voltage at all of the generating stations simultaneously until the trouble has cleared and then re-establish normal voltage. On the old 150,000-volt system, and so far on the 220,000-volt system, this has been done manually by manipulation of the field rheostats at the generating plants. A system of relays is now being installed, however, which will perform this operation automatically and in much shorter time than is required under manual operation. J. P. Jollyman asked if anything had been done to use overvoltage relays on synchronous equipment to protect it in case a piece of line was left on a machine which would overload it. Mr. Wood said that 90,000 kva. of synchronous condenser capacity is cut in solid on the receiver end of the lines at two places and there is no likelihood of such trouble. J. A. Lighthipe, Los Angeles, said that the starting of the 220,000-volt system was no great occasion and "we are going higher."

GROUP OPERATION OF SYSTEMS OF DIFFERENT FREQUENCIES

L. M. Klauber, in discussing the paper by E. R. Stauffacher and H. J. Briggs on "Group Operation of Systems Having Different Frequencies," * said that a small company such as the San Diego Consolidated Gas & Electric Company tied in with a system the size of the Southern California Edison Company experienced trouble because of the frequent tendency of the small system to take a large and fluctuating amount of power. This is due, he said, to the fact that the governors on the steam turbines on the San Diego system are more sensitive than the governors on the hydraulic units of the Edison system. His company has experimented with two means of overcoming this trouble. One is by placing a rod on the governor of the steam turbine and applying friction to this rod and the other is by opening all of the regulating valves on the turbine and operating

*This paper will be abstracted in a later issue.

it by hand control. P. M. Downing, San Francisco, said that load control, in such cases presents a difficult problem. He thought that a small system trying to operate in parallel with a larger hydro-electric system must naturally expect trouble due to the difference in sensitiveness between steam turbine and waterwheel governors.

In presenting his paper on "Test Results of the Performance of Suspension Insulators in Service" C. F. Benham said that the important thing in insulator failure is the temperature cycles the insulators go through. Speaking of failure in dead-end strings, J. A. Koontz, Jr., said that if loading on dead-end insulators is kept down within reasonable limits, there is no more depreciation and deterioration than in suspension units. The practice of his company is to set a limit of 3,000 lb. per string of 10-in. insulator units. W. A. Hillebrand emphasized the importance of holding down working loads to moderate limits on suspension.

High-Voltage Equipment

Lightning-Arrester Practice and Experience—Need for Record of Lightning-Arrester Performance Emphasized—Operation of High-Voltage Circuit Breakers

OPINIONS on and experiences with lightning-arrester performance on the Southern California Edison system were presented in a paper by Harold Michener. The general policy of the company until within a year or two had been to install electrolytic arresters on lines ranging from 11 kv. to 150 kv. Experience with this type of arrester showed that they should not be installed inside of buildings, because of fire hazards, nor on a roof, because of these hazards and the deleterious effect of oil on composition roofing.

The actual value of lightning arresters is difficult to determine, in the opinion of Mr. Michener, because no accurate records are available and lightning trouble is rare in the territory served. It is generally conceded by the company that arresters afford a worth-while protection on 15-kv. circuits and lower. On the 60-kv. system the case is not so clear for the arrester. The fact that they are installed shows, however, the predominant opinion.

Arresters Discontinued

The 150-kv. system was completely equipped with electrolytic arresters until about a year ago, with the exception of a considerable period some years ago when the arresters at Big Creek No. 2 were out of commission. Since about a year ago the arresters have been taken off the lines, as the 220-kv. construction work made that necessary, and the fire at Eagle Rock eliminated those at that station. The fire brought forth the decision to abandon permanently the use of lightning arresters on the 150-kv. stations at Big Creek No. 1 and No. 2 and at Eagle Rock, where the arrester tanks were inside the buildings. It had previously been the intention to leave these arresters in service, although the lines had been changed to 220 kv. It has not definitely been decided whether or not the outdoor arresters at Vestal will be reinstalled.

On the 150-kv. lines there have been only two or three cases of trouble due to lightning. One of these was at Eagle Rock after the 150-kv. arresters had been removed. A 150-kv. insulator inside the building flashed over during a storm which was causing trouble on the 60-kv. and 15-kv. lines out of the same station. Another case of trouble attributed to lightning occurred on the 150-kv. bus connection inside the building at Big Creek No. 1, when the arresters were connected to the lines and apparently in perfect working conditions. At Big Creek No. 2 it was reported that the arresters discharged heavily at a time when lightning struck so near that the operators thought the building had been struck.

The arresters on the 150-kv. lines always discharged when 150-kv. line switching was being done. The statement is often made that arresters are not needed on 150-kv. and 220-kv. lines as a protection against lightning, but what will these voltage surges which cause the lightning arresters to discharge during switching do if the arresters are not there? The answer is, even though these voltages are high enough to jump the arrester gaps, they are not high enough to damage the station equipment. The fact that Big Creek No. 2 operated for many months without arresters indicates this. Recent studies made with a surge recorder on the 150-kv. lines indicate that switching of a 100-mile section of line does not produce surges of more than 200 per cent normal voltage. These studies were made at Eagle Rock while the 150-kv. arresters were in service, however.

At Vestal, near the middle of the 150-kv. line, there were two cases of 150-kv. transformer insulation breakdown. The transformers were old and the insulation was admittedly of a quality inferior to that used in modern transformers. Yet the extreme thickness of insulation punctured made it difficult to believe that inferior insulation could be the cause of the failure. Perhaps high voltage did it, but the 150-kv. lightning arresters were in service, having very advantageous connections to the 150-kv. lines. On the 220-kv. lines there are no lightning arresters and probably never will be.

In regard to the types of arresters used by the company, the electrolytic arresters, which until the last two or three years were considered the only arresters at all adequate for station service, have several faults, one of which is that they require expert maintenance, which often they do not get. Another fault is the fire hazard.

The oxide-film arrester has become popular and the company is installing many of them on voltages of 60 kv. and lower. Thus far they have given no trouble and it is assumed that they will give at least as good protection as the electrolytic arresters. There is apparently no fire danger from them and this is greatly to their advantage. The maintenance promises to be very low. There has been one case of a discharge throwing some of the active material out of a stack of the disks. Examination showed that there had been many discharges through this stack. This discharge occurred at the time of a heavy short circuit on the system and the arrester was in the heart of the system.

There is only one installation of the autovalve arresters of the distribution type on the system. This is on a 15-kv. line on Mount Wilson at an elevation of 5,000 ft., and though it is not definitely known to have functioned, at least one lightning storm has occurred on that part of the system since its installation.

The graded-resistance type of lightning arresters have been installed on 11-kv. lines at several stations during the last two years. These have given no trouble to date and have functioned satisfactorily in several instances.

There is one installation of the water-column surge arrester on the system. It functions properly when an arc is formed intentionally across the horn gap, but that is all that is known of it as yet.

Referring to the subject of lightning arresters, E. R. Stauffacher emphasized the need for a reliable and cheap lightning-discharge recorder to be installed on a set of lightning arresters to obtain a record of their performance over a period of time. It is his opinion that the real value of lightning arresters will not be determined until such a device is brought out.

High-Voltage Switches

H. Michener, in continuing his paper on the experience of the Southern California Edison Company with high-voltage switches, bushings and lightning arresters on its 150-kv. and 220-kv. systems, said that no trouble has been experienced with the 220-kv. circuit breakers on the Big Creek lines since they have been made automatic. One flashover has occurred since full automatic operation of the breakers, and the section of the line where the flashover occurred cleared itself from the system without any trouble. The method of going to automatic operation was first to set the relays heavy and then decrease the setting by steps until the proper point was reached. His company has found it necessary to install oil

circuit breakers to break the arc of paralleling switches. On one occasion when air-break switches were in use a high wind carried the opening arc over and caused a flashover. The author stated that since his paper was written there has been one case of trouble on a 60-kv. oxide-film lightning arrester in which the arrester blew up, throwing out several of the disks between line wire and ground.

In connection with his paper on "High-Voltage Circuit Breakers," A. W. Copley exhibited some slides showing the construction of high-voltage circuit breakers. In discussing the papers on circuit breakers J. S. Thompson said that his company had developed a circuit breaker with six breaks per pole without increasing the insulation to ground. One of these circuit breakers was recently tested and after being subjected to thirteen successive operations on 60,000 volts, including two dead short circuits on the system, which was of large capacity, the switch showed no signs of trouble except minor pitting. Oscillograms showed that the circuit was opened in a total of 30 cycles with an initial current of 2,000 amp., which dropped to 1,300 amp. before the circuit was opened. Prof. R. W. Sorensen, Pasadena, called attention to the lack of information on the methods of technical analysis employed to study the phenomena involved in opening electric circuits where large amounts of energy are involved. He applied some of the formulas of M. Charpentier to determine the theoretical interrupting capacity of circuit breakers, with the result that interrupting values were obtained from one and one-half to several times the known interrupting capacity of some of the breakers.

In commenting on lowering the voltage on the 220,000-volt transmission lines during the operation of sectionalizing switches, a practice of the Southern California Edison Company, R. M. Spurk, Schenectady, stated that it is preferable to use automatic circuit breakers for sectionizing purposes because of better continuity of service. Although breakers are highly expensive, their expense is justified. The reason they are expensive is because they have to be designed for 220,000 volts, and it is the voltage that makes the high cost rather than the interrupting requirements. One of the types of circuit breakers now in operation on the 220,000-volt system on the Pacific Coast utilizes the explosion-chamber principle. He enumerated the advantages of the explosion-chamber-type breaker and asserted that exhaustive tests had been made not only in the field but in the factory which permit the interrupting ratings to be figured with considerable accuracy.

High-Voltage Transformers

Clinton Blume, Schenectady, in commenting on the paper by Messrs. Mini, Moore and Wilkins on "Performance of Auto-Transformers with Tertiaries Under Short-Circuit Conditions," said that the paper involved many interesting problems because the transformer connections to which the authors refer are a mongrel development which has inherited its present traits from three distinct sources. In this one transformer connection are combined the various aspects of (a) an auto-transformer, (b) the Y-connection and (c) the three-winding transformer. He brought out a few of the salient characteristics of the three-winding transformer, saying that it is being employed for two distinct reasons, one being based on economy both in first cost and operation and the other being the desire to obtain specific improvements in operating characteristics. The one purpose may be called the economical use and the other the non-economical use of the three-winding transformer. There are two new problems introduced by this transformer—first, the determination of size of the tertiary winding may not be obtained in the ordinary manner, but by one or more of the unique functons which it is called upon to perform; second, the three windings are so related to each other that impedance and regulation cannot be so simply expressed as in ordinary transformers, although by means of a simple equivalent impedance values can be determined for each winding and these values used in the ordinary formula to obtain regulation or current division for any given condition. Besides these features, three-winding transformers are not in any way different from the ordinary transformer.

The paper by A. W. Copley on "Transformers for High-Voltage Systems" was discussed by Prof. R. W. Sorensen. He said: "I doubt the advisability of saying that engineers are universally of the opinion that 220,000-volt systems should be provided with solidly grounded neutrals only. As such a system grows it may be necessary to use Petersen coils or a resistance of some kind in the neutral of the 220,000-volt system and also for systems of other voltages, even though we have by long practice accustomed ourselves to the use of solidly grounded neutrals on the Pacific Coast."

Mr. Copley, in closing the discussion, said it had not been seriously proposed that circuits of 220,000 volts be operated in any other way than with grounded neutrals and he did not think that the Petersen coil is applicable. He said he does not recommend the use of tertiary windings for general use except under special conditions where the load imposed by the synchronous condensers is such that there is good voltage regulation of the tertiary winding.

Carrier-Current Telephone Systems

Experience with Two Installations, One of 200 Miles Length, Cited—Load-Dispatching Operations Carried on with Entire Satisfaction

SOME very interesting experiences with carrier-current systems were described. L. F. Fuller discussed recent developments of the system and expressed the opinion that such systems are practicable and reliable.

Calling is accomplished on existing carrier-current channels either by one or more gong bells operated by a local relay or by means of a loud speaker which permits direct voice or "howler" calling.

Each method has its inherent advantages and disadvantages. The loud speaker cuts the time for short dispatching orders almost in half when operators are constantly within hearing distance. In such cases calling and answering calls are dispensed with. The dispatcher gives an order and the station to which it was directed repeats it. The Great Western Power Company has used this method for more than a year and the Pacific Gas & Electric Company has also found it satisfactory.

If there are several carrier sets on a system which intercommunicate frequently, it is often annoying and generally undesirable to have a loud speaker talking when its station is not concerned with the conversation. In one installation there was an objection to the loud speaker, not because of undesired conversations, which did not exist in this case, but because of the line and electric storm noises which were reproduced. Relay and gong-bell ringing is necessary in such cases.

Selective ringing is a further refinement which may be employed when code ringing of a gong bell would cause annoying and unnecessary disturbance at several stations of which only one is desired.

Time-limit attachments are often furnished with the calling relay system to prevent electric storms and other high-frequency disturbances from ringing the gong bell. Code ringing is possible with such attachments, since the time-limit feature is automatically inoperative after the first signal, which must be a long dash. It may be followed by any desired dot-and-dash combination.

An excellent calling system is a relay with time-limit attachments arranged to connect a loud speaker in circuit at the end of the long dash above mentioned. A gong bell may be added if desired. In this way the loud speaker does not reproduce undesired noises, but comes into service automatically for any speech or code calling.

A selector system may be added to such a combination. In this case the loud speaker is connected in circuit only when its station is called, but after being connected the message may follow immediately, if desired, with the resultant saving in time.

Duplex operation was considered unsatisfactory by Mr. Fuller, but the use of continuous or intermittent wave telegraphy provides an important adjunct.

Experiences with a carrier-current installation on the lines of the Pacific Gas & Electric Company were given by E. A. Crellin. The carrier current since April, 1923, has answered all dispatching requirements. The carrier system is coupled to the transmission line by a single-wire antenna about 1,800 ft. long. The system ground is used for the carrier ground and a frequency of 50,000 cycles is used.

The transmission equipment is similar to that installed in several of the high-powered broadcasting stations in some respects, and employs two 250-watt oscillator tubes, two 250-watt modulator tubes and a 50-watt speech-amplifier tube. It is appreciated that this is a relatively high-powered transmitter and that for all normal conditions of operation such an amount of power is not necessary. However, communication is more urgently needed during periods of abnormal condition than at any other time, and it is then that this excess power is called upon to get the message through.

Calling is accomplished by mounting a standard telephone microphone in the horn of the loud speaker which, when the calling circuit is completed, will oscillate and "howl" much as the ordinary telephone will "howl" when the receiver is placed against the transmitter. This gives a very loud note whose pitch will depend upon the natural period of oscillation of the diaphragms and which is clearly audible in all parts of the station. Ordinarily, it is not necessary to use the calling system, as the receivers are always in service and the operator near the set, so that the loud speaker simply talks at him and he starts up his set and talks back.

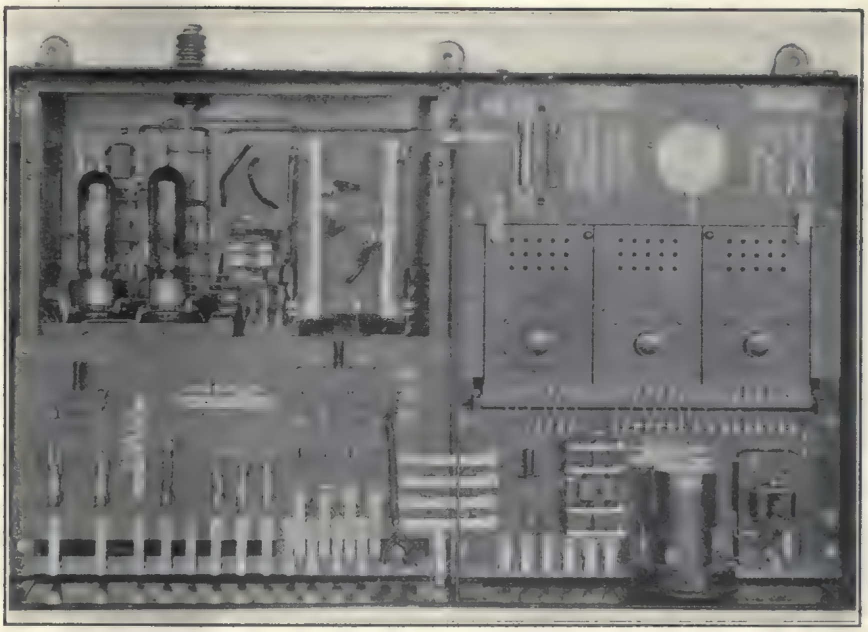
The system is arranged for simplex operation, and all that is necessary is to operate a small telephone switch which energizes a contactor to connect either the transmitting or receiving set to the antenna, thus permitting talking or listening. Some tests made with a view to establishing the possibility of operating as a duplex system are described further on in the paper.

Normal rating of the 250-watt tubes used is based upon a filament lighting supply of 11 volts and a plate pressure of 2,000 volts. With the transmission line in operation and all conditions normal, it is possible to obtain an antenna radiation of 6.2 amp. with the tubes operated at rated voltage. This gives a received signal at the other end of the 202-mile transmission line considerably louder than necessary. The receiver is a standard regenerative set using two stages of audio-frequency amplification to operate a loud speaker, and speech can be heard all over the power house when maximum amplification is employed. For regular service, therefore, the filament lighting supply on the transmitter is reduced to about 10.4 volts and the plate pressure to 1,600 volts, which gives an antenna radiation of approximately 5.0 amp. The tubes are extremely sensitive to variation in filament voltage, and it has been found by experience that 10.4 volts is about as low as it is desirable to operate.

Communication cannot be carried on with three-phase grounds at either or both ends of the transmission line. All three wires were recently grounded at Hat Creek, about 3 miles distant from Pit toward Vaca, and communication could not be carried on. At least one wire insulated from the ground between the two points is necessary for successful communication by carrier-current telephone.

When the transmission line is dead and isolated, by opening the disconnecting switches at each end of the line considerably more power output from the transmitter is required than when the line is connected to the transformers and energized at 60 cycles. This difference is probably due to the change in transmission-line constants by the removal of the reactance of the transformers, which in turn cuts down on the current radiated from the antenna. When the transmission line is thus isolated, the station operators immediately increase the power output of the carrier-current telephone transmitter to its maximum by raising plate and filament voltages to 2,000 volts and 11 volts respectively. Communication is then carried on as usual and no difficulty is experienced in directing operations.

The Pacific Gas & Electric Company is entirely satisfied with the results from the carrier-current telephone thus far obtained. Many conditions of operation have been met and the carrier-current telephone has at all times been ready to perform the duties required of it. The principal difficulty to be overcome is that of understanding the loud speaker, which is simply a matter of becoming accustomed to the voice as reproduced in a loud-speaker horn rather than in a telephone receiver. The operators in general seem to prefer the loud speaker to the head telephones and rely upon it at all times to receive their messages.



TRANSMITTER-RECEIVER FOR 50-WATT CARRIER-CURRENT TELEPHONE

GREAT WESTERN CARRIER SYSTEM

The Great Western Power Company has used a carrier system on its high-tension lines, and J. A. Koontz, Jr., described the installation. Two 250-watt tubes are used in the oscillating circuit and one 250-watt modulating tube. The system has been in operation for more than a year with very satisfactory results.

Because of the complex circuit arrangement at times an echoing effect exists during reception. This is possibly due to the carrier current flowing along lines that have different characteristics, producing different attenuations, or due to reflection. There is, however, one very peculiar thing about this effect. Often by shifting a substation from one of the twin circuits to the other the effect will be eliminated, and thus far no reasonable explanation has been given why this change should eliminate the trouble.

The general equipment consists of a 2,000-volt, three-wire direct-current generator for producing suitable plate voltage for the tubes, 1,000 volts being placed across the 50-watt amplifier tube and 2,000 volts across the 250-watt tubes. Filaments are lighted from alternating current, with rotary converters provided for supplying this current from the station storage battery should there be a failure in the alternating-current supply at the dispatcher's office.

The "simplex" system of communication is used, it being necessary to operate a double-pole, double-throw switch to change from talking to receiving. The antenna are strung upon the towers at two of the stations, while

the Caribou antenna is stretched across the canyon about 40 ft. from the high-voltage wires. Here a single ⅜-in. steel-core aluminum cable 930 ft. in length is used, tapped at the center, giving a T-type aërial. The wire used is the same as that used on the tower circuits.

The carrier-current system has several features which undoubtedly will be of interest to the operating power men. First, it is a good detector of poor switch contacts, as the minute a switch is closed a click can be heard on the loud speakers indicating that the switched is closed, and should the contacts continue to arc, a hissing or howling noise will immediately be set up in the loud speakers. In this way faulty switch contacts have been located and taken out of service before any trouble occurred. Arcing grounds on the secondary systems can be instantly detected, though often hard to locate.

The system is operating on a wave length of 5,500 m. This particular wave length was selected after careful test as giving about the best transmission. It was of suitable length to avoid most outside telegraph interference, placing the station just between two of the high-powered government telegraph stations. The transmission lines make a good antenna for the longer wave lengths—3,000 m. to 20,000 m.—but a very poor one for wave lengths covered by the amateur or broadcasting range.

Miscellaneous Subjects

High-Voltage Insulation—Voltage and Power-Factor Control of Transmission Lines—The National Power Problem—Waterwheel Problems—Telephone Papers

A FINE paper on "High-Voltage Insulation," by J. L. R. Hayden and C. P. Steinmetz, was abstracted by Mr. Hayden. Prof. R. W. Sorensen, Pasadena, said: "We are deeply indebted to Steinmetz, Hayden, Peek, Ryan, Whitehead and others for the careful work they have done in providing methods of analysis of insulation values. This paper presents the phenomena of breakdown in a way so greatly in contrast with our habits of thinking developed from a study of the standard works in physics as to make us think at first glance that contrary opinions are expressed by the authors. Unfortunately, we have not had the paper long enough to check the results and bring to our own minds an understanding of the meaning of a number of statements. For example, we are surprised to discover that breakdown occurs more readily from point to sphere when the point is positive, whereas we have for many years been informed by Townsend and other investigators that breakdown occurs more readily at a given voltage when the point is negative."

In discussing the paper by J. A. Koontz, Jr., on "Methods of Voltage Control of Long Transmission Lines by the Use of Synchronous Condensers," A. W. Copley said: "There is a very definite power limit on a transmission line on which the generator and receiver voltage has been fixed, beyond which the addition of synchronous equipment does no good. It is possible, however, to increase the power limit of a long transmission line by breaking the line into two parts and installing synchronous equipment at the center and at the end. For instance, on a line operating at 220,000 volts it would be possible to increase the capacity of the line from 125,000 kva. to 200,000 kva. by this means."

R. J. C. Wood, Los Angeles, in referring to Mr. Copley's statement, said that a study of the Big Creek transmission lines of the Southern California Edison Company indicated that there was no advantage in placing synchronous equipment at the center of the line. There is no advantage in dividing short lines and considering a part of them as a new line.

Frank G. Baum, in discussing the paper on "The Economic Considerations of Power-Factor Control of Long High-Voltage Transmission Lines," by A. V. Joslin, said that a 220,000-volt line of any length at a load of approximately 120,000 kw. is self-regulating and the voltage is equal at all points along the line. If it were possible to hold the load at this value, then synchronous equipment would not be necessary. For less loads lagging kva. is supplied at points along the line and for greater loads leading kva. is supplied. The point is reached at which the line becomes unstable at approximately 160,000 kva., or on an overload at 200,000 kva. on a 500-mile, 220,000-volt line.

"Some Factors in the Power Problem of the United States" was the subject of an address by F. G. Baum. In illustrating the importance of a national power scheme Mr. Baum said that the combined output of all the plants in the United States varies only about 10 per cent from month to month, whereas the outputs of individual plants vary as much as 50 per cent. The importance of interconnection is shown by the fact that California has a capacity factor of 46 per cent, whereas Missouri for instance has a capacity factor of only 17 per cent. This is because of extensive interconnection in California as against isolated plants in the case of Missouri. "We cannot realize the greatest economies in power generation and transmission until we have a comprehensive interconnected system on a national scale. The amount of reserve capacity is reduced to the smallest possible extent by interconnection."

Instead of abstracting his paper on "Waterwheel Construction and Governing," E. M. Breed presented an illustrated talk showing some recent developments in hydraulic turbines. He pointed out the advantages of the propeller-type runner and spoke of the recent development in governor design by which the operator may change from automatic to manual control by merely throwing a lever.

Roy Wilkins, in abstracting his paper on "A Study of Irregularity in Francis Turbines,"* said that vibration in Francis-type turbines is due to the lack of clearance between the guide vanes and the runner blades. In overcoming the vibration on its Pit River units the Pacific Gas & Electric Company cut back 2½ in. on each side of a runner of 105-in. diameter without impairing the efficiency or load as far as could be determined.

Robert Treat suggested the application of the device used by Mr. Wilkins to determine the point of vibration in hydraulic turbines and to determine the pressure in oil circuit breakers and porcelain insulator supports. R. L. Hearn expressed the opinion that some of the vibration experienced with the units described in John Harisberger's paper on "Experience with Bearings and Vibration Conditions of Large Hydro-Electric Units" was due to the draft-tube design. He felt that the Moody type of draft tube would help in overcoming the trouble.

In the discussion E. M. Breed said that the manufacturer has realized that vibration in the larger-sized units would be a serious problem. He felt that operating companies by such tests as described by Mr. Wilkins will greatly assist the manufacturer in overcoming this trouble. "The manufacturer has approached the problem from the angle of the vibration set up by varying the number of guide vanes and the number of buckets. If the difference in number is even, the vibration is regular and hence more destructive, whereas if the difference is odd, the vibration is irregular and moves alternately from points diametrically opposite backward around the turbine." John Sturgis said that he looks to see an entirely new roller-type gate as a result of the development of the propeller-type runner.

H. W. Hitchcock, in presenting his paper on "Applications of Long-Distance Telephony on the Pacific Coast," showed some interesting pictures of the laying of the telephone cable from Avalon, on Catalina Island, to San Pedro. H. F. Osborne, in presenting his paper on "Telephone Transmission Over Long Distances," showed some slides of oscillograms of currents set up by voice energy in a transmitter. He said that the wave filter has been an important factor in the development of carrier-current telephony by filtering out wave lengths of different frequencies.

*This paper will be abstracted in a later issue.

An Engineer's Analysis of

Why Some Appliances Are Not in Use

Need for More Rugged Construction, Better Design and Education of User—Too Many Household Devices Fail Within a Few Months—Central Station Repairs Do Not Solve Problem

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HOUSEHOLD appliances have undergone many improvements in the past few years, but there is still room for more durable products. Some manufacturers have made more progress than others and are producing reliable and efficient articles, but a number of them are not looking at the appliance business from the standpoint of the consumer and central-station company. Yet unless appliances are used they are of no value to the consumer and are bringing no returns whatever to the central station. It is far better for a central station to sell five hundred appliances and have them all used than to sell a thousand and have only three hundred used.

There are many devices on the market that have excellent heating elements and are very efficient electrically, but are deficient in little mechanical details that spoil the whole device. Household appliances are the weakest link in the electrical chain. They have not received from the manufacturer the same attention as power equipments. On the other hand, appliances are used by people unfamiliar with electricity. For this very reason they should be as nearly foolproof as possible and very durable. Ever since appliances first appeared I have been a liberal user in my home. I use all appliances from the electric range down to the soda mixer and have spent many evenings and Sundays making repairs, although I always purchase the best articles obtainable. About 80 per cent of the repairs have been necessitated by poor manufacture and design, the two being probably equally divided. The remaining 20 per cent are divided between natural wear and tear of the appliance and irregularity of voltage, the latter trouble having since been corrected.

As a result of experience in using and testing these appliances, I feel that a few suggestions as a customer may be of interest and assistance to the electric utility and some of the appliance manufacturers. I wish it understood that these suggestions are made in a friendly way with the idea of assisting those who are interested in making improvements and bettering this branch of the industry.

Appliances Not Seasoned

A number of manufacturers have been and are still putting out a product that has not been carefully "seasoned" and are continually making changes in their line that reduce cost as well as reliability. These manufacturers are letting the public do their experimental work, which is a very risky thing and often leads to failure. The manufacturers are getting their experience at the expense of the central station and the dealer.

The failure of an appliance hurts in many ways, much more so than the manufacturer realizes. I have heard a manufacturer say that all that was necessary for a customer to do was to send back the appliance if it went wrong and he would make it good. This, of course, is true, and any reliable firm would do the same thing, but the damage has already been done, and the difficulty in many cases could have been eliminated by more care in the original design and the construction by the manufacturer.

Some typical cases will illustrate the results of failure in an appliance from the user back to the manufacturer. Here are a few cases taken from actual practice which represent only a few out of several hundred which have come to my attention within the last few years:

1. A WASHER EXPERIENCE—For a typical illustration consider a progressive jobber who represents a manufacturer in his territory. This jobber sold a line of washers

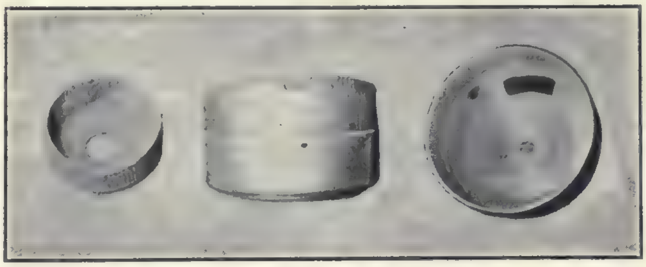


FIG. 1—STEPS IN FAILURE OF SWITCH ON ELECTRIC RANGE

to a central station which was disposing of them at retail to its customers on a partial-payment plan. The central station entered into an extensive sales campaign of this machine as it had been very highly recommended by the jobber and had been well advertised. One machine was sent direct to the customer's premises and uncrated. It was found that the crate covered only three sides of the machine and that the fourth side was left entirely exposed. During transit it had come in contact with some other material and was badly dented. If the crate had been properly made, such a thing would not have happened.

After the machine had been uncrated it was found that the motor was supported on a wooden base, and during transit this base cracked as it was mechanically weak. This threw the motor out of line and a new base had to be made. A small operating handle had also jarred out of position while in transit and was lost. After waiting a week for a new handle to replace the one that was lost, the machine was finally put to work. It operated splendidly for about a month and then began to show some of the defects that are common to many washing machines.

The customer called the utility salesman on the telephone and explained her difficulty. This salesman had to give up half a day of sales work in order to make an investigation of the washer. He found that the drain at the bottom of the washer had become unsoldered on one side but was being held in place by two rivets. These rivets were mechanically strong, but the soldering was very poorly done, and as the whole bottom was flimsy, it gave way with the frequent use of the drain. The customer had to meet with this difficulty by continually keeping a pail under the washer.

But the real cause of the complaint was the fact that the switch which was used on the machine was very weak

in its construction and the continual small arc in breaking the contact had charred the fiber insulation until it finally broke and rendered the machine inoperative. The customer also told the salesman that she could not leave the machine for any length of time as the wooden cover on the revolving drum was very apt to fall off and stop the washer altogether. This would "stall" the machine and the slipping of the belt would fill the room with smoke. It was found that the screws were loose and the cover had not been properly fitted to the drum. In going over the machine the salesman also noticed that the manufacturer had neglected to put any grease in the grease cups and that in a short time there would have been further trouble from this cause.

In the above case the switch was renewed free of charge as one of the utility company's employees placed it on the machine so that it did not cost the customer a cent. However, the customer was obliged to pay $5.50 for a plumber to come out to the house and resolder the drain to the bottom of the washer. To return the washer to the manufacturer would have cost $30, and the customer would have been without its use for at least six weeks.

With due respect to this housewife, the instance was given considerable publicity, especially to prospective buyers. Unfortunately many of these difficulties are exaggerated, especially as the story passes from one to another. Such difficulties and several others not mentioned forced the central station to curb its activities in this line. Machines that went wrong caused a loss in several ways—first, in the sale of current; second, the sales cost was excessive, eating all possible profit; third, it was found hard to collect the full price of the machine.

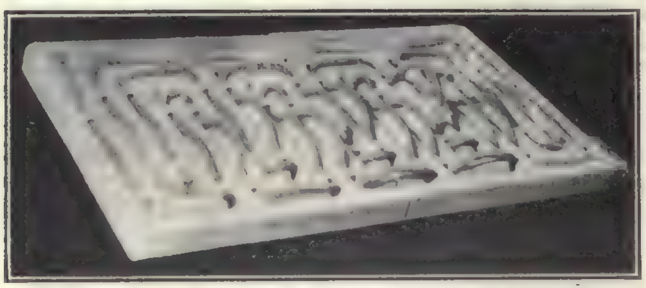


FIG. 2—POORLY DESIGNED INVERTED HEATING ELEMENT

2. A RANGE EXPERIENCE—A few years ago the electric range was one of my greatest problems, but after using several makes I now have an outfit that in comparison costs little to maintain and is very economical in its operation. My maintenance cost for material alone averages $1 per month, not including labor. This is a low figure, and in many cases it runs as high as $4 a month. It was necessary to educate my family about every detail of this range in order to get results, and much more instruction being necessary than with any other means of cooking.

In some towns where ranges were recently tried they proved so poor that it was impossible for the utility to do any business with this appliance in spite of an exceptionally low rate. Some of the smaller things that give trouble are switches, contacts, oven door handles, temperature indicators and poor location of switches, all of which are a bother to the consumer.

I am always having difficulty with the insulating lining in the snap switches when the switch is placed directly in front of the heating units of the range. It is impossible to keep it dry when placed so near the cooking utensils. This lining becomes moist and will then conduct electricity in sufficient quantity to burn up eventually the whole lining. (See Fig. 1.) This is very noticeable on the 220-volt ranges. On the 110-volt ranges the lining will dry out so thoroughly that it will finally crack and break away, thus causing a short circuit in the switch. Referring again to Fig. 1, examine the fiber switch lining. This lining has absorbed moisture and is just beginning to steam and burn. At the top on the inside can be seen a bulge in the lining. This is caused by expansion due to steam between the layers in the fiber. The same picture shows where the lining has burned through and a short circuit results, burning a hole in the metal cover. Another hole in the metal cover which resulted from the same cause is shown. These switches, when new and tested in the laboratory, withstood a dielectric test of 2,200 volts between the cover and the switch terminals inside. An air space between the switch contacts and the fiber linings of the switch cover would reduce this difficulty to a minimum. If the switch cover is not grounded, it will give the operator many unpleasant shocks.

Fig. 2 illustrates difficulty incurred with the *inverted* heating unit as used in an oven. By examining this picture it will be noticed that the heating wires hang down from the unit about 1½ in. from the surface, making it possible for them to come in contact with the contents of the oven. The active heating wire has not been properly supported.

Many ranges have spaces between the units and the range proper that will accumulate dirt, and it is impossible to remove this dirt without taking the units out altogether. One of the most essential things on an electric range is to see that no food is spilled on the heating units, especially those of the open type. I have been told by a salesman that this means nothing to exposed coil units, which would soon burn up the food, when it could be brushed away. This is true, but in many cases it has burned out the unit at the same time. With the inclosed type of units this trouble is not so probable.

I have found one type of range useless on a three-wire system with the neutral grounded, but on the non-grounded, two-wire system the range would give fairly reliable service. This range employed exposed coils in the heating element, but they were covered by a slotted iron grating. As this grating was grounded and was only ¼ in. above the active element, a short circuit would result whenever any food was spilled on the unit and allowed to carbonize. After having replaced five units within six months' time I gave up the range altogether. I received no assistance from the manufacturer, who stated that the range was all right in every respect and offered as a proof that the device had been "approved" by some household magazine and this alone was sufficient indorsement to make the range satisfactory to any one.

Another great difficulty with ranges, and in fact with all heating devices requiring a large amount of energy, is in the electrical contacts. This is especially true if the contacts become heated. Unless the contacts are very tightly made and perfectly clean, they are almost sure to give trouble. The best results are obtained when the contacts are made under considerable pressure. There are very few devices on the market today that have not shown the difficulty very prominently.

3. RESULTS OF IMPROPER DESIGN—Air heaters, especially in the larger sizes of 1 kw. and over, have given considerable trouble because of the poor contacts between the heating element and the leading-in wires from the switch. In many cases they have burned off completely after the heater has been in operation for a short time. (See Fig. 3.) The controlling switch is often of insufficient size or has been placed too near the heating element, which results in the fiber lining becoming badly charred and finally breaking, allowing the switch to short-circuit, as already shown in Fig. 1. One of the greatest difficulties with the smaller heaters has been due to "burn-outs." Another difficulty with air heaters has been due to their being put together by numerous small bolts without lock washers or double nuts, with the result that vibration during transportation often makes them fall apart.

4. Toasters and flatirons are the leading appliances and are more universally used than any others. Undoubtedly, the percentage of failures in toasters is small compared with the number in use, the greatest difficulty being with burn-outs. On the other hand, the toaster is comparatively simple and has everything in its favor for reliability. Some of the more modern toasters put out recently are excellent electrically but poor mechanically and are not so durable as they should be.

The electric flatiron is a different matter and is subjected to hard usage. While repairs on irons, on the whole, are large, this is to be expected because of the enormous number in use. The first thing to wear out on a good flatiron is the cord. Mechanical devices for testing

MISCELLANEOUS DATA ON TWELVE MAKES OF STANDARD 6-LB. IRONS

Flatiron	Number of Screws to Remove Heating Unit	Temperature of Top (Degrees) with Bottom at 400 Deg. F.	Watts at 110 Volts
A	1	120	594
B	1	125	478
C	7	160	522
D	7	135	458
E	7	128	478
F	3	222	550
G	5	159	561
H	4	230	605
I	6	180	440
J	8	175	473
K	5	197	616
L	7	120	577

cords do not represent actual conditions as the cord receives much more and different bending. It is usually wrapped tightly around the handle when not in use.

Unless the heating element of any household heating appliance is the best it is not worth selling at all. Burnouts are, however, bound to occur in time, and under these circumstances the manufacturer should make the questions of renewals as simple as possible. The units in very few irons can be replaced readily, and a good field is waiting for the manufacturer who will put out a device where the unit can be easily renewed by the consumer.

Complicated Assembly of Some Appliances

Many irons are held together by a number of screws which become loose after the iron has been in use for a short time. During an investigation some time ago I found that manufacturers use anywhere from one to eight screws to hold the device together. The accompanying table shows the number of screws used in different irons to hold them together. With some irons it is necessary in order to replace a burned-out unit to take out at least seven screws.

I also found that many manufacturers do not consider the temperature of the handle of the iron. In many cases the handles get so hot that their use is uncomfortable, while others will operate at a temperature on the top under the handle of not over 120 deg. F. I have found irons whose tops reached a temperature of 230 deg. F., and this represents waste heat as well as discomfort in the use of the iron. Poor contacts which heat and eventually burn away are very noticeable in many makes of irons. The small arc is much more destructive than the continual making and breaking of the circuit If the contacts between the iron and cord are not absolutely tight, they will arc and eventually burn away.

5. The vacuum cleaner is another appliance which needs improvement, although a much better product is made today than was put on the market a few years ago. Recent improvements in motors and fans have helped a great deal, but many petty troubles with switches, handles, belts, etc., need to be looked after. A frequent trouble with belt-driven brush machines has been in the belt itself. The user never knows that the belt has broken and is missing unless he happens to notice that the belt is on the floor or to examine the machine before it is used. The cleaner does not clean satisfactorily without the brush, but the customer does not think it necessary to have repairs made, so the machine is eventually put away and not used and is considered a failure. The consumer should also be educated to the fact that the cleaner itself must be clean.

A great number of cases similar to the above have come to my attention, and interviews with others from all parts of the country convince me that the manufacturers should be more careful in analyzing trouble. Failures on their part hurt every branch of the electrical industry and lessen their own profits. Many consumers have given up the use of appliances on account of failures even after having repairs made. Repairs in many cases are simple when the customer can return the apparatus direct to the manufacturer, or if the utility or dealer maintains an appliance repair shop.

A repair shop is a necessity to those who wish to keep these appliances in use and obtain future business. It is the service that counts. If this department can be made to pay, so much the better, otherwise the appliance business is not attractive, especially to the dealer.

It usually costs the dealer or central station more to make repairs than it costs the manufacturer, and if the cost is very high in proportion to the original price of the device, this tends to discourage their use. Many purchasers will not bother with repairs. They go back to their old ways and stay clear of anything electrical. I have talked with many central-station men who say that they could not run an appliance department without maintaining a service department to look out for the difficulties.

It is not my intention to go into details of appliance troubles, but I want to bring out the fact that the continual use of these devices depends greatly upon the manufacturer. This is a point in which the central station, jobber and dealer are vitally interested. The majority of manufacturers will say that they have no trouble with their devices and can prove the fact by showing that very few ever come back to them. That very few go back is undoubtedly true, but it is not true that their goods are giving 100 per cent service. The fact is that they hear of only a very few of the troubles. The difficulties are taken care of by the customer or, more likely, by the central station or the dealers and do not reach the manufacturer.

The value of laboratory tests may easily be overestimated unless the man in charge has used the appliance in his own home. As a rule laboratory tests do not represent actual working conditions, and the device usually receives better treatment than in the home. The laboratory man understands how to look out for weak points far better than the average user and is apt to favor the device.

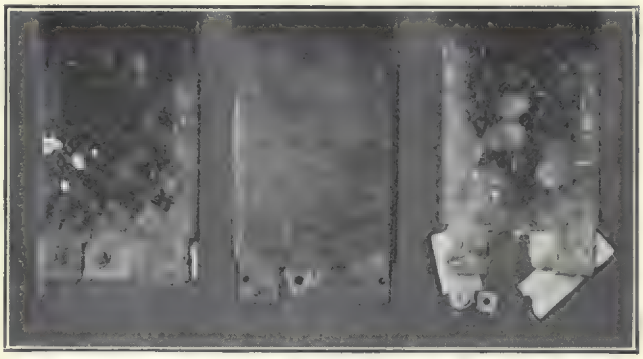


FIG. 3—RESULT OF POOR CONTACTS ON HEATING ELEMENTS OF AIR HEATER

The real test of household appliances, more than with any other class of electrical equipment, is with the consumer. Defects that are not noticeable in the laboratory are often very pronounced in the home. Efficiency tests, dielectric tests and others can be better made in the laboratory, but it is the "home test" that will give true value and reliability.

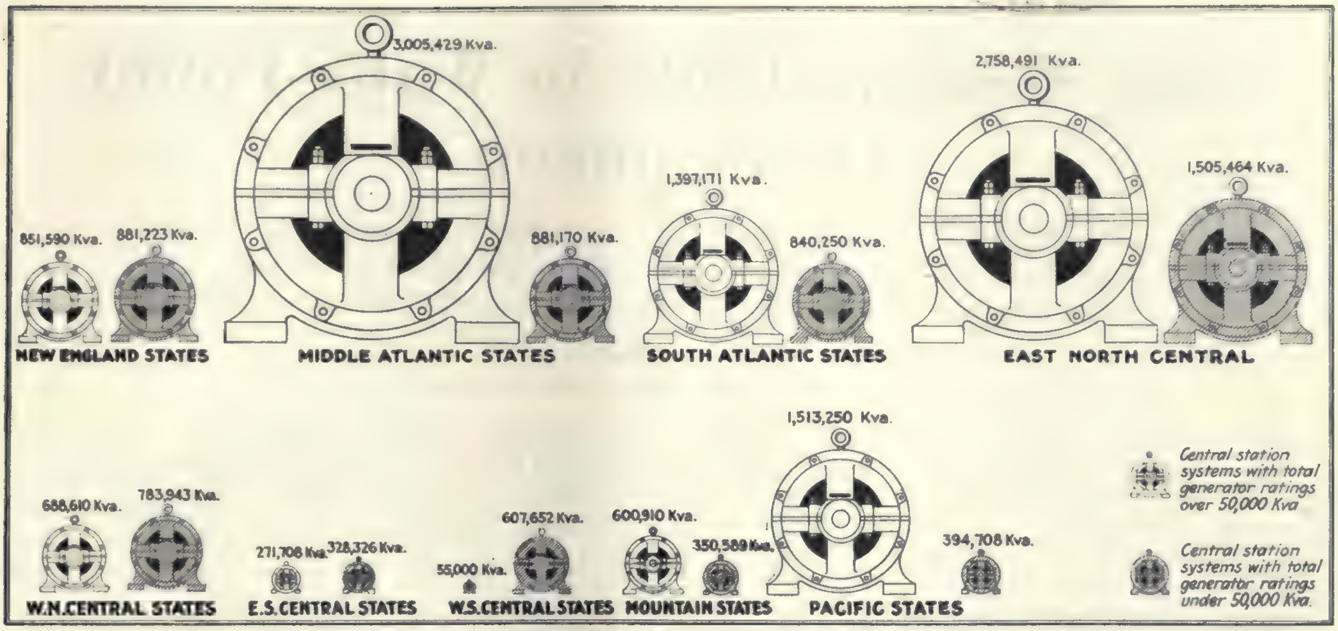
If manufacturers would "season" their appliances before placing them on the market, it would eliminate many petty difficulties. The central-station company, jobber and dealer should also try these appliances themselves before making sales on an extensive scale. Look for the bad points; the good ones will take care of themselves. See if the device can be easily repaired.

Great improvements can be made in issuing better instruction sheets with appliances, especially washers and ranges. More detail should be given as to the care of the device. Some instruction sheets supplied with washers never mention the subject of lubrication in any way. These sheets should be in better form, more attractive and furnished in duplicate.

Thousands and thousands of dollars have been spent and are being spent to educate the public to use appliances, and from my experience I believe that considerable effort should be put into education to show the public how to care for these appliances. Such an effort would help every branch of the industry directly. The object can be accomplished by better instruction data when the device is sold, this information coming from the manufacturer. The central station could assist by sending its customers a small pamphlet on the subject of care of appliances in general. The customer would then have information from two independent sources.

Central-Station Systems Grouped in Accordance with Total Rating of Installed Electric Generators—Oct. 1, 1922

Sections and States	Cos. Operating Generating Plants	Total Rating of Generators, Kva.	Systems Under 50 Kva.		Systems From 51 to 100 Kva.		Systems From 100 to 250 Kva.		Systems From 251 to 500 Kva.		Systems From 501 to 1,000 Kva.		Systems From 1,001 to 2,500 Kva.		Systems From 2,501 to 10,000 Kva.		Systems From 10,001 to 25,000 Kva.		Systems From 25,001 to 50,000 Kva.		Systems Over 50,000 Kva.	
			No. Cos.	Total Generator Rating	No. Cos.	Total Generator Rating	No. Cos.	Total Generator Rating	No. Cos.	Total Generator Rating	No. Cos.	Total Generator Rating	No. Cos.	Total Generator Rating	No. Cos.	Total Generator Rating	No. Cos.	Total Generator Rating	No. Cos.	Total Generator Rating	No. Cos.	Total Generator Rating
United States	4,489	17,715,484	638	20,554	664	52,308	1,064	188,343	707	260,361	440	321,481	410	672,740	314	1,625,226	127	2,001,591	44	1,430,721	81	11,142,159
New England	255	1,732,813	14	492	22	1,820	32	6,114	37	13,991	37	28,909	42	66,978	36	183,546	18	278,960	9	300,413	8	851,590
Middle Atlantic	457	3,886,599	32	1,047	41	3,422	87	15,154	81	28,437	66	46,962	62	100,341	45	230,589	20	327,998	4	127,220	19	3,005,429
South Atlantic	532	2,237,421	54	1,717	79	6,321	146	25,553	85	31,538	51	38,546	39	65,306	43	230,602	18	261,617	6	179,050	11	1,397,171
East North Central	866	4,263,955	106	3,326	129	10,237	187	33,852	146	55,357	86	60,243	80	128,643	73	398,911	31	486,665	10	328,230	18	2,758,491
West North Central	1,101	1,472,553	253	8,240	175	13,425	281	49,280	166	59,600	81	58,655	79	128,855	46	226,747	10	144,530	3	94,611	7	688,610
East South Central	314	600,034	44	1,331	71	5,645	73	12,775	58	21,076	20	14,830	17	30,327	21	94,159	6	101,850	1	46,333	3	271,708
West South Central	524	662,652	80	2,651	84	6,578	164	29,070	74	26,787	48	34,400	39	64,143	17	94,397	13	212,632	4	136,994	1	55,000
Mountain	266	951,499	34	1,142	37	2,100	68	12,040	43	16,901	30	22,395	28	45,608	12	64,926	6	102,207	3	82,670	5	600,910
Pacific	174	1,907,958	21	608	26	2,160	26	4,505	17	6,674	21	16,541	24	42,539	21	101,349	5	85,132	4	135,200	9	1,513,250
New England																						
Maine	53	142,129	6	225	7	591	13	2,263	8	3,090	8	6,446	1	1,250	6	28,304	3	52,662	1	47,298	0	0
New Hampshire	44	79,121	2	56	7	583	6	1,155	10	3,868	8	6,160	7	12,582	2	6,312	1	14,375	1	34,030	0	0
Vermont	50	123,335	2	20	5	399	4	840	12	4,401	8	5,475	11	16,197	5	35,528	2	25,475	1	35,000	0	0
Massachusetts	67	914,361	3	141	1	100	6	1,206	6	2,288	7	5,948	13	20,855	15	78,584	8	132,474	2	55,675	6	617,090
Rhode Island	6	215,425	0	0	0	0	0	0	0	0	1	1,000	1	1,950	2	6,875	0	0	1	43,100	1	162,500
Connecticut	35	258,442	1	50	2	147	3	650	1	344	5	3,880	9	14,144	6	27,943	4	53,974	3	85,310	1	72,000
Middle Atlantic																						
New York	233	1,985,117	22	713	20	1,681	56	9,697	32	11,970	27	19,294	34	57,137	23	115,017	8	136,025	2	63,095	9	1,570,488
New Jersey	47	348,467	3	105	5	357	7	1,287	12	4,401	7	4,924	5	7,055	6	29,122	1	10,416	0	0	1	290,800
Pennsylvania	177	1,553,015	7	229	16	1,384	24	4,170	37	12,066	32	22,744	23	36,149	16	86,450	11	181,557	2	64,125	9	1,144,141
South Atlantic																						
Delaware	10	35,287	0	0	0	0	6	1,100	0	0	1	562	1	2,400	1	3,225	0	0	1	28,000	0	0
Maryland	36	278,834	6	189	5	451	12	2,115	3	862	3	1,917	2	3,150	2	10,400	2	21,500	0	0	1	238,250
Dist. of Columbia	2	91,850	0	0	0	0	0	0	0	0	0	0	0	0	1	4,850	0	0	0	0	1	87,000
Virginia	80	243,216	11	300	7	544	21	3,508	14	5,245	9	6,957	3	4,575	11	62,187	2	29,625	0	0	2	130,275
West Virginia	52	449,612	4	129	6	490	9	1,654	9	3,547	6	4,347	3	4,735	6	33,437	3	35,570	2	55,175	4	310,528
North Carolina	89	177,909	6	216	17	1,371	25	4,361	13	4,792	9	7,512	11	19,226	6	34,131	0	0	1	30,000	1	76,300
South Carolina	67	453,873	6	262	12	1,078	18	2,916	11	4,163	2	1,562	6	11,180	7	36,725	3	38,862	1	25,625	1	331,500
Georgia	120	392,140	11	318	22	1,688	34	6,140	24	8,832	12	8,662	5	8,285	6	32,272	4	62,375	1	40,250	1	223,318
Florida	76	114,700	10	303	10	699	21	3,759	11	4,097	9	7,027	8	11,755	3	13,375	4	73,685	0	0	0	0
East North Central																						
Ohio	175	1,278,441	12	382	18	1,405	39	6,653	30	11,123	26	19,100	10	17,999	24	142,614	6	97,750	1	27,000	9	954,415
Indiana	127	425,638	14	489	14	1,029	18	4,462	23	8,635	15	10,377	17	27,233	14	80,658	8	126,975	3	102,780	1	63,000
Illinois	196	1,210,241	32	928	31	2,493	39	6,986	35	13,663	16	11,458	19	28,425	11	61,745	7	117,185	4	144,100	2	823,258
Michigan	181	812,028	18	583	28	2,204	46	8,194	31	11,295	18	11,766	19	30,638	16	73,242	2	31,200	0	0	3	642,900
Wisconsin	187	537,607	30	944	38	3,106	45	7,557	27	10,641	11	7,542	15	24,348	8	40,652	8	113,555	2	54,350	3	274,912
West North Central																						
Minnesota	153	349,162	28	918	19	1,517	45	7,987	20	7,700	11	7,815	12	19,518	11	62,202	5	62,305	0	0	2	179,200
Iowa	160	352,112	13	442	20	1,589	39	7,296	30	11,512	22	14,707	16	24,805	16	77,055	1	11,875	2	63,831	1	139,000
Missouri	179	435,230	44	1,429	27	2,083	46	8,154	24	8,426	12	9,476	17	28,219	3	14,683	3	45,350	0	0	3	317,410
North Dakota	123	27,062	55	1,788	23	1,813	24	3,739	10	3,580	4	2,842	6	9,175	1	4,125	0	0	0	0	0	0
South Dakota	95	39,320	28	815	21	1,518	20	3,345	9	3,346	10	7,559	4	5,762	3	16,975	0	0	0	0	0	0
Nebraska	195	120,088	53	1,715	35	2,660	49	8,380	34	11,490	9	7,187	9	13,886	5	21,770	0	0	0	0	1	53,000
Kansas	196	149,579	32	1,133	30	2,245	58	10,379	39	13,546	13	9,069	15	27,490	7	29,937	1	25,000	1	30,780	0	0
East South Central																						
Kentucky	91	127,220	23	647	23	1,810	18	3,115	12	3,979	2	1,590	5	9,562	6	27,142	1	20,000	0	0	1	59,375
Tennessee	84	208,420	13	456	13	1,037	16	2,516	20	7,614	8	5,626	4	7,233	5	22,855	3	56,250	1	46,333	1	58,500
Alabama	56	215,633	5	148	11	935	12	1,917	11	3,648	7	5,427	3	4,700	4	19,425	2	25,600	0	0	1	153,833
Mississippi	83	48,761	3	80	24	1,863	27	5,227	15	5,835	3	2,187	5	8,832	6	24,737	0	0	0	0	0	0
West South Central																						
Arkansas	79	79,824	12	468	14	1,071	23	4,559	8	2,855	9	5,868	7	11,685	5	35,068	1	18,250	0	0	0	0
Louisiana	68	97,798	10	335	15	1,208	20	3,555	11	4,008	3	1,812	4	7,755	3	18,925	1	13,700	1	46,500	0	0
Oklahoma	132	136,267	18	536	17	1,275	44	7,724	22	7,641	14	10,014	10	17,185	3	18,200	3	48,573	1	25,119	0	0
Texas	245	348,763	40	1,312	38	3,024	77	13,232	33	12,283	22	16,706	18	27,518	6	22,204	8	132,109	2	65,375	1	55,000
Mountain																						
Montana	46	410,051	12	425	10	649	6	1,059	7	2,891	4	2,977	3	5,050	1	3,000	0	0	1	30,000	2	364,000
Idaho	30	165,423	5	178	2	162	8	1,349	4	1,675	4	3,290	5	8,059	0	0	0	0	0	0	2	150,710
Wyoming	38	32,890	4	102	9	693	8	1,480	4	1,635	7	4,802	3	5,200	2	6,036	1	12,942	0	0	0	0
Colorado	63	153,029	5	167	6	439	24	4,338	10	4,039	2	1,290	8	13,331	3	21,000	3	55,755	2	52,670	0	0
New Mexico	28	12,469	4	100	2	155	7	1,174	9	3,282	3	2,465	3	5,293	0	0	0	0	0	0	0	0
Arizona	24	64,230	3	120	1	75	3	502	4	1,412	6	4,921	1	1,300	4	22,390	2	33,510	0	0	0	0
Utah	29	99,902	1	50	7	527	10	1,763	3	1,087	3	2,025	3	3,750	1	4,500	0	0	0	0	1	86,200
Nevada	8	13,505	0	0	0	0	2	375	2	880	1	625	2	3,625	1	8,000	0	0	0	0	0	0
Pacific																						
Washington	68	426,038	8	243	14	1,173	6	1,073	6	2,413	8	6,657	11	21,424	10	44,805	2	32,800	0	0	3	316,250
Oregon	54	180,417	8	155	7	606	13	2,145	5	1,856	7	5,499	3	7,012	6	29,324	1	10,870	1	29,000	1	94,750
California	52	1,301,503	5	210	5	381	7	1,287	6	2,405	6	4,385	8	14,103	5	27,220	2	43,862	3	106,200	5	1,102,250



THE PACIFIC STATES LEAD IN PERCENTAGE OF LARGE GENERATING SYSTEMS, FOLLOWED CLOSELY BY THE MIDDLE ATLANTIC STATES

Eighty-one Generating Systems of Over 50,000 Kva. Rating

More than 85 per Cent of the Installed Generator Rating Is Operated by Systems with a Total Generator Rating of Over 5,000 Kva.

A STUDY of the data contained in the 1923 issue of the McGraw Central Station Directory and Data Book brings out the recent rapid growth of the superpower generating plant and the consequent elimination of large numbers of small inefficient generating plants. It was only about sixteen years ago that the total rating of systems with a generator rating under 5,000 kw. was 1,524,000 kw., or 30 per cent of the total generator rating of the country. On Oct. 1, 1922, the rating of such systems had increased only to 2,130,000 kw., while the percentage decreased to 15 per cent of the total. Records available indicate that in 1907 there was not a system with a total rating of more than 50,000 kva., whereas on Oct. 1, 1922, there were eighty-one such companies, representing a combined rating of 11,142,159 kva., or about 63 per cent of the total rating of the country.

The accompanying tabulation gives the central-station systems grouped in accordance with the total rating of installed generators. This tabulation indicates that there are 4,489 companies in the United States operating one or more generating plants with a total rating on Oct. 1, 1922, of 17,715,484 kva. There are 5,974 operating companies in the country, indicating that of this number 1,485, or 24.9 per cent, purchase all of the electrical energy which they distribute to consumers.

The results of a study of generator activity indicate that the total generator rating necessary to take care of the aggregate average load of the United States totals about 12,170,000 kva. and that the generator rating necessary to take care of the present aggregate maximum peak loads of the country totals 16,020,000 kva. The generator rating of the country in excess of the aggregate maximum peak load of the country totals 4,430,000 kva. The indications are, therefore, that 8,280,000 kva., or 40.5 of the total generator rating of the country, is in reserve for peak or emergency conditions, is temporarily out of service for repair or is idle because of some other cause.

New Zealand Has 4,000,000 Potential Hydro-Electric Horsepower

ESTIMATES of the amount of available water power in New Zealand forwarded to the Department of Commerce by Vice-Consul J. C. Hudson show a total of 4,076,700 hp., of which 759,700 hp. is in the North and 3,317,000 in the South Island. In the distribution of power resources the South Island is in an advantageous position as the bulk of its potential supply is near the deep-water sounds of the west coast, where there are many sites suitable for electrochemical and electrometallurgical industries.

A program for water-power development has been laid out in which the important sites of the North Island will be utilized. These include Lake Waikaremoana, which has sufficient storage capacity to run the proposed generating plant for twenty-one months without rainfall, and the Waikato River project, which tops Lake Taupo. The first installment will involve an estimated expenditure of £15,000,000 for the headworks, plant and transmission line to Auckland, and will develop 50,000 hp. of the 138,000 hp. which it is estimated can be ultimately obtained.

State commitments up to the end of 1923 for the Lake Waikaremoana project amount to £110,000. By the end of 1924 it is planned to spend £1,075,000, when it is expected that 24,000 hp. will be available from this source. The method of financing hydro-electric development in New Zealand is chiefly through state aid, no projects of importance being promoted by private organization. The Southland province, with some assistance from the state, is carrying on its development through a local body, the Southland Power Board.

State Responsibility in Water-Power Development*

Despite Advance of Hydro-Electricity, Unsettled State Policies and Chaotic Condition of State Regulation Handicap Progress—Relations of Federal Commission to Industrial Developments

By O. C. MERRILL
Executive Secretary Federal Power Commission

ACCORDING to the best estimates available, there was approximately 9,000,000 hp. installed in all the water-power plants, electric and otherwise, in the United States in 1920. Since that time there have been completed or put under construction under authority of the federal water-power act alone projects totaling 2,500,000 hp. Some of these, of course, will take several more years to complete, but it can safely be said that we are now in the period of the greatest water-power development we have ever known. The possibilities of the near future are indicated by the fact that applications have been filed with the Federal Power Commission for projects involving the installation of 21,500,000 hp. and that permits and licenses have been issued for an aggregate of 7,000,000 hp. Notable work has also been done in the field of transmission. Only four gaps, with a total of about 25 miles, require to be closed in order to have an interconnected transmission system along the Pacific Coast from Canada to Mexico, a distance of about 1,400 miles. It is not improbable that within ten years, if certain interstate problems are settled, similar interconnections will have been made through Idaho, Montana, Utah, Colorado and Arizona, with junctions at each end with the Pacific Coast lines, giving an interconnected circuit of more than 3,000 miles. In the South Atlantic States interconnection has been effected through Alabama, Georgia, North and South Carolina and Tennessee and will in the near future be extended into Kentucky, the Virginias and Ohio. It is only a matter of time, and that not far distant, when through the natural expansion of adjacent local groups of plants and lines we should have in the eastern United States a superpower system rivaling that of the Pacific Coast.

HARMONIOUS ACTION NEEDED

There is need of harmonious action, however, between the nation and the states, and between state and state, not only in matters of water-power development but in the whole field of public utility relations.

I have told you that under the federal law 2,500,000 hp. is already built or building. You do not need to be told how little, outside of the reconstruction at Niagara, has been built or started in New York under that law or otherwise in the last three years, notwithstanding the fact that applications for millions of horsepower have been filed before your commission and ours affecting streams within this state or on its boundaries, and notwithstanding the probability that a use could be found for the power as fast as it could be developed. While it is true that the major sites applied for are on an international stream, requiring an international agreement before development can proceed—a situation that would of itself mean delay—the problem is unnecessarily complicated by the lack of any fixed state policy respecting the development of its water powers, and until such a policy has been established no development of consequence can be expected.

PERMANENT STATE POLICIES NEEDED

The determination of such a policy is a responsibility of the people of this state. The Federal Power Commission, out of the interest which it has in power development and with its appreciation of the desirability of common action, may recommend a course which it believes should be pursued, and it will, of course, exercise such authority as it has to protect, if necessary, the common interest of all the states; but it is too thoroughly convinced of the desirability of the maintenance of state sovereignty within its legitimate sphere, and of the exercise of individual state responsibility, to have any intention of dictating a domestic policy for this or any other state.

Differences of opinion, as you are well aware, have arisen between the State of New York and the Federal Power Commission respecting the ultimate limit of the authority of the state and of the nation over navigable waters and in international streams. The commission has certain views of its own powers in the premises, as has also the State of New York. It happens that the respective powers thus viewed overlap to a certain degree. But the possession of a power and its exercise are quite different matters. The commission's unquestioned duties are of such magnitude that it would not be inclined to assume others which the states have the authority and the disposition to perform, even if the letter and spirit of the federal water-power act did not call for co-operative rather than independent action. There are no differences of opinion between the commission and the State of New York which need be an obstacle in the consideration of any particular case or which would justify the failure of either to co-operate with the other, if the state had a settled policy and was ready to proceed.

New York, however, is not the only state with an unsettled policy. Arizona presented to the Federal Power Commission only a few days ago a proposed new policy diametrically opposed to what it has hitherto pursued, a policy having no apparent hope of success, but serving to delay the state's own development and to prolong its conflict with its neighbors. California, with electric systems among the best equipped, best managed and best regulated in the United States, and with the cheapest and most abundant energy supply,

*Abstract of address given before the Empire State Gas and Electric Association, Lake Placid, Oct. 8, 1923.

went through an expensive campaign only a year ago to defeat the proposals of those who would reverse the established policy and risk the wrecking of existing systems that they might embark the state on the troubled seas of political ownership. Other similar examples might also be cited.

These divergent views and unsettled policies have reference almost exclusively to water-power development, for water powers are generally still subject to some form of public control, and they occupy a peculiar status in the public mind. They are deemed a natural resource, and there is fear lest they escape from public ownership and control. They are believed to be immensely valuable, and there is fear lest such values be capitalized for rate-making purposes. There is lack of knowledge concerning construction and operating costs, and the opinion is prevalent respecting both water powers and public utility service in general that there is a wide difference between the actual investment and the values claimed for rate-making purposes, that this difference is responsible for unnecessarily high rates, that public regulation has failed adequately to meet the situation, and that public ownership and operation is, in consequence, the only recourse. These objections and doubts must be frankly met and answered; for the views held, whether correct or not, have had the effect of injecting water-power development into the field of political controversy to such a degree as seriously to hinder present development and to endanger, if prolonged, any comprehensive program of future development.

Public Interests Safeguarded

That water powers are a natural resource, and that whenever owned or controlled by public agencies that ownership and control should be permanently retained, is a fundamental principle of the federal policy. It should be equally a principle of state policy to the full extent that the states have ownership or control, either concurrently with or independently of the federal government. It is a principle, furthermore, to which you gentlemen of the industry should freely subscribe. All that you need ask is that the control be intelligently exercised.

The principle that values inherent in a public resource developed and used in the performance of an essential public service by an agency created by law for that purpose shall not be capitalized in excess of amounts actually expended in acquisition is likewise a fundamental feature of the federal policy, applicable in all cases where power sites are licensed under the federal law. Furthermore, this principle applies not only to the site itself, but to all structures and equipment erected or used on the site or in connection with it. Whether our water powers have great values or not, the public fear that their values will be capitalized at the expense of the ratepayer is groundless as far as sites under federal ownership or control are concerned, and these sites involve 85 per cent of the total water powers of the United States. This provision of the federal law is not hindering in any degree the financing and construction of water powers under federal control, and a similar provision would not hinder the development of the remaining 15 per cent subject to exclusive state control. This is a policy on which all, the utilities included, can well agree and thus remove it from the field of controversy.

It is argued, however, that there are other properties involved and that their value rather than their cost determines the rate base. The fact that such basis has legal sanction, coupled with the belief that there is, in general, a wide and undue disparity between actual investment in electric utility properties and the amounts allowed as the rate base, has afforded the chief ground for the complaint, whether justified or otherwise, that public regulation does not regulate and that therefore it is necessary to substitute public ownership. It is doubtless true that public regulation has not met with full success. It has failed adequately to protect the public in some instances and adequately to protect the utility in others. There has, however, been too little honest attempt to give it a fair trial. Until there has developed a public opinion which will insist that our public service commissions be chosen because of fitness for the task rather than political affiliations, that they shall be as unhampered in their operations as our courts, we cannot expect to have continuity of policy or to reach an intelligent solution of the perplexing problems of public utility regulation. The remedy, however, is not to discard regulation but to strengthen it. Make it honest, make it effective, make it fair. When we shall have done this there will be no valid reason remaining why we should abandon in the field of power development that course which has been responsible for our whole industrial structure—reliance on the driving power of private initiative.

Misinformation Responsible

To no inconsiderable degree the attitude toward water-power development which I have discussed is due to lack of correct information, particularly with respect to costs of construction and of operation. Many people do not realize that when the hydro-electric plant is erected less than half of the cost of the combined generating, transmission and distributing system has been incurred. Still fewer people realize that from 70 to 90 per cent of the costs of delivering the electricity to the resident consumer is incurred after the power has left the generating station. You gentlemen of the industry have this information. You should give it full publicity, without concealment and without bias, and should co-operate with all public agencies in its dissemination. We cannot expect to develop a wise public policy or to secure its general acceptance without the support of an informed public opinion. We should, therefore, use every legitimate means to present the facts and the essential economic principles involved in power development, distribution and utilization. When the full truth is known and recognized as such, the field of controversy will be materially narrowed, even if it does not altogether disappear.

Other Problems Also to Be Solved

I have laid stress on the water-power problem and the unsettled policy with respect to it which exists in many quarters because water powers form an essential part of any comprehensive superpower system and because the controversies concerning them demand early solution if we are to be free to proceed with our greater program. But there are other problems which must also be met and solved. We must first of all make it clear that we are dealing with a program far wider than the territory or the authority of any individual state and yet of vital interest to the citizens of each state. We must harmonize these interests, while at the same time developing a policy and accomplishing a program which

will be to the common interests of them all. This will require co-operative action and reasonable uniformity of legislation. There must be no state barriers against the interchange of energy and no type of development that cannot become an integral operating part of the combined system.

If we are to accomplish our purpose, we must have ourselves a positive program around which we may rally all those who are honestly seeking development in the common public interest. With respect to water power, the principles of the federal policy as contained in the federal water-power act may well form the basis of such a program. I do not suggest this just because it is a federal policy, but because it is a policy which has been tested by experience and which is producing results. Capital has no difficulty in meeting the terms of the law and its provisions afford protection to every legitimate public interest. With state legislation and state policy in reasonable conformity with federal law and policy, and with that full co-operation between state and nation which it is the purpose of the Federal Power Commission to promote and maintain, the obstacles now existing to water-power development would disappear.

PUT REGULATION ON A PERMANENT BASIS

These same principles are equally applicable in the general field of electric utility operation and regulation, and we should strive to bring about in this field also reasonable uniformity of policy and of legislation. Above all, we should seek to place the principle of public utility regulation on a sound, consistent, permanent basis, wholly divorced from every consideration of partisan politics. Rate and service regulation is now and should continue to be a state function. When the program we have in view has developed there may arise questions requiring adjustment between the states. If so, I would suggest that they may best be handled by direct negotiation between the states in accordance with the precedent recently established with respect to the Colorado River, where seven states, through their appointed representatives, have negotiated a compact covering the allocation of the waters of that river.

Finally, there is the problem of harmonizing the various interests within the industry itself. It should no longer be possible for any utility to draw plans for future extension except in such manner that interconnections may be readily effected whenever its territory merges with the territory of any other utility. There is still too much of a tendency for each individual group to approach the problem of interconnection solely from the viewpoint of its own immediate interest, overlooking its own future interest, ignoring the general advantage to the industry as a whole, and forgetting that, as a quasi-public agent performing an essential public service, it has a public duty to perform for which it will be held accountable.

There will be no more important factor in our future industrial development than cheap and abundant electrical energy. Few other factors have more important social relations or give greater promise, by the progressive substitution of mechanical for manual labor, of raising the economic level and improving the social status of the great masses of the people. To promote means whereby these results may be accomplished should be worthy of the best endeavors of us all. It is a combined financial, administrative and governmental problem. We should unite all forces in its solution, in the spirit of co-operation, seeking the common good of all, even though it may sometimes require the partial submergence of individual interests.

Radio Signals for Coast Protection

A RADIO fog signal has been installed in the new light vessel on Nantucket Shoals, one of the most important lightship stations in the world as well as one of the most exposed, since it is anchored 41 miles from land. This signal will be operated by an automatic apparatus sending during fog a group of four dashes every thirty seconds and thus enabling vessels equipped with radio direction finders to obtain an accurate bearing from a distance of 30 miles or more in any weather conditions and to steer for and "make" the lightship. In addition, a powerful electrically operated signal is to be substituted for a submarine bell hitherto employed. This signal will be of 3,000 cp. and will show at the masthead four occultations a minute. The Nantucket Shoals installation is the eighth radio fog signal thus far put into commission, and five more are being established. Ten of the thirteen are on lightships. Nine are on the Atlantic Coast and four on the Pacific.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Control Problems with High-Voltage Networks

To the Editors of the ELECTRICAL WORLD:

I note your editorial of Sept. 8 on "Growth of High-Voltage Networks Introduces Control Problems." The answer to most of the points raised was given in my paper "Voltage Regulation and Insulation for Large-Power, Long-Distance Transmission Systems" (A. I. E. E., June, 1921). The answer is also given in the "Atlas of U. S. A. Electric Power Industry," page 15 and plates XV and XVI.

In such a system of constant-potential transmission the generating stations supply the kilowatt-hours or the energy kva. of the system, and the synchronous condensers supply the wattless kva. to control the voltage of the system. This necessarily gives a constant-voltage system stabilized inherently by the condensers. This is the only way that I can see in which we can get the large-capacity transmission systems required for the solution of the power problems of the United States.

But to get the large capacity per circuit required, it is necessary that for the main transmission system the operating voltage be around 220 kv., and I proposed 220 kv. as standard for the high-power transmission lines of the nation. At this voltage the charging kva. becomes a very valuable asset and gives a transmission with a natural capacity of 120,000 kw. per circuit and a full-load capacity of 150,000 kw. to 200,000 kw.

I believe engineers should study the proposed system. They will be surprised at its simplicity and flexibility and by the method of calculating transmission. The need for such a system is becoming apparent to engineers.

F. G. BAUM,
Consulting Engineer.

San Francisco, Cal.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Method of Locating Faults in Buried Lead-Covered Cables

By H. S. Baker

Meter Department, Ontario Power Company, Niagara Falls, Canada

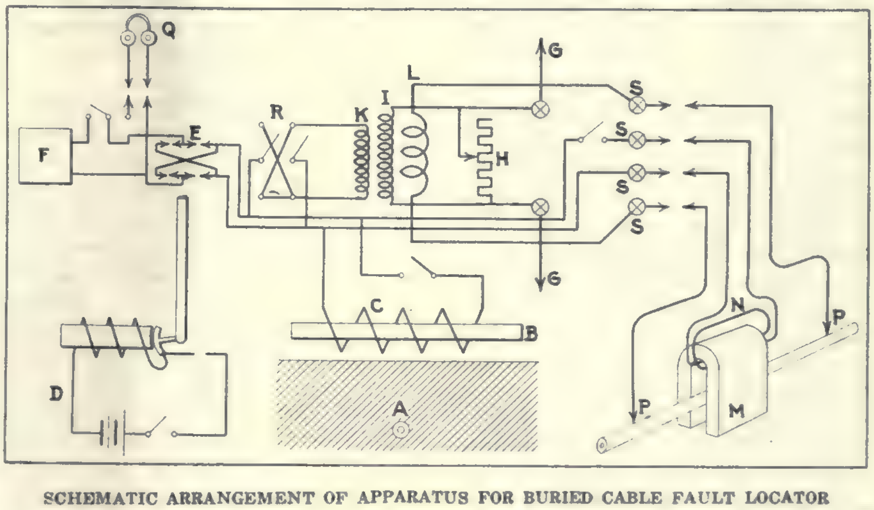
The method of locating cable faults here described is an adaptation of the "hetero-galvanometer" described by P. A. Borden in a paper on "Balance Methods in Alternating-Current Measurement," presented at the A. I. E. E. Convention at New York in February, 1923. The hetero-galvanometer is essentially a direct-current voltmeter or ammeter with rectified alternating current applied to it in which the commutator frequency is somewhat above or below that of the alternating current to be detected. In operation the meter makes periodic swings whose amplitude is an indication of the alternating current or voltage to be measured and whose rate of swinging is a measure of the difference of frequency between the alternating-current source and the rate of commutation. This method utilizes the direct-current permanent type of instrument, which gives a scale that is uniform right down to zero and whose sensitivity to very small voltages far exceeds that of the alternating-current styles of instruments.

The cable system on which the method was developed and used was a four-wire, three-phase, 4,000-volt, 25-cycle feeder in which all cables were buried about 18 in. in the ground and the lead sheath was in direct contact with the soil. The neutral was dead-grounded, thus making all conductors 2,300 volts from ground potential. Three separate single-conductor cables of No. 6 copper with a lead sheath about ⅝ in. in diameter were buried in one trench. The feeder was about 10 miles long in sections of 1 mile to 3 miles each.

The cable fault-finding device takes cognizance of two elements, namely, (1) the magnetic field of the artificial 25-cycle current being fed into the fault, and (2) the potential drop between test points inserted into the earth near the cable and some distance apart along the cable. Both effects are communicated simultaneously to the direct-current millivoltmeter by a commutator whose frequency is somewhat different from the main 25 cycles of the alternating current. A reading of the swing is taken, and then one of the effects is reversed by a reversing switch, and another reading is taken. The direction of throw of the reversing switch giving the larger reading is an indication of whether the fault is farther from the source of power or nearer to it than the point midway between the two potential test points inserted in the ground.

A very simple form of commutator was employed, which was energized by a single dry battery. A make-and-break vibrator on the principle of an electric bell caused a shaft to oscillate at a rate adjustable in the neighborhood of 25 cycles per second. This oscillating shaft operated four contacts, of which each was alternately closed for about a half cycle and open for about a half cycle, two of them being closed when the other two were open.

The magnetic-field detector consisted of a coil of about 1,600 turns of No. 28 wire wound near the middle of a laminated bar about 30 in. x 1 in. x ½ in. The bar was placed on the ground crosswise of the cable, and every alternate half cycle of its coil voltage was applied to the direct-current millivoltmeter through one contact of the asynchronous commutator. The resulting swings of the



SCHEMATIC ARRANGEMENT OF APPARATUS FOR BURIED CABLE FAULT LOCATOR

A—Cable buried in ground.
B—Laminated iron bar.
C—Winding, 1,600 turns No. 28 wire.
D—Vibrator, adjustable in speed, in neighborhood of 25 cycles.
E—Asynchronous commutator operated by motion of vibrator.
F—Permanent magnet type of direct-current voltmeter. 0.62 volts full scale and 62 ohms resistance.
G, G—Contact points inserted in ground near cable at points, say, 100 ft. apart along cable.
H—Variable resistance to reduce value of potential drop effect to a value comparable with the magnetic effect received from bar *B*.
I, K, L—Three-coil transformer with air gap in iron. Iron ½ in. x 3 in. section.
I—2,400 turns No. 28 wire.
K—1,600 turns No. 28 wire.
L—50 turns No. 14 wire.
M—"U"-Shaped core ½ in. x 3 in. to slip over exposed cable.
N—1,600 turns No. 28 wire.
O—Exposed cable (when exposed cable test is made).
P, P—Potential taps on sheath of exposed cable, about 1 ft. apart.
Q—Head phones used in locating position of buried cable by detecting the influence of cable *A* on bar *B*. The current from coil *C* passes intermittently through contacts *E* to phone *Q*. The varying position of bar *B* in regard to cable *A* gives varying sound in head phones.
R—Reversing switch used to vectorially add or subtract the potential effect received through *G* or *P* from the current effect received through cores *B* or *M* respectively.
S, S—Terminals used only in the exposed cable test.

needle gave an indication of the net amperes flowing beneath the bar. Part of this was artificial fault current, part was return fault current along the lead sheath, and part was load current in other cables in the same trench. It will be shown later that there is no sudden change in the vector sum of conductor fault current with sheath return current, as the point of fault is passed in moving along the cable. This is why it is in practice necessary to take cognizance of potential drop also. About a quarter-inch total swing was produced by a 7-amp. artificial fault current at 1½ ft. below the bar.

Operation of Fault-Locating Testing Apparatus

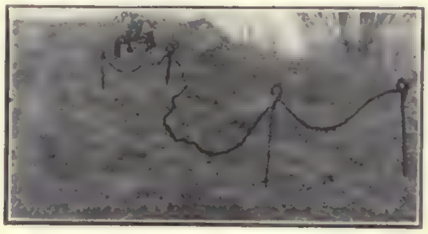
The potential between two test spikes driven in the ground a hundred feet or so apart along the cable was first passed through a reversing switch and then through the remaining contact on the asynchronous commutator and applied to the direct-current millivoltmeter during the half cycles that the magnetic effect was not applied to it. With the magnetic coil disconnected, the swings of the pointer gave an indication of potential difference between test spikes. It was noted that a spike ¾ in. in diameter and 18 in. in the soil gave about twenty times as strong action as ¼-in. spikes driven 6 in. in the soil. Thus the amount of swing due to potential drop depended greatly on the earth resistance at test spikes and nearness of spikes to cable. The required readings, however, clearly showed which throw of the reversing switch gave the greater swing of the pointer and whether the fault was still ahead or whether it had been passed. A simple phase-shifting transformer is used to advance the potential-drop wave by a considerable angle before applying it to the reversing switch. This consisted of a primary of 2,400 turns of No. 28 wire wound on a laminated bar 12 in. x 3 in. x ½ in. A secondary of 1,600 turns of No. 28 wire fed the reversing switch.

Resistor for Test Current

A 2,200-volt, 7-amp. resistor was built to feed artificial current into the fault. It was about 3 ft. x 5 ft. in size, being of No. 22 "Nichrome" wire with springs to keep the wires tight as they expanded with heat.

If the load currents in adjacent cables bring the net magnetic effect into approximate step with the potential drop between test spikes, it is better to omit the phase-shifting transformer, because if the two effects reaching the device are in quadrature, their vector difference and vector sum are equal and no difference of readings upon throwing the reversing switch will be obtained.

The reason for there being no sudden change in magnetic effect as



PRACTICAL METHOD OF LOCATING CABLE FAULTS USED BY ONTARIO COMPANY

the fault is passed is as follows: Suppose x amp. is flowing forward along a copper conductor and through the fault into the lead sheath. Part of this current flows backward along the sheath, and part flows forward if the sheath is not burned off. Call the amount flowing back y amp. Then the amount flowing in the sheath forward from fault is $x - y$. It will be noted that immediately before the fault is reached the magnetic effect of y amp. in the sheath with x amp. in the copper gives the same value, $x - y$ amp., producing magnetic fields above ground.

Of course, at points a considerable distance from the fault the sheath currents are not these values because a part of the current has spread out into the soil. In the case of the lead sheath being burned off and the fault current taking entirely to the power side of the break, the value $x - y$ becomes zero at the point of fault, and the magnetic search coil and bar must be kept at a position giving some appreciable readings on magnetic effect.

The above-described test is made without digging to expose the faulty cable and is a saving of labor in long sections of buried cable. When, however, the fault has been bracketed to a space of, say, 150 ft., the above tests applied within this range become unreliable.

Final Test on Exposed Cable

The following test is then applied to the cable after exposing about a foot of it by digging. The small U-shaped core and coil shown in diagram replaces the long laminated bar, in the above described test, and the potential test points are applied directly to the cable sheath about a foot apart and feed the 50-turn heavy wire coil of the phase-shifting transformer. This test has proved extremely reliable and distinct up to within a few inches of the fault. Care must be taken to avoid mistaking a good cable under load for the faulty cable under test where more than one cable is buried in one trench. It is liable to save time and avoid confusion if the load is cut off all other cables in the trench with the cable under test.

Before experimenting on the use of the 25-cycle artificial fault current we tried out 750-cycle current produced by an electrically operated tuning fork carrying contacts interrupting battery direct current and using triangular coil and telephone as detector. The above system gave plenty of sound in telephone, but the sound could be heard on adjacent cables not connected at all to the source of 750 cycles. In a few cases the 750-cycle method gave fair results, but in general it proved useless.

Keeping Transformer Records

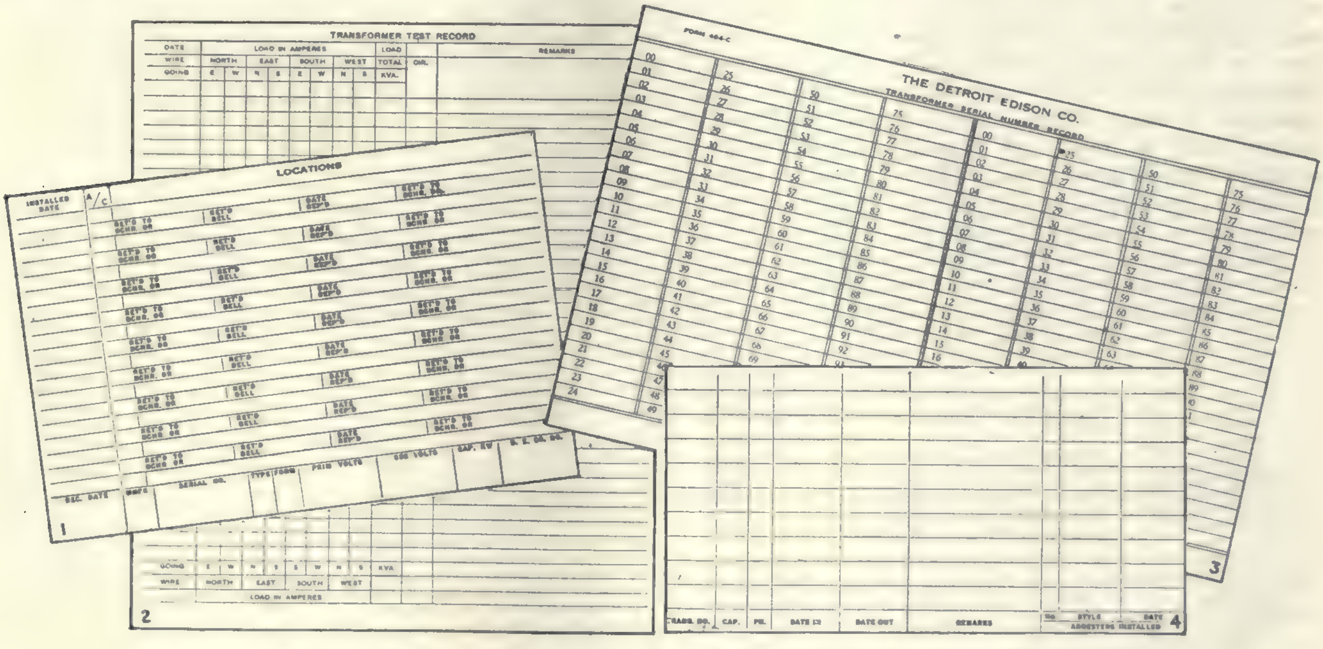
On a large system it is convenient to use a card file for keeping transformer records. The Detroit Edison Company has this system installed and has complete data on the 18,000 transformers used.

The system is flexible, easy to administer and quickly used. The card shown in Fig. 1, white for single-phase and buff for three-phase, is used with each transformer. When a transformer is received at the warehouse the date, the maker, the maker's serial number, type, form, primary and secondary voltage and the serial number of the

Detroit Edison Company, as indicated by Fig. 1, are placed in the space at the bottom of the card. If installed on the system, a record is made on the card, starting at the bottom column. Another card (Fig. 2) is filed in the rear of the card shown in Fig. 1 and contains data as to tests, repairs, loads, location, etc., of the transformer. As in the former case, white is used for single-phase and buff for three-phase.

Complete Record Available

These two cards give the whole history of the transformer. A red tab placed on the record card (Fig. 1) indicates that the transformer is junk, but the card is held in the file. Green tabs show the pole-type series transformers and purple tabs the potential transformers. These cards are filed serially in trays which are readily accessible, and a cross-indexing system adds to the convenience of the arrangement. One cross-index (Fig. 3) is made on the basis of the serial numbers of the manufacturer and the Edison company. If a record comes in giving a serial number only, this file affords means for identification. Another cross-record file (Fig. 4) is made on basis of location and the load is put on this card file so as to have a record of each transformer that has served a given load.



TRANSFORMER RECORDS AS USED BY THE DETROIT EDISON COMPANY HAVE PROVED VERY SUCCESSFUL

This system has proved very successful and can be used to advantage by the property record department, as photostats of the trays give detailed information on all transformers, which can be readily checked.

Aspects of High-Pressure Steam-Plant Design

COMMENTING upon the design of equipment for the Weymouth station of the Edison Electric Illuminating Company of Boston at the recent Swampscott convention of the New England Division, N. E. L. A., I. E. Moultrop of the Boston company pointed out that the high-pressure boiler to be installed has practically the same dimensions as an ordinary boiler and occupies the same space as the latter unit in the plant layout. The drum of the high-pressure boiler (designed for 1,000-1,200 lb. operation) is to be built like a gun barrel, and it has a 3-ft. diameter shell 4 in. thick, without riveting and with swaged ends. Welded joints will be used on the high-pressure piping. The other boilers for this station will operate at 375 lb. It is noteworthy that the cost per kilowatt of a standard 375-lb. plant is about the same as that of a plant including say 1,200 lb. pressure and reheating equipment, owing to the increased capacity anticipated with the high-pressure addition. This turbine will have three stages and will drive a synchronous generator.

R. E. Dillon, assistant superintendent of the generating department, Boston Edison Company, referred to the efficiency curves presented by Moultrop and Pope in their A. I. E. E. paper on the Weymouth station (see diagram), showing the relation between efficiency and pressure without resort to reheating.

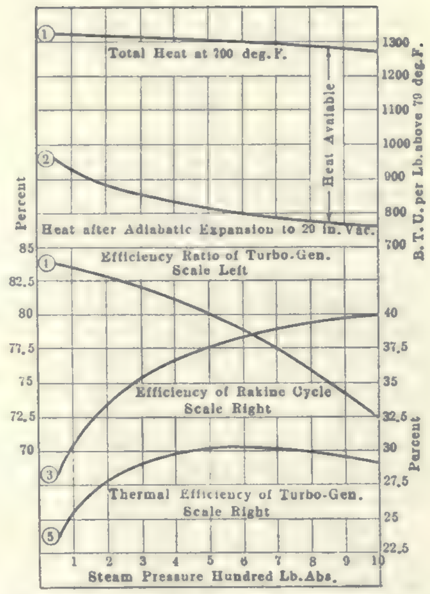


FIG. 1—EFFECT OF STEAM PRESSURE ON TURBINE THERMAL EFFICIENCY

Mr. Dillon pointed out that if curves should be drawn showing this relation with reheat, the Rankine efficiency curve would be only slightly higher than the corresponding curve No. 3 in Fig. 1 and the turbo-generator efficiency curve No. 4 would indicate that there is very little drop in efficiency throughout the pressure range. The curve corresponding to curve 5, which shows the product of the values given in the two other curves, would show a steady rise of value with pressure to a point beyond 1,200 lb. At 1,000 lb. pressure, Mr. Moultrop stated, this over-all efficiency of the turbine would contribute to a B.t.u. value per kilowatt-

hour net output for the reheat station of 13,600 against 15,100 B.t.u. per kilowatt-hour for the non-reheat station. This represents a 10 per cent increase.

The authors showed that the approach which may be made to this figure depends on whether the reheat station is a base-load plant. Mr. Dillon said that it is desirable to emphasize this point lest this feature be overlooked in connection with the curves of Fig. 1. The reheat design is primarily suited to base-load operation. It is difficult to control or to bypass the reheaters when sudden changes of load occur, and at such times the superheat will discharge to the condensers. If there is a base load for one turbine only, the rest of the station can probably best be served at 375 lb. pressure without reheat.

The use of high pressure in closed vessels is not a new experiment, and material and structural factors for such pressures are well developed. "We have not become accustomed to think of high temperatures in connection with high pressure, perhaps," said Mr. Dillon, "but no complications are added in this connection. The furnace temperatures to which the high-pressure boiler surface will be subjected and the fluid temperature in contact with the metal are not in excess of temperatures now used, and the additional stresses imposed at these temperatures can be adequately cared for by increased thickness of steel without causing undue strain at joints or unequal expansion which is excessive. There are details to work out, but this is nothing more than may be expected to come up with new development.

Unit Costs of Industrial Lighting Systems

THE unit costs of installing and operating several industrial lighting systems given in the accompanying tables were presented in a paper by D. H. Tuck, electrical engineer of the Holphane Glass Company, at the recent convention of the Illuminating Engineering Society at Lake George, N. Y. Mr. Tuck pointed out that the most logical and useful method of expressing the unit cost of a lighting system is in cents per foot-candle per square foot. The value of unit costs is in comparing the economy of installation and operating costs of various types of lighting and in arriving at a quick estimate of the cost of any industrial lighting installation when the area to be illuminated, the foot-candle intensity to be obtained and the type of equipment to be used are known.

The unit costs of installation for several industrial lighting installations are given in Table I. These costs were obtained from the formula $X = 100C/EA$, where X is the unit cost in cents per foot-candle per square foot, C the total cost of complete job, E calculated illumination intensity checked after installation with a portable illuminometer and A total floor area in square feet. It may be seen from the table that the cost for direct lighting of the "RLM" industrial type is roughly 2 cents, and that of semi-indirect lighting (totally inclosed globe type—indirect 69 per cent, direct 31 per cent—Item 11) is 5 cents. Item 9 has a low unit cost, 0.52 cent, because 750-watt lamps were used, thereby lowering the installation and reflector cost.

The low unit installation costs of Items 1 and 12 are due to the method of installation. In both these cases the localized general type of installation was employed, and owing to the intensive type of light distribution a high illumination intensity on the looms was received at the expense of the aisle illumination. It is to be noted that in such cases where the illumination is not uniform over the entire floor area the unit cost expressed in cents per foot-candle per square foot is in a way a misnomer, inasmuch as the foot-candles times the square feet of floor area does not give the total useful lumens. When interpreting unit costs of lighting for non-uniform systems, the nature of the work must be taken into account. This suggests possible ways of lowering the unit cost of installation by judicious engineering.

The unit operating costs for the same installations given in Table I are presented in Table II. The same formula may be used to obtain these values except that C is the total operating cost and E is the actual average intensity in foot-candles as read before and after cleaning intervals.

This table indicates that the unit costs of operation for direct illumination of the "RLM" type is roughly 1.3 cents per foot-candle per square foot and that the unit cost of semi-indirect (indirect 63 per cent, direct 31 per cent) lighting of a high-class totally inclosing globe is roughly 2.3 cents per foot-candle per square foot. It will be noted that the units cost for the "RLM" installation vary from 1.0 to 1.6. This difference is due to the way in which the installation was planned and the degree of depreciation before the illumination test.

TABLE I—UNIT COSTS OF INSTALLATION FOR VARIOUS TYPES OF INDUSTRIAL LIGHTING SYSTEMS

Industry	Type of Reflector	Area per Sq.Ft.	Foot-Candles	Unit Costs, Cents per Foot-Candle per Square Foot
1. Wool-yarn mule spinning*............	Hol. No. 621	12,000	30	0.48
2. Metal stamping......	RLM	5,424	3.5	2.95
3. Electric manufacture, assembly smlal parts	RLM	6,860	11	1.78
4. Wool weaving.......	Porcelain-enam., shallow dome	4,888	11.9	2.45
5. Knit goods—knitting machinery.........	RLM	3,200	5.6	1.23
6. Soap manufacture, general	RLM	7,974	2.5	2.68
7. Structural steel, general...............	Porcelain-enam., deep bowl	208,380	2	0.66
8. Auto paint shops.....	Steel-enam., deep bowl	3,264	3.5	1.01
9. Railroad repair shops.	Steel-enam., deep bowl	48,000	1.7	0.52
10. Aluminum spinning..	RLM	29,680	3.6	1.25
11. Office coal company..	Filterlite inclosing glass	5,500	3.0	5.14
12. Silk weaving*.......	Hol. No. 621	12,000	30	0.50

TABLE II—UNIT COSTS OF OPERATION FOR SEVERAL INDUSTRIAL LIGHTING INSTALLATIONS

Industry	Type Reflector	Area per Sq.Ft.	Foot-Candles	Unit Costs, Cents per Foot-Candle per Square Foot
1. Wool-yarn mule spinning*	Hol. No. 621	12,000	30	0.36
2. Metal stamping......	RLM	5,424	3.5	1.60
3. Electric manufacture, assembly small parts	RLM	6,860	11	1.20
4. Wool weaving.......	Shallow dome Porcelain enam.	4,888	11.9	1.60
5. Knit goods—knitting machinery.........	RLM	3,200	5.6	1.01
6. Soap manufacture, general............	RLM	7,974	2.5	1.63
7. Structural steel, general...............	Porcelain-enam., deep bowl	208,380	2	1.3
8. Auto paint shops.....	Porcelain-enam., deep bowl	3,264	3.5	0.98
9. Railroad repair shops.	Porcelain-enam., deep bowl	48,000	1.7	1.47
10. Aluminum spinning..	RLM	29,680	3.6	1.26
11. Office coal company..	Filterlite inclosing glass 69-31	5,500	3.0	2.3
12. Silk weaving*.......	Hol. No. 621	12,000	30	0.45

*Localized general system of illumination. All other installations shown in tables are of the general system.

How Central-Station Merchandising Affects Other Dealers

A Review of Past Policies and Trends with Suggestions as to Ways and Means of Developing Better Retail Selling Methods Throughout the Local Electrical Industry

BY C. E. GREENWOOD
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C. E. GREENWOOD

NO SUBJECT of central-station activity has received more marked attention during the past year than electric merchandising. The appliance business is a particularly active one because the manufacturers are continually producing in varying volume during periods of depression and periods of prosperity. The central-station company's concern in the distribution of devices varies in direct proportion to the confidence of the management in the revenue-producing value of the devices, and the policy of distribution by the management varies in accordance with franchise rights and the established relationships of other electric interests in the community.

Cycles of thought on the subject of electric appliance distribution have been marked. It is less than two decades since we had the central-station museums—otherwise known as appliance exchanges or showrooms (I do not think they are all extinct even today). Appliances were considered in the light of curiosities, but the central-station company rightly adopted them as a part of the electric home service. The commercial man saw possibilities for adding kilowatts to his lines, and the next cycle, that of appliance distribution, started. This was marked by effort in getting consumers interested in using the devices. The method employed in getting the appliances into the possession of the consumer was of minor importance, provided that the expense was justified by the return in future revenue.

Meanwhile, the manufacturer, producing in larger volume, sought that wider distribution which is essential for building all permanent business, and he started solving his wider-distribution problem by interesting a greater number of dealers, both electric and non-electric. They started in so-termed competition with the central station.

But the dealer, having as a rule poor facilities for promotion and lacking creative selling ability, found out that in communities where central-station companies followed an unethical merchandise practice, he had more of a museum than a store, with no turnover. This situation became disturbing enough to call for a Moses to lead the way out. Heated discussion and noticeable dents in central-station good will in the industry followed, but constructive principles were evolved in the end, and the cycle of appliance distribution gave way to the cycle of dealer recognition. Central-station merchandising departments were analyzed, reconstructed and re-established on a more efficient operating basis. This was a trial cycle and of value in that manufacturers, jobbers and others admitted that the central station, "the daddy of the industry," must be the leader.

We are now moving rapidly into the cycle of aggressive central-station merchandising on co-operative principles. Let us call it co-operative competition.

The central-station company is and will be the leader in the merchandising field for many years to come, because manufacturer, jobber and dealer need this active leadership. Experience in the varying cycles has taught this lesson. But the central station must do business on ethical principles and at a profit. A subsidiary company would not have the interest in the small independent firm that the central station maintains as an essential, and the dealer would have lessened opportunities. Witness the largest independent now, the department store which, is the real competitor of the small dealer. The department store has no interest in the smaller dealer or his success.

Again, the practice of any central station favoring one of a few dealers and building their business at the expense of others has caused discontent. It is authoritative opinion that more good will is lost by this practice, through arousing jealousies and animosity among the dealers themselves, than could result from occasional errors of judgment in central-station merchandise practice.

ATTITUDE OF PUBLIC SERVICE COMMISSION

A member of the Massachusetts Department of Public Utilities recently stated to me that he believed the public wanted our merchandising service in preference to that of others, but that no special operating advantages should be granted us that other dealers did not have. This was said in a discussion of the question of cutting off service because of unpaid appliance bills.

We shall all agree that the leading manufacturers would consider it a calamity for the central stations to

stop merchandising. A central-station outlet for their products has first consideration. This could not be had if it was general practice for the central station to cut prices on the standard lines or practice other policies destructive to competition. The manufacturer has a deep interest in the dealers, who are the vital factor in his problem of distribution. He wants no injury done to them. But he knows that when the central station is advertising vacuum cleaners, for example, his own factory agent, or the jobber, receives more small-dealer orders than at any other time. It is true in other lines. That is, the aggressive selling of an electrical device is selling the idea to the public. A wrong impression is obtained from those not intimately acquainted with the field that the central station is getting all the sales away from the dealers, but the fact is that the dealer is "cashing in" on the central-station promotion of its own business.

WHY NOT PROMOTION ONLY?

Now, others might say: "Why not, then, let the central station promote and the dealers get all the sales?" The answer is simply that the public mind does not work in a way that would make this plan the remedy for the assumed ills. If the neighborhood haberdasher advertises a hat that has a national trademark, the average man does not buy it from the small dealer, although he may want one of this brand. He goes to a better-known merchant in whom he has confidence and buys the same hat. If it were something that might get out of order and there was a guarantee to fulfill, he would positively go to his own tradesman. Does this not give the answer on the small-dealer question, and can the central station change the public's mind?

Referring to the policy of non-merchandising by the central station, attention is naturally directed to Cleveland, where the company actively co-operates with all electrical dealers but sells no appliances itself. However, the head of the promotion department of one of the best known vacuum-cleaner manufacturers in the country in a recent article made the following statement:

"The investigation which I have made in the last few months has shown me that in no community have there been so many home demonstrations for the major appliances—washers, ironers and sweepers—as there are new home meters being connected. In Cleveland I found that the home demonstrations did not equal more than 50 per cent of the homes being electrified."

Now, I venture the statement that if the Cleveland company had been in the merchandise business as well as the dealers, all would have done more than 50 per cent of demonstration on these major devices.

JOBBERS' AND DEALERS' OPINIONS

The leading jobber in Atlanta gave me the information that the greatest per capita sale on appliances in Georgia was in Athens and vicinity, where the central station was aggressively merchandising. He found that the dealers were getting along as well as in any other community.

A recognized live dealer in one of the Massachusetts cities where the central station gave up merchandising a few years ago stated to me at a recent convention that he wished that company would go into the business again. As he expressed it, the appliance business had lost its punch.

Now, these statements of different interests outside the central station are not isolated cases. I believe they are representative of sober thought based on experience. And these cases are not mentioned for the purpose of proving that central stations ought to merchandise—that is not the subject at issue—because the executives of some of the larger central stations have quite definite opinion now on the subject. The discussion thus far has been to emphasize the fact that help rather than injury results to the dealer from an aggressive merchandising policy on true cost principles. There are lamp policies and service policies existing in different communities which give the dealers and contractors far more concern than merchandising practices. I repeat this remark by a man who has been foremost in advancing the dealer cause.

Let it be assumed, then, that the present cycle is to be a constructive one, that the central-station merchandise department should be self-supporting. One of the misfortunes of this merchandise business in the past has been the slight attention paid to it by central-station executives. The particular attention which the business is receiving now and which it merits is one of the most encouraging signs of its future success. Due consideration of the needs of the merchandising business from executives, correct buying and volume sales will produce a net profit on operations, even without taking into account the factor of load building.

In some companies (Boston Edison, for example) promotion expense has always been borne by the appliance department. The work naturally falls in the sphere of that department's activities. As a good business expedient, I believe the consensus of opinion is against any allowance being made the merchandise department for load building or energy sale. This value of the department in this way is obvious and is generally recognized, but to make such an allowance is unfair to the independent dealer. There is a large field for promotion work, and expenses incurred in promotion activity ought to be kept in a separate account and due consideration be given it in merchandising operations. Our special salesmen spend a substantial portion of their time in promotion, interesting apartment-house owners to put in heating circuits and institutions to put in electric kitchens or laundries; but we sell a comparatively small percentage of the total, because, after we spread the idea, the "prospect" does some shopping and our prices are beaten. One prominent jobber sells at his cost price, many contractors sell to homes at a price necessary to get the wiring job, and the bakery-supply people secure better discounts from the manufacturer than the central station can receive and so can quote lower. But the company gets the business. How shall we charge up the expense of the merchandise department in such promotion work? I believe a special account should be opened and the amount of this expense be credited to the merchandise department.

POSSIBLE INJURY TO DEALERS

The question is often raised of injury to dealers because of the central-station company's merchandising. If the central station is carrying on its business on sound principles, injury cannot result, but rather advantages. "Competition is the life of trade" applies to our business like any other. But we have a further interest in our competitors and wish to co-operate with them.

Recognizing the fact that with the average independent dealer merchandising is a side line and that his organization is small, it follows that he has had less time to learn as much as he would wish about electrical appliances.

The central station can tell the contractor when, how and why to buy

electric appliances, and what to buy because it buys and sells big quantities and it has to find out what sells and what does not, what wears and what will not.

The central station can show the contractor how to exhibit his stock of appliances to the best advantage, how to get the most advertising for the least money. Few dealers can afford a professional display man. The central station could sell this service on an hourly basis.

The central-station company can prove to the contractor that for every sale the company has a chance to make the contractor has a better chance, because he is on the ground before the customer is connected up at all and before the company even knows there is a customer. Being first in the field, if the contractor has the right line of the right goods, he may keep the customer for life.

Small Power Customer's Consumption Doubled

TWO noteworthy instances of increasing the use of energy by the application of electric heating units to linotype pots were cited at a recent convention of the New England Division of the N. E. L. A. by H. E. Duren, manager Greenfield (Mass.) Electric Light & Power Company, and E. D. Learned, power engineer Worcester Electric Light Company. At Greenfield there is a printing establishment which has for some time made a specialty of catalogs. The installation is equipped with fourteen motors with a combined capacity of 49 hp. Seven linotype machines are operated. About nine months ago electrically heated lead pots were installed.

The energy used in the heating elements is combined with the power consumption. For the nine months previous to the installation of the electric heating elements the total energy consumption was 19,090 kw.-hr. and the total bill $797.60, or an average of $88.52 per month. The first nine months' service of the electrically heated pots resulted in a total energy consumption of 39,320 kw.-hr., with a total bill of $1,411.08 and an average monthly bill of $156.78. The total connected heating load is 14.2 kw., and the revenue per kilowatt of heating apparatus per annum on the above basis is $57.60. The room is free from excessive heat and gas fumes and the temperature control far superior to the gas-heated method.

At Worcester a plant has in service thirty linotype machines with a connected load of 1,500 watts each and three monotype machines of 2,800 watts each. The energy consumption for 1922 of this installation was 165,000 kw.-hr., with a demand of 50 kw., and the average use of the demand was 275 hours per month compared with an average use of the motor demand of 160 hours per month. The power factor is between 95 and 100 per cent. Mr. Learned stated that it would be impossible satisfactorily to operate the plant with gas-heated pots on account of the discomfort caused employees. The gas-heated pot requires about one hour to attain operating temperature against thirty minutes with electric heating. The yearly revenue from the electric pot heating in this installation to the central station is about $80 per kw., compared with $25 to $30 per kilowatt of connected motor load on the same premises.

Central Station Co-operates in Developing New Residential Section

THE accompanying illustration shows how it is possible for the central-station company and real-estate firms to join interests in the development of residential districts. To enlist the co-operation of the real-estate brokers one of the Georgia Railway & Power Company's salesmen approached the manager of a realty company with the argument that the installation of electric ranges would increase the value of the property and mean quicker sales. As a result of several conferences twenty-two electric ranges were sold for the houses already completed and others under construction. The billboard was erected on the site of the subdivision at the expense of the central station. Real-estate agents have since reported that these houses have proved to be the best sellers.

What Other Companies Are Doing

Providence, R. I.—Electricity supplied by the Narragansett Electric Lighting Company is playing a vital part in the construction of the new Scituate dam in connection with the Providence water supply. This is to be one of the largest earth dams in the country. Energy is used for lighting and power service, including a 315-hp. centrifugal pumping installation in five units, a 75-hp. camp pumping service, a 50-hp. sawmill and a 75-hp. machine and repair shop, with lighting of eighty-six buildings used by the construction force.

Georgia.—Its water-power developments in the north Georgia mountains are proving a prolific source of advertisement for the Georgia Railway & Power Company, as evidenced by the fact that during the month of August 1,032 visitors registered at the Tallulah plant and made the descent on the company's inclined railway to inspect the operations of the station at the bottom of the gorge. Fifteen states, from California to Virginia, as well as the Philippines, were represented in the visitors.

Lake Geneva, Wis.—With a view to giving the public a bird's-eye view of its electric light and power distribution system, a large relief map of the territory served by the Southern Wisconsin Electric Company was displayed at the Walworth County fair. The generating plants, transmission lines, substations, etc., of the company were built in, and each town was lighted, showing the number of lighting and heating customers served by the company.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Hydro-Electric Development and Steam Equipment

Paper Company Completes Power Plant on the Hudson.—By the completion of the International Paper Company's Sherman Island hydro-electric development on the Hudson River near Glens Falls, N. Y., 40,000 hp. has been added to the available supply in northern New York. This plant uses the total head between the tailwater elevation of the power plant at Spier Falls and the pond of the Champlain Canal feeder dam at Glens Falls, an average of 65 ft. The ultimate installation will be five units of 10,000 hp. each and will utilize at full load a total flow of 7,600 sec.-ft.; but on account of the present unregulated flow of the Hudson River, only four units have been installed. Energy is generated at 6,600 volts and transmitted at 114,000 volts to the trunk distribution system of the Adirondack Power & Light Corporation. This seven-page article deals principally with constructional features of both the power house and dam.—*Engineering News-Record*, Sept. 20, 1923.

Boiler-Feed Water Circuits in Power Stations. — A consideration of feed-water circuits with special reference to problems of de-aëration of boiler feed. The characteristic properties as regards corrosion of water with and without air in solution are discussed. It is very important in power-station operation to determine the corrosive action of water passing to the boiler. A corrosion detector for detecting air in boiler-feed water is described.—*Electrical Times* (*England*), Sept. 13, 1923.

Generation, Control, Switching and Protection

Grounding Problems.—M. SCHIESSER.—Authorized by the Swiss Federal Electrical Commission, the author presents in this paper his findings as the result of investigations made on the different problems of safe grounding methods for central-station practice. How to provide permanent ground connections and to ground metallic or reinforced concrete transmission towers so as to minimize danger to passers-by in case of an accidental ground on the line is told as the main purpose of this article. Starting with a tabulation taken from official Swiss statistics of forty-eight electrical accidents caused by faulty groundings, the author gives an exact analysis of each case and recommends a remedy. About twenty voltage distribution charts which measure the drop of potential from the grounding point radially in all directions are reproduced for different arrangements and various soil conditions. The advantages and disadvantages of separate and combined grounding electrodes for protective and for permanent grounding are discussed. Results of tests made with pipe, plate and ribbon ground electrodes under various conditions are described and shown in photographs. It is stated that the ribbon electrode, placed singly or in several concentric rings around the station, tower, etc., and placed at a carefully determined depth, gave best results and a minimum of danger. A suggestion is accordingly made that three concentric ribbon circles, 5, 7 and 9 m. in diameter, be placed around the cement footing of a steel tower and buried respectively 5, 20 and 50 cm. deep in the ground, all being connected to the tower. With an assumed ground current of about 400 amp. this arrangement guarantees a voltage gradient not exceeding 100 volts for a distance of a man's step or arm reach.—*Bulletin de l'Association Suisse des Electriciens*, July and August, 1923.

Transmission, Substations and Distribution

Solution of Electric Power Transmission Problems by Miniature Circuits.—O. R. SCHURIG.—The author outlines the established processes by which transmission circuits in operation or to be constructed may be reproduced on a small scale in the laboratory. In this way theoretically calculated phenomena may be confirmed experimentally in a simple manner. Moreover, miniature systems afford a number of practical advantages in the experimental solution of specific circuit problems.—*General Electric Review*, September, 1923.

Large-Capacity Transformers. — G. STERN.—While the fact is not mentioned in this paper, it is apparent from its many illustrations that the magnetic circuit of transformers made by German manufacturers is built up with butt joints, a method practically unknown in America. Core-type transformers with circular coils have been standardized by the A. E. G. Previously the laminations of cores and yokes of large dimensions have been held together by a large number of rivets arranged in several rows. The possibility of a short circuit between two faulty iron bolts was considerable, and many transformers failed for this reason. Modern cores and yokes have only one row of bolts, which distribute their pressure over the entire surface of the core by means of a number of square cast-steel plates. The bolts themselves are insulated with a heavy tube of paper. Cores have a cross-section closely approaching a circle. On very large three-phase transformers, where shipment of the completely assembled apparatus is essential, a five-legged core construction is used merely for the purpose of cutting down the height of the yokes. In this construction the height of the yokes can be reduced almost 50 per cent. Transformers for a potential of more than 30,000 volts are built as a rule with two low-voltage barrel windings inclosing the inner high-voltage winding. The finished windings are vacuum-treated and lacquered to make them impervious to humidity during the assembling period. The high-voltage winding consists of single-layer disk coils, wound with paper-and-cotton-covered copper conductors of rectangular shape. Cylinders of a fibrous material called "geax" furnish the major insulation between high-voltage and low-voltage coils. The individual disk coils are separated from one another by an unusual spacing method which relieves the coils of any mechanical pressure. This coil-stacking method is claimed to be electrically excellent and to withstand without trouble mechanical shocks such as may occur during long-distance shipment or short circuits. For very high voltages a metallic static shielding ring is placed on the top and the bottom of the high-voltage coil stack and is metallically connected to the beginning and the the end of the winding. Star-delta is the usual connection of three-phase units. The delta of the low-voltage winding avoids the third harmonic, and the star permits the connection of a Petersen coil to the Y-point. Mechanical tap-changing devices are being used. Large transformers are cooled almost exclusively by external or forced oil-cooling methods, an arrangement which permits the smallest possible over-all dimensions of the machine.—*Festschrift of Elektrotechnische Zeitschrift*, Aug. 26, 1923.

Illumination

Status of Illuminating Engineering in Russia.—The last All-Russian Electrotechnic Congress (October, 1921) appointed a committee on illuminating engineering under the chairmanship of Prof. M. A. de Chatelain, the Russian representative on the International Electrotechnical Commission. The committee worked out standards and rules for the testing of electric lamps with carbon as well as tungsten filament. Very explicit regulations on school illumination are also given. — *Electrichestvo* (*Russian*), No. 4, 1923.

The Year's Progress in Illumination.—This report of the I. E. S. committee on progress covers the developments, not necessarily improvements, in the whole field of illuminating engineering as reported in the scientific and technical press. The report contains nearly a hundred pages of information which will be found valuable to any one wishing to keep up with the advances in illumination as recorded during the past year.—*Transactions of the I. E. S.*, September, 1923.

Units, Measurements and Instruments

Use of Insulating Varnishes.—A. W. STRINGHAM.—The capabilities and limitations of each kind of insulation varnish should be known to every one who uses them. The author lays down the methods of testing for dryness, oil and acid resistance, dielectric strength, etc., and gives a general discussion of the main features and field of application of each kind, with suggestions on the proper treatment. —*Electrical Record*, September, 1923.

How to Check Instrument Transformer and Meter Connections.—V. H. TODD.—Checking the polarity of instrument transformers, connecting up wattmeters, polarity of polyphase circuits, installing meter wiring in conduit and the use of multi-colored cable for wattmeter connections are among the subjects discussed in this well-illustrated article.—*Power*, Sept. 11, 1923.

Motors and Control

Starting of Synchronous Motors.—A. DOSWALD.—Synchronous motors are available for practically any motor drive. The frequently maintained opinion that a synchronous motor does not start under full load does not apply to the recently developed synchronous induction motor, which permits an easy start under at least full torque and which synchronizes under full load. For economic reasons the use of a straight synchronous motor for capacities below 25 kw. is not recommended. Improvement of power factor of lines on which there are a large number of small induction motors is much more economically accomplished by the installation of one or more large rotary condensers. A description of the synchronous induction motor, including complete wiring diagrams of such a motor with the necessary auxiliary apparatus, is given.—*Brown-Boveri Mitteilungen*, September, 1923.

Developments in Mine Pumping.—EDGAR GEALY.—The author relates how mine pumping is being revolutionized by means of automatically primed, started and controlled centrifugal pumps. The development of automatic equipment, application of simple devices to complex operations, advantages and economies realized and details of equipment and operation are discussed.—*Coal Age*, Sept. 13, 1923.

Electrophysics, Electrochemistry and Batteries

Battery Repair Methods.—During the past three years the Chicago, Burlington & Quincy Railroad has completely changed its system of overhauling car-lighting batteries. A short description of the battery-repair shop, the methods of hauling storage batteries in a special freight car and the economies effected by the new system are discussed.—*Railway Age*, Sept. 1, 1923.

Magnetic Rotary Dispersion in Paramagnetic Liquids.—R. W. ROBERTS.—It is well known that the presence of iron salts in aqueous solution will cause a diminution of the magnetic rotation of the solvent. It was found by Richardson, Roberts and Smith that the same is true for cobalt salts at ultra-violet frequencies, but not for nickel salts. As the effect shown by cobalt salts might be a dispersive one, the ordinary dispersion of aqueous solutions of several cobalt salts in the visible and ultra-violet portions of the spectrum has been investigated. The results obtained show that the depression in the magnetic rotation exhibited by aqueous solutions of cobalt salts is a true paramagnetic one, superimposed on the usual positive rotation, explained by the Hall effect.—*Paper presented before the British Association at Liverpool, England*, Sept. 12-19, 1923.

Traction

Electrification of the Railroad from Narvik to Riksgränsen in Norway.—HJ. SCHREINER.—A general description of the Norwegian part of the railroad between Lulea, Sweden and Narvik, Norway, is given. The entire Swedish part (Lulea to Riksgränsen) was opened for electrical operation on July 10, 1923. The Norwegian part (from Riksgränsen to Narvik) will be ready for electrical operation next year. Power will be supplied from the power station at Porjus, Sweden. The transmission line will carry single-phase current at 80,000 volts and 15 cycles. This voltage will be reduced to 16,200 volts in two transformer stations, each having two 1,500-kva. transformers. Six locomotives have been ordered of the type 1—C+C—1. Each locomotive has a weight of 134 metric tons. The motors are of the twin type with two pairs on each locomotive giving a total hour rating of 2,800 hp. The maximum speed will be 36 miles per hour and the maximum tractive effort 68,000 lb. The entire electrification will, when completed, have a length of about 295 miles, of which 26 miles are Norwegian and 269 miles are Swedish. It represents the longest continuous electrification in Europe.—*Teknisk Ukeblad* (*Norwegian*), Aug. 31, 1923.

Testing Method to Distinguish Between an Overload and a Short Circuit on a Traction System.—R. ALLIAUME.—Substation operators on railroad systems have no sure means to know whether an automatic breaker opened on account of an undue overload or a short circuit, and in reclosing the breaker a certain chance has to be taken. A system to determine the cause of the tripping has been suggested by the author and was successfully installed and tried out on one French railway line. An alternating current of 25 cycles and 120 volts is impressed upon the faulty feeder, with a hot-wire ammeter in series. The readings on this instrument are quite different for an overload and for a short circuit, because an overload, with its usually high inductive character, will offer an alternating current a much higher resistance than a short circuit. This difference in the resistance is three to four times more pronounced for an alternating current than for regular-operation direct current. A fixed-current limiting resistance is in series with the source of alternating current to prevent a too high rise of the testing current in case of a heavy short circuit on the feeder.—*Revue Générale de l'Electricité*, Sept. 1, 1923.

Telegraphy, Telephony, Radio and Signals

Calculation of Self-Inductance of Coils Wound on Square Forms.—Y. NIWA.—In a former paper (*Researches of Electrotechnical Laboratory*, No. 73, 1918) the author considered the solenoid with rectangular section and derived a formula for the calculation of the self-inductance of such a solenoid. In the present paper he discusses the range of application in which the formula can be used with allowable error. From experiments as well as calculation it is shown that the formula may be applied with accuracy for all coils where the ratio of pitch to the diameter of the wire is less than six or seven, and even for the coils with this ratio as great as twenty or thirty. —*Researches of the Electrotechnical Laboratory*, No. 126, Tokyo, Japan.

Miscellaneous

Electric Machinery of Large Capacity.—K. SACHS.—The author gives a general résumé of the accomplishments in the design of large generators and motors during the last ten years, with particular attention to the problems of insulation and heating. Methods are described which enable the modern designer to build generators with windings withstanding safely the dangerous glow discharges of high voltages up to about 12,000. Metallized coil ends, with the metal connected to the stator lamination, are explained, and latest coil compounding processes are mentioned. Careful and systematic measurements of internal heating of windings have shown that mica and asbestos are safe for temperatures considerably in excess of the previous assumption. Cooling and ventilating problems of turbo-generators are discussed at length. The following interesting statement is made: A single kilowatt raises the temperature of 3 cu.m. of air 17 deg. C. per minute, so that a 30,000-kw. generator with 96 per cent efficiency and an air heating of 30 deg. requires 2,050 cu.m. of air per minute, or, in other words, there has to be blown through the generator an amount of air per hour weighing about as much as the total machine. Several successful attempts have been made to cool the stator or the rotor or both with water or with oil pumped through ducts provided next to the windings. Forced air cooling, propelled by either one or two fan shields on the machine itself or by an external blower, seems quite adequate for even the largest units where space is not limited. The author shows great familiarity with American practice and mentions frequently apparatus of our manufacture.—*Elektrotechnik und Maschinenbau*, Sept. 2, 1923.

Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

Conducted by PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N. Y.*

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Converter, Electrolytic

A high-tension converter with electrolytic cells has been developed for converting alternating current into direct current, or for transforming a direct current into one of higher voltage. The range is from 200 milliamp. at 600 volts direct current to 5 milliamp. at 150,000 volts direct current.—*G. Gmür, Aarau, Switzerland.*

Hydraulic Turbine, Labyrinth Seal for Reducing Leakage of

The labyrinth seal consists of a series of alternately expanded and contracted passages which destroy the velocity head and reduce the head on the final free jet to one-third of its initial value.—*H. G. Acres, Hydro-Electric Power Commission, Toronto.*

Instruments, Measuring, Life Tests on

With increasing quantity production of common measuring instruments, such as pressure gages, thermometers, ammeters, voltmeters and watt-hour meters, coupled with extensive use of such devices in connection with millions of automobiles, household utensils and the like in everyday use, the matter of studying the life of such instruments and other more specialized sorts, becomes one of first importance. A report embodying the general principles of such life tests has been recently presented to the American Societies of Mechanical Engineers by F. J. Schlink.

Insulating Material Named "Paramold"

This material has pure rubber as a base and is formed in steel dies under enormous pressure. It is suitable for transformer bushings, entrance bushings, insulating tubes, bus supports, etc. It is non-hygroscopic and retains its insulating characteristics after being subjected to boiling oil or boiling water. A power arc will cause it to burn only as long as the arc is sustained. Removing the carbonized surface restores the insulating properties of paramold. The material is resilient and withstands shocks better than porcelain. Metal parts or reinforcements can be introduced during the process of manufacture.—*Hopewell (Va.) Insulation & Manufacturing Co.*

Lamp, Daylight, for Scientific Work

The light from a "Mazda" bulb is filtered through an accurate blue-glass lens the color composition of which has been scientifically determined. The resultant north skylight rays are directed upon a reflector which increases the light diffusion and thus produces a more accurate and uniform illumination.—*Glenn Cullen, University of Pennsylvania, Philadelphia.*

Motor Starter, Overload Protection for

This overload device consists of two expansion wires stretched tight. In case of a three-wire system these expansion wires are connected in series in two of the lines, thus giving protection to all three phases. In case of two-phase circuit one expansion wire is connected in each phase. The expansion wires are sufficient to carry the normal motor current without expanding enough to trip the contact which breaks the circuit of the main holding coil. In case of a heavy overload in any circuit its expansion wire expands rapidly, and by tripping a contact that opens the holding coil of the handle, the compensator is thrown to the off position.—*Electric Controller & Manufacturing Company, Cleveland.*

Plating of Iron on Iron

The plating of iron on iron so as to produce a homogeneous, or at least an adherent and mechanically good, coating has been recently accomplished. Extremely severe service tests proved that not only was the coating produced satisfactory for press fits, but that worn shafts and undersized parts requiring severe service could be satisfactorily recovered. We have recovered armature shafts corroded by sea water, worn automobile shackle bolts, worn railway motor shafts and worn crank pins on gasoline engines.—*C. E. Skinner, Westinghouse Electric & Manufacturing Company, Pittsburgh.*

Potentiometer, Double-Range

A double-range potentiometer has been developed, with ranges of 1.6 and 0.15 volt or 0 to 200 and 0 to 20 millivolts. In these instruments the current can be checked while operating on either range, and the effect of the variable resistance of plug contact has been completely eliminated. For details see Optical Society of America, *Journal*, 1923, Vol. 7, page 665.—*Leo Behr, Cornell University, Ithaca, N. Y*

Relays, Undervoltage

New undervoltage relays have been developed which provide protection of apparatus from damage caused by sudden return of supply voltage after its failure or reduction. These relays are used for tripping electrically operated circuit breakers when the voltage has decreased to a certain predetermined value, for automatically disconnecting motors on undervoltage, and in any case where it is desirable to operate an auxiliary circuit on the occurrence of a decrease in voltage.—*General Electric Company, Schenectady, N. Y.*

In Progress or Purposed

Alloys, Shrinkage of

The contraction and shrinkage of alloys in casting is of great practical importance. Work has just been finished on light aluminum alloys, and an investigation is under way on the contraction of a series of commercial brasses and bronzes.—*R. J. Anderson, Bureau of Mines, Washington, D. C.*

Oil, Insulating, Microscopic Study of

The dielectric strength of transformer oil is reduced by moisture, lint fibers and other impurities. A small spark gap may be so arranged that while the oil under test is being subjected to an electrostatic field it is also being observed through a microscope. In this manner the bridging over of the gap by various impurities can be directly observed. This method should be useful in a study of different oils and of different methods of filtration. For example, a filter may be very effective in removing moisture but not lint, or *vice versa*. A beginning of such a study of oil has been recently made by F. Schroeter. —*Archiv für Elektrotechnik*, 1923, Vol. 12, page 67.

Petersen Earthing Coil

The Petersen coil has decidedly reduced the number of interruptions due to insulator flashovers during lightning storms. It has, however, produced several actions which need further investigation, namely, the bus insulator flashovers which occurred when line switching was done with the coil in service. It is proposed to make further tests to see if high voltages are actually produced. Points which operating experience with the Petersen coil has thus far proved are: (1) All insulator pins should be grounded in order to secure the best action on the coil. (2) All switching, both hand and automatic, should be done with the coil out of service, and with the system neutral solidly grounded. (3) Grounded phase operation is not advisable.—*J. M. Oliver and W. W. Eberhardt, in the A. I. E. E. Journal, 1923, Vol. 42, page 904.*

Refrigerators for Household Use

In addition to the general public, the government departments and the American Engineering Standards Committee are interested in the question of specifications for household refrigerators. The bureau considered that data obtained by it several months ago on refrigerators of this type might prove sufficient to serve as a basis for a performance specification. Such a specification has been drafted after reviewing the test data and after completing numerous computations relative to heat flow in assumed cases. It is hoped that satisfactory specifications covering household refrigerators may result from this preliminary work.—*Bureau of Standards, Washington, D. C.*

Zinc, Electrothermic Metallurgy of

Because of the imperfections of the retort and electrolytic processes and of the promise which the electric furnace offers in overcoming these imperfections, the United States Bureau of Mines, in co-operation with the Missouri School of Mines and Metallurgy, has undertaken a study of the electrothermic metallurgy of zinc.

Suggestions for Research

Dielectric Tests, Use of Anilin Oil to Prevent Corona

When testing thin sheets of solid insulation for dielectric strength, it is difficult to avoid corona formation at the edges of the electrode disks. As a result a breakdown often takes place in a non-uniform field and inconsistent results are obtained. Grünewald has recently used anilin oil with good success for filling around the electrode edges to exclude the air (*Archiv für Elektrotechnik*, 1923, Vol. 12, page 81). The relative permittivity of this oil being quite high (about seven times that of the air) practically a uniform field is obtained in the sample under test, and the puncture usually takes place between the flat portions of the electrode surfaces. It would be of interest to the industry to standardize the use of some such "filler" or "stress reliever."

Frequency Converter, Cascade Type

In the development of superpower and interconnected systems frequency transformation will be involved in at least some important cases. For example, 25 cycles is used at Niagara Falls, 40 cycles in the vicinity of Albany and Troy and 60 cycles elsewhere in New York State. Some engineers look with favor upon the so-called cascade converter in place of the usual synchronous frequency changer. To tie a 25-cycle and a 60-cycle system, such a converter might consist of a ten-pole 25-cycle, 300-r.p.m. synchronous machine coupled to a fourteen-pole 60-cycle induction machine. The stator of the synchronous machine is connected through a transformer to the collector rings of the rotor of the induction machine. The 25-cycle rotating mmf. in the rotor, revolved at the frequency of 35 cycles, acts on the stator of the induction machine at the frequency of 60 cycles. In view of a possible discussion of the merits of the two types of frequency changers, an investigation is desired in which will be determined their relative weight, cost, voltage regulation, behavior under abnormal conditions and other operating characteristics.

Network, Surge-Absorbing

In the familiar Campos system of surge protection reactors are shunted by energy-absorbing resistors. A more general and more effective system of surge absorption is desired, to consist of a combination of resistances, reactances, etc., cross-connected between the phases. This network must be such (a) to absorb a negligible amount of power under balanced three-phase conditions at normal voltage, (b) instantly to begin absorbing considerable power under surge conditions, i. e., unbalanced, steep-wave-front overvoltage, (c) automatically to return to its normal functioning without moving parts. The network is thus to be of the nature of a filter, such as those which are used in the field of communication engineering.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Electricity on the Farm

Three Cabinet Members Promise Co-operation with the Committee Recently Set Up

FEDERAL co-operation in the movement to make more electric power available for use on farms was assured on Wednesday of this week, when the Secretaries of Commerce and the Interior and the Assistant Secretary of Agriculture met with the recently established Committee on the Relation of Electricity to Agriculture.

Secretary Hoover, in addressing the gathering, declared that he has long been convinced that highly profitable use of electricity could be made in connection with farming operations. He commended the industry for its willingness to co-operate to that end. In addition, he declared that the extension of electric transmission lines to the farm carried with it a new responsibility for bringing about the standardization necessary to enable farmers to obtain repair parts easily and to make convenient use of any accessory. He also pointed out the relationship of superpower projects to the movement for electricity on the farms.

Foreign Survey to Be Made

Secretary Hoover will undertake a survey at once of the use to which electric power has been put on farms in other countries. He expressed the opinion, however, that the survey will reveal that the United States already has made more progress in that direction than has any other country. He referred specifically to the use of electricity on many farms in California.

Secretary Work of the Interior Department emphasized the need for making living conditions on the farm more attractive. In addition to the government's interest on account of the general welfare, it has concern in the matter on behalf of its own establishment. He referred to the crying need at this time for making reclamation projects more attractive to farmers.

Assistant Secretary of Agriculture Gore, speaking in the unavoidable absence of Secretary Wallace, said that in these days of labor shortages on farms consideration may well be given to this project.

J. W. Coverdale, secretary of the American Farm Bureau Federation, told the committee that farmers prefer to have experiments in electrical farm equipment performed by the government or on a limited, designated scale rather than at their individual expense as was done in the pioneer days of tractor farming. Combining the activities of the Departments of Agriculture, Commerce and Interior with that of the committee, the farmers hope to introduce electric power on the farm with a smaller shrinkage in farmers' pocketbooks than occurred during the period when heavy-weight tractors were purchased by farmers long before they were so constructed as to operate economically.

Oscar E. Bradfute, president of the federation, spoke to similar effect.

Rural Service in Minnesota

At a recent meeting of farmers, representing the Minnesota Farm Bureau Association, and officials of the Northern States Power Company a plan for rural electrification that is expected to have a far-reaching influence on farming in the North Central States as well as to develop a large potential market for the output of electrical energy was drawn up. The plan provides for an experiment that will establish definitely the practicability of group or community power service in rural districts and the lowest cost at which it may be sold by the company. The scheme involves the installation of a 5-mile line through a farm community near West Concord, Minn.; providing fifteen farms with electrical equipment, tapping power from the trial line; keeping an exact record of costs of line, operation and upkeep, and computing the output of each farm before and after electrification.

Two propositions were presented at the conference. One was for the company to finance the line, the other for the farmers to buy the equipment and turn the operation over to the company. The first would require no investment on the part of the farmer, but would entail higher prices for service because of interest rates. The second would call for an investment from each customer at a cost below the price of electric systems now on the market.

Philadelphia Electric to Build Huge Plant

The Philadelphia Electric Company has just announced the purchase of 58 acres on the west shore of the Delaware River and just below the Delaware River bridge of the Pennsylvania Railroad, on which it plans to erect a large base-load power station. The plans so far are only tentative, but they contemplate a station with an ultimate rating of 600,000 kw., built in three units of 200,000 kw. each, each of them having four 50,000-kw. generating sets. This plant is an outcome of the move which the Philadelphia Electric Company is making to install capacity to meet the ever-increasing demand of the community for additional electric service.

The site of the plant is particularly favorable as there is more than 2,000 ft. frontage on the Delaware River, with its unlimited water supply, and the Pennsylvania Railroad is on the north and the Reading Railroad on the south, giving excellent rail facilities. It is expected that construction work will be started on the new power station early in 1924.

"Romex" Not Approved

But Modified Indorsement Is Given to Underfloor Duct System by Electrical Committee

ACCORDING to an announcement authorized by Dana Pierce, chairman of the electrical committee, National Fire Protection Association, "Romex" has not been approved by the committee on new developments for trial installations, and the underfloor duct system, while approved if armored cables are used, is not recommended for use with rubber-covered wires.

The formal statement authorized for publication is as follows:

"The committee on new developments of the electrical committee, National Fire Protection Association, held a meeting in New York on Oct. 15 to consider the applications for recommendations permitting trial installations of the new wiring conductor, "Romex," manufactured by the Rome Wire Company, Rome, N. Y., and of the underfloor-duct system manufactured by the Johns-Manville Company of New York City.

"The following committee opinions were adopted after full discussion:

"*'Romex'*.—The committee on new developments finds that the material 'Romex,' submitted by the Rome Wire Company, conflicts with numerous provisions of the National Electrical Code requiring protection of conductors and their separation from each other and the surfaces wired over, and further does not find properties in this material or methods of installation proposed for it which, in its opinion, warrant the committee in recommending trial installations.

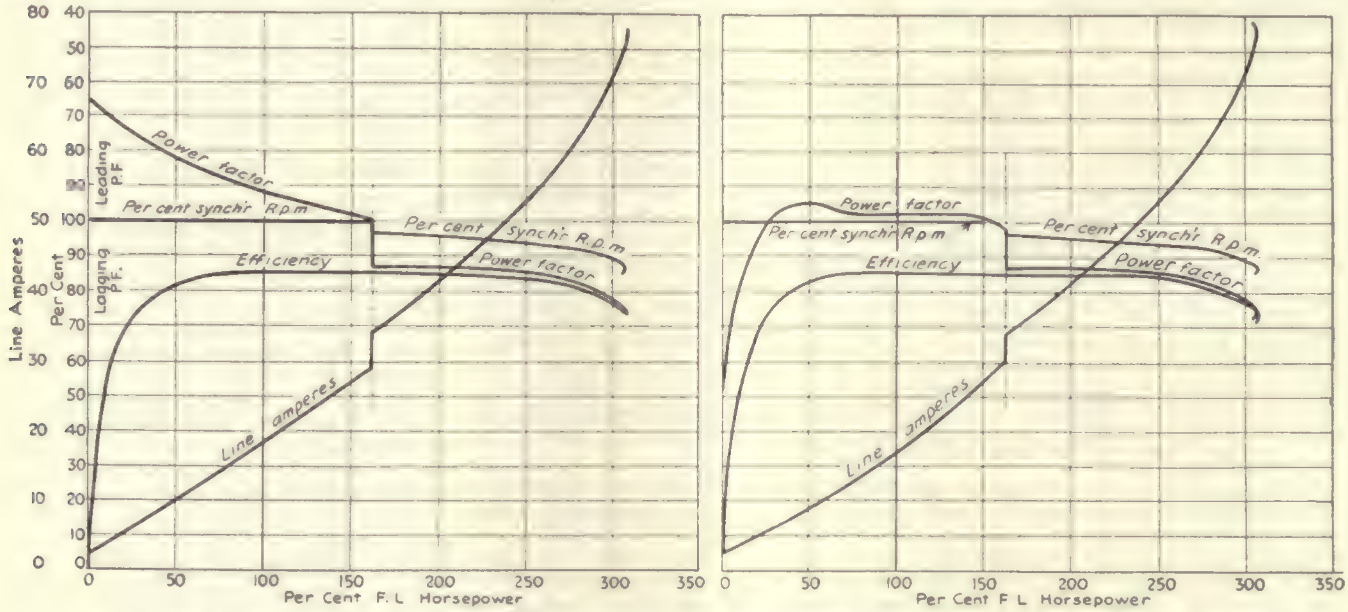
"*Underfloor Duct System.*—The committee does not recommend trial installations of the underfloor duct system using unarmored rubber-covered wires

in the ducts. It is the opinion of the committee that when these duct systems are used with approved armored cables for the electric light and power wires the installation can be made in conformity with present requirements of the National Electrical Code, and that when the ducts are so used signal or communication wires may be run in the same ducts with the armored cable."

Motor to Help Power-Factor Trouble

A Type of Induction Motor with a Secondary Stator and a Primary Rotary-Converter-Type Rotor, Giving Leading Power Factor, Described Before N. E. L. A. Committee

At the recent group committee meetings of the Technical Section of the N. E. L. A. at Omaha A. H. Timmerman of the Wagner Electric Corporation described a new motor possessing features of interest to electrical engineers generally, central-station power engineers and industrial users. It is claimed that the motor offers a unique and practicable solution to some of the power-factor difficulties on many systems in industrial communities. Extended and somewhat exaggerated news reports of this announcement appeared in many daily newspapers all over the country, some of which, as might be expected, so misinterpreted and therefore wrongly headlined the news, indicating 30 to 50 per cent increase in efficiency of motors, as to carry the impression to the informed engineer that the new development must be a fake. Others, however, grasped the correct interpretation that any motor which would draw a leading power factor and thereby utilize "idle current" would allow more effective utilization of investment.



Figs. 1 and 2—Performance Curves of 15-Hp., Four-Pole, 60-Cycle, Three-Phase, 440-Volt Fynn-Weichsel Motor
The curves in the right-hand diagram show the motor adjusted for approximate unity power factor, synchronous operation.

Motor Based on Fynn Patent

The motor is based on a patent issued to Val A. Fynn about ten years ago. It is apparently somewhat similar to the Schrage motor developed in Germany and in some characteristics apparently similar to the Danielson motor in a portion of its range of operation. The Electrical World requested from Mr. Timmerman and Mr. Fynn information on the engineering details of the motor, and while these gentlemen are at the present time unwilling to present a schematic diagram of the windings and their interconnections, a statement of the general equation of the motor or of the constants of the motor, the following information furnished by them will doubtless be of interest to engineers: The motor is a combination of a synchronous and an induction motor with a rotary converter. The machine as now built carries a primary winding on the rotor connected to the line by means of slip rings and also connected to a small commutator. The stator is provided with starting and operating windings, the latter being connected to the commutator. The commutator voltage is low. The machine starts like a polyphase induction motor of usual design. Before the induction motor torque reaches zero, an additional torque is developed exceeding the full load torque, and this readily brings the motor into synchronism. The machine is held in synchronism by a suitable direct exciting current generated in the machine itself and until such time as the synchronous motor torque of the machine becomes overloaded. As the synchronous motor "breaks down" the induction-motor action automatically steps into the breach and the machine continues to operate as an induction motor. This transition is smooth and not readily detected by the casual observer except by means of some sort of stroboscope. When the overload disappears, the motor again steps back into synchronous operation. By different settings of the brushes the power factor can be adjusted to suit widely varying conditions.

The accompanying diagrams (Figs. 1, 2, and 3) indicate the characteristics of the motor, according to tests which have been made. Fig. 1 shows normal operation of the motor with brushes set for a high value of leading current at low load. Fig. 2 shows the motor adjusted close to unity power factor for most of its run. Fig 3 indicates the difference in total operation between two induction motors running in parallel and one induction motor and the new motor in parallel.

It is suggested that this motor lends itself to installation as a power-factor corrective without having to displace existing motor drives. It is proposed to build the motor in all commercial speeds and ratings at least up to 50 hp

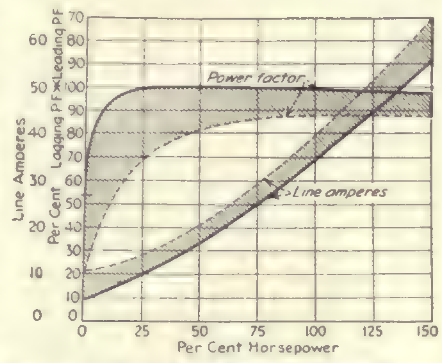


Fig. 3—15-Hp., Four-Pole, 60-Cycle Fynn-Weichsel Motor Operated in Parallel With 15-Hp., Four-Pole, 60-Cycle Slip-Ring Motor

Solid line indicates Fynn-Weichsel motor in parallel with slip-ring motor; dotted line indicates two slip-ring induction motors in parallel.

Work for Superpower Starts

Representatives of Public Service Commissions of Ten Northeastern States Indorse Secretary Hoover's Plea for Action on North Atlantic Coast Interconnection

INDORSEMENT from public service commissioners of the ten states most interested was obtained by Secretary Hoover at last Saturday's conference in New York for his program of co-operative effort to further electrical interconnection and superpower development in the North Atlantic Coast States. Secretary Hoover read a statement he had prepared in which he emphasized the various factors which made it not only advisable but necessary for the most effective and economical development of electric service to industry and to the public in general, and thereby also to the most effective and economical development of industry itself, that state lines and territorial limitations be wiped out in the interconnection of electric power supplies. He emphasized the "liquidity of power" and the fact that it cannot be stored, but that it is the demands of the instant, of the very second, which make interconnection necessary.

New Era in Electric Power

In this statement Mr. Hoover said:

"The reason and need for this discussion is simply that engineering science has brought us to the threshold of a new era in the development of electric power. This era promises great reductions in power cost and wide expansion of its use. Fundamentally, this new stage in progress is due to the perfection of high-voltage long-line transmission and more perfect mechanical development in generation of power. We can now undertake the cheaper sources of power from water sources further afield, such as the St. Lawrence, and cheaper generation from coal through larger and more favorably placed generation plants. We can secure great economies in distribution through the interconnection of load between systems, for thus we secure a reduction of the amount of reserve equipment, a better average load factor through pooling the effect of day and seasonal variations, together with wider diversification of use by increased industrial consumption. We can assure more security in the power supply from the effect of coal strikes and from transportation interruptions.

"All this means the liquidity of power over whole groups of states. At once power distribution spreads across state lines and into diverse legal jurisdictions. We are, therefore, confronted not only with problems of the co-ordination in the industries of their engineering, financial and ownership problems, but also with new legal problems in state rights and federal relations to power distribution.

"This super-development of great areas of cheaper power has been dramatized by those less familiar with the problem as the construction of great power highways traversing several states into which we should pour great streams at high voltages from giant water-power or central steam stations to be distributed to the public utilities and other large users along the lines of these great power streams. This, indeed, serves perhaps to picture what is meant by super-power development. As a matter of practical fact, however, the natural development of this situation lies first in the interconnection of power supplies between the existing great utility systems, and second, in common action for the erection of large units of production at advantageous points for the mutual supply of two or more of the present systems and in the development of such great water powers as the St. Lawrence."

Mr. Hoover then told briefly of the results of the Superpower Survey made three years ago, at the instance of the federal government, under the direction of W. S. Murray, pointing to the indicated annual saving of more than five hundred million dollars a year from a capital outlay of a billion and a quarter, as well as to the possibilities of railroad electrification involved. He continued:

"This new era of advanced projects is no theorists' or promoters' dream. It is a basic fact unanimously supported by our engineers, agreed to by the responsible men in the industry. It is true that there has been progress in the actual application of scientific advances in our national equipment, but we are far from the realization that is to-day practicable. I do not wish to be construed as stating that no progress has been made in enlarged co-ordination of power production and distribution. The electrical companies, under the regulation of the public service commissions, have already made excellent progress in the application of super-power principles in many localities. Power interconnections on the Pacific Coast reach from the southern border of California to Oregon; the States of Illinois, Indiana, Wisconsin and Michigan are associated in a network of interconnections, as are Georgia, Alabama, North and South Carolina and Tennessee. This being the case, one purpose of this conference is to consider why development in this, the greatest power zone of our country, where the greatest saving can be made, does not make progress. What measures can be devised to stimulate it? What obstacles in its realization can be removed?

"It is said that there is a lack of definite principles and of co-ordination in the policies of necessary regulation of power utilities by the different states and a lack of co-ordination and vision in our national administration of the development of nationally controlled power sources. It is also said that we should not permit the rivalry between our distribution systems and competition for territory to restrict the establishment of interconnection of load and the development of great generating units for their common use.

"Whatever the fault may be, it is the purpose of this conference to give preliminary consideration to the problems and principles that might be adopted in interstate relations, to discuss what measures can be devised to assure this needed development and what obstacles in its realization can be removed.

Power Must Flow Freely

"In the matter of public relations to power development and distribution it appears to me that one of the first principles we must realize is that the whole of this development implies the free flow of power. We have thus at once created at least a physical and economic interstate question. This great development of so much public interest cannot come about unless there is a complete liquidity in movement of power back and forth across the boundaries throughout the whole of the United States. We cannot secure centralized generation, great water-power development or interconnection of load unless there is this free flow. Without this we shall have permanently a larger cost of power and less expansion in its service. There are time-honored disputes over states' rights with regard to water, and somewhat similar questions are being raised as to power. Subject always to the sovereignty of states in taxation, etc., unless all citizens irrespective of state may have the same rights as to use of power, we shall destroy the hopes of a very great economic development.

"I am advised that it is probably true that no embargo could be constitutionally placed upon power flow across state frontiers, but unco-ordinated legislative and regulative actions by the states and the national government might amount to economic embargoes and discriminations and thus stifle development. Again, my argument that we must have free interstate flow of power implies free flow within the states and applies with the same strength to the complete necessity of state-wide regulation uninterfered with by municipal obstruction."

Declaring that the regulation of power distribution, profits and rates is "a concept fully fixed into our governmental system," Mr. Hoover said:

"In national relations to power development the public reaction against waste and exploitation of our national resources some years ago brought about a great movement for conservation, but it imported into the practice of conservation an implication of cold storage for these resources. We must adopt a new thought on conservation. Real conservation lies in use for public interest, not in prevention of use. Every water horsepower that can be used today which runs to waste is a burden

on man power. I am not here to advocate that the federal government abandon its policies of conservation of national resources, but I do advocate their proper use for the nation, not the deprival of the public through old fetishes, old hates and inertia."

Buckland Advocates State Action

After a reference to the potentialities inherent in the development of the St. Lawrence and to the natural division of the United States into several power areas, and the utterance of a tribute to the progress, ability and public spirit of the electrical industry, Mr. Hoover called on William S. Murray to give a picture of the physical gains to be made and the physical problems to be solved in the contemplated Superpower Zone and on E. G. Buckland, vice-president New York, New Haven & Hartford Railroad, who was a member of the advisory board of the Superpower Survey made in 1921, to discuss the legal phases of the matter Mr. Buckland advocated the removal of any legal inhibitions on the exchange of power over state lines through agreement among the states rather than by federal compulsion. He favored a harmonization of state laws to permit but not to direct superpower development. Once the inhibition is removed, the very economics of the situation will do the rest, he maintained. If the people could be brought to understand the instantaneous feature of energy transfer, export and import and that for every kilowatt-hour sent a kilowatt-hour can be obtained any time that they need it, he felt that much of the hesitancy to allow or to encourage interconnection between states would be dissipated.

Mr. Buckland said he believed there ought to be devised a kind of uniform legislation—similar, for example, to the uniform negotiable securities act now in force in various states—so that the states of their own volition will arrange by adopting it that superpower can be regulated, financed, produced and transmitted and thus each state will do its part in the general economic, social and industrial development of the region. If the study is pursued, he said, there will be evolved the uniform statute which the governors and the legislatures under the advice of the utilities commissions, which are the closest students of the problem, will adopt in the best interests of their own individual states. This legislation will see to it that the development of superpower is made permissive.

Mr. Buckland said that the picture would not be complete without a statement of what he had learned from the utilities themselves. He said he had found a certain hesitancy on the part of the owners of the power stations in some places to acquiesce in the general plan in the thought that their immediate investment might be jeopardized. But Mr. Buckland pointed out that the whole theory is to use or to utilize what is now in existence and to add more.

Later on, in reply to a question as to whether there was any fundamental weakness in the project, assuming that there were no inhibitory laws, Mr. Buckland said that he knew of no state in the Union in which a comity between states did not exist with reference to business between states except where certain inhibitory laws exist. That is, if no inhibitory law exists, no permissive law is necessary. The principal difficulty as between the various states, without a permissive law, he said, is with reference to capitalization and security issues, because some of the states do have distinct statutes and differences might arise which would embarrass satisfactory capitalization and corporate organization.

Commissioners Pledge Support

W. A. Prendergast, the chairman of the New York Public Service Commission, pledged the co-operation of that body. He was optimistic concerning the accomplishment of joint state action looking toward power development. It is, in Mr. Prendergast's opinion, only necessary to tell the people fully and accurately what is projected in order to get the thing accomplished. He cited as a case in point the Port Authority, which is a sort of treaty between New York and New Jersey through which common port facilities are being developed and the whole port of New York and New Jersey developed as one general plan.

Commissioner William T. Gunnison of New Hampshire said that state would get behind any scheme for the economical development of power. Commissioner Richard T. Higgins of Connecticut was inclined to blame the opposition to the importation of power into that state upon the attitude of certain utility companies. Connecticut, he said, was ready to co-operate. Co-operation was pledged also by Commissioner William C. Bliss of Rhode Island, who told of the interconnection between Fall River, Mass., and Rhode Island cities.

Commissioner Everett E. Stone of Massachusetts pointed out that that state is virtually operating under a superpower system at the present time and told of its connections with all the bordering states. Commissioner W. D. B. Ainey of Pennsylvania alluded to the "tremendous human side of the program," which, he felt, could be made to appeal to the public as a whole. He expressed hearty agreement with all the major matters in Secretary Hoover's proposal and told of the superpower study now being conducted by his state. Commissioner Walter A. Dutton of Vermont said interconnection was bound to come and no law could stop it. Commissioner H. V. Osborne of New Jersey said his state needed power and the program could count on its support.

Commissioner C. E. Gurney of Maine dealt with Maine's law prohibiting the export of water power, defending its action in the past as the natural outcome of a feeling that Maine had permitted other natural resources to pass into private hands and must cling to the ones left, but asserting his interest in the arguments of Secretary Hoover and others. Maine, he said, would not be a "dog in the manger." When her own needs shall have been supplied and a general plan developed she will enter in on a proper basis. Commissioner Ezra B. Whitman of Maryland said his state, already interconnected with Pennsylvania, was sure to co-operate.

Three Outstanding Problems

Secretary Hoover said that the conference had developed that there were three outstanding problems—legal problems, engineering problems and problems of feasibility. The third class arises in cases where the possibilities are manifest enough and are accepted by utilities and yet it is not possible or does not seem feasible to bring them into the necessary co-operation to get action. It was a question then of establishing co-operation between utilities. There was the question, too, of co-operation with federal authorities and state authorities, more particularly in the case of the St. Lawrence development. In getting Canadian power international relationships come in. If there is to be any benefit from St. Lawrence power, it will actually benefit all the states, Mr. Hoover said, even though most of the power might be used in one or two states. This is because of the general fluidity of power in the form of electricity, all of which militates to keep the total investment down.

M. H. Aylesworth, executive manager of the National Electric Light Association, and O. C. Merrill, executive secretary of the Federal Power Commission, also spoke in indorsement of the project, and, at the suggestion of Mr. Hoover, it was resolved to have a larger conference in from four to six weeks to which the utility companies will be asked to send representatives. Mr. Hoover will prepare a program with the aid of the commissioners.

Third Radio Exposition Held at New York

An unusual display of the latest developments of radio receiving equipment with extensive demonstrations marked the annual radio show of the American Radio Exposition Company held in New York from Oct. 6 to Oct. 13. Compared with the exhibits of last year, the sets are more compact and have fewer controls, making them much more easy to operate. Many of the leading manufacturers exhibited sets in cabinets similar to phonographs and in one case in the base of a table lamp. Loud speakers have increased in variety of design and the indoor loop antenna has gained in favor.

Among the entertaining features were radio motion pictures and loud speakers giving a play-by-play description of the championship baseball games.

Departmental Reform

To Be Pushed by F. A. E. S.—Rejoinder to Secretary Work—President Cooley Resigns

THE executive board of the Federated American Engineering Societies resolved at its meeting in Rochester, N. Y., last week to launch a nation-wide movement to bring about the adoption by Congress of that portion of the late President Harding's government reorganization program which calls for making over the Department of the Interior. Fearing that the whole plan of government reorganization will fail, the board has determined to bend its efforts toward consolidating the functions of the Interior Department in a Division of Public Works and a Division of the Public Domain. In the Division of Public Works the engineering functions of the federal government, now scattered through many departments and bureaus, would be grouped. Several years ago engineers organized the National Public Works Department Association, with committees all over the country, for the purpose of abolishing the Interior Department and erecting in its stead a Department of Public Works. Under the present scheme of the F. A. E. S., however, the name of the Interior Department would be retained, the engineering activities being co-ordinated in a separate division. This plan will be embodied in a bill to be introduced in Congress.

Constructive co-operation in reforestation between the federal government and the states was urged by the executive board in a comprehensive resolution.

A report signed by J. Parke Channey, chairman of the federation's committee on public affairs, was read which recommended that a letter be sent to the Secretary of the Interior with reference to the dismissal of A. P. Davis as director of the Reclamation Service and in answer to Secretary Work's letter of Aug. 14, addressed to L. W. Wallace, executive secretary of the F. A. E. S. In the letter to Secretary Work it was suggested that the points be made that an engineer and a business man are not necessarily two distinct individuals, that the Secretary is wrong in assuming that as soon as a project is finished its engineering aspect ends, and that no important technical employee of the government should be dismissed arbitrarily and without a hearing. This proposed letter from the council to Secretary Work was authorized.

Registration of Engineers

The report of the committee on registration of engineers occasioned a long debate. The model law drawn up by the committee, of which Gardner S. Williams is chairman, and submitted at the St. Paul meeting is still being circulated for suggestion and comment. The mining and the chemical engineers object to any model law, urging that even if the expressed attitude of the F. A. E. S. is against registration, the attempt to insure sanity and uniformity in states where registration is inevitable by offering a law which is least objectionable will be misunderstood, the law will become known as the F. A. E. S. law and the societies will become committed to it.

Dean P. F. Walker reported for the committee on coal storage, the work of which is still in progress. The report when it is ready, about the first of the year, will deal with how coal may be stored in consideration of its physical and chemical characteristics and with methods of storage, physical means, equipment and cost. It may be possible to state what coal can be safely stored, Professor Parr being at work upon this phase of the question. The relative cost of storage in different sections and localities and a special study of the situation in New England will be included.

Eulogizing the leadership of Dean Mortimer E. Cooley as productive of dignity, respect and public confidence, the board adopted a resolution expressing great regret that Dean Cooley is forced by ill health to relinquish the presidency of the federation. Dean Cooley's successor will be elected at the annual meeting of the council to be held in Washington on Jan. 10 and 11, 1924.

Fire Damages Lines of Southern California Edison

A forest fire sweeping through the canyons near Pasadena, Cal., has caused considerable damage and a number of interruptions on the 220,000-volt lines of the Southern California Edison Company. The first flashover due to the heat and flames occurred about noon on Saturday, Oct. 13. There were eighteen flashovers during the fire, with an average interruption of one minute, each affecting those parts of the system not served by steam plants or small hydro-electric plants.

A thirty-five-mile wind caused the flames to leap 150 ft. into the air from burning brush which in some places had grown to a height of 10 ft. About two miles of the company's right-of-way was burned over, necessitating changing 2,400 insulators damaged by the heat. It is probable that a total of four spans of 683,000-circ. mil aluminum conductor will have to be replaced in the two lines in the burned area. Twenty-four poles of the company's private telephone line were burned down and the four wires so annealed that it will be necessary for the company to replace them.

Governors' Conference to Discuss "Giant Power"

Governor Pinchot of Pennsylvania was to address the fifteenth annual three-day conference of state governors at West Baden, Ind., on Friday morning, taking as his subject "Giant Power." "Railroad Valuation and the States' Obligation" was to be discussed by Governor Blaine of Wisconsin. Thirty-two governors had registered up to Wednesday evening.

Edison Opens Exposition

New York Show Attracts Veteran Inventor—"Merely at Threshold" of Development, Says Lieb

THE sixteenth New York Electrical and Industrial Exposition opened with a flourish on Wednesday of this week. Thomas A. Edison was the guest at a luncheon given by the New York Edison Company as a preliminary to the actual opening of the show. Nearly two hundred were present at this luncheon, the largest gathering of generally representative New York electrical men ever held, according to J. W. Lieb, vice-president New York Edison Company.

In his remarks Mr. Lieb mentioned the large scrappage and obsolescence in the electrical industry and laid it to the fact that no other industry has made such progress in the same time and no other industry has such a progressive spirit. While it has had an enormous expansion, and while it now has enormous popularity in industry and with the people, "we are merely at the threshold of what is in store," Mr. Lieb said.

Arthur Williams, general commercial manager New York Edison Company and president of the exposition company, thanked Mr. Edison for his attendance and pointed to New York as the greatest concrete example of that to which Mr. Edison's early work had led. "Throughout the entire range of electrical service in this city," Mr. Williams said, "one can find no single thing known to modern engineering which has been left undone to insure the highest standards of public service with the utmost economy and lowest possible price consistent with these standards. This is true whether it relates to so-called superpower—a new name for an old method long since utilized in the electrical systems of this city and many other parts of the country—or to any other known method of efficiently generating and distributing electrical energy for public uses."

Using the "Movies"

Following the luncheon to Mr. Edison, a mass meeting of electrical men of New York City was held in the Forty-eighth Street Theater to hear plans for the newly organized Electrical Board of Trade and to witness the New York Edison Company's new motion-picture film, "At Your Service."

Charles L. Eidlitz, chairman of the board of governors of the Electrical Board of Trade, announced the election of Mr. Edison as the first honorary member of the body, whose objects, he explained, are "to see to it that every one engaged in the electrical business in New York City plays the game fairly and squarely with himself, his employees, his business associates and the public."

The new motion-picture film is one of the best so far produced and traces the generation of electricity in the New York Edison plants from the coal pile to the home and office. The radio "storm signal," which gives warning

of approaching clouds, enabling boilers and plants to be got ready for emergency daytime loads, proved a dramatic feature of the film. Electricity in the home and the electric fire-fighting equipment of New York City were also interestingly shown.

After the showing of the picture, Mr. Edison formally opened the exposition, some description of which will appear in an early issue of the ELECTRICAL WORLD.

Ford Says His Offer Is Still Before Congress

In the course of an acrimonious newspaper attack on Secretary of War Weeks because of the sale by the government of the Gorgas plant at Muscle Shoals, Henry Ford said:

"My offer is still before Congress. I shall not withdraw it. There is nothing whatever for me to explain. If I get Muscle Shoals, we shall run power lines 200 miles in every direction from Muscle Shoals. We have been working and have learned how to send power long distances without losses by leakage. I say this now for the benefit of the international financiers, who, with the Alabama Power Company, have Muscle Shoals almost hopelessly in their grasp."

Engineers of the Ordnance Division of the army are said to have informed Secretary Weeks that in plant No. 2 at Muscle Shoals there is laid a foundation for a steam plant capable of generating 30,000 hp. and that this plant could be completed at a maximum cost of $1,500,000. This sum could be expended by the government out of the sum paid for the Gorgas plant, putting it again in possession of a steam plant and leaving a surplus of $2,000,000 from the sale.

Ford to Develop Water Power in North Central States

Rumors that Henry Ford plans to embark upon the generation of electricity on a large scale in the North Central States are borne out by the formal application of the Ford Hydro-Electric Company to the Wisconsin Railroad Commission for permission to construct and operate a dam and power plant in the Menominee River in Florence County. The site upon which the company has decided to erect the dam is close to the Michigan line. Blueprints included with the application show how the power developed through the dam will be distributed to points all over Michigan.

In addition to this water-power site the Ford Hydro-Electric Company controls many others along the Menominee River and on several other streams in Wisconsin. It is asserted that a great power system is to be built up by this company in Wisconsin, Minnesota and Michigan, the sites being contiguous to proposed plants where completed machines will be made or raw manufacturing operations will take place.

Largest Western Hydro Plant Starts Up

Several Noteworthy Features Have Been Embodied in the Design of Big Creek Plant No. 3—Units Have Individual Oiling Systems—Venturi Meters Are Installed

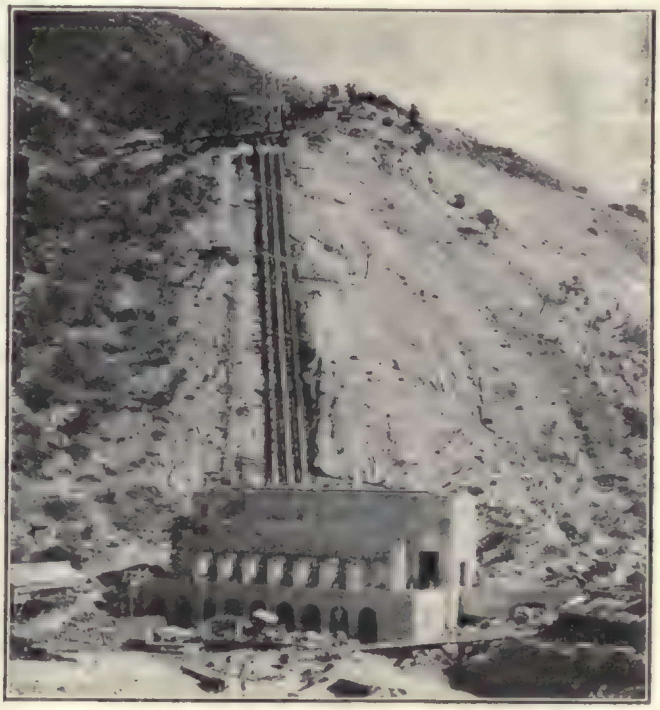
THE placing of Big Creek plant No. 3 of the Southern California Edison company on the line, as announced in the Oct. 6 issue of the ELECTRICAL WORLD, marks the completion of the fourth generating plant in the Big Creek development of this company, which will ultimately consist of about ten plants with a combined capacity of over a million horsepower. The plant has three 27,500-kva. generators operating under a head of 740 ft., making it the largest hydro-electric plant west of the Mississippi River. The addition of this plant brings the total generating capacity of the Edison system up to 501,000 hp.

There are several noteworthy features in the new plant, one of which is the omission of a separate lubricating oil system. Each bearing of the main unit has its own lubricating oil pump driven by gears from the shaft, thus eliminating outside oil filters, pumps, supply tanks and piping, which are likely to cause trouble in operation. A motor-driven pump is used to supply oil on the starting up of the unit, after which the oil supply is provided by the direct-connected pump. Stoppage of oil from the direct pump automatically starts the motor-driven pump.

A feature in the design of the power house is the elimination of the basement in the generator room. As the plant is laid out, the operating floor is on two levels, one at the base of the generators and the other at the elevation of the turbines, so that virtually all of the equipment is in view of the operator at all times.

In connection with the hydraulic end of the plant there are several points of special interest. At the intake to the tunnel there is a cylindrical gate 22 ft. in diameter and 90 ft. high for shutting off the water to the tunnel line. This gate is motor-operated and is installed in a concrete tower several hundred feet upstream from the dam. A surge chamber of hour-glass section is installed at the lower end of the tunnel. It is excavated of solid rock, the bottom diameter being 60 ft., the central shaft 25 ft. and the top diameter 75 ft. The large section at the bottom provides for a load suddenly applied and the large section at the top will take care of any surge created by loads rejected.

The design of a manifold connecting an 18-ft. steel pipe from the end of the tunnel and the six 7½-ft. penstocks to operate under a head of approximately 200 ft. offered many difficulties. The design developed consists of two plate-steel spheres joined by a short section of pipe. To one of these spheres the 18-ft. pipe and two of the penstocks connect, and the other sphere provides connections for four penstocks. The entire penstock lines are of forge-welded steel. Expansion joints are installed between anchors. The expansion joints are made so that the portion of the pipe on which the packing bears is copper-plated to a thickness of about $\frac{1}{16}$ in. This will provide a perfectly smooth non-rusting surface. The pipes are installed on cast-iron rockers spaced every 40 ft. to reduce the friction. Venturi meters are installed on the three turbines in the plant to assist the operators in obtaining the maximum kilowatt-hour output from the water available.



BIG CREEK NO. 3 PLANT ADDS 105,000 HP. TO POWER SYSTEM OF SOUTHERN CALIFORNIA EDISON COMPANY

The 220,000-volt lines from the three other plants in the Big Creek development are looped into a 220,000-volt switching station at the new No. 3 plant, where all switching for the two 275-mile, 220,000-volt lines to Los Angeles is done.

Federal Board Activities

No Agreement on Diamond Creek—Rival Projects for Susquehanna River Site

INABILITY of Secretary Wallace to attend made it impossible for the Federal Power Commission to hold the meeting scheduled for Oct. 15. Since a full attendance of the members of the commission is imperative to consider the Girand license and the other important matters which will come up at this meeting, there is some uncertainty as to the exact date on which it will be held.

No definite prediction concerning a license from the commission for the Diamond Creek (Ariz.) development can be made. The representatives of the upstream states on the Colorado River have returned to the West without having effected a compromise with James B. Girand in regard to the conditions under which a license might be issued. It has been learned that the upstream states insisted on a proviso which would make the right to use water at Diamond Creek subservient to the right to use it for power development in the upper basin. They also demanded that the license embody as conditions not only the provisions of the Colorado River compact but of any interstate pact which might be substituted for it. The financiers back of the plan decline to accept either condition. Government officials think that there was no cause for apprehension over the first condition, but there is general concurrence in the view that the second condition was unreasonable.

SUSQUEHANNA DEVELOPMENT

An important hydro-electric development near Harrisburg, Pa., is indicated by the filing with the commission of a declaration of intention by the Hydro-Electric Company, which has just been incorporated and is made up largely of engineers and other professional men living in Harrisburg. It is proposed to develop two sites on the Susquehanna River. One is at Clark's Ferry, just above the mouth of the Juniata near Harrisburg, and the other is at Millersburg, at the head of the pool it is proposed to create. A long and expensive dam will be required, but a head of 50 ft. can be developed. In addition to the sale of power, the company expects to draw material profit from a roadway across the river, which is to be built on the crest of the dam. Toll is to be collected.

The declaration of intention also covers the construction of two dams and power houses on Toms River in New Jersey. It seems probable that the Federal Power Commission will take jurisdiction over the Susquehanna development, but there is doubt as to whether or not the Toms River project will affect navigable streams.

An application for a preliminary permit covering the Clark's Ferry site has been filed by Frank M. Waring of Tyrone, Pa. His application is in direct conflict with that of the Hydro-Electric Company. Mr. Waring proposes to put in a 10-ft. dam, five-eighths of a mile long, at the head of Haldeman Island. He proposes to install 6-ft. Taintor gates to divert the stream through the minor channel to the west of the island, for a distance of 2½ miles to the power house. Under that arrangement a head of 26 ft. would be available and 30,000 hp. would be installed.

Florida's first project under the water-power act has reached the point where final action has been requested. Pursuant to its preliminary permit, the Ocklawaha River Farms, Inc., of Ocala has applied for a license to go ahead with the construction of the plant which is to make use of the dam which the federal government is to construct in the interest of improved navigation. The 700 hp. of primary power is to be used to supply the needs of the farms and small communities of the region.

NEW YORK STATE'S SUIT

There are indications that the State of New York will withdraw its suit against the government in which it threatened to test the constitutionality of the water-power act. The Department of Justice recently made informal inquiry as to whether or not the State of New York would consent to withdraw its suit without prejudice. Although the reply is understood to have indicated that the decision in the matter could not be reached until May, the belief is that the state will withdraw its suit at that time.

Hetch Hetchy Grant Held to Bar Resale of Power

A flurry has been caused in municipal government circles in San Francisco by an opinion expressed by the solicitor of the United States Department of the Interior that in selling surplus power from its Hetch Hetchy plant to the Pacific Gas & Electric Company the city has violated a provision of the Raker act, the law by which it was permitted to build a reservoir and power plant on United States land, and that its entire investment at Hetch Hetchy might conceivably be forfeited to the United States in consequence.

The advisory committee appointed by the Mayor to find a way of marketing the energy from the big new plant has made a unanimous declaration that the city, under the legal terms of the Hetch Hetchy grant, is estopped from marketing electric power for purposes of resale to any corporation or individual except a municipality or a municipal water district. It expresses itself also as unanimously opposed to the proposal that the city should market its power through a power corporation acting as the city's agent. The committee took the stand that this is merely the power-sale proposition in another form.

A recommendation to the Board of Supervisors to pass a resolution, requesting the California Railroad Commission not to consider any merger between existing private corporations distributing electricity in San Francisco, in view of the city's expressed intention to acquire one or both of those systems, was made by the committee. As already stated, neither company will consent voluntarily to the sale of its distribution plant to the city.

Americans Form Company to Develop Italian Power

The Italian Power Company, composed entirely of Americans, with a capital of $2,000,000, has been incorporated in Delaware to finance power and light properties in Italy, and a loan is now being floated in its support by a syndicate of New York bankers headed by Aldred & Company, specialists in power and light development projects. The Italian Power Company represents a new phase in the investment of American capital abroad, inasmuch as the company is neither a holding company nor an operating corporation, but will confine its activities solely to providing a vehicle for the investment of American funds in European industries. Heretofore the financing of Italy's power and light enterprises has been done chiefly with French, Swiss and German capital, which is no longer available in the amounts needed. Development of the practically unlimited water power in the Alps and Apennines is urgently needed. As stated in the ELECTRICAL WORLD for Sept. 29, Aldred & Company recently arranged a loan of $2,000,000 for the Edison Company of Milan. This the present bond issue will cover.

J. E. Aldred will be president of the new company. Its vice-president will be Howard Murray, who is also vice-president of the Shawinigan Water & Power Company, Montreal. Among the directors of the Italian Power Company are C. A. Coffin, J. W. Lieb, F. P. Royce of Stone & Webster and A. W. Burchard, president International General Electric Company.

American Committee, World Power Conference, at Work

Meeting at New York recently, the executive committee for the American committee appointed to further the World Power Conference to be held in London next year approved the plan of the committee on membership to limit invitations to take part in the conference to persons identified with engineering problems. From three hundred to five hundred such invitations will be issued, and an American representation of from seventy-five to a hundred is expected to result. Chairman O. C. Merrill named as members of a subcommittee to investigate and report upon the proposals of the British committee for the creation of a permanent organization David B. Rushmore, Calvin W. Rice, William M. Steuart, C. O. Mailloux and Gano Dunn. He urged the desirability of making the final selections for membership on the general committee and of arranging the program at the earliest practicable date.

Contractors Debate "Super-Standard" Code

Association of Electragists International Decides to Study the Possibility of Obtaining Reductions in Insurance Premiums for Work of High Quality

IN THE concluding days of the twenty-third annual convention of the Association of Electragists International at Washington last week two debates which proved exceedingly interesting formed a part of the program. On the topic "Resolved, that the best results are obtained by a combined contracting and merchandising business," M. H. Johnson, Utica, N. Y., took the affirmative and Louis Kalischer, Brooklyn, N. Y., the negative, the leaders being supported by general debate from the floor. The judges were Farquson Johnson, editor of the *Electragist;* Frank E. Watts, editor of the *Electrical Record*, and Earl E. Whitehorne, commercial editor of the ELECTRICAL WORLD. The decision was given for the affirmative, the general conclusion being that, even though profits from the sale of electrical merchandise at the present time are exceedingly small, an appliance business is, according to common experience, of great advantage to a contractor because it brings him into contact with a large number of persons and is a feeder for his contracting business.

SUPER-STANDARDS PRO AND CON

The other debate was on the question whether super-standard electrical installations would reduce the hazard of fire from electrical causes and whether a reduction in insurance rates for super-standard installations would be in the interests of the public and also tend to improve the quality of all electrical construction and build up good will for the industry. L. K. Comstock of New York led the debate for the affirmative, and F. J. T. Stewart, secretary of the New York Board of Fire Underwriters, for the negative. Mr. Comstock maintained that since a reduction in the insurance rate is given for sprinkler systems, fire doors, heavier fire walls, etc., a reduction should also be given for super-quality in electrical construction. The inspection cost, he believed, would be no greater because the inspector would need only to look for conditions as they exist and rate them according to their value for fire prevention; moreover, such a standard should have great value to the electrical industry by inducing more intelligent competition on the basis of quality. The present code, he said, is a minimum standard and tends to degrade the work to that standard. Mr. Comstock's paper appears in full in this issue, page 836.

Mr. Stewart claimed that any rate reduction possible for super-standard construction would amount to too little to justify the cost of maintaining such standards and in fact would only set up another standard which would be immediately adopted by municipalities and result in establishing a single minimum standard, though on a higher plane, through the weakening of public confidence in the present standard. The losses on electrical installations made in accordance with the present standard, he said, are so small that it would not be worth while setting up a super-standard. Such a move, he believed, would also be exceedingly embarrassing to the insurance societies because it would lead to a demand for super-standards on all other fire-prevention equipment.

Clarence Wheeler, Rochester, representing the Electrical Supply Jobbers' Association, stated that the electrical jobbers have seen with alarm the large reduction in the demand for quality materials and a great increase in the demand for low-grade materials since the cost of building has gone up. The jobbers favor the establishment of a super-standard which would enjoy a reduction in insurance rate.

W. J. Canada, representing the National Electric Light Association; Joseph Fowler of Memphis, W. J. Shore of New York, R. S. Hale of Boston, Creighton Peet of New York, Louis Kalischer of Brooklyn and Earnest McCleary of Detroit contributed to the debate. R. A. Lundquist, chief of the electrical equipment division, Department of Commerce; E. C. Crittenden, chief of the electrical division, Bureau of Standards, and F. T. Cartwright, secretary of the building code division, Bureau of Housing, acted as judges of the debate. In rendering the decision the judges agreed that a rate reduction for super-standards was desirable but that its feasibility had not been proved. On the resolution of Creighton Peet, the association approved the idea of super-standard construction, and a committee is to be appointed to investigate the matter of feasibility.

OTHER FEATURES ON PROGRAM

The following addresses concluded the program: "Illumination," Samuel G. Hibben, manager illumination bureau, Westinghouse Lamp Company; "The Electrical Press," Earl E. Whitehorne, commercial editor ELECTRICAL WORLD; "Fundamentals of Organization of Retail Electrical Business," Frank E. Watts, *Electrical Record*, New York; "The National Electrical Code," A. Penn Denton; "The Association and Its Development Work," Lawrence W. Davis, New York; "Distribution from the Manufacturers' Viewpoint," J. S. Tritle, New York; "Economies to be Effected by the Elimination of Overlapping Functions," William L. Goodwin, Society for Electrical Development.

Throughout the meeting the subject of merchandise distribution and compensation for services rendered was constantly being brought up for discussion. Finally at the suggestion of Earnest McCleary, Detroit, a committee consisting of Mr. McCleary, W. L. Goodwin, J. S. Tritle and Franz Nielson was appointed to consider the subject and make a recommendation to the meeting as to whether any definite study should be made of this problem. At the last session this committee recommended that the president appoint a special committee of three to undertake a thorough study of the subject and report to the executive committee. The following were assigned to this work: Creighton Peet, New York; Joseph Fowler, Memphis, and J. G. Crosby, Philadelphia. It was announced that the next convention of the association will be held next year on Oct. 5 at West Baden Springs, Ind.

Brief News Notes

Kent, Iowa, Sells Municipal Plant.—At a special election held at Kent, Iowa, it was voted unanimously to sell the municipal electric lighting plant to the Iowa Southern Utilities Company. The town will be served from a high-tension line.

Aberdeen, Wash., Has Municipal Project.—The city of Aberdeen, Wash., is considering the erection of a power plant on the Wynooche River at an estimated cost of $2,000,000. Engineers say that a plant capable of generating 27,000 hp. could be built on the Wynooche and that power could be furnished in Aberdeen and other Gray's Harbor cities at not more than $75 per horsepower. The Wynooche River is 20 miles from Aberdeen.

Ohio Edison Plans to Build Plant on Mad River.—Site for a proposed auxiliary power plant on the Mad River near Springfield, Ohio, has been acquired by the Ohio Edison Company, which was recently incorporated to take over several light and power projects in central western Ohio. Construction work on the new plant is expected to be started within the near future. When the plant is completed it is planned to have it and the Springfield plant of the Springfield Light, Heat & Power Company furnish all of the power for the cities and towns in which the two companies operate.

Seattle Makes Low Street-Lighting Charge for Advertising Purposes.—At a recent meeting of the Seattle City Council it was decided to cut the total amount appropriated for street lighting from $256,000 to $250,000 and to fix 1 cent per kilowatt-hour as the charge to be made by the light department for energy used in street lighting, the actual cost of maintenance of the street-lighting apparatus to be defrayed from the general fund. "Seattle can now advertise to the world that its municipal light plant is furnishing current to the city for street-lighting purposes at 1 cent a kilowatt-hour," Mayor Brown declared. "This will be a con-

vincing answer to the critics of the municipal utilities who have claimed that the light plant charges an exorbitant rate for lighting the city streets."

Pasadena Will Probably Get Pacific A. I. E. E. Convention Next Year.—A resolution was passed at the Del Monte convention of the American Institute of Electrical Engineers recommending to the board of directors of the Institute that Pasadena, Cal., be selected as the place for the Pacific Coast convention of 1924.

New Oil-Burning Plant in Kentucky.—The Kentucky Power Company is erecting a central station in Augusta to supply Augusta, Brooksville, Dover, Germantown, Minerva and probably Foster and Lenoxburg with electrical energy over transmission lines to be erected. New distribution systems will be built or old ones remodeled. The plant will be equipped with Diesel engines.

Central-Station Company to Build a Church.—When the backwater from the Chippewa Dam reservoir of the Wisconsin-Minnesota Light & Power Company flowed the lands and Indian village of Couderay it inevitably destroyed property. The Northern States Power Company, which now owns the dam, has issued a call to the Chippewa Indians for the purpose of selecting a location for a church which it will erect to replace one that was destroyed.

Only 100,000 Potential Horsepower on Hiawassee.—Regarding an item appearing in this column on Oct. 8 on the development of the Hiawassee River, Thorndike Saville of the North Carolina Geological and Economic Survey writes that it is not true that anything like 500,000 hp. can be developed on this stream and its tributaries. Although their studies are not yet complete, the engineers engaged in the survey regard it as unlikely that more than 100,000 primary horsepower can be developed.

Alabama Power Company Takes Over Tuscaloosa Utilities Company. — Arrangements have been made between the Alabama Power Company and the Tuscaloosa Railways Utilities Company whereby the first-named company will take over the operation of the lighting and power systems of the city of Tuscaloosa. It is understood that headquarters for West Alabama will be established in Tuscaloosa and that substantial reductions in rates will be a result of the new ownership.

Liebman Prize Awarded.—At a meeting last week of the Institute of Radio Engineers J. H. Morecroft presented the annual Liebman prize to Harold H. Beverage of the Radio Corporation of America. This prize is the yearly income of $10,000 presented to the Institute by anonymous members in memory of Col. Morris Liebman and is given to one of the younger men in the radio industry for some notable achievement, which in the case of Mr. Beverage was his research work on the wave antenna.

Ten Oklahoma Municipal Plants Abandoned in Eighteen Months.—The municipal electric light plant operated by Wynnewood, Okla., since 1904 has been abandoned, and its customers will be served by the Oklahoma Gas & Electric Company. This makes the tenth municipal plant abandoned in Oklahoma in the past eighteen months and taken over by the Oklahoma Gas & Electric Company.

Southern Colorado Power Company Installs New Generators.—To meet the constantly increasing demand for service, the Southern Colorado Power Company has recently completed the installation of a 10,000-hp. steam-turbine generating unit at its Pueblo plant. This gives the company a combined steam and water-power generating capacity in excess of 33,000 hp.

Superior (Wis.) Situation Before United States Supreme Court. — The question whether Superior, Wis., is entitled to take over the Superior Water, Light & Power Company for municipal ownership and operation was reached for argument in the United States Supreme Court on Wednesday, Oct. 10. Attorneys for the company contended that the city cannot take over the company for the reason that a part of the plant is in Minnesota and that a state cannot condemn a plant situated in two states, even though it furnishes its entire product in the city seeking to acquire it.

Louisiana Utility Association to Be Formed.—At a recent meeting of the Louisiana-Mississippi Public Utility Information Bureau at Baton Rouge, La., it was decided to organize a state association for Louisiana utilities along the lines of similar co-operative associations in other states. The purpose of the association will be to insure unity of action in all matters of legislation affecting the interests of the state public utilities. W. J. Aicklen, general manager of the Consumers' Light & Power Company of New Orleans, is in charge of the movement. When the association shall have been placed on an enduring footing a similar association will be formed of the public utilities of Mississippi.

Carrier-Current Adopted by Indiana Company.—Carrier-current communication has been adopted by the Central Indiana Power Company, Indianapolis, to supplement its wire lines in handling interstation communication, according to John Ferguson, manager of operation. The company has about 800 miles of transmission line which will be utilized for the guiding medium of the high-frequency carrier current. A frequency of 20,000 cycles per second has been selected. The first of these telephone sets have been installed at the power houses at Rochester and Wabash, and communication is being carried on continuously. Additional sets are being installed in all the other power houses.

Associations and Societies

Cincinnati Electric Club.—Reorganization of the Cincinnati Electric Club along the lines proposed at the conference of representatives of electrical organizations held at Association Island has just been effected. The reorganization plans, according to M. M. Curran, president, embody a newspaper advertising and publicity campaign on a large scale.

New York Electrical League Co-operates in Lectures on Artificial Lighting.—The New York Electrical League calls attention to lectures on artificial lighting to be given by F. J. McGuire of the New York City Department of Education at the Murray Hill Evening Trade School, 237 East Thirty-seventh Street, on Monday and Wednesday evenings during the ensuing weeks. Albert Goldman, 555 East Tremont Avenue, is secretary of the league.

Divisional Meeting of Oklahoma Utilities Association. — Electric light and power company operating officials and employees representing the Seventh and Ninth Districts of the Electrical Division of the Oklahoma Utilities Association met at Hobart Oct. 10 for their annual conference. W. E. Corn of Elk City, chairman of the Ninth District organization, presided. Features of the program were an address on "Public Relations," by L. P. Arnold of the Chickasha Gas & Electric Company, an address on "The Year in Regulation," by B. P. Stockwell, engineer for the Corporation Commission, and one on "High-Line Service Compared with Local Plant Service," by S. I. McElhoes.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

American Welding Society—Fort Pitt Hotel, Pittsburgh, Oct. 24-26.

West Virginia Public Utilities Association—Hotel Kanawha, Charleston, W. Va., Nov. 9-10.

Electrical Supply Jobbers' Association—Hotel Statler, Buffalo, Nov. 12-15.

Electrical Manufacturers' Club — Hot Springs, Va., Nov. 14-18.

Electrical Credit Association, Central Division—Chicago, Nov. 15-16.

Arkansas Utilities Association—Pine Bluff, Nov. 15-16.

Electric Power Club—French Lick Springs Hotel, French Lick, Ind., Nov. 19-22. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Southeastern Division, N. E. L. A.—Hillsboro Hotel, Tampa, Fla., Nov. 19-22. Charles A. Collier, Georgia Railway & Power Company, Atlanta, Ga.

American Society of Mechanical Engineers—New York City, Dec. 3-6. C. W. Rice, 29 West 39th St., New York.

National Association of Railway and Utilities Commissioners—Miami, Fla., Dec. 4-7. J. B. Walker, New York Transit Commission, New York City.

American Engineering Council (F. A. E. S.)—Washington, Jan. 10-11.

American Institute of Electrical Engineers — Midwinter convention, Philadelphia. Feb. 4-8. F. L. Hutchinson. 33 West 39th St., New York.

Commission Rulings

Reasonable Franchise Should Precede Compulsory Expansion. — Maintaining that a utility company should not be required to expend a considerable sum of money to provide additional equipment before it has received a franchise under which it can operate efficiently and economically and at the same time be protected in its investment, the Illinois Commerce Commission suggested that differences between the city of Mount Carmel and the Mount Carmel Public Utility & Service Company, which operates an electric light and power plant in that city, should be adjusted by mutual concession. "The commission has no desire," it said, "nor does it intend, to dictate the terms of the franchise ordinance. It is apparent, however, that the best interests of the city and the consumers of electrical energy in Mount Carmel will be served by the granting to the company of a franchise ordinance that is reasonable in its terms. The ordinances proposed both by the city and the company are open to criticism, and it would appear that the difference between them could be readily eliminated."

Oklahoma Commission Insists on Depreciation Reserve Funds.—A final order making compulsory on public utilities the setting up of a depreciation reserve fund has been issued by the Oklahoma Corporation Commission. It contains the following provisions: No public utility company will be permitted to pay out in dividends any sum in excess of 8 per cent on its valuation until after the full amount of allowed depreciation shall be paid into its depreciation reserve fund. This fund shall be handled separate from other funds. The depreciation reserve shall be held strictly in said fund and shall be used only for meeting depreciation or for investment in government or other high-grade listed securities paying not less than 4 per cent. The utility may borrow from its depreciation reserve fund, for a period of not to exceed three years, an amount equal to the cost of any new construction, extension or addition to the property—items chargeable to capital account—but as security to said fund there shall be deposited in same the utility's own bonds or the notes of such utility bearing interest at the rate of not less than 5 per cent per annum, which interest shall accrue to said fund. In handling such fund the utility will be held strictly accountable for its safe investment, proper administration and accounting.

Proper and Improper Charges to Operating Expenses. — Complainants against the electric rates of the Luzerne County Gas & Electric Company used the volume of business done in the twelve months ended Sept. 30, 1921, as a basis and contended that the operating expenses reported for this period should be reduced by the amounts charged for amortization of bond discount and for interest on consumers' deposits, by the use of average amounts for certain items which have varied widely in recent years and by recognition of a decline in coal prices. The Public Service Commission of Pennsylvania found that the charges for amortization of bond discount and for interest on consumers' deposits were not properly included in operating expenses. Complainants' claim of $22,500 reduction, resulting from averaging certain expenditures, was reduced to $12,-200. The quarterly statements showed a marked decline in the cost of steam generation, about 65 per cent of which is fuel cost. Complainants' claim of $48,200 reduction was based on the difference between the average cost during the year ended Sept. 30, 1921, and the cost of coal as of March 1, 1922. The evidence indicated the propriety of a reduction, the commission said, but to base this reduction on a single price level is unsatisfactory and incorrect.

Recent Court Decisions

Powers of Louisiana Commission.—The Supreme Court of Louisiana, reversing the lower court in State ex rel. Louisiana Public Service Commission vs. Lancaster, has found that the Public Service Commission has no power to inflict a penalty for violation of rules of the antecedent Railroad Commission where such violation took place prior to its own creation, notwithstanding that the Public Service Commission adopted all rules and regulations of the superseded Railroad Commission as its own. The clause in the constitution of 1921 giving the commission power to punish violations of its orders provided for the future and not for the past. (97 So. 347.)*

Maintenance of Reservoir Not a Nuisance per Se.—Jeffers vs. Montana Power Company was an action to enjoin the maintenance and operation of a reservoir at the Hebgen Dam as being a nuisance. It was contended that during the winter season when water was released for power development an unnatural fluctuation of several feet in the level of the river below resulted, which fluctuation caused the ice to break and form jams with resulting flood and damage to plaintiff's property. The Supreme Court of Montana, declaring that the impounding of water for irrigation and power development is a lawful business and not a nuisance *per se*, and that to predicate nuisance against persons or corporations acting within legislative authority negligence must be alleged and proved, which had not been done, affirmed judgment for the defendant company. The impounder of water, the court found, is not an insurer against damage caused thereby, but liable only for failure to exercise reasonable care. (217 Pac. 652.)

Irrigation Corporation Held Empowered to Construct Additional Dam to Aid in Power Development.—Orme vs. Salt River Valley Water Users' Association was an action brought to enjoin the association from carrying out a contemplated improvement designated as Mormon Flat Development No. 1 and to have declared void a proposed bond issue in furtherance of it. In affirming judgment for the defendant, the Supreme Court of Arizona incidentally declared that it is within the legitimate powers of a corporation organized primarily for irrigation purposes, but authorized to construct power houses and transmission lines and to create, transmit and use power for the accomplishment of its purposes, also to install in the river, below its reservoir, a second dam, for the purpose of catching water released from above and using it again to develop power, thus enabling the association to furnish power throughout the year and secure a more advantageous market than would otherwise have been possible. (217 Pac. 935.)

Taxation of Water Rights.—Affirming in Shawmut Manufacturing Company vs. Inhabitants of Benton a judgment upholding an assessment for taxation purposes on the "privilege water right" of the plaintiff, which owns a dam across the Kennebec River together with the bed of the river on which it is erected and the land at either end on which it abuts and generates electrical energy at Fairfield, Me., the Supreme Judicial Court of Maine said: "Water power, as has been argued, in and of itself is not taxable. The reason why is that the riparian proprietor has no property in the water which runs by his land. He has, as incident to his ownership, the right of interrupting and using the water for needed and useful industries and otherwise while it passes along, and of taking thereby all the profit, utility and advantage which it may produce, without prejudice to the rights of other owners, above or below, unless he has acquired a superior right. In a word, he has the correlative rights and duties of a usufructuary. Insistence that the words 'water right' in the record of the assessment are a substitute expression for 'water power' does not find assent in the mind addressed. That which the assessors wrote is interpretable: 'We are levying, not simply a tax on a dam by a dam site, but, additionally, a tax on the site by the dam, the "privilege water right," unoccupied at the present time, but with potential possibilities, attributable to advantageous position, affecting just and assessable value, in the view of sovereignty's taxing power'." (122 At. 49.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Mortimer E. Cooley Resigns Presidency of Engineering Council

Mortimer E. Cooley, dean of the College of Engineering and Architecture of the University of Michigan, has resigned as president of the American Engineering Council of the Federated American Engineering Societies, his resignation to take effect at the annual meeting in January. Dean Cooley stated that he retires on account of ill health and also made it known that he has been granted leave of absence by the university for the second half of the academic year of 1923-1924. With his retirement as principal executive of the F. A. E. S. Dean Cooley rounds out a career of almost half a century in the service of the state, of education and of his profession. He was graduated from the United States Naval Academy in 1878, but resigned from the navy in 1885 to accept the chair of mechanical engineering at the University of Michigan, to which he had been detailed as a professor while an engineer officer in the navy. He became dean of the College of Engineering in 1904 and of the College of Architecture in 1913. His association with the university covers a period of forty years, interrupted only by service in the Spanish-American War. Since his return to the university in 1899 Mr. Cooley has been engaged in important appraisal and valuation work, including investigations for the Wisconsin Railroad Commission and the Michigan Public Utilities Commission covering public utility properties. Dean Cooley has been a prominent figure in the engineering profession's representative associations. He has served as president and vice-president of the A. S. M. E., director of the A. S. C. E., vice-president of the S. P. E. E. and president of the Michigan Engineering Society.

G. M. Pierce, manager of the Wisconsin-Minnesota Light & Power Company at Menomonie, Wis., for the past year, discontinued his business relations with this company on Oct. 10, and has formed a connection with the H. M. Byllesby & Company properties in California. His local successor has not been announced, but F. S. Schornstein, district manager of the company at Eau Claire, will direct the affairs of the company at Menomonie pending the appointment of a new manager.

J. G. Johannesen, manager of the Southern Electric Company, Baltimore, was recently elected president of the Sibley-Pitman Electric Corporation, New York City, electrical distributor. Mr. Johannesen has been prominent in the affairs of the Supply Jobbers' Association and is well known in the electrical industry. He is succeeding Theodore Beran, who resigned Oct. 8, having served as president of the Sibley corporation for six and one-half years. Mr. Beran held this post in addition to his duties as New York district manager of the General Electric Company, and he withdrew from it in order that the office might be filled by some one who could devote his whole attention to the affairs of the company.

Britton I. Budd Heads Railway Association

Britton I. Budd, president of the Public Service Company of Northern Illinois, the Chicago, North Shore & Milwaukee Railroad and the Chicago Elevated Railways, was elected president of the American Electric Railway Association at its convention held last week in Atlantic City. Mr. Budd has been associated with the transportation business since he left school, and of late years he has been nationally prominent in the electric railway field, where his record of accomplishment made his selection to direct the affairs of the association the natural one. A further recognition of Mr. Budd's achievements was made when to the Chicago, North Shore & Milwaukee Railroad, of which Mr. Budd is president, was awarded the gold medal offered this year for the first time by the Charles A. Coffin Foundation for distinguished contribution to the development of electric transportation. Details of Mr. Budd's career were recounted in the Feb. 17 issue of the ELECTRICAL WORLD at the time his election to the presidency of the Public Service Company of Northern Illinois was announced.

W. J. Cahill has relinquished his duties as system operator of the Adirondack Power & Light Corporation, Amsterdam, N. Y., to become electrical superintendent of the company's Utica district, succeeding G. E. Benkesser.

A. D. Stewart has been appointed branch manager of the Butte office of the Westinghouse Electric & Manufacturing Company, succeeding R. J. Cobban, who has been transferred to the Seattle office, where he will give special attention to mining activities.

IN VIEW of the World Power Conference to be held in London, England, next year, the *Electrical World* will publish weekly, beginning with the issue of Oct. 27, biographical sketches of prominent British electrical engineers so that Americans who contemplate attending the conference may have some acquaintance with England's representative electrical men.

N. H. McLeod is now superintendent of the Carolina Electric Company, Maxton, N. C., succeeding J. B. Moore.

W. L. Berry, sales engineer of the Union Electric Light & Power Company, St. Louis, has been appointed assistant sales manager of the company.

C. W. Campbell has been made chief engineer of the Texas Power & Light Company at Tyler, Tex., to succeed J. B. Baltimore, who resigned to take up similar work with the Cotton Belt Railroad.

W. J. Wooldridge, who recently severed his connection with the Wheeling Steel Corporation, successor to the Whitaker-Glessner Company, Portsmouth, Ohio, as was announced in the June 16 issue of the ELECTRICAL WORLD, has become manager of the electrical sheet department of the Mansfield (Ohio) Sheet & Tin Plate Company.

William H. Onken, Jr., editor of the ELECTRICAL WORLD, returned on Monday of this week from a three and one-half-month trip to Europe. While abroad he visited England, Norway, Sweden, Denmark, Germany, Austria, Switzerland, Italy and France, investigating the European situation in electrical engineering and in the electrical industry. Mr. Onken reports that this situation presents a variety of aspects of wide interest. The results of his detailed studies in the various countries will be printed in forthcoming issues of the ELECTRICAL WORLD.

Obituary

Robert B. Watts, who was associated with his brother in B. C. Watts & Company, electrical supply dealers of Denver, died suddenly on Thursday, Oct. 11. Mr. Watts was forty-five years of age.

William L. Cosgrove of Atlanta, for many years prominently identified with the Georgia Railway & Power Company as an engineer, and at one time president of the Atlanta Gas Light Company, a subsidiary organization, died Oct. 8 in a hospital at Kent, England, according to a cablegram received in Atlanta. Mr. Cosgrove, with his wife, had been traveling in Europe for the past two years, and about a month prior to his death he was striken with apoplexy. He was sixty-four years of age. He retired from active business life five years ago.

Charles E. Mann, for many years executive secretary of the Massachusetts Railroad Commission and later of the Public Service Commission and Department of Public Utilities in that state, died at Malden, Mass., Oct. 15, at the age of sixty-six. Mr. Mann was born at Natick, Mass., and for many years was engaged in newspaper work in eastern Massachusetts. In 1904 he organized the State House News Service at Boston and was also appointed secretary of the Railroad Commission. He issued valuable compilations of public utility laws in Massachusetts and in later years organized the commission library at Boston for effective service

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Super-Standard Construction Deserves a Credit on Insurance Rates*

A Frank Discussion of the Importance of Better-than-Code Construction and Its Title to Consideration by the Underwriters

By Louis K. Comstock
President L. K. Comstock & Company, New York

It is an unquestionable truth, though one often lost sight of, that all losses by fire must ultimately be borne by the public. The insurance companies are the machinery for distributing these losses, nothing more. If the losses fell on them, their funds, large as they are, would speedily be exhausted, and the service which they render to the public would come to an end. Therefore a necessary condition precedent to the prosperity of the insurance companies is that the rate of premium paid for insurance should be remunerative, and the main object of the tariff system is to secure such remunerative rates. Prosperity of insurance companies depends on both a decrease in fire hazards and equitable but remunerative premium rates.

L. K. Comstock

The premium rate system has steadily developed in minuteness of classification and in adaptation to wider experience, as well as to changes in the character of many classes of risks by improvements in building and by the introduction of new kinds of materials and machinery. The estimates of risks and the determinations of premiums are largely governed by individual opinion and by competition, no amount of experience furnishing a statistical basis on which trustworthy predictions of average loss can be made.

Basis of Insurance Rate

Every rate is a composite of many rates evolved from experience and opinion. Every rate consists of two parts, the base rate and those other rates which affect the base rate by revision up or down. These secondary rates have been determined largely by experience, while into the base rate other considerations enter which resemble collective and competitive opinion rather than judgment resulting from the analysis of and scientific classification of data.

That portion of the rate due to the electrical hazard falls within the group of rates forming the base rate and has not been derived from a careful scrutiny of the facts flowing from this particular hazard. While it is recognized that the electrical hazard may vary through wide ranges, depending on the varying degrees of excellence of the material used and the quality of the labor expended on them, yet no attempt has been made to vary the rate to accord with the wide differences in the hazard.

It is conceded, I hope, in the last analysis that the public pays the whole cost of insurance administration and profits, as well as all the losses and therefore is entitled to a hearing whenever it can find a mouthpiece. It is axiomatic that any plan tending toward an improvement in electrical construction from a fire hazard standpoint is desirable, and it is desirable for the following reasons.

1. It will tend toward the elimination of economic waste incident to the destruction of buildings by fire.
2. It will decrease the loss of life by fire.
3. It will tend to prevent positive losses incurred by interruptions of business, the processes of production and the pursuit of pleasure.

Workmanship Should Be Rated

It is a well-known fact that there are in nearly every line of material used in electrical construction articles possessing qualities of serviceability and durability far in excess of the quality known as "code" material. Heretofore underwriters have confined their attention almost solely to materials and have been all but silent on workmanship. But the quality of workmanship can be greatly improved and ought to be entitled to consideration in the same manner as super-standard quality of materials.

Code material represents the lowest permissible standard, and whenever higher qualities of material and workmanship find their way into installations, they do so against the competition of low-standard materials, a competition unsound economically and ruinous financially to the competitors; but insurance companies do not recognize the value of better construction by a lower rate of insurance.

Various other fire risks have and ought to have their appropriate valuation in the making of rates. As instances of this I need only mention the reduction of rates when watchmen's clocks are used; the reduction of rates for the use of fire-alarm and sprinkler systems, wire-glass, fire doors, fire walls and elevator inclosures. The fire hazard due to electrical installation, however, is not separately evaluated in rate making, but is lumped into the base rate along with other risk considerations, such as fire department equipment, frequency of stations, efficiency, district

*A paper presented before the Association of Electragists International, Washington, D. C., Oct. 12, 1923.

characteristics, competition and other points which individually do not yield readily to scientific evaluation.

Notwithstanding the fact that in the consideration of rate making underwriters regard fire risks due to electrical causes as of small import, yet it has been estimated that from 4 per cent to 5 per cent of all urban fires are of electrical origin, because of faulty material, faulty installation or the wrong use of proper materials. If any appreciable number of fires are of a determinable origin, it would seem that that particular risk ought to be separately evaluated and that the rate of insurance should be correspondingly affected. A rate ought to be lowered in direct proportion as its corresponding risk is removed, and ought to be raised in proportion to the presence of its risk.

"Give" Demands "Take" Also

Underwriters have set the lowest permissible standard by putting their stamp of approval on so called "code" material; but on the basis of the use of code material many fires are known to have an electrical origin, and many other fires whose origin is pronounced "unknown" by the fire marshal are undoubtedly of electrical origin, owing to the use of faulty material or the wrong use of right material. Therefore, if installations are made of a super-standard quality, a reduced rate of insurance is indicated.

Should the fire underwriters admit this contention, but plead impracticability on the ground that the risk is small and an appropriate adjustment of the rate difficult, they place themselves in an untenable position, because a risk that causes 4 per cent or 5 per cent of all fires is measurable, and if measurable, the risk can be translated into an adjustment of the rate. Should the fire underwriters argue against the reduced rate on the ground of difficulty of inspection, it may be said, by way of retort, that the difficulty of inspection need be no greater, because the inspector under present conditions merely satisfies himself that code material has been used, and under the proposed conditions he would spend no more time in satisfying himself that super-standard material had been used.

Every one knows that there is much material manufactured many degrees better than code, and if such super-code material is used, it is but common sense to conclude that the installation of super-code material is a better risk from an insurance viewpoint; and if such an installation is a better risk, that fact ought to be reflected in the rate.

In New York the underwriters admit that out of a total of 2,357 orders to remedy 57 per cent were ignored. These refusals or failures to remedy were no doubt listed with the insurance companies and no doubt resulted in an increased rate. If therefore there is a penalty for failure to comply with the code, there should be a benefit in the form of a decreased rate accruing to policy holders if super-code material is used.

The Life Hazard

If the underwriters would adopt the principle of penalties for substandard work and the correlative principle of benefits for super-standard work, losses by fire would be reduced and hazard to life would decrease. The life hazard seems to have been lost sight of. A fire hazard has always a potential life hazard. Almost all insurance companies make good the fire damage—what is to be said about the life hazard? If the life insurance companies are awake to this situation, they should be interested also in better standards of electrical construction and an increase in the use of super-code material.

If, as has been stated, the fire loss due to the electrical hazard is 4 per cent or 5 per cent, how can the insurance companies afford to skimp on their inspections? That the inspections in cities like New York, Philadelphia and Chicago are insufficient is established by the fact that out of a total loss of $205,883 in 1922 in New York, the underwriters stated that $189,749 occurred on premises which had not been inspected at all and of which they had no knowledge. Perhaps some of this sort of thing will always occur, but obviously the proportion indicated here is altogether too large and requires attention on the part of insurance companies. If the underwriters cause it to be generally understood that a reduction in premium rates is available when super-standard construction is used, that fact alone will go a long way toward the elimination of fire losses from electrical causes and the consequent fear on the part of the public of the use of electricity.

I ask the very serious consideration of the underwriters to the question of the creation of a super-standard code of electrical material, with a corresponding reduction in premium rates.

I have shown the public interest in a super-code standard. That the adoption of a super-code standard will improve the quality of electrical construction is so axiomatic that it requires no debate.

The adoption of a super-code standard will build up good will in industry. This statement is also beyond the field of debate, but it requires restatement, about as follows: The adoption of a super-code standard, accompanied by a reduction in premium rate, will tend to make competition more intelligent than it is now. It would introduce into the comparison of bids an element, now lacking, tending toward a proper evaluation of both workmanship and materials; and any fact which introduces more intelligence into the comparison of bids makes for good will in the industry.

Japanese Methods of Foreign Purchase

Electrical men, appreciating the tremendous need for electrical materials and equipment of every description in the devastated area of Japan, are particularly interested in the possibilities for immediate sales to the Island Empire and desirous of knowing just how to approach the market. For the information of American manufacturers the Department of Commerce has just issued a bulletin which bears on the Japanese methods of foreign purchase in the rehabilitation of the earthquake area. Much of the essential buying abroad by the Japanese to date has been done at the foreign sources of production. The import business of Japan is being gradually taken away from the representatives of foreign exporters in Japan, however, and placed in the hands of foreign representatives of large Japanese importing houses. Thus practically all the raw cotton which Japan uses, and which constitutes nearly 30 per cent of her total imports, is purchased by Japanese agents in the raw-cotton centers of the United States and in India. Much of the wool which is used in Japan is purchased at the source in Australia, and the same is true of other raw materials for manufacture, including lumber, leather and some iron and

steel. On the other hand, in such items as machinery, fabricated-steel products and other specialties, which require an expert knowledge in their utilization—in which electrical equipment would naturally be included—the tendency has been to purchase such articles from foreign representatives in Japan and with the commodity to purchase also the services of expert mechanics and erection and construction engineers.

The outstanding items in import needs are indicated by the type of industries affected in Tokyo. The accompanying figures show paid-up capital in the various industries as of 1920, and the relative importance of these industries has remained virtually the same to date.

CAPITAL OF JAPANESE INDUSTRIES

Electrical goods	$84,566,835
Metal ware	46,847,439
Machine shops	30,202,538
Shipbuilding and vehicle manufacturing	22,742,700
Gas works	19,881,250
Weaving	15,268,092
Electrical machinery	11,291,712
Paper and paper goods	11,048,025
House building	10,680,965
Chemical manufacture	7,022,000
All other industries	284,198,642
Total	$543,790,198

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

THE spirit of caution which has characterized American business for many months has evidenced itself conspicuously in the electrical industry in the past week. According to custom, the opening of the fall buying season registered first in New England some time ago and spread rapidly across the country so that corroborating reports of increasing market activity came from all sections of the United States. Last week, however, there was a distinct lull reported from nearly all points except New England and the Southeast.

Business was active in the Boston district; apparatus sales were growing, radio demand heavier, fixture business unusually good and competition keener on wire, and there was some complaint from central stations on delayed deliveries. Atlanta reported a very satisfactory volume of business in practically all lines and active selling in industrial apparatus and heavy lines. Although appliance sales and the demand for conduit and cable were good in New York, buyers seemed to be limiting their purchases and the week was quiet otherwise. Chicago reported good demand for wire, conduit and pole-line hardware and, in fact, some demand by telegraph for conduit and cable lines, perhaps due to rumors there of a possible railroad strike. In San Francisco fixture business showed improvement and orders from operating companies and railroads were good. Bare copper wire dropped ¼ cent and the rest of the market had eased up, though schedule material was in fair demand.

In short, the lull was general but has been interpreted almost universally as an evidence of the cautious condition of purchasing and no discouragement is felt. In fact, from all quarters the utmost confidence is expressed that the fall market will be exceedingly strong and the demand for holiday goods abnormal. Indications from the manufacturing field prove a healthy condition of the industry, for record-breaking employment, an active program of construction and a heavy record of sales and profits compared with last year have formed conspicuous features of recent news from the electrical manufacturing and trade centers.

Waterwheel Market Strong with Very Keen Competition

A STEADILY increasing interest throughout the industry in the development of water power has been building up a strong market for the manufacturers of waterwheels, and the outlook is exceptionally good. The bulk of the business at the present time is coming from the Pacific Coast. The New England States stand second today in the volume of demand.

Conditions in this field have been changing during recent years. Formerly there were two well-defined types of waterwheels produced by different manufacturers, who specialized either in impulse or reactance-type wheels and had their field pretty much to themselves. Gradually, however, this rigid specialization has been breaking down and some manufacturers have been overlapping into both fields, with the result that competition is much more intense and the increased number of lines has made a healthier situation from the buyers' viewpoint. There is a question, however, as to whether this rivalry is not being carried too far and depressing prices too greatly in consideration of the value of this product.

Waterwheels run into a large amount of money, and the tendency is for this to increase as larger units are developed. Hydraulic engineers are building wheels of the maximum size that can be employed economically in line with the growth of interconnected systems. But the cost of selling is exceedingly high, for every installation involves an individual engineering problem and construction job with a very small degree of standardization possible, and because the element of maintenance and repair is very small, the manufacturer must make his profit on the initial sale.

There are four or five principal manufacturers employed in the field and rivalry is very keen. Different makes have their own patented features, but these are usually of secondary importance, so that the field is fairly open and bidding is close. The opinion is expressed, therefore, that the hydraulic waterwheel purchaser is actually getting his equipment today more cheaply than he should, and that if the very heavy service costs are to be carried by the manufacturer, the future is bound to bring a necessity for an increased price on waterwheels.

Larger Instruments for Schools; Progress of Standardization

WITH buying in the electrical instrument field at its highest peak for the year, several interesting developments affecting both engineering principles and merchandising problems have come to the surface of that business. Manufacturers are noting a distinct trend toward specialized lines. Schools, experimental agencies and laboratories are now buying instruments which have been specially ordered to suit their purposes, and those manufacturers who cater to this class of purchasers have found it possible to manufacture and sell large quantities of these special instruments at a reasonable price with fair profit. There is a demand for very large instruments with illuminated dials which may be adjusted to several kinds of reading.

Most instruments for automobiles are being made by a class of manufacturer who might be classed as semi-electrical. This is particularly true since the cheaper makes of automobiles are demanding lower costs for every part of equipment which enters into these cars. Where once the automobile manufacturer was very willing to buy instruments at a full cost of $5, simplification of parts and use of lower values in materials, together with production in large quantities, are making it possible to buy an equally satisfactory instrument at less than one dollar. The same situation is working itself out in the radio field, where some manufacturers of better grades of instruments believe they have a greater opportunity to obtain business than they have in the automotive field. However, many of the most expensive automobiles in the American field continue to use only instruments made by high-grade instrument manufacturers.

The trend in the switchboard field is away from the use of many dials to record readings at many different places on circuits and decidedly toward fewer instruments to afford easier reading and therefore avoidance of errors. In the industrial switchboard field and in the central stations as well the movement is

away from illuminated and large dials for general use.

It is believed by the instrument manufacturers that all standardization programs set by the different societies and associations have been carried out as nearly as possible. They claim that their businesses must be guided by consideration of the good service which they must give to their customers, rather than by an effort to make a product which will be interchangeable in its make-up because another manufacturer is able to fit any one of his numerous parts in it. The three-hole base on instruments is now universally used, while further progress has been made during the past three months by the standardization bodies toward developing different widths and depths.

New York's Market Sustained by Appliances and Cable

NEW YORK'S electrical jobbing and manufacturing circles report a steady market which is greatly sustained by heavy household appliance sales and attractive orders for armored cable and conduit. Among the important consumers—central stations, railroads, etc.—there is a feeling of doubt concerning the future of prices. Some wide fluctuations in the price of wire and wiring devices have, in turn, caused leading manufacturers in these lines to curb operations as to future orders. Moreover, at the present time the jobbers say that the trend toward the limiting of purchases to actual requirements shows signs of growing stronger.

Seasonal requirements for holiday goods have bettered the market generally, but the expectations of the jobbers and manufacturers have not been reached thus far, and quotations are easier in those markets which supply the needs of new construction and which so recently showed unusual strength. Several advertising campaigns for lamps, fixtures, all kinds of household appliances and wiring devices which started in the metropolitan territory in the last week are reported to be progressing well. As three of these campaigns are the largest ever seen in this territory, it is evident that trade circles feel very confident of the near future and expect great returns in this season's market.

West Coast Circles Report a Short Lull in Buying

A RATHER quiet week is reported in the West Coast's electrical markets. Authorities in that field state that this falling off in demand is not caused by any undue depression in that territory. They consider it merely as a short lull in buying. In fact, jobbers and manufacturers in that territory expect this season's business to be record-breaking for many of the commodities entering into new construction and extensions of central-station lines. Stocks of materials are still fairly high, and additional effort by advertising is being made to improve their movement before the period of inventory taking.

Bare copper wire has dropped another quarter of a cent to $19.50, base, but the insulated wires are still firm and perhaps due for an advance in the near future. Schedule material is selling briskly, with an especially good call for brass-shell sockets and the new shallow convenience outlets. Fixture sales are improving in the office lighting units. Some improvement is seen in buying by the railroad and power companies.

Chicago Jobbers Report Improved Business; Utilities Active

ELECTRICAL jobbers in Chicago report an encouraging week of trade. While no startingly large business has been booked, the volume as a whole seems to show a better outlook for the fall months. Contractors and smaller dealers are buying more heavily than they have done in the past two months. With renewed building activity business looks promising. Central-station companies have purchased considerable quantities of wire, conduit and pole-line hardware and other sales of these three items have increased. Conduit prices remain firm, but there is a rumor prevalent that the price is about to advance, several conduit manufacturers reporting that they have received numerous large orders which were telegraphed in from their jobbers. While there is no price advance indicated at this time, the sudden loading up of the conduit mills would have a tendency to bring about a price increase.

Atlanta Reports Spotty Conditions; Stocks Are Ample

EXCELLENT cotton crops in certain localities, with almost an absence of crops in others, are causing particularly spotty conditions over the Southeast, with the result that conflicting reports of business prosperity are very much in evidence. Those sections where the agricultural conditions are unfavorable are being bolstered up materially by the presence of industrial plants of large size and by construction work.

The volume of business reported by jobbers, while in keeping with the general conditions mentioned above, is on the whole very satisfactory, with stocks in practically all lines ample to meet current demands. Throughout the entire section counties are holding their annual fairs, which are being well attended, and manufacturers having farm-lighting equipment exhibits at these fairs anticipate a material increase in the volume of sales and are making preparations accordingly.

It is anticipated that the holiday trade this fall will set a record, although few actual orders have been received from the retailers as yet. The lull in industrial apparatus and other heavy lines reported for the month of September is being replaced by considerable activity, one of the largest of the jobbers having closed orders this week for two industrial-plant installations of unusual size, with prospects very bright for additional orders in the near future.

New England Business Active with Well-Distributed Orders

JOBBERS report active business with well-distributed orders and increasing demand for radio apparatus, fixtures and appliances. Stocks are readily meeting current requirements but are being refilled constantly. House wiring and lamp sales are vigorous and apartment-house construction in Greater Boston is absorbing liberal quotas of electrical material. Apparatus manufacturers report substantial gains over last year's business, and central-station outputs are taxing generating-plant facilities in most localities.

Prices weakened slightly on rubber-covered No. 14 wire this week and sockets also showed a tendency toward lower quotations. Competitive conditions apparently account for this. General business in New England continues in excellent volume, barring spotty conditions in textiles. Building contracts in New England totaled $7,551,900 for the week ended Oct. 9 against $5,487,000 for the same week last year. A fine fixture business is being handled this fall, and both sign and billboard lighting are developing rapidly in the Boston district. Central-station complaints of slow cable deliveries are being heard in some quarters.

The Metal Market

PRICES of metals have been somewhat lower during the last week. Copper has been particularly weak, despite some business at the 13-cent level. Lead and zinc prices have been rather well maintained, but the undertone is none too strong.

The Western Electric Company, according to an announcement in the financial district last week, recently has purchased between 15,000,000 lb. and 20,000,000 lb. of copper at 13 cents a pound. The fact that such a large consumer of the metal has placed orders of this size was interpreted in some quarters of the trade as indicating a resumption of buying by other users.

The official contract price of lead by the American Smelting & Refining Company continues at 6.85 cents, New York. Although quotations are nominally unchanged, a slightly weaker tendency in the New York lead market is evident. It is now possible to buy lead from Middle Western producers for delivery in the East at the same level as that asked for lead refined on the Eastern seaboard, despite the fact that this lead will in general not net sellers more than 6.50 cents at St. Louis.

NEW YORK METAL MARKET PRICES

	Oct. 10, 1923 Cents per Pound	Oct. 17, 1923 Cents per Pound
Copper, electrolytic.	13 00	13.00
Lead, Am.S.& R.price	6.85	6.85
Antimony..........	7.75	7.75
Nickel, ingot.........	27.00 to 32.00	27.00 to 32.00
Zinc, spot..........	6.30	6.25
Tin, Straits........	41.75	41.75
Aluminum, 98 to 99 per cent..........	26.00 to 27.00	26.00 to 27.00

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

General Electric Orders Running 30 per Cent Above 1922

The General Electric Company received orders amounting to $65,483,549 during the three months which ended Sept. 30, as against orders totaling $58,914,620 in the corresponding three months of 1922, an increase of 11 per cent.

For the first three-quarters of the present year, covering the nine months ended Sept. 30, the orders amounted to $229,747,304, compared with $176,171,194 in the corresponding period of 1922, or a gain of 30 per cent.

Norma Company of America Places Contracts

The Norma Company of America has placed contracts for the erection of the first unit of its new plant upon its property recently acquired at Stamford, Conn. This property consists of seventeen acres of land facing the main-line tracks of the New York, New Haven & Hartford Railroad adjacent to Glenbrook station, and the buildings now under construction will be of one story sawtooth roof type occupying about 60,000 sq.ft. of space. The company's present plant at Anable Avenue, Long Island City, will be continued for the production of Norma precision open-type annular ball bearings.

The company's Stamford plant will be equipped for the manufacture of Hoffmann precision roller bearings, the American rights to which, as well as to all other Hoffmann products, were recently acquired by the company from the Hoffmann Manufacturing Company, Ltd., of Chelmsford, Essex, England. The plant will also be equipped for the expansion of the manufacture of Norma precision ball bearings.

St. Louis Mazda Making Extensive Changes in Factory Equipment

The St. Louis Mazda Lamp Division of the General Electric Company, at 6251 Etzel Avenue, is making extensive changes in its factory equipment, which when completed will make possible an increase in production from 60,000 lamps per day to 100,000 lamps per day.

These changes consist of replacing much of the old machinery used in the manufacture of incandescent lamps with the newest and most improved machinery obtainable for this purpose. In addition to the installation of this new machinery the lighting system is being completely changed. The General Electric Company's new totally inclosed lamps for factory lighting will be installed throughout the plant, increasing the intensity of illumination from about 3 foot-candles to 10 foot-candles on the working plane.

Decision in Battery Suit

A long-drawn lawsuit between rival electrical manufacturers of Madison, Wis., which has continued in the courts there for more than a year, was terminated on Sept. 25, when Judge E. Ray Stevens of the Circuit Court awarded the rights of one patent process to the Burgess Laboratories and gave the right of other battery patents to the French Battery & Carbon Company.

It is estimated that the suit has cost $100,000 to date, and the case is now expected to be taken before the Supreme Court for final decision. The Burgess Laboratories won the right to the chromate process, said to be valuable in the manufacture of dry-cell batteries for flashlights, etc. The French company was ordered by Judge Stevens to pay the Burgess company $50,000 in cash to compensate it for the use of the process since 1922.

Appoints Mrs. Jane Carroll to Promote the "Apex" Products

Appointment of Mrs. Jane Carroll to head its newly organized department of home economics was announced last week by the Apex Electrical Distributing Company, Cleveland, manufacturer of household appliances.

Mrs. Carroll is well known for the essays by her on home economics in electrical housekeeping which have been published by the daily and trade newspapers. During the last five years she has conducted sewing and cooking classes in New York City in connection with promotion work by New York central-station companies. Her first work for the Apex company will be to travel and educate various district managers on the merits of the company's latest appliance, the "Rotarex Electric Kook-Rite." Later she will conduct an electrical housekeeping school for the exemplification of better electrical methods of cleaning, washing, ironing and cooking.

Western Electric Employees Own 140,000 Shares of Stock

Western Electric employees to date have purchased and are paying for more than 140,000 shares of stock. This is about $18,000,000 worth in the Western Electric Company and the American Telephone & Telegraph Company. About 2,000, or 30 per cent of the number of employees eligible, are participating in the various purchase plans.

Goodyear & Hammersley Agents of Electric Power Equipment

The Electric Power Equipment Corporation, 412 North Eighteenth Street, Philadelphia, announces the appointment of Goodyear & Hammersley, Inc., 30 Church Street, as its agents in the New York and northern New Jersey territory.

Mr. Goodyear is an electrical engineer and has been employed by the Electric Power Equipment Corporation for a number of years. Prior to his connection with that company, he was sales engineer in charge of sales and service engineering for the Rail Welding & Bonding Company of Cleveland. Mr. Hammersley was associated with the Electric Storage Battery Company of Philadelphia.

Appropriations for Specialists in Foreign Markets

Industry is becoming convinced more and more, judging from communications reaching Washington, that commodity specialists should be employed abroad to a greater extent than is the case at present. With a very few exceptions, the government's representatives abroad who deal with industrial matters are expected to report on all commodities and all lines of endeavor in which this country is interested.

While there is no expression of feeling that the maintenance of such men is not more than justified by the value of material which they submit, the need for specialists, particularly in those countries offering promising markets for machinery, chemicals and electrical equipment, nevertheless exists. Specialized knowledge of these lines is almost essential to a comprehensive analysis of the trade possibilities.

There is reason to think that Congress will consider at the forthcoming session the granting of an appropriation for a limited experiment along those lines.

Link-Belt Acquires Business of Meese & Gottfried

Charles Piez, president of the Link-Belt Company, Chicago, announces the purchase of the Meese & Gottfried Company, San Francisco, Los Angeles, Seattle and Portland. For the past ten years the Link-Belt Company has been distributing its products on the West Coast through its subsidiaries, the Link-Belt Northwest Company at Seattle and the Link-Belt Pacific Company at San Francisco. The improvement in distributing facilities effected by the consolidation and the additional manufacturing facilities acquired should give the rapidly growing industries of the Pacific Coast highly economical and efficient service.

The Meese & Gottfried Company and its predecessors have been manufacturers of power-transmission machinery on the West Coast for more than forty years. It is the intention of the new owner to add to the facilities and en-

large present stocks so that prompt service to its customers will be insured.

The new organization will be known as the Link-Belt Meese & Gottfried Company, with headquarters at San Francisco. The officials will be: Charles Piez, chairman of the board; B. A. Gayman, president; Harold H. Clark, vice-president and sales manager; Leslie W. Shirley, treasurer, and Richard W. Yerkes, secretary.

American Smelting & Refining Wants to Market Own Copper

Permission has been asked by the American Smelting & Refining Company to sell independently of the Copper Export Association copper which it is marketing on contract for smaller producers who are not members of the association. It is said that no action has been taken as yet by the association on the request.

The smelting company is said to have expressed its desire to continue as a member of the association, but feels that its hands should not be tied in the matter of disposing of copper through contract for small companies.

Robbins & Myers Receives Large Contract from Eden Washer

The Robbins & Myers Company, Springfield, Ohio, announces that it has just booked one of the largest contracts ever received by the company, and as a result immediate increase in the working force is contemplated. The contract comes from the Eden Washer Corporation of Paterson, N. J., and covers the manufacture of 1,000 "Eden" electrical washers a month for the company. Material is already arriving and production at the local plant will begin at once.

Westinghouse Japanese Order

The Westinghouse Electric International Company has received orders for electrical apparatus to be used in reconstruction work in Japan totaling well over a million dollars. Other orders are in course of negotiation which will bring the total amount to approximately two million dollars. It is understood that the power plants in the earthquake zone were not seriously damaged, but that the distribution systems were practically destroyed.

Mathias-Hart Opens Office in Newark to Better Service

In order to take care of the rapidly growing business of the Mathias-Hart Company, Boston, manufacturer of linemen's tools and equipment, an office has been opened at 101 Halsey Street, Newark, N. J., in charge of Robert Mathias, who was one of the originators of the firm.

All business originating outside of the New England States is now being handled from the Newark office, where adequate stocks are being carried.

Lincoln Electric Company Moves Into Larger Plant

The Lincoln Electric Company, manufacturer of motors and arc-welding equipment, Cleveland, has recently completed removal from its old plant at Thirty-eighth Street and Kelley Avenue to its new location at Coit and Kirby Avenues.

In the new location the Lincoln Electric Company has nearly five acres of floor space, more than half of this space being on one floor, where the main manufacturing will be done. Adequate railroad siding facilities are also available. The larger plant provides for the materially increased production which has been found necessary to meet growing demand.

International Combustion Dividend

The International Combustion Engineering Corporation in announcing the regular quarterly dividend of 50 cents per share states that the corporation now has outstanding 374,759 shares, of which 49,952 shares were recently acquired by stockholders and the underwriters of the offering to stockholders, and 75,048 shares were issued in connection with the acquisition of all of the now outstanding stock, 2,500 shares of the Raymond Brothers Impact Pulverizer Company.

Planning "Palace of Electricity" at San Francisco Exposition

The electrical industry is planning to secure the entire right wing of the big auditorium at the third annual California Industrial Exposition, which is to be held in the San Francisco Civic Auditorium from Saturday, Nov. 17, to Sunday, Dec. 2, inclusive. This section will be named the "Palace of Electricity" and will be divided into about forty booths, each having a floor space 10 ft. wide by 10 ft. deep. One hundred and fifty dollars will be the rental of each of these spaces for the period of the exposition. Many interesting exhibits of radio and household devices are promised, with the usual impressive power displays.

This exposition is held "in the interest of exhibitors and manufacturers, for the industrial development of San Francisco, the Bay Cities and northern and central California." Working exhibits, showing products being manufactured or assembled, are desired.

Mitchell-Rand Production Not Affected by Slight Fire

The Mitchell-Rand Manufacturing Company, 18 Vesey Street, New York City, maufacturer of electrical insulating materials, wishes to correct the impression that a fire which occurred Oct. 8 at its factory in Jersey City in any way affected its production.

Accounts of the fire in the daily papers, officials of the company state, were overdrawn. The blaze was confined to the wax-compound department, where production was resumed almost immediately.

The Western Electric Company announces that it has moved its supply advertising department to 100 East Forty-second Street from 195 Broadway, New York City.

John R. Thornton, for five years manager of the Carter Electric Company's Savannah warehouse, has resigned his position with the Carter Electric Company to take a position with the Westinghouse Lamp Company where he will have charge of lamp sales in North and South Carolina. This change becomes effective Nov. 1.

W. O. Jaudon has resigned as purchasing agent of the Walker Electric & Plumbing Company, Atlanta, and is now affiliated with the Bryant Electric Manufacturing Company, Bridgeport, Conn. Mr. Jaudon will be Southern representative of the latter company, stationed in Atlanta.

The Detroit Stoker Company, General Motors Building, Detroit, announces the appointment of E. L. Beckwith as district manager in charge of the company's Chicago office at 230 Clark Street.

The Kant-Kool Electric Water Heater Company, Inc., 22 North Water Street, Odgensburg, N. Y., has been organized with capital stock of $100,000 to manufacture electric water heaters and kindred products. Factory buildings have been obtained, and the company will equip its plant for manufacturing in the the near future.

Mathew Brothers, 1661 West Washington Street, Los Angeles, manufacturers of batteries and other kindred electrical equipment, has purchased a site at 1729 Santee Street for a new plant. It is expected to start work early in 1924.

The Packard Electric Company, Warren, Ohio, has started the erection of a two-story transformer plant, 110 ft. x 220 ft., which will involve the expenditure of $350,000. The present works will be used exclusively for the manufacture of cable. With the new building the company will largely increase its transformer production and will manufacture transformers in capacities up to 7,500 kva.

The International Lamp Corporation, 736 West Monroe Street, Chicago, has purchased the Vitanola plant in Cicero, Ill., and will occupy it for the manufacture of lamps. The building, which is at South Fifty-second Avenue and West Nineteenth Street, has 225,000 sq.ft. of floor space.

The Otis Elevator Company, 2300 Stockton Street, San Francisco, has plans for a two-story factory branch, 135 ft. x 275 ft., estimated to cost $350,000, including machinery.

The Union Electrical Company, Baltimore, has leased the three-story building at Charles Street and Lafayette Avenue for the establishment of a new manufacturing plant.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase and agency are desired in Calcutta, India (No. 7,962), for electrical accessories.

M. F. JACQUET, Rue Saint-Bernard 127, Brussels, Belgium, would like to get in touch with American manufacturers of electrical goods, with a view of acting as their representative in Belgium.

ELECTRIC RECORDING INSTRUMENTS FOR NEW ZEALAND.—Tenders will be received by the Public Works Department, Wellington, New Zealand, until Nov. 27 for electric recording instruments for the Mangahao electric power supply.

HIGH-TENSION APPARATUS FOR SYDNEY, AUSTRALIA.—Tenders will be received by the Municipal Council, Sydney, Australia, until Dec. 31 for high-tension switchgear and apparatus. Tenders will also be received until Jan. 21 by the Town Council for high-tension split conductor feeder panels.

ROTARY CONVERTERS FOR NEW SOUTH WALES, AUSTRALIA.—Tenders will be received by the New South Wales Government Railways and Tramways Commissioners, Sydney, Australia, until Dec. 13 for rotary-converter units.

ELECTRIC PLANTS FOR BALLARAT AND BENDIGO, AUSTRALIA.—Arrangements are being made by the Electric Supply Company, Victoria, Australia, to install electric plants in Ballarat and Bendigo, each plant to be equipped with two 1,000-kw. steam-driven turbo-alternators, which have been purchased in England. The cost of the project is estimated at £70,000.

PROPOSED HYDRO-ELECTRIC SCHEME FOR WINGHAM, AUSTRALIA.—A report has been submitted to the Municipal Council by Armstrong, Whitworth & Company, Ltd., Sydney, Australia, on a proposed hydro-electric power scheme for the district by utilizing the Ellenborough River. The cost is estimated at £50,000.

PROPOSED HYDRO-ELECTRIC PROJECT FOR CZECHOSLOVAKIA. — Official sanction has been secured for the construction of a large dam on the River Thaya in connection with the scheme for harnessing that river to generate electricity. The cost of the project is estimated at 520,000,000 Czech kronen and will require from five to six years to complete.

CONCESSION GRANTED FOR HYDRO-ELECTRIC PLANT IN SPAIN.—A concession for the establishment of a hydro-electric plant on the River Villefria, near Respende de la Pena, Province of Valencia to supply electricity for light and power purposes, has recently been granted by the Spanish government.

New Apparatus and Publications

CO_2 METERS.—The Brown Instrument Company, Philadelphia, has brought out a new indicating and recording CO_2 meter, which works on the principle of the difference in thermal conductivity of various gases.

SAFETY DEVICES.—The Mathias-Hart Company, 101 Halsey Street, Newark, N. J., is distributing a leaflet calling attention to its rubber goods and safety devices for electrical workers.

ELECTRICAL TOOLS.—Mathias Klein & Sons, 3,200 Belmont Avenue, Chicago, is distributing catalog No. 19, covering the "Klein" tools for electricians, linemen and mechanics.

TROUBLE LAMP.—A. B. Stewart & Company, 219 West Huron Street, Chicago, has placed on the market the "Klasp-Tite" trouble lamp.

ELECTRIC TOASTER. — A turn-over electric toaster has been brought out by the Gold Seal Electric Company, 1,270 Ontario Street, Cleveland, Ohio.

TABLE TAP.—The Magnus Electric Company, Inc., 451 Greenwich Street, New York City, has placed on the market a table tap for the connection of several appliances.

ELECTRIC FREEZER. — The Alaska Freezer Company, Lincoln Avenue Extension, Winchendon, Mass., has added a new electric freezer to its line of products.

CORDS AND CABLES.—The Rome Wire Company, Rome, N. Y., has issued a booklet describing and illustrating its "Super-Service" cords and cables.

ELECTRICAL RECORDER.—The Evershed patent 1923 electrical record has recently been placed on the English market by Evershed & Vignoles, Ltd., Chiswick, London, England.

DIE-CASTINGS.—The Doehler Die-Casting Company, Court and Huntington Streets, Brooklyn, N. Y., is distributing a booklet giving a brief review of the manufacture and use of the "Doehler" die castings.

RECIPROCATING SWITCH.—The Arrow Electric Company, Hartford, Conn., has placed on the market a line of single-pole and double-pole reciprocating heater switches.

PORTABLE LAMP.—The Wirt Company, 5,221 Greene Street, Germantown, Philadelphia, brought out a new portable lamp under the name of "Dim-A-Lamp."

ELECTRIC REFRIGERATOR. — A refrigerating machine rated at 50, 75 and 100 lb. has been developed by the Copeland Products, Inc., Flint, Mich.

MACHINE TENDER TRUCK.—A machine tender truck for electricians and contractors has been placed on the market by the Angle Steel Tool Company, Plainwell, Mich.

New Incorporations

THE COMMUNITY POWER & LIGHT COMPANY, Marlin, Tex., has been organized to take over the ice and electric plants in Marlin, Mexia, Lott, Chilton, Rosebud and other towns. The company is capitalized at $1,000,000 and proposes to operate electric, gas, ice and refrigerating plants. The incorporators are T. A. Cheeves, N. D. Naman and George H. Carter.

HISEVILLE (KY.) LIGHT & POWER COMPANY has been incorporated by E. L. Palmer, W. M. Forest and others.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

FRYEBURG, ME.—The property of the Fryeburg Electric Light Company has been purchased by the Western Maine Power Company, Limerick. A new power house, it is understood, will be built at Swans Falls.

WATERVILLE, ME.—The installation of electrically operated machinery at the new pumping station of the Kennebec Water District is under consideration. Metcalf & Eddy, 14 Beacon Street, Boston, are engineers.

PORTSMOUTH, N. H.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 23 for 50,000 attachment plug terminals. (Schedule 1426).

GLASTONBURY, CONN.—The Glastonbury Tobacco Warehouse Company plans to build a power house at its new works to cost about $47,000. Buck & Sheldon, Hartford, are architects.

Middle Atlantic States

BUFFALO, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Oct. 31 for rewiring wards 13, 14, 15, 32, 33 and 34 at the Buffalo State Hospital.

BUFFALO, N. Y.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Nov. 7 for the installation of a magnet electric passenger elevator, etc. For details see Searchlight Section.

PALMYRA, N. Y.—Bids will be received by Edward S. Walsh, Commissioner of Canals and Highways, Capitol, Albany, until Nov. 1 for completion of new power station at Lock No. 29 at Palmyra.

TENAFLY, N. J.—Plans are under consideration for extending the street-lighting system on Oak and Front Streets and other thoroughfares.

ASYLUM, PA.—The Asylum Township Electric Company, recently organized, has applied for permission to install and operate a light and power system in Asylum Township.

CLARKS FERRY, PA.—Frank M. Waring, Tyrone, and associates, have applied to the Federal Power Commission for permission to build a hydro-electric power plant on the Susquehanna River, with transmission system. A company will be organized to carry out the project.

GROVE CITY, PA.—Plans are under consideration for consolidating the municipal power plant with the city waterworks. The plans include a new building and the installation of new equipment.

HANOVER, PA.—The Hanover Power Company is negotiating for the purchase of the property of the Paradise Township York Power Company and plans for extensions to the system.

HYNDMAN, PA.—The Savage Fire Brick Company will install electric power equipment in connection with additions at its local plant and branch refractory works at Williams, and also at its proposed plant at Franklin Junction.

JUNIATA, PA. — The Watts Water & Power Company and the Juniata Water Power Company, recently organized, have secured permission to build a hydro-electric plant on the Juniata River, near Iroquois, to cost about $400,000.

McKEESPORT, PA.—The installation of electrically operated pumps in connection with proposed waterworks extensions, to cost about $230,000, is under consideration.

PHILADELPHIA, PA.—The new woodworking plant of George W. Smith & Company, Inc., Botanic Avenue and Fifty-first Street, will be equipped with electrically driven machinery. The cost is estimated at $200,000.

PITTSBURGH, PA.—The Pittsburgh Reinforced Brazing Company, Liberty Avenue, has filed plans for the construction of a new transformer station at its plant.

PITTSBURGH, PA. — Plans are being prepared by the Pittsburgh Terminal Railroad & Coal Company, Wabash Building, for a substation and a 22,000-volt transmission line from Pittsburgh to Rook, Pa., and to Horning, W. Va.

READING, PA.—The Metropolitan Edison Company has secured permission to build a steel-tower transmission line on Neversink Mountain in connection with its new system from Reading to Shanesville, where connection will be made with the lines between Easton and Shanesville.

SHENANDOAH, PA.—Plans are under consideration for the installation of electrically operated pumping machinery in connection with extensions to the municipal waterworks, to cost about $200,000.

STANDING STONE, PA.—The Standing Stone Township Electric Company, recently organized, has applied for permission to install and operate a system in Standing Stone Township.

WARREN, PA.—The Watson Township Public Service Company and the Cherry Grove Township Public Service Company, recently formed, plan to erect transmission lines. G. C. Savering, Johnstown, is treasurer.

DOVER, DEL.—The Town Council is considering extending the municipal electric system to Cheswold.

BALTIMORE, MD.—The Anthracite Fuel Corporation, 708 Continental Building, recently formed, plans to build a power plant at its proposed local fuel briquette manufacturing plant, to cost about $350,000.

BELINGTON, W. VA.—Plans are being considered for rebuilding the municipal power plant, recently damaged by fire The loss is estimated at $30,000.

MARLINTON, W. VA.—The Raine Lumber Company contemplates the installation of electrical equipment in its plant at Clover Lick.

MORGANTOWN, W. VA.—Extensions and improvements in the municipal lighting system are under consideration.

WEST UNION, W. VA.—The Midland Electric Service Company, recently organized, has acquired a site on Middle Island Creek, on which it proposes to build an electric power plant. J. Lambert McCormick is interested in the company.

STAUNTON, VA.—Plans are under consideration for the installation of electrically operated pumping machinery at the proposed new municipal waterworks, to cost about $500,000.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Oct. 22 for 2,500 ft. of conduit, 100 switchboard jacks, 100 lamp sockets, 850 lb. of switchboard wire, etc. (Circular C.P. 15890-1.)

WASHINGTON, D. C.—Bids will soon be called by the Bureau of Yards and Docks, Navy Department, for motor-generator, transformers, substation equipment and switchboard, for the Pearl Harbor (H. T.) navy yard (Specification 4924, superseding Specification 4548.)

North Central States

DETROIT, MICH. — The Ford Hydro Electric Company, Highland Park, has applied for permission to construct and operate a hydro-electric plant on the Menominee River, in Florence County, Wis., to cost about $750,000.

DOLLAR BAY, MICH.—The Dollar Bay Lumber Company plans to install additional equipment at its power house.

KINGSTON, MICH.—A special election will be called to vote bonds for extensions in the street-lighting system and for commercial service. The Great Lakes Power Company plans to extend its line from Yale to furnish electricity here.

MARQUETTE, MICH.—The City Council is considering calling a special election to submit the proposal to issue $100,000 in bonds for extensions to the municipal electric plant on the Dead River. Orbison & Orbison, 812 College Avenue, Appleton, Wis., are engineers.

NEWARK, OHIO. — The Ohio Power Company plans to construct an electric plant, to cost about $500,000. Sargent & Lundy, 72 West Adams Street, Chicago, are engineers.

TOLEDO, OHIO.—Electric power equipment will be installed in the proposed local ice and cold-storage plant to be erected by the Baltimore & Ohio Railroad Company, to cost about $2,500,000.

TOLEDO, OHIO. — The Libbey-Owens Sheet Glass Company, Nicholas Building, plans to construct a power house at its proposed new plant, to cost about $1,000,000. The Devore Company, Nicholas Building, is engineer.

TORONTO, OHIO.—The Ohio River Edison Company has been granted permission to construct an electric plant on the Ohio River near Toronto, to cost about $1,000,000.

INDIANAPOLIS, IND. — The Taggart Baking Company, 18 North New Jersey Avenue, plans to erect a power plant at its works on East Market Street.

INDIANAPOLIS, IND.—The Bemis-Indianapolis Bag Company, 1940 Barth Avenue, has filed plans for the erection of a power house at its plant.

SULLIVAN, IND.—The Indiana Electric Corporation, subsidiary of the Central Indiana Power Company, contemplates the erection of a 33,000-volt transmission line from Sullivan to Worthington.

ASHMORE, ILL.—The Central Illinois Public Service Company, Springfield, will install a local street-lighting system. A ten-year franchise has been granted.

CHICAGO, ILL.—Plans have been filed for the erection of an addition to the power house at the Elizabeth Hospital, 1400 Claremont Avenue, to cost about $40,000.

BELGIUM, WIS. — The Village Board has authorized the Badger Public Service Company to install a street-lighting system here. W. N. Albertson, First Wisconsin National Bank Building, Milwaukee, is president.

CEDAR GROVE, WIS. — The Village Board has authorized the Badger Public Service Company to install twenty-two additional street lamps of 250 cp. W. N. Albertson, First Wisconsin National Bank Building, Milwaukee, is president.

CLEVELAND, WIS.—The Badger Public Service Company contemplates changing its local system from direct to alternating current, and also to extend its transmission lines to St. Wendel and Centerville. W. N. Albertson, First Wisconsin National Bank Building, Milwaukee, is president.

EAU CLAIRE, WIS.—Extensive construction work in this district is contemplated by the Northern States Power Company, including a substation at Wissota, to cost about $1,000,000, a number of smaller substations and the erection of high-tension transmission lines. J. N. Clark is manager of the local office of the Byllesby Engineering & Management Corporation, Chicago.

ELCHO, WIS. — The Charles W. Fish Lumber Company is planning to build a power house at its new woodworking plant, to replace a works recently destroyed by fire with loss of about $175,000.

GREEN BAY, WIS.—Arrangements have been made by the Northern Paper Mills Company for a hydro-electric development on the Menominee River, 14 miles from Wausaukee.

MADISON, WIS.—Plans have been completed by the State Capitol Commission for laying underground light and power cables on the Capitol grounds. Electricity will be supplied by the Madison Gas & Electric Company.

MADISON, WIS. — The installation of fifty new street lamps will be recommended to the Board of Estimates by the street-lighting committee.

MARINETTE, WIS. — The question of improving the present (arc-lamp) street-lighting system is under consideration. The installation of ornamental lamps in the business section is being considered.

MARION, WIS.—The Marion Light & Power Company, recently organized with a capital stock of $25,000, plans to establish an electric plant for commercial service. Electricity will be purchased.

NEENAH, WIS. — Petitions have been presented to the City Council asking for extensions and improvements to the present street-lighting system.

RACINE, WIS.—The City Council is considering changing the present street-lighting system on Mead Street and DeKoven Avenue.

RACINE, WIS.—The installation of electrically operated pumping machinery in the proposed addition to the municipal pumping plant is under consideration.

WAUSAUKEE, WIS. — The Wisconsin Public Service Corporation plans to erect a 13,000-volt transmission line from its new generating plant at Johnsons Falls, about 25 miles, to cost about $45,000. A light and power system will be installed at Crivitz, Wis.

WOODMAN, WIS.—The proposal to install an electric distributing system and to erect a transmission line from Wauzeka and to purchase electricity from the Interstate Light & Power Company will be submitted to the voters.

DODGE CENTER, MINN.—The Northwestern Power Company plans to erect additional lines in this section for farm and municipal service.

LITTLE FALLS, MINN.—The Pike Rapids Hydro-Electric Company contemplates the construction of a new hydro-electric plant at Pike Rapids, to cost about $100,000.

MINNEAPOLIS, MINN.—The construction of a power plant, 45 ft. x 75 ft., two stories, at the Norwegian Deaconess Hospital is under consideration.

MINNEAPOLIS, MINN.—The Standard Gas & Electric Company has issued $2,500,000 in notes, part of the proceeds to be used for extensions.

OWATONNA, MINN.—The establishment of a municipal electric light plant is under consideration by the City Council.

ST. PAUL, MINN.—The American Radiator Company, Chicago, plans to install electric power equipment at its proposed plant addition here, to cost about $250,000.

COUNCIL BLUFFS, IOWA.—The Citizens' Gas & Electric Company contemplates extensive additions and improvements in its system, including the installation of new equipment. The company is negotiating for a twenty-five-year franchise.

MANSON, IOWA.—Under the terms of an extension of its franchise the Manson Light, Heat & Power Company agrees to install new equipment in its plant and to change its system from direct to alternating current within the next twelve months.

OSKALOOSA, IOWA.—The Des Moines (Iowa) Electric Company is planning to extend its transmission line from Otley to Oskaloosa. The company has been granted permission to erect its line through Pella.

BOLIVAR, MO.—Frank W. Graham, St. Louis, has applied for a twenty-year franchise in Bolivar. He proposes to construct an electric and water plant.

CAMERON, MO.—Bonds to the amount of $64,500 have been voted for extensions to the municipal electric light plant and lines. Burns & McDonnell, Interstate Building, Kansas City, are engineers.

FARMINGTON, MO.—The installation of electrically operated pumping machinery at the waterworks and sewerage plants, in connection with proposed extensions, to cost $100,000, is under consideration. Charles A. Haskins, Finance Building, Kansas City, is consulting engineer.

MOBERLY, MO.—The Wabash Railway Company, St. Louis, will install electric power equipment in connection with extensions and improvements at its local shops. A. O. Cunningham is chief engineer.

CHAMBERLAIN, S. D.—The plant of the Chamberlain Gas Light & Power Company was recently damaged by fire.

CRETE, NEB.—The construction of an electric light and power plant in Crete is under consideration by the Council.

PIERCE, NEB.—The Nebraska Gas & Electric Company, Norfolk, has taken over the local electric plant of the Pierce Milling Company and plans to extend its transmission line here.

WALTHILL, NEB. — A bond issue of $46,000 is being arranged for the installation of a municipal electric plant and ice factory. The Prince-Nixon Engineering Company, Peters Trust Building, Omaha, is engineer.

Southern States

DAVIDSON, N. C.—The installation of a lighting system in Davidson is under consideration.

ROCKY MOUNT, N. C.—The Atlantic Coast Line Railway Company, Wilmington, plans to install electric substation and power equipment at its proposed local car repair shops, to cost about $100,000.

ARCADIA, S. C.—The Arcadia Mills, Inc., plans to build a power house in connection with extensions at its local textile plant. Lockwood, Greene & Company, Charlotte, N. C., are engineers.

DENMARK, S. C.—Electric power and substation equipment will be installed in the proposed plant of the Denmark Fertilizer Manufacturing Company. A contract for electricity has been made with the Edisto Public Service Company.

ST. PETERSBURG, FLA.—The Pinnellas County Power Company plans to install a light and power system in the Ridgewood Terrace section.

SOUTH JACKSONVILLE, FLA. — An issue of $350,000 in bonds is being considered for extensions and improvements to the electric system, waterworks and sewerage plant.

TALLAHASSEE, FLA. — The citizens have voted to lease the municipal electric plant to the West Florida Power Company for a period of twenty years.

TAMPA, FLA.—The United States Export Chemical Corporation, recently organized, plans to install a substation at its proposed local superphosphate plant, to cost about $350,000. Harry A. Pierce is vice-president in charge.

BIRMINGHAM, ALA.—Steps have been taken by the Civitan Club for the installation of ornamental lamps on Fifth Avenue from the main part of the city to the Union Station.

BIRMINGHAM, ALA. — The Alabama Power Company has been granted permission to erect a power transmission line from Montgomery to Greenville.

FLORENCE, ALA.—Steps are being taken for the installation of an electric pumping plant for the municipal waterworks, to replace the present steam-driven equipment.

BOSSIER CITY, LA.—Plans are being arranged for the installation of electrically operated pumping machinery in connection with a proposed waterworks and sewerage system, to cost about $125,000.

VERBENA, ALA.—B. J. Baldwin is organizing a company to construct and operate an electric plant for local commercial service, to cost about $75,000.

HIRAM, ARK.—The Big Creek Power Company, it is understood, will soon ask for bids for the construction of a dam, two turbines, two 75-kw. generators with exciters, transformers, etc., and for 3½ miles of transmission line. The cost is estimated at about $44,000.

SHREVEPORT, LA.—Plans are under way for the installation of electrically operated pumping machinery at the municipal waterworks, to cost about $200,000, in connection with extensions to the waterworks system, for which $1,000,000 in bonds has been voted.

HOLDENVILLE, OKLA. — Plans are under way for the installation of electrically operated pumping machinery in connection with extensions in the municipal waterworks, to cost about $50,000.

WYNNEWOOD, OKLA.—The municipal electric plant has been taken over by the Oklahoma Gas & Electric Company. The company proposes to extend its transmission lines to furnish electricity here.

LUBBOCK, TEX.—Plans are being arranged for a bond issue of $100,000, one-half of which will be used for extensions to the municipal electric power plant, and the remainder for extensions in the municipal light and conduit systems.

MARLIN, TEX.—The Community Power & Light Company contemplates improvements to its plants at Marlin, Chilton, Rosebud, Mart, Mexia, Reisel and Lott, to cost about $500,000.

SAN BENITO, TEX.—The Valley Ice & Electric Company has authorized the construction of a transmission line in the lower Rio Grande Valley section, for light and power service in a number of communities.

VERNON, TEX.—The Waggoner Ranch Corporation, recently formed, plans to build an electric plant to cost about $60,000, for commercial power and light service in connection with the development of its property.

Pacific and Mountain States

COLBERT, WASH.—The Mount Spokane Power Company, Milan, plans to erect a transmission line from Chattaroy to Colbert, about 25 miles. A number of branch lines will be built for light and power service to different communities.

SEATTLE, WASH. — The Puget Sound Power & Light Company has been granted a number of permits for extensions in its transmission lines in the county.

TACOMA, WASH.—An ordinance is being arranged for the installation of an ornamental street-lighting system on South Thirty-eighth Street.

NEWPORT, ORE.—Plans are under consideration for the installation of electrically operated pumping machinery in connection with extensions in the municipal waterworks. P. W. Peasley, 603 Railway Exchange Building, Portland, is engineer.

ROSEBURG, ORE. — The California Oregon Power Company, San Francisco, has applied for a temporary permit covering a proposed hydro-electric development on the North Umpqua River. The application covers four units, the first at Lemola Falls, near Diamond Lake; the second at Ireland Falls, the third and fourth units to take in all the river from Steamboat Creek to the Narrows, near Idlyld Park.

BISHOP, CAL.—The Owens Valley Irrigation District plans extensions to its system, including the installation of electric power and pumping equipment. Bonds for $1,650,000 have been approved.

FORT MASON, CAL.—Bids will be received by the Constructing Quartermaster, United States Army, until Nov. 5 for motor, pump and auxiliary equipment for the pumping plant at Presidio, San Francisco.

LOS ANGELES, CAL.—Bids will be received by the Department of Public Service until Oct. 23 for high-voltage transformers (Specification P-314); also, for 35,000-volt lightning arresters (Specification P-317). James P. Vroman is secretary.

LOS ANGELES, CAL.—The Climax Engineering Company, Clinton, Iowa, manufacturer of refrigerating machinery, contemplates the construction of a power house at its proposed local plant, to cost about $115,000.

MILLBRAE, CAL.—The West Coast Porcelain Company will install electric power equipment at its plant in connection with proposed additions, to cost about $500,000.

OCEANSIDE, CAL.—Plans are being considered for the installation of electrically operated pumping machinery in connection with a new municipal waterworks system, to cost $80,000.

ORLAND, CAL.—The purchase of the local system of the Pacific Gas & Electric Company, to be operated by the municipality, is under consideration. It is proposed to purchase electricity from the company.

OXNARD, CAL.—The Ord Ice Company will install electric power equipment at its proposed ice-manufacturing plant at the foot of Enterprise Street, to cost about $75,000.

REDWOOD CITY, CAL. — The Pacific Portland Cement Company, Pacific Building, San Francisco, plans for the construction of a power plant at its proposed local mill, estimated to cost in excess of $750,000, with machinery.

SAN FRANCISCO, CAL. — The Great Western Power Company is considering an issue of $1,000,000 in bonds, the entire proceeds to be used for extensions and improvements to its system.

SAN FRANCISCO, CAL.—The Board of Supervisors of the city and San Francisco County have voted for the municipal distribution of electricity generated at the Hetch Hetchy project. M. M. O'Shaughnessy, city engineer, has been instructed to prepare plans.

SAN FRANCISCO, CAL.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 23, for 5,000 ft. of light and power wiring for the Mare Island navy yard (Schedule 1416.)

SANTA BARBARA, CAL.—A site has been acquired in Santa Barbara by the Southern California Edison Company on which it will erect a new transformer station, to cost about $150,000. The present transformer station on Castillo Street, near the carbarns, will be dismantled.

WOODLAND, CAL.—The Union Ice Company will install electric power equipment in its proposed local ice-manufacturing plant.

EMMETT, IDAHO.—Plans are being prepared for the construction of a hydro-electric plant at the Black Canyon Dam, to cost about $150,000. F. E. Weymouth, Boise, is engineer in charge.

TUCSON, ARIZ.—The Board of Directors, University of Arizona, plans to purchase equipment in connection with the establishment of an electrical engineering department at the institution. Professor Paul Cloke is head of the department.

NACO, ARIZ.—Frank J. Keogh, Naco, has applied for a certificate of convenience and necessity to build and operate an electric power plant to furnish electricity in the town of Naco.

CASPER, WYO.—The installation of electrically operated pumping machinery at the proposed new municipal waterworks is under consideration. Black & Veatch, Mutual Building, Kansas City, Mo., are engineers.

DENVER, COL.—A building permit has been issued by the city to the Public Service Company of Colorado for the construction of an automatic substation at Thirty-ninth and Columbine Streets.

Canada

CHEMAINUS, B. C.—The Weyerhauser Timber Company, Tacoma, Wash., plans to construct a power plant at its proposed local lumber mill, to cost about $1,200,000.

FORT WILLIAM, ONT. — The Great Lakes Pulp & Paper Company plans to build a power plant at its proposed new pulp and paper mill, to cost about $2,000,000.

HAMILTON, ONT. — The City Council has appropriated $14,000 for placing power transmission lines underground.

HAMILTON, ONT. — The Hamilton Hydro-Electric System contemplates the construction of a substation on the Beach Road, to cost about $40,000.

QUEBEC, QUE.—The Lower St. Lawrence Power Company has been granted permission by the Public Service Commission to erect a transmission line in the town of Matane.

MELVILLE, SASK.—The municipal electric plant was recently destroyed by fire, causing a loss of about $100,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued Oct. 2, 1923)

15,693 (reissue). TROLLEY WHEEL; O. Moore, Frankfort, Ind. App. filed March 26, 1919. Automatic sliding and rotating trolley wheel for use on electric cars.

1,469,208. SWITCHBOARD LAMP; E. A. Bohlman, Chicago, Ill. App. filed Feb. 14, 1921. Improved terminal strip for switchboard lamp.

1,469,210. MOTOR-CONTROL SYSTEM; A. H. Candee, Forest Hills, Pa. App. filed Nov. 29, 1920. For motors operating brooms of snow sweepers.

1,469,213. CONSTANT-CURRENT TRANSFORMERS; W. E. Douglass, Wilkinsburg, Pa. App. filed July 12, 1917. Moving-coil type.

1,469,253. CARRIER TELEGRAPH CIRCUITS; R. W. Deardorff, Brooklyn, N. Y. App. filed Oct. 21, 1920. Ordinary telegraph subscriber's circuit with channels of carrier system.

1,469,254. CARRIER TELEGRAPH CIRCUITS; R. W. Deardorff, Brooklyn, N. Y. App. filed Oct. 21, 1920. Means for associating local telegraph circuit loop with channels of carrier telegraph system.

1,469,259. CARRIER TELEGRAPH CIRCUITS; B. P. Hamilton, Brooklyn, N. Y. App. filed Oct. 21, 1920. Loop circuit used to transmit current to transmission line.

1,469,260. CARRIER TELEGRAPH CIRCUITS; B. P. Hamilton, Brooklyn, N. Y. App. filed Oct. 21, 1920. Relates to repeater apparatus.

1,469,264. REGENERATIVE BRAKING SYSTEM FOR ELECTRICALLY DRIVEN VEHICLES; H. Lübeck, Herserud, Sweden. App. filed Dec. 28, 1918. For vehicle driven by storage battery.

1,469,271. TESTING SYSTEM; H. Fletcher, New York, N. Y. App. filed Oct. 19, 1922. For determining efficiency of telephone transmitters.

1,469,295. ADAPTER; H. P. Donle, Meriden, Conn. App. filed Jan. 19, 1920. App. filed Jan. 19, 1920. For electron tubes.

1,469,302. MULTIPLE BOND FOR SIGNAL SERVICE TRACK-CIRCUIT RAILS; C. O. Harrington, Chicago, Ill. App. filed Sept. 24, 1920.

1,469,328. CIRCUIT ARRANGEMENT FOR RECEIVING RADIO ENERGY; E. Mayer and A. Leib, Berlin, Germany. App. filed Aug. 3, 1922.

1,469,337. BACKING ALARM AND SIGNAL FOR AUTOMOBILES; E. M. Sanborn, Oakland, Cal. App. filed July 14, 1919. Rear direction signal.

1,469,349. RADIO CONTROL SYSTEM; A. L. Wilson, Edgewood, Pa. App. filed April 1, 1921. Remote control of distant equipment.

1,469,400. DIRECT-CURRENT RELAY COMPENSATING COIL; A. R. Whitehorn, Downers Grove, Ill. App. filed March 5, 1921. For relays used in track signal systems.

1,469,418. APPARATUS FOR OPERATING DIRECT-CURRENT THREE-MAIN SUPPLY CIRCUITS BY MEANS OF METAL VAPOR RECTIFIERS; J. Kubler, Baden, Switzerland. App. filed Aug. 31, 1921. Main rectifier for feeding outer mains of three-wire circuit and two auxiliary rectifiers which supply part voltages.

1,469,438. ELECTRICAL APPARATUS FOR THE LOCAL AND DISTANT REPETITION OF MOVEMENTS; J. F. Gill and J. N. Chaviara, Liverpool, England. App. filed March 1, 1920. Step-by-step mechanism.

1,469,458. KINETIC HEAT INSULATION; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed Aug. 18, 1921. Electric oven.

1,469,469. METHOD OF AND MEANS FOR APPLYING THE INSULATION OF HIGH-TENSION COILS; S. R. Wright, Rawdon, England. App. filed Aug. 22, 1921.

1,469,471. ELECTROTHERAPEUTIC APPARATUS; E. Aba, Los Angeles, Cal. App. filed Nov. 12, 1921. Casing for high-frequency induction coil or resonator.

1,469,481. VEHICLE SIGNAL; P. J. Messer, Olean, N. Y. App. filed Nov. 7, 1919. Direction signal visible from front or rear.

1,469,558. INDUCTION WATTMETER; J. Harris, Lafayette, Ind. App. filed Jan. 26, 1920. For three-wire alternating-current system.

1,469,561. SIGNAL RECORDING AND TRANSCRIBING METHOD AND APPARATUS; M. R. Hutchinson, West Orange, N. J. App. filed Jan. 21, 1920.

1,469,582. IGNITION SYSTEM; E. G. Buresch, Chicago, Ill. App. filed Dec. 30, 1921.

1,469,584. TUBE-FORMING MACHINE; F. M. Case, Cleveland, Ohio. App. filed Dec. 30, 1921. For making porcelain insulating tubes.

1,469,588. ELECTRICAL HEATING DEVICE; P. E. Onwiler, Billings, Mont. App. filed Aug. 28, 1922. Water heater placed directly in pipe line.

1,469,603. LAWN MOWER; J. W. Peters, Roslyn, N. Y. App. filed March 2, 1921. Driven by electric motor.

1,469,626. ELECTRIC HEATING SYSTEM; J. W. Dorsey, Winnipeg, Manitoba, Canada. App. filed Sept. 18, 1920. Garment electrically heated.

1,469,652. SAFETY DEVICE; W. E. James, Beards Fork, W. Va. App. filed July 12, 1922. Fusible nip to protect gathering reel cable of electric motors and coal-cutting machines used in mines.

1,469,654. ELECTRIC CLIPPER; M. H. Kotzebue, Tulsa, Okla. App. filed March 16, 1920. Hair clippers electrically operated.

1,469,672. CAR-CONTROLLED TROLLEY-LINE CUT-OUT; J. H. Miller, MacDunn, W. Va. App. filed Oct. 5, 1922. For mine railway system.

1,469,720. BRUSH RIGGING; F. F. Dorsey, Rochester, N. Y. App. filed Dec. 31, 1921. For small electric motors.

1,469,727. THERMOSTATIC SWITCHING DEVICE FOR ELECTRIC IRONS; F. Jermin, Alpena, Mich. App. filed March 14, 1922.

1,469,736. STORAGE-BATTERY SYSTEM; R. H. Sullivan, Rochester, N. Y. App. filed May 4, 1922. Charging equipment for automobiles.

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W. H. ONKEN, JR.
Editor

HAROLD V. BOZELL
Editor

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Lay Aside the Habiliments of Strife!

IT IS an inspiring thing to see an idea travel and gain speed. There was a time when central-station companies armed themselves against their customers with legal swords and bucklers, laid down barrages of rules and regulations and set up entanglements of red tape, lest any applicant for service should encroach upon the company in some detail. To prevent unfair advantage on the part of the public they entrenched behind the grim ramparts of technicality and tradition and themselves took unfair advantage of the public in ways only possible because they stood in the position of power.

But those days have gone in most cities, and where they linger still their strength is visibly weakening—and it is high time.

Consider, for instance, the process whereby a fair-minded, virtuous citizen makes application to the electric light and power company (that he himself has enfranchised) for service which that corporation has been empowered to render in the public interest. In days gone by that meant a signed application, the payment of a deposit lodged as security, and then a delay to enable the wheels of system to grind out an order that would bring him light. Gradually, step by step, these creaking cogs in the machinery are being pried out and cast away, until the householder moving into a vacant dwelling in a city served by one of our most enlightened companies today finds the service ready waiting for the turn of a switch and a little card dangling from the hall chandelier welcoming him to the service and asking him to notify the office on his arrival.

The first utility company that—in defiance of tradition—proposed such a liberal policy of convenience to the public was looked upon by other central-station men as mad. Such free-thinking innovations since time began have been branded as pernicious practices destined to bring the world down about men's ears. But today in Baltimore, Cleveland, Harrisburg, Utica, New Orleans and probably many other cities the current is not turned off at all when homes become vacant. In New York, Syracuse and doubtless many more communities the meter is left in, that the new tenant may not be delayed when he arrives and wishes light.

It is only a matter of viewpoint after all—part of the slow transition from an intolerant state of mind, where all men assumed that the other fellow would impose on them if he had the chance, to a general acceptance of the oft-proved fact that most folks are honest and disposed to be fair. However, it is good business, since the cost of unbilled energy is far less than the cost of reconnections. All this but for example.

The world is moving up out of the mists, and the mind of man is gradually thawing in the sunlight. Public utility executives are learning that the exercise of helpful constructive service is both more profitable and more enjoyable than practicing any of the subtle arts of defense that they have considered so necessary for so long. But a little while and all this rusty armor of the era of strife will have been laid away, and the industry will discover how much easier it is to serve and grow when the mind is free to think ahead in the service of humanity.

Henry Metcalf Hobart

An author and engineer who applies his talents broadly to the development of engineering and to the cause of standardization.

IN THIS age of engineering specialization Henry M. Hobart is numbered among those who have not been attracted altogether from the path of the general practitioner to the more restricted field of special training and special service on particular engineering problems. He may, in fact, be said to be a leader among those engineers who are applying their talents broadly to all questions of compelling moment and whose training will fit them to cope effectively with almost any problem.

A hard worker, an individualist in his methods and with a high conception of his profession, Mr. Hobart brings an inexhaustible fund of enthusiasm to all questions. To him engineering is at once a business and a hobby. He is an authority on arc welding and has always been a stanch champion of the cause of international and national electrical standardization. The catholicity of his engineering interests is indicated by the wide range of subjects which have held his attention and on which he has written treatises.

He is known for his work in the development of mercury-arc rectifiers, already used successfully abroad, partly because of his pioneering activity, and for his studies in the design of special forms of generator windings. He performed noteworthy service during the war on the welding committee formed by the United States Shipping Board. He has brought the influence of his experience and knowledge to bear strongly on the results accomplished by the International Electrotechnical Commission, of which he is an active member.

Born in Boston, Nov. 29, 1868, where he received his early education, he was graduated from the Massachusetts Institute of Technology in 1889 and for the next five years was connected with the Thomson-Houston Company and afterward with the British company of the same name. Mr. Hobart resigned from the British Thomson-Houston Company in 1889 to become associated as consulting engineer with the Allgemeine Elektricitäts-Gesellschaft, Berlin, and three years later he established an independent consulting practice in London which he continued for eight years. In 1911 he became a consulting engineer for the General Electric Company, the position he now holds.

Among technical societies and associations Mr. Hobart has been particularly active as a member of the standards committee of the A. I. E. E., of which association he is a fellow; of the United States committee of the International Electrotechnical Commission and of the American Engineering Standards Committee.

Editorial Comment

Electrical World, October 27, 1923
Volume 82 Number 17

A Medal Team in Public Relations

A "SAFETY FIRST" medal team of the West Penn Power Company demonstrated its efficiency at the recent meeting of the Pennsylvania Electric Association. These men of the organization were the carefully selected group who had proved most proficient in grasping and applying first-aid principles. Each of them had won a company medal for proficiency, and pride in accomplishment showed in their faces at the Pennsylvania meeting. They came from the rank and file of the company employees.

Why not have a medal team of similar type for proficiency in improving public relations? Annually utility men and executives come together and agree that public relations work is fundamental in their business. Too frequently this is the end of the matter. All go home to attend to business, and because of the pressure of their everyday work their good resolutions about improving public relations soon become only a vague remembrance.

It would seem very possible to appoint a public relations director and organize an educational system in public relations work. Make public relations the definite job of one man and support his efforts by rewarding his proficient students. In public relations as in any other activity everybody's business turns out to be very much nobody's business.

Swallowing Camels and Straining at Gnats

THE attitude of some central-station executives toward investing money in commercial expansion as compared with engineering and plant investment affords a striking example of the biblical paradox quoted above. A case in point has recently come to light:

A certain company with a 3,000-kw. surplus of hydro-electric power serves a city of 50,000 population. It is not an industrial community, so the prospect of selling the excess capacity to power users is slim. However, it is imperative to find a market for the 3,000 kw., and building of transmission lines to connect a number of small towns has been proposed. To do this will cost upward of a million dollars. A commercial survey of the territory to be reached was very discouraging. It showed that nearly one-half the people who compose the population are of a class which would never become customers of the company. There was not enough real business in sight to pay carrying charges on the transmission lines, let alone earn a return on the total plant investment.

As an alternative the commercial man who made the survey proposed that the company adopt a plan of intensive development in the city of 50,000 already served. Residential customers have never been asked to use appliances and commercial customers follow their own judgment as to how much or how little illumination they require. The company's office is in one corner of a building on a back street where all the line material and other general supplies are kept. Customers find their way to this office and pay their bills as they pay their taxes—grudgingly. The commercial man proposes to change all this. He would find a new location in the business section, install an up-to-date electrical store, put on a force of salesmen, offer a 3-cent rate for cooking, and is confident that he can sell the surplus capacity of 3,000 kw. within two years. It could be done with an investment of not more than $50,000.

The powers that be hesitate. They incline toward the transmission lines, as something tangible that could be included in the value of the property. It would represent so much money spent for actual construction which they could feel with their hands, even though it would mean the expenditure of a million or more and not earn its salt. They cannot "see" spending $50,000—one-twentieth of the cost of the transmission lines—to get the business lying right at their feet. They can easily swallow the expensive construction camel, but they strain at the commercial gnat. The thought of putting a comparatively small sum into new business equipment to make their existing investment pay is unattractive.

This is, of course, an extreme case; but such a company does exist. It represents the product of a state of mind which still pervades the industry to a degree and is wasting money every day. To restrict the sales department in this manner, however, is one sure way of maintaining a high ratio of invested capital to annual income. No other business could long exist if its selling force were so hobbled. Still, the condition bids fair to continue until "the men higher up" awaken to the greater value of the dollar earned by intelligent selling over that of the dollar which comes in as a meager return on costly construction into new and unproved fields.

Low Distillation of By-products Making Progress

THE operating performance of the Walkerville station of the Ford Motor Company is awaited with interest by the central-station industry. This station involves the use of low-temperature distillation on a large scale, and if successful, it will afford great opportunities for securing a worth-while reduction in the cost of energy production from coal. Moreover, the scheme is reported to be such that it can be adopted by existing stations with a minimum amount of change in station arrangements. This results from the fact that the by-product plant can be made separate from the station proper.

The system as described consists of the use of a molten-lead bath over which the coal passes continu-

ously, with a resultant distillation of volatile matter which, when refined and condensed, gives appreciable quantities of gas, gasoline, tar, ammonium sulphate and some other oils. The coal after distillation is very largely coke, which can be used by any of the ordinary boiler coal-burning equipments.

Whether successful or not, the installation should determine conclusively the possibilities of using a by-product process in conjunction with the production of electrical energy. This mammoth experiment is but one of many that bring nearer an economic status where the supremacy of electrical power in promoting national prosperity and convenience will be even greater than now.

Simplifying Inductive Co-ordination

DURING the past two years some very encouraging results in handling inductive-interference problems have been brought about by the co-operation of telephone and power companies through the joint committee on inductive co-ordination. The first and fundamental agreement was that both services are essential to the public and that each must be rendered without making it economically impossible for the other to endure. With the subsequent code of principles which has been formulated and agreed upon by both interests a long step has been taken toward solving what once looked to be a very serious problem.

The geographical extent of both services is so great, however, and as a consequence the persons who are familiar with any local situation are so many, that it now appears to be a question how the well-formulated principles can best be applied. The problem is rapidly outgrowing the physical ability of any centralized organization like the joint committee, although this committee or some body with equivalent functions must always be looked upon as the co-ordinating force. At the present stage of the situation it looks as if many of the detailed investigations and conferences prior to the solution of any individual inductive co-ordination problem might be handled locally by sub-committees on inductive co-ordination, the final action to be passed upon or taken by the central body. As an indication that this can be practically undertaken attention might be called to the Nebraska inductive co-ordination committee, which has been functioning in the manner outlined for some time. It has found that local situations can thus be taken up more promptly, with more intimate information regarding the situation and with more closely interested and informed men participating, than in any other way so far tried. Naturally such pioneer work would not be perfectly co-ordinated with the national work, but it is expected that this phase of the matter would show constant improvements.

Whether problems of inductive co-ordination should be handled by state or divisional sub-committees is a question for the joint committee or the N. E. L. A. committee to decide. It must be said, however, that divisional committees might work under more handicaps than a state committee owing to the distances which delegates would have to travel and their less intimate acquaintance with each case. Furthermore, the conditions in each state may differ in such a way that state committees would be in a better position to function effectively.

This subject is already receiving the consideration of the National Electric Light Association, and if it decides that more effective and expeditious action can be secured through the sub-committee plan, it is to be hoped that every interest will co-operate in the establishment and operation of such sub-committees.

High-Voltage Continuous-Current Generators

IT IS interesting to speculate as to what would have been the probable course of the development of electric power transmission equipment if in the early days it had been possible to produce direct-current generators of higher and higher voltages to keep pace with the increasing distances of distribution and transmission. The direct-current generator in its essential elements was a finished machine before the alternator and the transformer, and for a short period before the development of the latter there was a marked delay in the expansion of power distribution owing to the low operating voltage of direct-current generators. Alternating-current transformation and transmission offered so simple a solution as to eclipse completely for a long time some of the advantages possessed by the continuous-current system.

The principal limitation in the increase of voltage in the direct-current generator has been the question of commutation. The first great improvement for offsetting this difficulty was the use of the commutating pole, providing as it does a reversing field at commutation, and so permitting not only increased loading but also higher voltages. But even with this manifest advantage the commutating pole alone has its limitations. It does not completely neutralize armature reaction, and it even introduces troublesome distortion of the normal field flux. An interesting result of a closer study of the commutating pole, and of the conditions in the direct-current armature, is described in a paper presented by S. R. Bergman before the 1923 annual convention of the American Institute of Electrical Engineers. In this paper the author describes the development of a continuous-current generator rated at 15,000 volts and 15 kw. The successful construction of such a machine has been made possible by the use of a compensating winding closely encircling the armature and placed in slots on the field pole, by a distributed form of field winding occupying the same slots, and by the use of a commutating pole with sufficient separation from the field teeth to remove the exciting flux from the coils undergoing commutation. In other words, by the point-to-point neutralization of armature reaction, by a sine-wave-flux distribution, and by proper design of the commutating pole, it has been possible to raise the total voltage to the figure mentioned, notwithstanding the fact that the voltage between commutator bars is approximately four times the present conventional value. The machine also embraces a new type of commutator construction, combining mechanical strength with high insulating properties. It is stated that, in conjunction with vacuum tubes, the machine meets admirably the needs of radio transmission for conversion into high-frequency alternating current, operating continuously with perfect commutation.

It is interesting to recall that some of the advantages of the commutating pole were pointed out very early in the history of the development of the direct-current

machine and that it was neglected over a considerable period of years. Very much the same may be said of the compensating winding. Its advantages were pointed out by Ryan many years ago. While it has had a notable application in various types of alternating-current machinery, particularly in the series commutator motor, its use in direct-current machinery has been practically nil until its introduction in the machine mentioned above.

Two Interests Involved in Patenting Engineering Arrangements

ANY one who is watching the patents issued each week by the United States Patent Office will probably have observed that a number of patents are being granted to engineers for various arrangements of engineering equipment as distinguished from designs of the apparatus itself. No doubt there are more applications for similar patents.

The situation is particularly worthy of consideration in the electrical industry because many utility companies and industrial plants in the United States have been working during the past years of development on the basis that they were free to arrange or install apparatus which they purchased in any way they desired. As an outcome of the new movement toward patenting these arrangements some companies will begin to find that they have independently developed and installed, or even purposely copied, some other company's arrangements of equipment, which were considered free property to all at the time they were adopted, but which have since been patented. For example, patents have been issued on at least one isolated phase arrangement, and others have been granted on various combinations and arrangements of heat-balancing equipment and boiler arrangements. Any company which has duplicated these specific arrangements has technically infringed a patent.

If this wave of patenting engineering arrangements spreads, it is the belief of some engineers that it will seriously hamper the development of the industry because of the preliminary searches which will have to be made hereafter to avoid the infringement of patents and because of the royalties which some companies will have to pay engineers or other companies, where they have intentionally or unintentionally copied some patented arrangement of equipment. While this argument has a logical basis if patents of the kind mentioned increase, it must be remembered that operating companies are not the only ones to face this situation. Ever since the patent system was adopted to permit the inventor of a new device to profit financially from the commercial development of his idea, the same situation has faced all manufacturers. They, too, have been handicapped in using ideas promiscuously, but they have recognized that the originators of ideas are entitled to remuneration and that withholding this compensation would discourage many new developments.

In other words, if this new patent situation comes to a point where it gives prospect of becoming burdensome, every one will have to remember that the two interests involved must receive equal consideration. There is the right of the individual who develops a new idea to profit thereby, but, on the other hand, the development of the industry in which the public has a great interest must not be unnecessarily hampered.

The solution of the problem, if there is any problem, will undoubtedly be found in the practices and the experience of manufacturing companies which now have to contend with the patent situation every day in the development of new apparatus. Some of these companies have taken the broad-minded attitude of allowing engineers to patent ideas which they have developed in their employ and then paying them an equitable price for the patent. Other companies require that all employees sign a contract relinquishing patent rights secured while in their employment to the employer. Between independent manufacturing companies there are signs of co-operation in the form of an exchange of patent rights. Whether these methods are applicable or desirable in the utility and industrial fields, where so many more companies are involved, is a question.

Standards in Hats and in Manufacture

IT WOULD not be easy to design a standard woman's hat if more than one man or woman was concerned in its design. It would be very difficult to get any organization to adopt the standard hat and it would be next to impossible to get all women to wear it. Style, personal opinion, facial architecture, complexion artistry, economics and other elements present an impassable barrier to hat standardization. In some degree, depending on the article, this same condition holds true in manufacture. The archives record many instances where a committee or an organization has adopted a standard device or specification which became a dead letter because the user would have none of it. Standards, to be worth while, must be followed through and carried out as commercial practices.

It is just such conditions—commercial jealousies, personal animosities, false economic conclusions and the general cussedness of humans by and large—that make the work of any standards committee disheartening and exhaustive. Over and over turns the treadmill of repetitive arguments, the committee reacting to the varying personalities in the industry immediately concerned and diplomatically presenting the larger perspective to conscientious objectors. Progress is snail-like and its a "fifty-fifty bet" whether standards when adopted will be followed. Yet progress does occur under these conditions, and the most cursory view of the accomplishments of engineering standards committees gives cause for congratulations to the committees and to industry. Steadily, persistently they are carrying forward the work, and industry is beginning to appreciate the substantial value of their recommendations. As a result, a large proportion of the adopted standards are carried into commercial practices.

The principle of standardization is of especial appeal and interest within the electrical industry because of the complexity of the products, the desire to simplify electrical equipment in the interest of popular understanding, and also a natural caution lest the expansion of the industry be curbed by repressive measures. And so it is ever a live topic before electrical men and an accepted common objective. Long-continued educational activities, fair treatment, unbiased judgment, co-operative attack and infinite patience have produced the present encouraging situation in standardization activities, and easier and easier become the tasks of standards committees because the work has been tried in the crucible of commercial competition and found worth while to industry.

Typical Swedish Hydro-Electric Developments

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1. The 55,000-kw. state plant at Älvkarleby is a splendid example of the standard Swedish low-head type of construction. The head is 60 ft.

2. The intake dam at Porjus has 600 ft. of Ambursen type spillway and a 40-ft. timber chute with a roller gate.

3. At Porjus the waters of Greater Lule River are led to and from the turbines through tunnels and the distribution basin is roof covered to prevent freezing during the four-months arctic night.

4. Yngeradsfors is another typical low-head plant.

5. Röttle, near the Lake Vättern, is one of the few Swedish plants with more than 300-ft. head.

Illustrations Nos. 2, 3 and 4 are published by courtesy of Borgquist, Sweden. Illustration No. 5 by courtesy of Vattenbyggnadsbyran, Stockholm.

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Water-Power Development in Sweden

Far-Flung System of Low-Head Plants Extending to the Arctic Circle Is Fast Being Interconnected Into One Great Group—How Hydro-Electricity Is Supplemented by Steam

By W. BORGQUIST
Director of Plant and Operation, Royal Board of Waterfalls, Stockholm

A SURVEY recently made by the Swedish Electrification Committee showed that about 750,000,000 Swedish crowns ($200,000,000) is invested in electric generating and distributing plants in Sweden. The total railroad investment is only about 1,600,000,000 crowns, or little more than twice as much, indicating what an important part the electric power industry plays in the economic life of the nation. The energy production is estimated at about 2,500,000,000 kw.-hr. per annum, with an aggregate peak of about 1,000,000 kw. The greater part of the energy is utilized in high-class industrial and domestic service, as shown in the tabulation below:

	Per Cent
Wood, wood pulp and paper mills	35
Mines, iron and steel works	10
Mechanical industries, textile mills, etc.	10
Railways and railroads	5
Domestic uses in cities and towns	5
Farms and villages	5
Electrothermic and electrochemical industries and steam generation	30

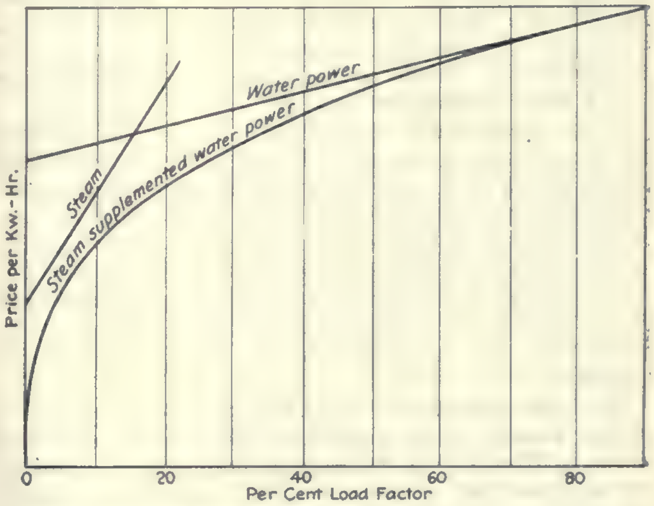
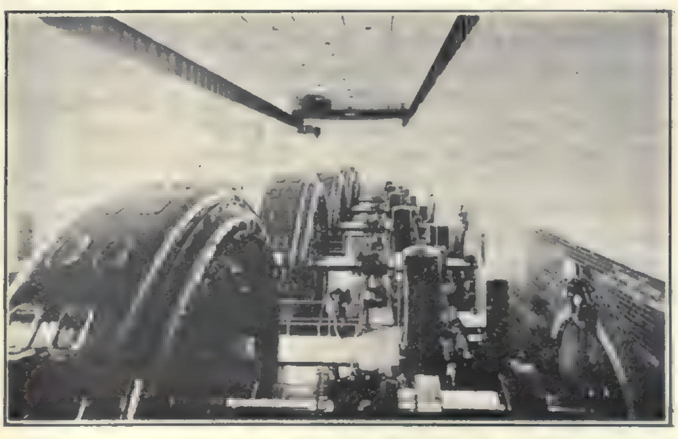


FIG. 1—STEAM SUPPLEMENTED WATER POWER COMPETES SUCCESSFULLY WITH LOCAL STEAM PLANTS EVEN FOR PEAK ENERGY

Although about 95 per cent of the energy is generated in hydro-electric stations, steam stations have played and still play an important part. The first electrical power stations were local steam plants, and through them a market was developed. The steam plants, therefore, paved the way for the hydro-electric developments, while at the same time serving as competition and automatically keeping the price of hydro-electric energy down to a level corresponding to the lowest possible fuel and maintenance cost of steam-generating stations. With the rapidly increasing power demand, however, hydro-electric energy had to be utilized more and more, and the steam stations finally acted only as stand-by stations or were used at peak loads. Thus the bulk of the load was supplied from water-power stations. However, for a time this increased the difficulties of hydro-electric development because it was not possible at first to utilize the generating and transmitting plants at full capacity.

Competition between water power and steam power has however, gradually subsided, and by increasing the reliability of service and offering reasonable rates the hydro-electric systems have now secured the greater part of the power business. Steam stations are maintained for use at low-water periods and to supplement the available water-power supply of energy, particularly at times of peak load and during seasons of flood water, when the head in hydro-electric stations is reduced. By

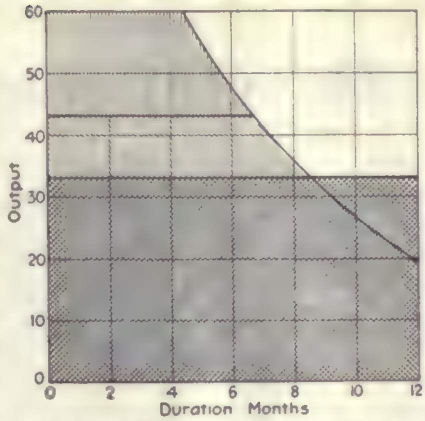


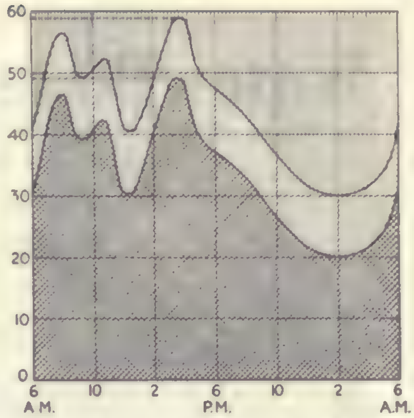
HORIZONTAL UNITS ARE USED IN LOW-HEAD STATIONS

At Left—The generator room at Älvkarleby contains only the alternators and governors. The turbines lie to the right, in open turbine chambers, while all switching equipment is in the substation building, on the bank of the river to left of the station.
At Right—The subterranean generator room at Porjus, hewn out of solid rock.

this means centralized water power, supplemented by centralized steam power, is able to compete successfully with local steam stations even for the peak load. This, of course, does not apply in industries where low-grade by-products and refuse are burned, as for instance, sawdust, or to the paper and sulphite industries, where a great deal of steam is used for heating purposes.

The cost curve of a hydro-electric plant usually takes the shape shown at top in Fig. 1. Consequently, in Sweden, the energy is sold at a fixed rate per kilowatt plus so much per kilowatt-hour. While a steam plant has a lower investment cost the cost per unit developed is higher and the price curve takes the form shown at the left. A comparison of the curves shows that a local steam plant can always compete successfully with water power on loads of low factors. As a matter of fact, however, a large water-power station with a steam standby is usually able to work on a cost curve similar to the parabola in Fig. 1, and therefore is in a position to compete successfully with a local steam plant, not only on base-load but also on peak-load business.





FIGS. 2 AND 3—(AT LEFT) AVAILABLE POWER IN STEAM SUPPLEMENTED WATER-POWER PLANT. (AT RIGHT) AVERAGE LOAD CONDITIONS IN THE HIGH-WATER SEASON

In large Swedish water-power plants the available power usually varies about as shown in the duration curve in Fig. 2. The generating equipment as a rule is so designed that it may be fully utilized for energy production during four or five months of a normal year. The demand, however, is greater than the available nine months' power, so that steam power must be used to supplement water power, and a block of energy corresponding to the cross-hatched area in Fig. 2 is made available all the year. Fig. 3 shows the load variation during a normal day with full water supply. If sufficient day-to-day hydraulic regulation facilities are available, the primary power cross-hatched is taken care of all the year by the combination of water power and steam. During six to eight months secondary power, corresponding to the obliquely lined area, is delivered on a yearly contract basis at reduced rates and during flood season off-peak energy, corresponding to the vertically lined area, is dumped at very low rates in electric-steam boilers, in pulp mills and similar plants.

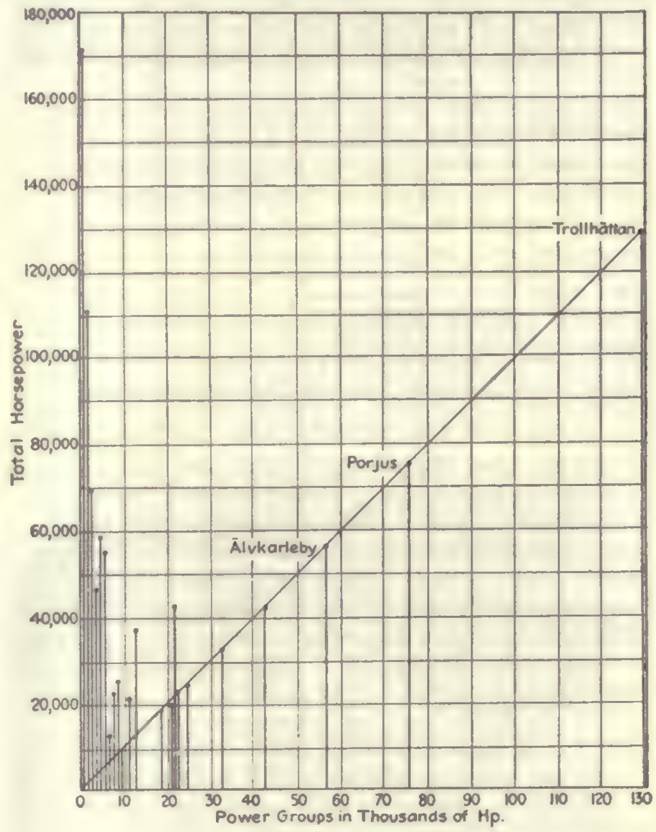


FIG. 4—SWEDISH HYDRO-ELECTRIC DEVELOPMENTS ARRANGED IN GROUPS ACCORDING TO OUTPUT

By hydraulic regulation and co-operation and interconnection of the different generating stations the supply of hydro-electric energy is made more reliable and a greater part of the available total energy can be utilized for high-class purposes. The cross-hatched areas then grow bigger, without change in generating equipment, and the reserve steam plants have less and less to do during normal years. In practice, the electric generators in the auxiliary steam plants are utilized as synchronous condensers for supplying the necessary reactive kilovolt-amperes so that the hydro-electric generating equipment may be utilized to full kilowatt capacity.

Many Small Power Sites with Low Head

If Sweden's hydro-electric stations are grouped according to rating, and the aggregate turbine capacity of each group is plotted against the group individual rating, a diagram like that in Fig. 4 is obtained. The diagram shows that the evolution has been rather

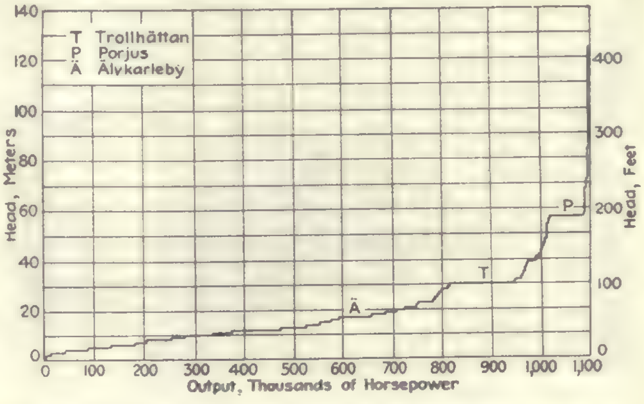


FIG. 5—THE MAJORITY OF THE SWEDISH WATER-POWER STATIONS ARE OF A LOW-HEAD TYPE

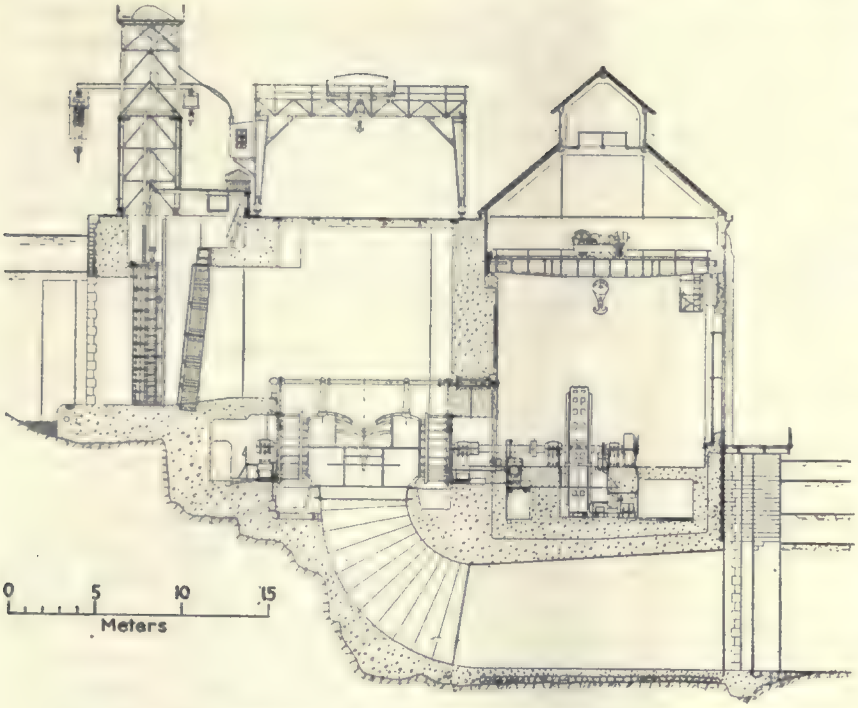
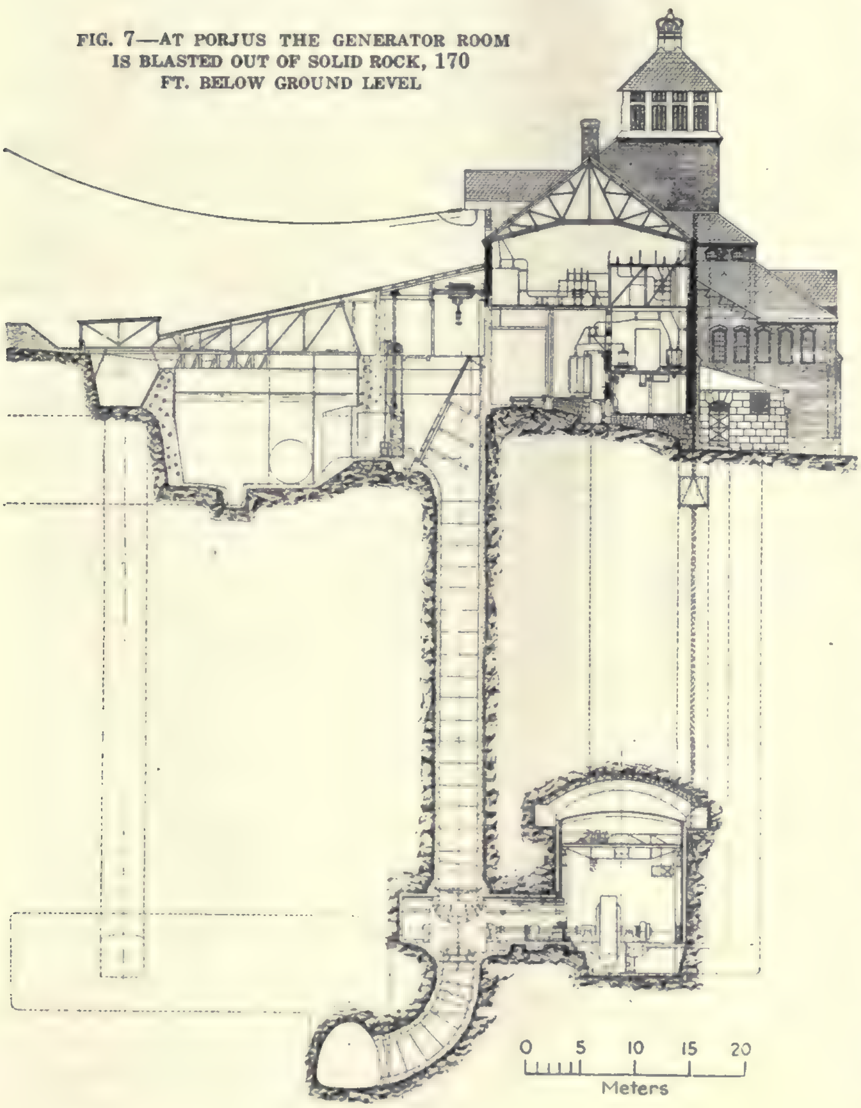


FIG. 6—THE UNTRA PLANT IS TYPICAL OF A LARGE GROUP OF SWEDISH WATER-POWER STATIONS WITH LOW HEAD

FIG. 7—AT PORJUS THE GENERATOR ROOM IS BLASTED OUT OF SOLID ROCK, 170 FT. BELOW GROUND LEVEL



democratic in character, as a considerable part of the total turbine capacity is represented by stations of very moderate size. The diagram of Fig. 4 was made by the Royal Board of Trade in 1917, and if brought up to date would show the same tendency, only more pronounced, since the fuel crisis during the years 1918-1920 caused a considerable number of more or less unimportant sites to be developed.

The majority of Swedish water-power stations operate under low hydrostatic heads. This is shown very clearly in Fig. 5, where the stations are grouped according to height of head. Each station is represented by a horizontal line proportional in length to the turbine capacity. It will be seen from the diagram that about 85 per cent of the hydro-electric capacity is represented by stations operating under a head of a hundred feet or less.

The low head has naturally resulted in a relatively high investment per horsepower. However, investigations by the Royal Board of Trade have shown that at heads above 15 m. the specific investment decreases very slowly with the increasing head. Stations rated at more than 5,000 turbine horsepower show an average investment of 300 crowns ($80) per horsepower. Although many plants were built or enlarged during the war, the average investment cost is only about 50 per cent above pre-war value.

Some Typical Stations

Some typical Swedish power stations are illustrated in Figs. 6 to 10.

The Röttle power plant, shown in section in Fig. 8, operates under a head of 105 m. and is an example of the few high-head plants in Sweden.

The Porjus station on Lule Alv—near the Polar Circle—with its 57-m. head, represents the medium high-head group. In this station the generator room is a subterranean chamber blasted out of solid rock. Similar construction has also been used in the power station at Mockfjärd on Västerdalälven and will be used for a number of projected large power stations, where a series of rapids is utilized rather than one concentrated waterfall.

The Untra power station on the Dalälven is typical of a great number of medium low-head plants. It has open concrete turbine chambers and horizontal-shaft twin turbines, operating under a head of 12.4 m.

Of a similar type, but belonging to the extreme low-head group (5.5 m.) is the Fleminge power station, shown in Fig. 9, with its horizontal double-twin turbines.

Fig. 10 shows the station at Lilla Edet, a more recent development in the same group, which is now under construction on the Göta Alv. This plant will operate under a head of from 6 m. to 7 m. with a minimum flow of about 400 cu.m. per second. By using turbines of the Kaplan and Lawaczeck types, with vertical shafts, it has been possible to employ large units, with a diameter practically equal to the operating head, for this station.

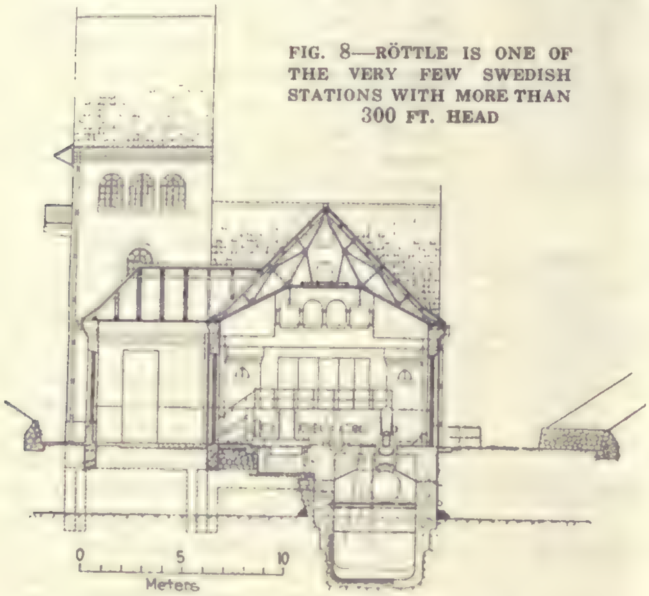


FIG. 8—RÖTTLE IS ONE OF THE VERY FEW SWEDISH STATIONS WITH MORE THAN 300 FT. HEAD

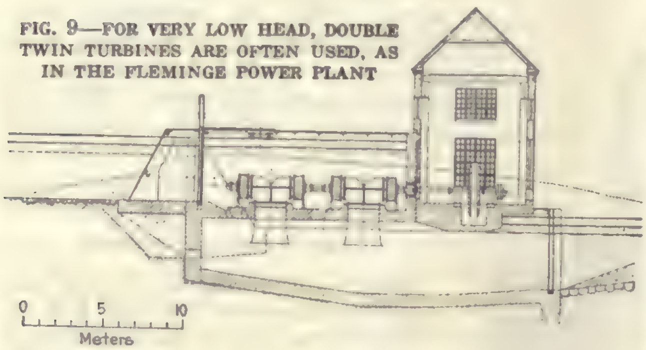


FIG. 9—FOR VERY LOW HEAD, DOUBLE TWIN TURBINES ARE OFTEN USED, AS IN THE FLEMINGE POWER PLANT

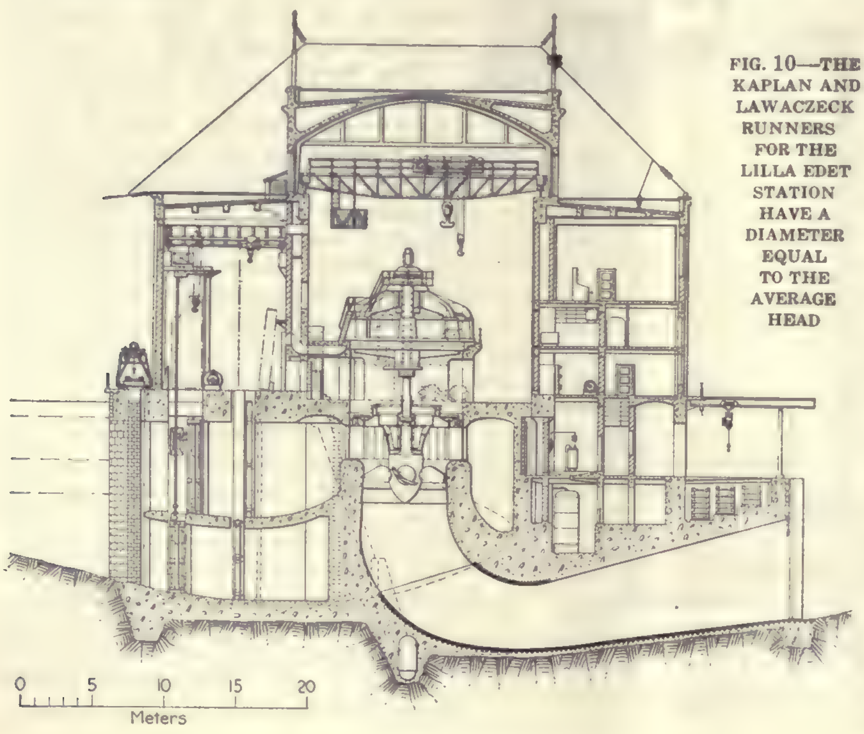


FIG. 10—THE KAPLAN AND LAWACZECK RUNNERS FOR THE LILLA EDET STATION HAVE A DIAMETER EQUAL TO THE AVERAGE HEAD

The early local stations were almost always equipped with direct-current generators, and by means of storage batteries the fuel economy was improved as far as possible. With cheap three-phase energy available from hydro-electric stations alternating current is used directly for distribution in suburbs and newly settled districts and also has a decided tendency to crowd out the direct-current system in spite of the better reserve offered by the latter.

It is now generally agreed that 50 cycles is to be chosen as the standard frequency for a future all-Swedish power system. In southern and middle Sweden hundreds of individual power stations of this frequency, state-owned and private, are already interconnected for co-operation and power interchange.

The voltage series 44-77-132 kv. probably will be chosen as standard for interurban power transmission. This series does not conform with the voltages chosen in certain other European countries, but has been adopted for the following particular reasons: (1) Forty-four thousand volts is considered to be the highest voltage at which pin-type insulators may be used on long lines with complete reliability. (2) There is no material difference in cost for a chain insulator line when the voltage is raised from 66,000 to 77,000 and hence there is no reason to stop at any value below $\sqrt{3} \times 44,000$ volts. (3) A voltage of 132,000 ($\sqrt{3} \times 77,000$) is the lowest tension that can be used to advantage for interconnecting trunk lines over the distances determined by geographic conditions in Sweden.

For lines of moderate length 22,000 volts and 11,000 volts are generally used, and local lines are usually operated at 3,300 and 1,650 volts.

Great simplification of substations has been obtained by abolishing the use of horn gaps, condensers, induction coils and similar protective equipment. On the other hand, interest has been concentrated on the problem of obtaining a perfectly reliable insulation for transformers and lines.

In the southern part of the country, the South Swedish Power Company, privately owned, is the most important electrical enterprise. Its system is supplied from seventeen water-power stations, including the Lagan and Hemsjö stations, and aggregates about 50,000 kw. These are supplemented by two steam stations, with an aggregate rating of 18,000 kw. This company also has acquired control of the Finsjö plants on the east coast and is building a 132,000-volt line to interconnect different parts of its system.

In central Sweden the state power system predominates. The interconnected hydro-electric stations at Trollhättan, Alvkarleby and Motala, with a total generating capacity of 175,000 kw., and the steam plant at Västeras. rated at 40,000 kw., supply a great part of central Sweden with electric energy. To this system are also tied almost all private power systems of importance in that part of the country.

For two years a regular interchange of electrical energy has been going on between the interconnected stations, in many cases under long contracts. Certain misgivings have been felt regarding the advisability of tying together such a great number of synchronous stations, and of course it has been necessary to take certain precautions, but on the whole the plan has worked out very well.

Among private enterprises in southern Sweden which co-operate with the state system are the Yngeredsfors Power Company, with a generator rating of 10,000 kw.; the Gullspäng-Munkfors Power Company, with 18,000 kw., and the municipal system of Norrköping, with 5,000 kw.

In the iron-mining district in central Sweden the greater part of the existing water-power stations are operated by a common management, the Bergslagens Gemensamma Kraftförvaltning Company, the biggest co-operative combination of its kind in Sweden. To this system, which is also connected to the central network, belong the power stations of the Grängesberg-Oxelösund Company, with a total of 17,000 kw., and those of the Stora Kopparbergs Bergslags Company, aggregating 40,000 kw., located at Mockfjärd, Bullerfors, Kvarnsveden, Forshuvudforsen, etc. In the same region lies the Hällefors Bruks Company system, a combination of about twenty smaller hydro-electric stations, totaling about 15,000 kw.

The Uddeholm Company has developed 45,000 kw. in a number of waterfalls along Klarälven. These stations operate at 25 cycles and are not connected to the central power group. Another isolated 25-cycle system is Stockholm's municipal plant at Untra, with 30,000 kw. installed generator capacity, which is supplemented by a steam station of 33,000 kw. at Värtan, near Stockholm.

In the northern part of the country interconnection has not progressed very far and is mostly local in character. Following the coast northward, there are the power systems of the Bergvik-Ala Nya Company (4,000 kw.), the Arbra Company (3,000 kw.), the Skönvik Company (5,000 kw.) and the Kramfors Company (8,000 kw.). Further inland are the plants at Alby and Ljungaverk, with a total of 25,000 kw., and Hissmoforsen, with 7,000 kw.

These regions are still rich in undeveloped water power, but the power resources of central Sweden will be fully developed in a few years. To meet the steadily increasing demand for power in the industrial regions of central Sweden it will therefore be necessary to transmit power from the north. Anticipating this necessity, the state has purchased certain water rights in Norrland, among others at Stadsforsen on the Indalsälven, where about 100,000 kw. may be made available. In the not distant future a 132,000-volt line will probably be built from Stadsforsen to Västeras, and the last-mentioned isolated northern power systems then may be linked up with the central power group, if conditions should warrant.

In the Far North the most important electric power system is that of Porjus, where at present 55,000 kw. is developed. The power station at Porjus mainly delivers single-phase energy to the electrified railroad from Lulea to Narvik and three-phase to the Gellivare mines, but the entire northern coast district soon will be supplied with industrial and domestic power from this source.

It was recently decided to begin at once to electrify the railroad between Stockholm and Gothenburg as a first step toward a more general electrification of the main railroad lines. This railroad is to be supplied with energy from the general system of the central group, and this probably will tend to strengthen the existing tendency toward co-operation. Moreover, the lines of the South Swedish Company will very probably be linked up with the central group before long by a 132,000-volt trunk line between Trollhättan and Lagan, which in its turn may ultimately enter as a link in a projected inter-Scandinavian power system, carrying water power from Norway and Sweden to Denmark, and perhaps still further southward into Germany.

FIG. 11 — IN SOUTHERN AND CENTRAL SWEDEN HUNDREDS OF PRIVATE AND STATE-OWNED GENERATING STATIONS ARE INTERCONNECTED TO ONE "CENTRAL GROUP"

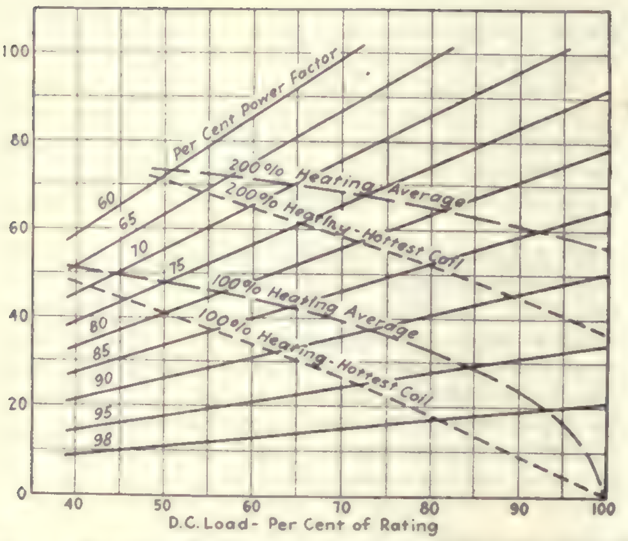


FIG. 2—RELATION BETWEEN HEAT DEVELOPED IN HOTTEST COIL OF SIX-RING BOOSTER CONVERTER AND POWER FACTOR FOR VARIOUS VALUES OF D.C. LOAD

When the power factor is not unity the minimum heat is produced in some other coil than the mid-coil. For example, suppose the current leads the voltage 15 deg. The alternating and direct currents will be in phase opposition in that coil which is 15 deg. ahead of the mid-coil, but the heat developed in this coil will be greater than that of the mid-coil at unity power factor because of the increase in the magnitude of the alternating current caused by the power-factor change. The heat developed in the leading tap coil will be reduced, that developed in the lagging tap coil will be increased, and that in the armature as a whole will be increased.

It is evident, therefore, that the converter should not be used at its rated output unless the power factor is closely adjusted to unity. It is, however, quite feasible to operate at a leading power factor so as to obtain very considerable reactive compensation, provided the direct-current output is reduced. With a direct current output limited to 80 per cent of that permissible at unity power factor, the converter may be used to supply a reactive component which in kilovolt-amperes is from 18 to 33 per cent of the rated kilowatt output, the exact figure depending on the possibilities for heat interchange between the various armature coils. This is to be compared with the 60 per cent reactive correction possible with synchronous-motor operation under the same conditions.

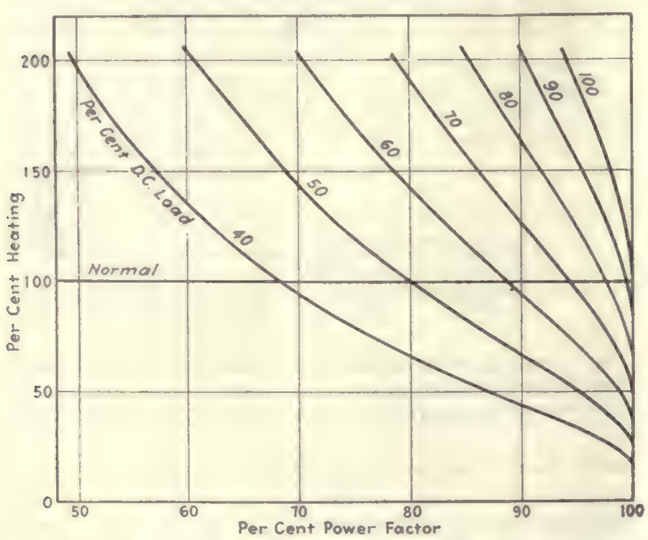


FIG. 3 — RELATION BETWEEN REACTIVE AND DIRECT-CURRENT LOADS OF SIX-RING BOOSTER CONVERTER FOR VARIOUS POWER FACTORS, SHOWING ALSO LIMITING LOADS FOR 100 AND 200 PER CENT OF NORMAL HEATING

FIELD MUST BE CONSIDERED

Since the supply of leading reactive load depends on the possibility of increasing the excitation above that necessary for normal full-load operation at unity power factor, the field coils must be capable of carrying the extra current. In order to permit the converter to operate at 50 per cent direct-current load with 45 per cent reactive load, the induced voltage must be increased about 10 per cent above that required for full-load unity-power-factor operation. This will require roughly 20 per cent increase in the exciting current, which in turn will heat the fields 40 to 50 per cent above the normal value.

The effect of the booster elements of a converter of this type as regards heating must be considered. If the booster is used to reduce the output voltage, it acts as a synchronous motor, helping to drive the converter proper, and the input is correspondingly decreased. The relative phase of the induced voltages in the booster and converter is determined solely by the relative position of the armature on the shaft, which should be such that the voltages are in phase. In this case the additional current due to the booster action is a power component only of the total input current.

DETERMINATION OF TOTAL LOAD WHICH MAY BE CARRIED

D.C. Load	Reactive Load at 100 per Cent Heating, Based on Hottest Coil	Reactive Load at 100 per Cent Heating, Based on Average Armature	Arithmetical Sum, Based on Hottest Coil	Arithmetical Sum, Based on Average Armature
40	48	51	88	91
50	41	48	91	98
60	34	44	94	104
70	27	39	97	109
80	18	33	98	113
90	9	24	99	114
100	0	0	100	100

A series of curves can be used to show the operation of the converter for power-factor correction. The curves were calculated for a six-phase converter, but the general conclusions as to heating, etc., apply to other types as well. The assumption was made that the rotational losses were constant and equal to 4 per cent of the input at full load, unity power factor, normal voltage.

The curves of Fig. 1 show the relation between the full-load heating in the armature of a six-phase booster converter and the power factor referred to the heating at normal load operation. Normal 100 per cent heating is considered to be the heating which exists at full-load current, 100 per cent power factor and normal voltage, in the hottest coil and in the average armature respectively when operating as a converter.

The relation between the heating of the hottest coil of a six-ring converter armature and the power factor for various constant values of the output is shown in Fig. 2. The curve for 100 per cent load is the same as the "normal voltage," hottest-coil curve of Fig. 1. The curves indicate quite a field of operation for lightly loaded converters without exceeding normal hottest-coil temperatures.

In Fig. 3 the curves indicate the relation between

the reactive and direct-current loads of a six-ring converter for various power factors and in addition the limiting loads for 100 per cent and 200 per cent of normal loading.

Consequently these curves give the limiting values of the reactive load which the converter may develop simultaneously with any particular direct-current output, according to whether the limit is considered to be due to the average or to the hottest coil heating equivalent either to direct-current rating or to a direct-current overload of 41 per cent at 100 per cent power factor. It will be seen that the total load which may be carried is determined roughly by the arithmetical sum of the direct-current load in kw. and the reactive load in kva., instead of being determined by the quadrature sum as is usual in the synchronous motor. The table, taken from the curves of Fig. 3, shows this statement to be true.

Street Lighting—An Undeveloped Source of Revenue

Adequate Illumination of Thoroughfares Presents Big Commercial Opportunity—Comparative Value of Load—Cost Data After One Year's Experience in East Cleveland

By G. E. MILLER
Sales Manager Cleveland Electric Illuminating Company

WHILE there undoubtedly has been an awakening of interest among central-station men in an effort to improve street and highway illumination, the problem has not been attacked from a strictly commercial angle. The initial investment in street-lighting equipment has also been such as to discourage many companies in their negotiations with city authorities. In East Cleveland a plan was worked out whereby the city installed at its own expense the poles, brackets and lamps, while the Cleveland Electric Illuminating Company provided the necessary overhead and underground distribution to lamps, transformers, etc. The details of the plan, together with cost data after one year's operation, were laid before the Sales Managers' Convention at Association Island last July by G. E. Miller, sales manager of the company. Mr. Miller has made a careful analysis of the value of this business to the central-station company and points to a large potential field which has been sadly neglected.

STREET lighting business in general is a field for the sale of central-station service which has been neglected by commercial men. This class of business has not kept pace, in so far as volume is concerned, with general development in the electrical industry.

Lighting the streets of our municipalities by electricity was one of the very earliest extensive uses of central-station service. This development was initiated at a time when none of our companies had even the semblance of a sales department. Street lighting was allowed to drift, and what progress has been made generally followed the lines of least resistance instead of being impelled by the vigorous selling effort which has characterized our development along other lines.

Then, too, there was not the justification for flooding our streets with light in the early days. That was the era of the horse-drawn vehicle and slow-moving traffic, when our streets were still adequate for the purpose of their design. With the passing of years there came a radical change in traffic conditions until today every large city, and even those of moderate size, have traffic problems difficult of solution. With this changed condition and the attendant increase in density of population there has come also an appalling increase in lawlessness and crime at night.

Statistics are now available to prove the value of intensive street lighting as a factor in reducing crime. It is also true that street lighting is beginning to be recognized by municipal authorities as a preventive measure in controlling crime and lawlessness. Aside from conditions in the congested areas of our cities, to which this applies in particular, there is the outlying highway, which owing to darkness at night presents a problem almost as serious.

For the lack of aggressive sales effort the improvement in quality of street lighting has not kept pace with the advance in the lighting art. Unlike the case of industrial and commercial lighting, improvements in the efficiency of light production accomplished by the high-power gas-filled incandescent lamp have in street lighting very largely gone into a reduction of the wattage rather than toward providing higher levels of lighting with the same or greater wattage. This would have been logical had the quantity of light supplied originally been ample, which it was not.

It is not too much to say that wherever the requirements have been studied on a sound engineering basis the conclusion has been that from three to ten times the amount of light now in use on the average is necessary and should be provided. This would mean that instead of an average spacing of 500 ft. or 600 ft. between lamps, as is now common (eliminating limited "white way" areas in business districts), there should be a lamp for each 150 ft. or 200 ft. of street, at least in residential sections, with a minimum consumption of 200 watts per lamp. For important streets or thoroughfares larger lamps, say 500 watts in size, are needed, and when these are placed on each side of the street in accordance with good practice, there is a minimum of one such lamp for every 100 ft. or 150 ft. of street—fully ten times the wattage so often found in the present sadly underlighted condition.

In considering the desirability of a street-lighting load as compared with other loads there are a number of factors which are worthy of note.

Street lighting is a fixed load throughout a contract period of from five to ten years. Its revenue is assured through periods of industrial depression as well as of prosperity. Rarely are there any bad debts or loss of revenue. This does not hold true for many power applications and other forms of lighting.

Street lighting operates usually as an all-night load of 4,000 hours, or an average of eleven hours a day. While it may include the evening peak, it also ranges through the midnight to morning valley in the load curve.

The revenue per connected kilowatt in street lighting is especially high in comparison with other forms of load. The following illustrative comparisons may serve to picture this a little more clearly:

A street lamp of 200-watt size consumes 800 kw.-hr. a year at a revenue for energy alone ranging from $20 a year upward. As a current-sales revenue producer, therefore, a single 200-watt street lamp is fully equal to:

(a) A residence customer with a large connected load of lamps and appliances, requiring meter reading, billing, connecting, disconnecting service, etc. The average residence customer returns a total of only $18 to $25 per year. The average for the United States is probably around $20.

(b) The installation of additional home-lighting fixtures taking a total of forty 50-watt lamps or 2 kw. connected. Surveys have shown that the average hours per day usage

COST DATA FOR EAST CLEVELAND INSTALLATION

Investment Cost for 115-Volt Multiple "Mazda" System—Cost per Lamp*†

	Labor	Material
Conduit	$31.43	$12.02
Lead cable No. 12	8.87	10.08
Poles and brackets (16-ft. and 4½-ft.)	11.53	32.89
Lanterns	2.60	12.33
Time switches	3.30	16.00
Total	$57.73	$83.32
Total investment per lamp by city		141.05
Investment exclusive of time switches—per lamp		121.75

Series "Mazda" System—Investment for Overhead and Underground Distribution to Lamps, Transformers, etc.*

	Labor	Material
Poles and brackets (20-ft. and 6-ft.)	$12.30	$41.40
Lanterns (large type)	2.60	13.00
Total	$14.90	$54.40
Total investment per lamp by city		69.30

Maintenance Costs for 115-Volt Multiple Street Lighting†

Number of Lamps	
115-volt, 150-watt (210-cp)	550
115-volt, 200-watt (300-cp.)	20
Total lamps multiple system	570
Repairs to Wiring and Underground Ducts:	
Cable failures first year	0
Cases of breaks or changes due to building excavation work	6
Labor and material to replace total of six approximately	$125.00
Cases of changes of attachment of fuse boxes and wiring made necessary by replacement of old wooden poles by new at rear lot line	25
Labor and material for twenty-five—approximate total	$150.00
Total East Cleveland maintenance cost on wiring and underground ducts	275.00
Average cost per lamp per year	.48
Lamp Post and Bracket Repairs:	
Lamp posts bent or broken through being struck by trucks‡	7
Total material and labor for repairs, approximately	$300.00
Number of cast-iron bases broken	15
Total material and labor for base repairs	300.00
Approximately two-thirds of cost of pole and base damage repair was collected from vehicle owners; East Cleveland cost—net	200.00
Average East Cleveland net cost per lamp per year	.35
Lamp Fixture Repairs—Globes and Refractors:	
Total globe breakage (includes thirty-six cracked globes)	84
Globes cracked or broken per fixture per year	0.15
Globe cost, eighty-four at $2.40 each, approximately	$202.00
Refractor breakage, one only at $3.50	3.50
Total repair cost globes and refractors	$205.50
Average cost per lamp per year	$0.36
Lamp Renewals:	
Rated life in hours	1,000
Average life from records, in hours	1,430
Lamp renewals per lamp per year	2.8
Average lamp renewal cost per lamp per year:	
150-watt (210-cp.) ($2,500 contract), at 0.71 cent, approximately	$2.00
200-watt (300-cp.) ($2,500 contract), at 0.92 cent, approximately	$2.60
General Maintenance:	
Supervision, painting, renewing lamps and fuses, cleaning, records, etc., including salaries equivalent to one electrician and helper, and miscellaneous supplies‖	$2,800
Share of one Ford truck per year	$360
Total general supervision, maintenance, renewing lamps, cleaning, painting, etc., annually	$3,160
Average cost per lamp per year	$5.55
Total maintenance cost per lamp per year:	
150-watt, 115-volt (210-cp.) underground	$8.74
200-watt, 115-volt (300-cp.) underground	$9.34

*Not including investment of Cleveland Electric Illuminating Company.
†Underground supply via side lot lines.
‡ Several of these were straightened without removal.
‖ City staff to consist of city electrician, one additional electrician and one helper. Regular duties include city electrical inspection and police and fire-alarm system maintenance as well as street lighting. In emergencies extra help is furnished by street department labor and charged by job.

Summary of Annual Costs for Residential System

115-VOLT, 150-WATT LAMPS

Fixed Charge:		
Interest and sinking fund charges on bond investment of city at 9 per cent on $141.05		$12.70
Maintenance:		
Repairs to wiring and underground ducts	$0.48	
Repairs to lamp posts	.35	
Globes and refractors	.36	
Lamp renewals	2.00	
General supervision, cleaning, renewing lamps, maintenance, painting, etc.	5.55	
Total maintenance		$8.74
Electrical Energy:		
Contract for electrical energy and switching		20.08
Total annual cost		$41.52

115-VOLT, 200-WATT

Fixed Charge:	
Same as for 150-watt	$12.70
Maintenance	
Same as for 150-watt except lamp renewals increased $0.60	9.34
Electrical Energy and Switching:	
Contract for electrical energy and switching	22.32
Total annual cost	$44.36

Summary of Operating Costs for Both Residential and Thoroughfare Systems

	150-Watt (210-cp). Multiple Underground	200-Watt (300-cp.) Multiple Underground.	250-cp. Series Overhead	400-cp. Series Overhead	1,000-cp. Series Underground
Fixed Charges:					
Interest and sinking fund on bond investment of city at 9 per cent; multiple, $141.05 (lamp post and underground complete)	$12.70	$12.70	......	......	....
Series, average, $69.30 (lamp post installed)	......	......	$6.24	$6.24	$6.24
Maintenance:					
Multiple (estimated from 1922-23)	8.74	9.34	......	......	....
Maintenance and electrical energy supply—series	......	......	43.80	55.20	94.80
Electrical energy and switching multiple	20.08	22.32	......	......	....
Total annual cost per lamp to city, including fixed charges	$41.52	$44.36	$50.04	$61.44	$101.04
Number of lamps in system	550	20	125	46	93
Total annual cost to East Cleveland for 834 lamps					$42,210.00

Old System (Cleveland Electric Illuminating Company)

Kind	No.	Lamp Type	Size	Rate	Annual Payment
Electric	130	Magnetite arcs	4 Amp.	$55.20	$7,176.00
Gas	626	....	25 cp. (approx.)	$20.00	$12,520.00
Total					$19,696.00

New System (Installed 1922)

No.	Lamp Type	Size	Rate	Annual Payment
93	"Mazda C"	1,000 cp.	$94.80	$8,816.40
46	"Mazda C"	400 cp.	55.20	2,539.20
125	"Mazda C"	250 cp.	43.80	5,475.00
550	"Mazda C"	150 watts	20.08	11,044.00
20	"Mazda C"	200 watts	22.32	446.40
834				$28,321.00
Fixed charge on city investment, 9 per cent				8,886.00
Maintenance of multiple lamps by city				5,003.00
Total				$42,210.00

	Old	New
Total number of lamps	756	834
Total candle power of system	70,000	265,000
Per cent increase in candlepower	......	280
Total annual payment	$19,696.00	$42,210.00
Increase in annual payment for lighting	....	$22,514.00
Per cent increase in annual payment	....	114
Payment per capita	$0.70	$1.50

of each lamp in the houses is a little over one hour, or about 400 hours per year, only one-tenth the burning time of a street lamp. Hence, a 200-watt street lamp consumes as much energy per year as 2 kw. connected in residence lighting.

(c) At least forty electric vacuum cleaners or electric washing machines sold to homes. These represent a connected load of about 10,000 watts, but, according to the Society for Electrical Development figures, consume on the average only about 20 kw.-hr. each per year, requiring forty machines to equal the consumption of a single 200-watt street lamp.

Undoubtedly the greatest single deterrent to a more active solicitation of street lighting on the part of central stations has been the very high investment in special apparatus and supply circuits that has been required. The central station has been expected to carry all of this cost, while, on account of the comparatively short-term contract during which the investment had to be amortized, a high rate was necessary to avoid possible loss in case the contract was not renewed, using the same equipment, or its renewal was contingent upon the installation of expensive improvements.

The wide spacings between lamps so commonly adhered to was responsible for still further increasing the investment cost per lamp. This special investment per lamp has run from \$100 to perhaps \$300, depending upon whether the lamp post consisted of a bracket on wooden pole or was of an ornamental type of construction and whether the supply was overhead or underground.

There are four obvious ways of reducing the central-station investment per kilowatt:

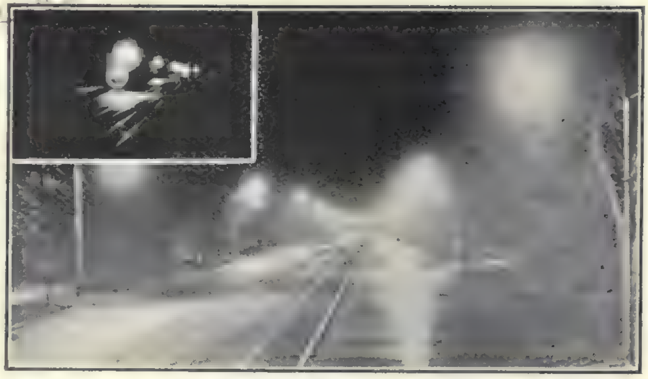
(1) *Higher-Wattage Lamps.*—Fixture, lamp, post and distribution construction is nearly the same for a 500-watt lamp as for a 100-watt lamp.

(2) *Closer Spacing.*—The circuit construction saving at a spacing, say, of 150 ft. as compared with 600 ft. may be very large.

(3) *Adoption of Less Expensive Means of Supply.*—Departures from the old standard arc-lamp circuit, each one of which had to be run back to a substation, may make possible very considerable reductions in special investment cost. In some instances the complete utilization of existing multiple-distribution systems by the adoption of 115-volt multiple instead of series lamps has very favorable possibilities.

(4) *Sharing Special Investment Cost with City.*—If the city pays for the poles and fixtures and perhaps part of the special circuit cost, the fixed charges on this investment (which sometimes amount to fully one-half the total annual bill for street-lighting service) do not appear in the charge made to the municipality by the central station. The smaller annual charge thus made possible, which then covers cost of energy and service only, is much less subject to misunderstanding or misinterpretation on the part of those who scrutinize municipal expenditures and who are accustomed to consider central-station rates as covering electrical energy only. An annual service rate which includes heavy fixed charges may seem exorbitant to one not acquainted with the circumstances and at the same time actually be below cost.

It should be emphasized that the present average expenditure per capita for street lighting is almost ridiculously low, ranging around 70 cents per capita per year. In other words, the total cost per year for this important service contributing greatly to safety, comfort and convenience is no greater than that of taking the family to a good moving picture show once a year. It is estimated that from \$1.50 to \$2 per year per capita is the minimum outlay which will provide an adequate system of street lighting. However, the increase in revenue from energy should be considerably greater than indicated by the difference between 70 cents and \$2 because in a properly designed system a much higher proportion of the increased outlay should go into a greater total of wattage rather than into increased fixed charges.



NIGHT VIEW OF STREET BEFORE AND AFTER NEW LIGHTING SYSTEM WAS INSTALLED

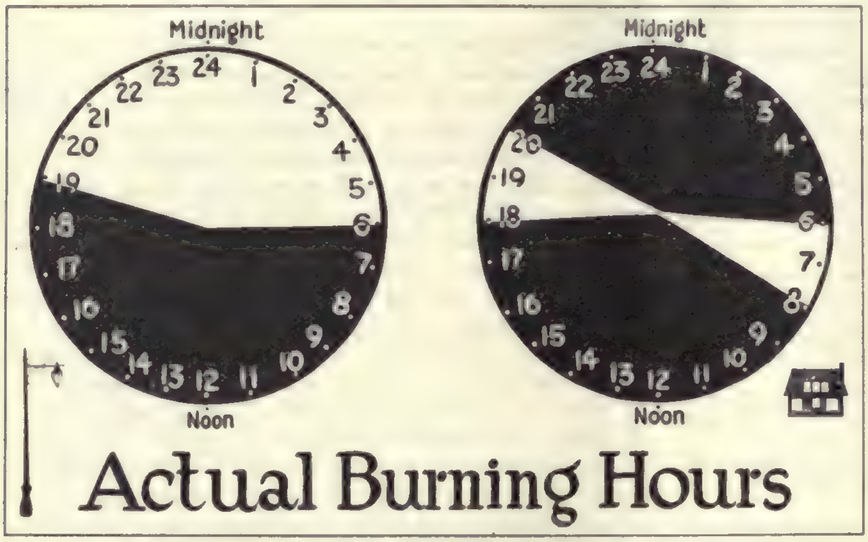
Street lighting is a service which is in no sense competitive with any other service supplied by the central station; in fact, it is common experience that a higher level of street lighting contributes materially to an increased development of commercial, industrial and residential lighting loads. It is fair to claim that real estate is worth 10 per cent more on a properly lighted street than on one that is poorly lighted.

An interesting illustration of what may be accomplished in the way of better street lighting with the proper application of combined sales and engineering effort is the installation in the city of East Cleveland. East Cleveland is a suburb of 28,000 inhabitants, with 39 miles of paved streets and a total street length of 42 miles. Previously this city was served with 120 arc lamps, bringing a revenue to the central station annually of about \$7,200. In addition there were about 600 gas lamps, so that the total expenditure of the city for street-lighting purposes came to approximately \$19,000 annually. Thus the expenditure was very nearly the country-wide average of 70 cents per capita.

LEFT—TYPICAL UNDERGROUND CONSTRUCTION USED IN RESIDENCE DISTRICT. RIGHT—TYPE OF RESIDENCE STANDARD USING 150-WATT GAS-FILLED LAMP

During the past year in the above city there was placed in operation an entirely new lighting system consisting, in the residential district, of twenty 200-watt (300-cp.), 115-volt multiple "Mazda" lamps and 550 150-watt (210-cp.), 115-volt multiple "Mazda" lamps, and in the thoroughfares of ninety-three 1,000-cp. "Mazda" series lamps, forty-six 400-cp. "Mazda" series lamps and 125 250-cp. "Mazda" series lamps. The total number of lamps in the new system was thus 834.

The lighting installation as designed called for a complete multiple system. However, in order to take advantage of series lines already in place on certain thoroughfares, series-type lamps were used for these streets. The total candlepower supplied by this new system is approximately 265,000, as compared with 70,000 cp. for the old system. The total cost to the city, including all maintenance and fixed charges on the new lighting system, was estimated at $45,000, of which a payment of approximately $28,000 represents the annual central-station revenue. The cost to the city for the first year was actually not much over $42,000, since repairs—as might be expected—were low during this period.



WHITE SPACE SHOWS COMPARATIVE AVERAGE DAILY BURNING HOURS OF STREET LAMP AND RESIDENTIAL USER

The total connected load of the 570 multiple lamps in the residential system is approximately 87 kw., which brings a revenue of $11,600 annually, or about $133 per kilowatt connected. The total connected load for East Cleveland streets, including both multiple residential and series thoroughfare lighting, is about 169 kw. hours. The rates are as follows:

1,000-cp. underground series	$94.82
400-cp. series overhead supply	55 20
250-cp. series overhead supply	43 80
200-watt, 115-volt (300-cp) (current and switching only)	22 32
150-watt, 115-volt (210-cp.) (current and switching only)	20.08

The city of East Cleveland furnished and erected all ornamental poles and fixtures. The central-station company installed the circuits and transformer supply for the series lamps (1,000, 400 and 250 cp.), and it supplies a complete electrical energy, lamp renewal, maintenance and repair service throughout the period of the contract for these series lamps. In the case of the 150-watt and 200-watt multiple lamps which are used on residential streets, East Cleveland not only erected the lamp poles and fixtures but also installed the underground supply and purchased time switches for controlling them. Bond issues totaling $102,000 were made by the city to cover its share of the investment. The city maintains the multiple-lamp posts, furnishes lamp renewals, repairs breaks in the supply circuits, etc. In other words, at the rate shown for the multiple lamps the central-station investment consisted only of connecting the lamp loops to the nearest existing pole of the secondary distribution system, and under the contract the central station is held only for the supply of current at 115 volts, including the connection of and the winding and maintenance of the time switches.

A detailed summary per lamp of the installation cost of the multiple lamps on residential streets, borne by the city, is shown in the accompanying tabulations. Two articles entitled "Improved Street Lighting that Assures Greater Safety to Traffic" and "Multiple Street Lighting Favored," published in the ELECTRICAL WORLD of July 29 and Aug. 26, 1922, give detailed descriptions of the various technical features of the installation.

Among the advantages which apply to 115-volt multiple supply under the conditions of this installation are the following:

(1) Central-station investment is exceedingly low compared with the usual practice.

(2) The standard secondary distribution system already in place and serving the territory is used and the duplication involved in running a separate series distribution system is avoided. A high-tension series street-lighting circuit operating at 6,000 volts carries a maximum load of about 40 kw. as supplied with a separate regulating transformer panelboard, etc. A standard three-phase lighting circuit of the same voltage and costing but little more for pole construction per wire has a capacity upward of 500 kw.

(3) The city is enabled to supply the type of lamp post and equipment which is desired, and the expense of this equipment does not enter into the central-station rate for supplying service.

(4) The multiple lamps are tied into central-station secondary distribution systems at several hundred different points, thus diversifying this load over the whole secondary system.

(5) Very little disturbance of the existing secondary system is involved. The additional load per secondary from a 150-watt or 200-watt lamp for every five to ten residences is very small. In fact, in East Cleveland no immediate transformer changes were necessary in any part of the city upon connecting the street lamps.

(6) The street-lighting load improves the average load factor upon the secondary distribution system. The annual load factor of this added load is 45.6 per cent.

I do not mean to imply that no progress has been made in street lighting, for we all know of excellent installations of "white way" lighting, and there are isolated examples of fair highway lighting installations. But they are all too few. What I wish to emphasize is that here is a large potential field for the use of central-station service which we, whose duty it is to sell this service, have neglected. Traffic conditions have brought about a demand; the time is right to go after it; equipment is available to produce satisfactory results—now it is up to us to sell it. If this is put on a commercial basis, there is no reason why the central-station company cannot obtain a large volume of profitable business.

Interconnection and Transformers

Group Operation of Interconnected Systems Having Different Frequencies Has Been Successfully Accomplished by Using Frequency Changers—Tests and Discussions of Transformers Having Tertiary Windings

AT THE recent convention of the A. I. E. E. at Del Monte, reported in the ELECTRICAL WORLD of Oct. 20, several papers of great interest were presented covering the practices and experiences of California companies. In southern California the group operation of high-tension transmission systems having different frequencies has been successfully accomplished by the use of rugged frequency changers. This development is a pioneering effort that should permit companies in other localities to profit.

Another phase of development in the transmission art very successfully carried out in California involves the extensive use of transformers having tertiary windings. Data and experiences were splendidly presented at the convention and the problems yet to be solved were clearly indicated. The following abstracts cover the chief features of the subjects discussed at the convention:

Operating Interconnected Systems of Different Frequencies

SOUTHERN California has a group of interconnected transmission systems which operate as interconnected units, although the system frequencies differ. This operating condition was described in a paper by E. R. Stauffacher and H. J. Briggs.

The position of the Southern California Edison Company is unique in that it is, with one exception, entirely surrounded by systems operating at a different frequency. The above company interchanges power with the San Joaquin Light & Power Corporation (60 cycles) on the north, the Southern Sierras Power Company (60 cycles) on the east and the San Diego Consolidated Gas & Electric Company (60 cycles) on the south. In addition to this there is an interchange of power between the systems of the city of Los Angeles and the Southern California Edison Company, but without the necessity of frequency changers as both systems operate at 50 cycles. To be more specific concerning the location and size of the various frequency changers, these data are given in Table I.

To give an idea of the value of group operation of a number of systems through frequency changes, Table II has been prepared showing the amount of power interchanged during the past year.

From a study of this table the flexibility of frequency changers as a means of interchanging power is well shown. In addition to delivering power from one company to another, the equipment can obviously be utilized as a means of delivering power to a third company.

It may be of interest to outline the method of metering when power is to be transmitted in either direction through a frequency changer. The scheme generally used is to have both sides of the machine equipped with a polyphase curve-drawing wattmeter and two polyphase integrating watthour meters. Each of the integrating instruments is equipped with a ratchet mechanism so arranged that one instrument will meter energy only when power is flowing toward the frequency changer while the other will register only when power is flowing from the machine.

In regard to the protection of the frequency changer, time-limit overload relays have been used on both ends, so that in case of trouble on either system the frequency changer is disconnected on the side of the system in trouble. Power directional relays can be used to good advantage for this purpose. In addition to this it is necessary to provide some means of protection against internal trouble of the frequency changer, and this has been provided for at Vestal by means of two sets of power directional relays so wired that their contacts are closed when power is going toward the frequency changer. In addition to this the contacts on each set of relays are wired in series, so arranged that the tripping circuit will kick out the switches on both sides of the frequency changer. Under these conditions it can be seen that power will flow toward the frequency changer from both sides in case of a severe ground developing in the machine, and it is hoped by this means to keep the damage to the machine windings and laminations down to a minimum.

In conclusion it was stated that the frequency changer had proved to be a very satisfactory means of interchange of power, and that it should cause no trouble provided it is of the proper size in relation to the two systems which it connects. In addition to its value as a means of interchanging power the frequency changer set may be used for power-factor correction when necessary.

TABLE II—POWER INTERCHANGE (KW.-HR.) THROUGH FREQUENCY CHANGERS

Month	Purchased and Delivered by Company B to Company A: Substation No. 1	Substation No. 2	Delivered by Company C to Company A	Purchased by Company D from Company A
January	100	1,850	0*	571,300
February	0	0	4,492,800	1,070,700
March	0	127,150†	604,800	1,799,850
April	0	0	99,000	3,184,300
May	8,150	1,350*	0	2,798,200
June	1,750*	0	41,400	2,767,200
July	342,500‡	1,462,850	19,800	1,957,500
August	24,700‡	211,050‡	5,079,600	2,192,900
September	....	19,750	7,619,400	1,910,700
October	....	450	8,499,100	1,749,300
November	....	300	6,080,400	1,558,700
December	120,050	137,550	5,337,000	1,400,800

* Purchased by Company A.
† Received for transfer to Company D.
‡ Part received for transfer to Company D and part utilised by Company A.

TABLE I—SYSTEMS INVOLVED AND FREQUENCY CHANGERS USED

Connection Between	Size of Unit: Kw.	Power Factor	Voltage	Location of Unit
Southern California Edison Company (50 cycles) and Southern Sierras Power Company (60 cycles)	5,000	0.8	11,000 (50 cycles) 6,600 (60 cycles)	Southern California Edison's Colton substation
Southern California Edison Company (50 cycles) and Southern Sierras Power Company (60 cycles)	5,000	0.8	11,000 (50 cycles) 6,600 (60 cycles)	Southern Sierras' San Bernardino steam plant
Southern California Edison Company (50 cycles) San Diego Consolidated Gas & Electric Company (60 cycles)	5,000	0.8	11,000 (50 cycles) 6,600 (60 cycles)	Southern California Edison's Capistrano substation
Southern California Edison Company (50 cycles) and San Joaquin Light & Power Company (60 cycles)	15,000	0.8	15,000 (50 cycles) 18,000 (60 cycles)	Southern California Edison's Vestal substation

Auto-Transformers with Tertiary Windings

MOST of the major companies using high-tension systems in California have adopted a permanently grounded neutral on the high-tension circuit and a considerable number of the later-built transformers have been auto-transformers, designed specifically to operate only with one terminal of the high-voltage winding grounded.

In present designs some of the tertiaries used to suppress harmonics have a current density 20 per cent higher than the primary of the same transformer for the name-plate rating. This relatively high resistance further increases the tertiary temperatures under short-circuit conditions. Having this condition in mind, it becomes an operating problem of when and how to protect the tertiary winding against destructive overheating during line short circuits, and a paper was presented by J. Mini, Jr., L. J. Moore and R. Wilkins.

Tertiary windings are used, in addition to the prevention of inductive interference, for:

1. Providing a path for the third harmonic current necessary for the proper magnetization of the core for a sine wave emf. across the main windings.
2. Stabilizing the neutral and providing a sufficient flow of current in the line or windings at times of single-phase short-circuit conditions to give proper operation of relays and circuit-breakers.
3. Providing a winding for load connections or a synchronous condenser.

In practice the size of the tertiary is fixed by the short-circuit kva. rather than the third harmonic component of magnetizing current; i. e., this winding must carry the short-circuit kva. long enough to allow circuit-opening devices to operate. The time required to open the circuit is usually short, of the order of five seconds or less, and therefore very little radiation of heat takes place; consequently the copper must store its I^2R losses by thermal capacity during this period.

For short-circuit conditions the size of the tertiary is determined by the value of short-circuit current that is desirable for protective reasons and by the duration of the heavy current.

From 300 to 400 per cent of normal current is usually desired for operation of protective relays, and this abnormal current requires a tertiary winding constructed to have from 25 to 30 per cent of the capacity of the main transformer windings.

The reactance in the tertiary circuit is then made such as to limit the current to the above values for the voltage applied to a short-circuited transformer.

It is unsafe to use less reactance on account of danger from burn-out and not wise to use more because the amount of the short-circuit current desired would not be obtained.

The kw. capacity and reactance of the tertiary are interdependent and with one value given the other is fixed.

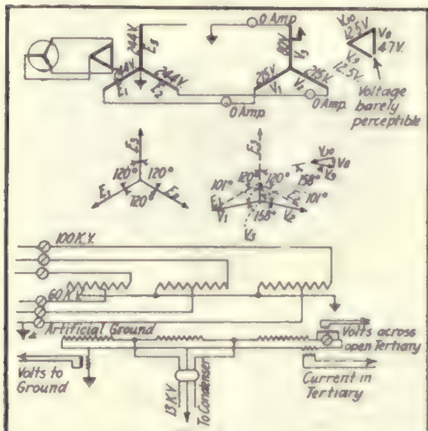


Fig. 1

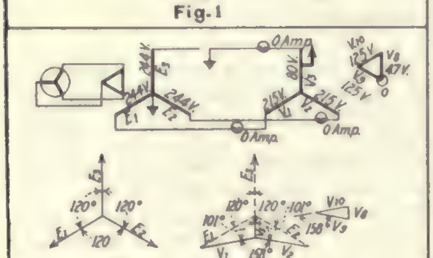


Fig. 2

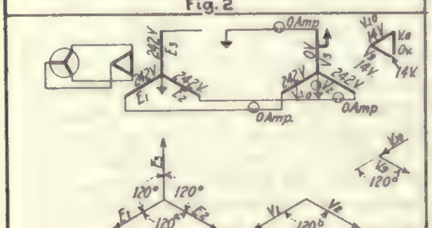


Fig. 3

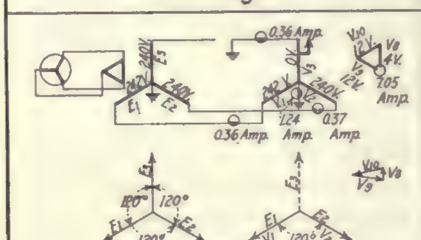


Fig. 4

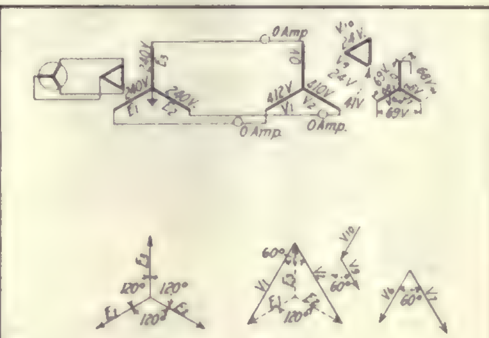


Fig. 5

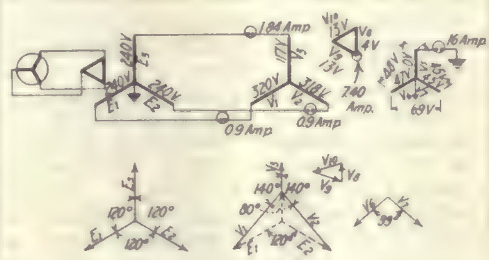


Fig. 6

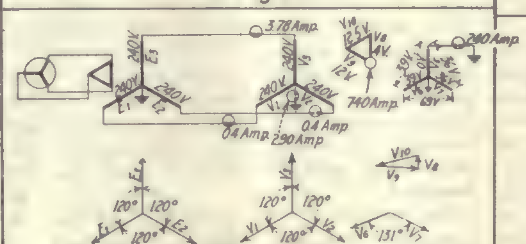


Fig. 7

TESTS ON TRANSFORMERS WITH TERTIARY WINDINGS

Rating:
Primary, 1,500 kva., 40,000 volts.
Secondary, 1,500 kva., 6,680 volts.
Tertiary, 300 kva., 2,340 volts.

Impedance:
Primary and secondary, 5.7 per cent at 1,500 kva.
Primary and tertiary, 20 per cent at 1,500 kva.

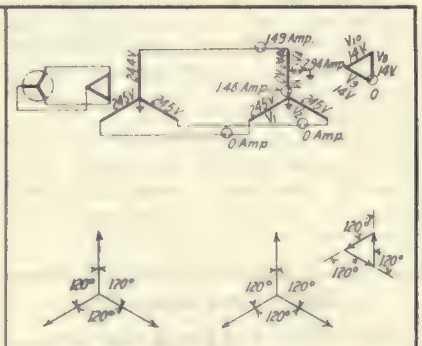


Fig. 8

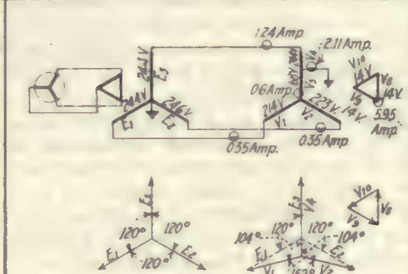


Fig. 9

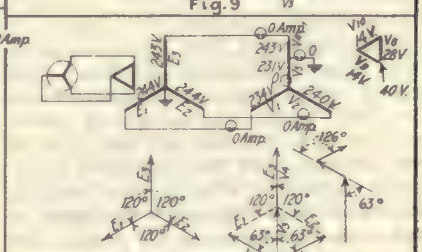


Fig. 10

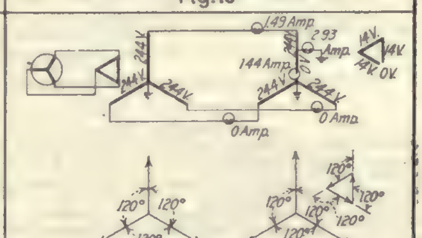


Fig. 11

Fig. 1—Ground or primary with neutral ungrounded and tertiary closed.
Fig. 2—Same as Fig. 1 with tertiary open.
Fig. 3—Neutral grounded tertiary open and Fig. 4, closed.

Figs. 5, 6 and 7—Transformers Y-Y with tertiary and grounds on secondary.
Figs. 8, 9, 10, 11—Conditions with transformers connected as auto-transformer with a tertiary. Tap is in exact center of primary.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Bridging the Gap Between Pure Science and the Business of Industry

To the Editors of the Electrical World:

Professor Karapetoff's letter in your issue of July 7 puts very concretely the thought that the men who are working on research, or, as Professor Karapetoff says, "working for unborn generations," feel that the men who are engaged in today's problems in the engineering and business world show an utter lack of interest in their work. Another phase of this same lack of appreciation of the kind of thinking that is essential if we as an American nation are to succeed to the heritages of the past has been lately expressed by a professor of English, who has stated that the only way a teacher can win recognition these days is to forget that he is a teacher and write articles outside of his work which will bring him into enough prominence to make his individuality apparent to boards of trustees and to others interested in the promotion of education in our country.

What can be done to vitalize and make dynamic in the minds of the rank and file of engineers and business men the need of pure research and the need of true teachers? One simple thing we may all do is to bring these two very closely allied questions in our engineering education to the forefront and to promote discussion of them before the fine faith and the splendid enthusiasm for research of a small and devoted group of men ends in tragedy. Not all men are fitted to teach and probably fewer still have a genius for research. When such a one is found the best all of us can do is to promote in every way possible his opportunity for service.

One of the problems of promoting these opportunities for service seems to me to lie in the fact that few of those who know that it should be done are attempting to bridge the gap between pure science and the business of industry. We are so busy carrying out commercially today the things that Faraday and Helmholtz and others did for us before we were born that we do not take time to think of the men who must be doing that same sort of thinking if our children's children are to inherit the things that are of the intellect and of the mind, as well as the material prosperity earlier discoveries have given us.

Pure research and every-day work are so far removed from each other that it is very difficult for either group to meet with a common understanding. What we need is a group of interpreters—men who will emphasize at every opportunity the place of pure research and the place of true teaching in our present industrial life. We need regularly to review the research now going on in our industry. We must see it as a whole by bringing together the separate entities, so that each man in research will know that he is really working with a larger group. The total pool of our research activity, which, after all, is relatively small, must appear in a new perspective to those of us workaday folk who have learned to subsist upon the superlative and who therefor fail to comprehend at times the true superlative in the painstaking, cloistered effort of the small minority who are at work now for our children's children.

F. M. Feiker,
Vice-President.

Society for Electrical Development,
New York, N. Y.

Young Engineers and the Seven-Day Week

To the Editors of the Electrical World:

I have read the brief rebuttal by "A Young Engineer" to an editorial in the Aug. 4 issue of your paper, and I should like to say that our "Young Engineer" certainly derived the wrong idea from the editorial. Young engineers are needed for power-house operation, not in the coal bunkers or on the headgates, nor at the throttle, but in charge of the plants, with their minds alert and clear to grasp new ideas and situations and to direct operations, repairs and construction along modern economical engineering lines. In order to do this the young engineer must spend his seven days a week for some time with overalls on so as to familiarize himself with operating conditions, the conditions which his future operators will be up against at either 2 a.m. or 2 p.m. Then, having met with and overcome these conditions, he is in a far better position to supervise.

There are a multitude of operators who simply thrive on power-plant operation seven days a week. They are cut out for such work and, while they are experts in the trade, they unfortunately have not had the education to go further. These men are not to be pitied but rather looked up to as men who are industrious, sturdy and trustworthy and big assets to the electrical industry.

It would appear that our "Young Engineer" has spent time enough in actual plant operating, and his three years' experience should prove of great value to him, and he should be on the lookout for a better position, provided there is nothing in his present position that he cannot master. If such is the case, he with his education would be very valuable to any operating company directing other operators and operations. Should he reach this point and be thoroughly interested in his work, he will not find routine or grind but hundreds of interesting problems confronting him. He will be glad to work seven days a week.

If our "Young Engineer" were more experienced, he would not advocate a six-day week, for reasons which he will learn later, and as he grows older he will find that there are objectionable features about every position which have to be endured with a smile.

An Experienced Engineer.

German Switching Practice

To the Editors of the Electrical World:

I was very much interested in the description of German switchgear pictured in the Sept. 29 issue of the Electrical World. The practices and the equipment differ very radically from those used in this country, and American engineers will question the use of the type of current transformers illustrated because of sad experiences with mechanical failures under heavy short-circuit conditions. The use of floor instead of ceiling mounting for the buses and disconnecting switches on 110-kv. circuit is, in my opinion, less safe and less serviceable construction. The angle-iron mounting of buses on top of cross girders, however, appears feasible and good practice. It may be that in stations using the equipment and the type of construction shown the load is small in comparison with conditions in this country.

A Power Plant Engineer.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Two-Intensity Substation Lighting System

While Regular Operation Can Be Performed with Low Intensities, This System Affords High Intensity Whenever Needed for Emergency and Construction

BY E. D. TILLSON

Testing Engineer Commonwealth Edison Company, Chicago

FREQUENTLY occasions arise where the most rapid and accurate discrimination is required in generating stations and substations and where failure of judgment may mean a great loss of property or time or may bring injury to those in the station. In sudden emergencies, at times when repairs, alterations or additions are under way, and in the discharge of such duties as phasing out, grounding circuits, pulling clips, setting and checking relays, adjusting circuit regulators, etc., quick decisions must be made, and as an aid to them the very best lighting is imperative.

Since the eye, when previously accustomed to moderate interior illumination, functions accurately in the neighborhood of 3½ ft.-candles, one might conclude that if the substations were laid out for an average illumination of this value all purposes would be served. But this is far from being the case, because the shadow ratio for direct lighting of a substation interior lies in the neighborhood of from ten up to twenty to one. In other words, if an object is in clear light, the illumination may be in the neighborhood of 3 ft.-candles, but if it is in shadow, then the illumination dwindles to 0.15 or 0.3 ft.-candle, which means groping in semi-darkness.

Nearly all of the most important parts of a substation are cast in deep shadow; for example, both the high-tension and low-tension clips and switch mechanisms, the relay mechanisms, instrument transformers, pendulum switches, regulator mechanisms, etc. The result is that operators or others who must work on the apparatus are compelled either to use flashlamps or drop cords or else simply work without additional light. All three ways are dangerous. Attention has many times been called to this condition by operators, testing and construction men.

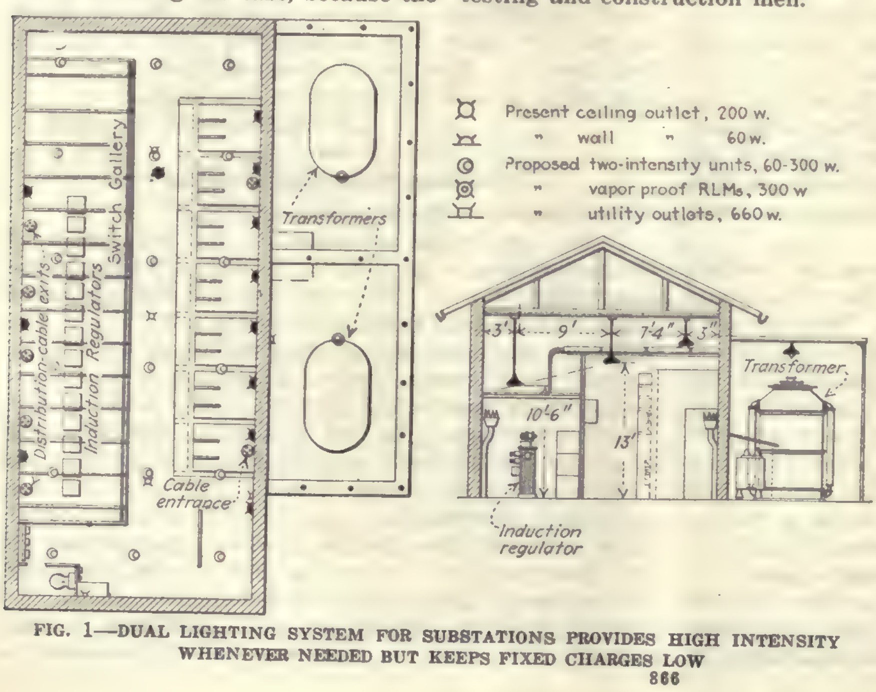


FIG. 1—DUAL LIGHTING SYSTEM FOR SUBSTATIONS PROVIDES HIGH INTENSITY WHENEVER NEEDED BUT KEEPS FIXED CHARGES LOW

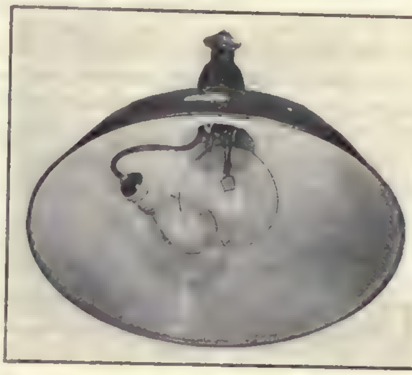


FIG. 2—COMPLETE ASSEMBLY OF TWO-INTENSITY LIGHTING UNIT

The question, then, is, how shall special operations be carried out quickly and safely? With any feasible plan of substation lighting it is impossible to get rid entirely of the shadows, but there is one thing that can be done. A great deal of reflected light can be thrown into the dark pockets, thus raising the illumination within the shadow to a point where small objects may be readily discerned, such as the hook hole in the clip. The only method of accomplishing this is to provide such a surplus of light originally that all objects surrounding the recesses will be strongly lighted. The reflected light from these objects will then enter the recesses at various angles and create sufficient illumination to permit of fine work without flashlamps, even though the place be at some distance from the primary source of light.

It would certainly be a waste of energy to keep such lighting in service except when there is a real need. As a matter of fact, the psychology of the average operating man would absolutely prohibit it. Hence the writer suggests that lighting equipment which provides alternative illumination be installed—first, a low intensity for routine care of stations about equal to the present, and, second, a value of fifteen times this figure for all occasions of special or emergency work. An illustration of this equipment for a 60-cycle substation is shown in Fig. 1. The luminaire

carries two light sources—a 60-watt type B white-spray enamel lamp and a 500-watt type C clear. Both are housed in a standard 300/500-watt "RLM" reflector (Figs. 2 and 3). It is therefore seen that there is no duplication of fixtures or outlets.

Virtually the only added expense

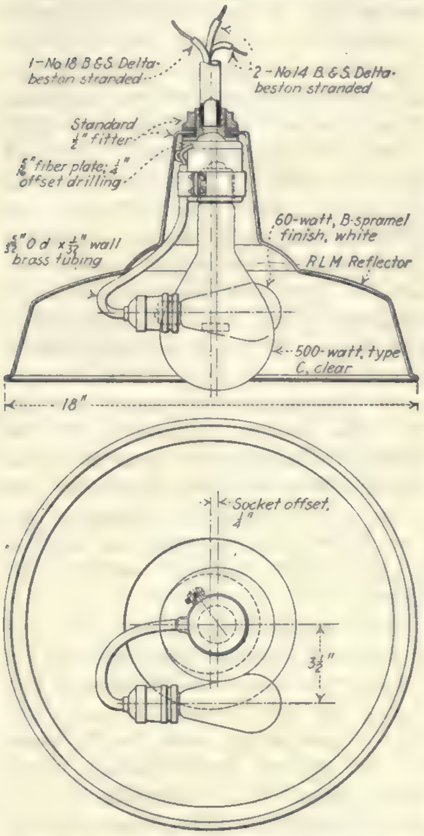


FIG. 3 — TWO-INTENSITY LIGHTING ARRANGEMENT FOR SUBSTATIONS USES THE REGULAR STANDARD "RLM" REFLECTOR

is the third wire and a somewhat larger reflector with a gooseneck and an extra socket. So far as the luminaire itself is concerned, any contractor with ordinary ingenuity should be able to make it up. The number of branch circuits might need to be increased, depending upon local rulings as to maximum circuit capacity. The branch circuits would run back to regulation panel boxes, each circuit being provided with a "1-2-off" snap or its equivalent.

With a scheme of this kind it is desirable to mount the units fairly close to the walls wherever feasible and to paint these walls white from the line of the eaves down to a point approximately 3 ft. below the edge of the reflector. The concrete barriers, steel work, regulator and transformer casings, etc., should be painted white or a light gray wherever possible. All of these factors add to the reflected light upon which the system rests.

For a substation of the type illustrated it has been computed that the special lighting would be used 200 hours per year for one-third of the equipment provided and would consume 660 kw.-hr. per year; that is, it would add only $10 to the equipment tied into the station and that may be affected by its failure to operate properly. The smallness of this expense is most evident when it is considered that the payroll of a construction gang working in this station would probably run to $10 or more per hour and that poor lighting may waste many hours of the time of these men on a single job. This takes no account of accidents or of mistakes that may be made by men working in an underlighted station. The 500-watt lamps should serve about ten years without burning out, while the regular lamp expense should be no more than it is now. The expense of putting in a two-intensity lighting over a similar single-intensity system with "RLM" reflectors would amount to approximately $200 per station.

Small Feed-Water-Treating Equipment for $100*

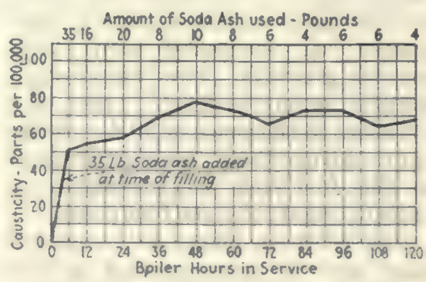
C. B. OLIVER

SMALL plants are usually left to devise their own schemes for keeping their boilers clean. The method of treatment described below is being used in three plants and will be referred to as the "inside" method. It can be installed for approximately $100 and operated more cheaply than an outside treatment plant. The first step to be taken is to have an analysis of the water made by a competent chemist and prevent undertreatment allowing scale formation or overtreatment and the resultant foaming action. Chemicals for simple daily tests will be supplied by the chemist. From data compiled after a few weeks' operation charts similar to those shown in the accompanying illustration can be made for a guide.

The material needed for constructing an "inside" treating plant consists of a 50-gal. steel barrel, a line connecting the barrel to the suction of the boiler-feed pump, a supply of soda ash (58 per cent light) and a water-testing outfit. The soda ash is mixed with hot water in the container and fed slowly throughout the day through a ½-in. petcock into the line to the pump suction. The solution should never be fed into the heater as the precipitation which takes place would soon foul the heater. There are three requisites for the successful operation of this system, namely: (1) Test the boiler water twice daily; (2) blow a quantity of water from the boilers periodically without fail, two to five times daily; (3) feed chemicals regularly in small quantities.

The constant precipitation of the scale-forming salts causes a sludge to accumulate in the rear header, and if not blown down, it backs up into the lower rows of tubes, and the results are bagged or blistered tubes. For example, suppose a water supply carries 200 parts per million of hardness and the boiler evaporates 2,000 gal. of water per day. This would mean that about 3 lb. of sludge would be formed in a day. This shows conclusively why frequent blowdowns are necessary if this method of treatment is to be used.

The amount of water necessary to be blown from a boiler requiring principally soda ash for softening is much less than that for water requiring principally heat for softening. The blowdown in the first case is governed by the rapidity and completeness with which the solid residue precipitates, and it requires only an appreciable small blow to expel, whereas with water of the latter type large and expensive blowdowns are necessary as the precipitation is very incomplete. The larger portion of the solid residue is held in suspension, necessitating a large amount of the water in the boiler to be blown



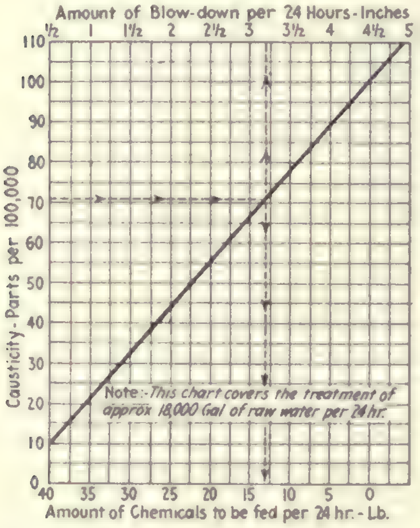
CURVE SHOWING RISE AND DAILY AVERAGE OF CAUSTICITY FOR FIVE DAYS AFTER WASHING 500-HP. BOILER

in order to keep the concentration down.

When using the "inside" treatment, the precipitation starts immediately when the water enters the boiler (if a Heine boiler, when it enters the mud drum), but not all of the precipitate settles in the rear header. A portion of it remains in

*Abstract of paper presented at the Southwest Geographic Division, N. E. L. A., convention at Oklahoma City, March 14-16, 1923.

circulation, being as fine as powder and the amount increasing with time after a blowdown. When the steam leaving the boiler becomes slightly moist, it is possible that some of the finer precipitated matter will pass over into the turbine or engine with serious results. When trouble of this nature is experienced, the number of



AMOUNTS OF BLOWDOWN AND CHEMICALS REQUIRED IN TWENTY-FOUR HOURS TO INCREASE OR DECREASE CAUSTICITY

blowdowns should be increased and the water level in the boiler maintained at about one gage in the boiler.

At the time the treatment was started at one plant scale formed in the tubes at the rate of $\frac{1}{16}$ in. in four weeks. This would increase the fuel consumption approximately 9 per cent. According to this, the average monthly fuel bill of $3,000 could be reduced $270. The actual fuel-cost figures taken from reports for seven months after the treatment was started, as compared with nine months previous, show an average monthly saving of $292. There was a change in the price of fuel, but the figure given above was determined on the fuel cost per kilowatt-hour basis, using a constant fuel price.

One of these plants is a standby plant and is only operated a few hours or days each month. The rest of the time only one boiler is kept banked; therefore it is not possible accurately to determine the saving effected in this plant.

The only difference between the treatment at the third plant and at the others was that caustic soda was used instead of soda ash. This was due to the fact that this water was made up mainly of bicarbonates and the chemist therefore recommended caustic soda. Actual fuel-cost figures in this plant for nine months previous to starting the treatment as compared with seven months under the treatment show a saving of $95 per month.

Cost of Substation Equipment

IN THE accompanying table are given various items from the cost sheets of a large New England central-station company covering work done or equipment purchased for substation service during the past few years. In most cases the figures cover the total cost of purchase and installation.

ITEMIZED COST DATA OF SUBSTATION EQUIPMENT

One seventy-five-lamp mercury-arc rectifier, 6,600 volts alternating current to 6.6 amp. direct current, complete with four-tube equipment, with lightning arrester and transfer bus connections	$2,670.73
Building work in connection with above	455.00
One seventy-five-lamp mercury-arc rectifier, 13,200 volts alternating current to 6.6 amp. direct current, complete with four-tube equipment, lightning arrester and transfer bus connections	2,863.38
Replacing three 200-kw. transformers with one 1,500-kw., three-phase transformer and making necessary changes in instrument equipment; installing knife switches for lightning arresters and cartridge fuses for 13,200-volt potential transformers	7,383.99
Installation of one 2,000-kva. rotary condenser, 600 volts, three-phase, 60 cycles, with switching and instruments complete	11,259.18
Installation of synchroscope with lamps on bracket on 13,800-volt switchboard, connecting with upper and lower bus potential transformers through fuses and double-pole knife switches	112.94
Building construction expense in connection with installation of one 1,340-kw. storage battery complete with control equipment	3,624.43
Cost of one 1,340-kw. storage battery complete with control equipment	91,640.89
One 12-kw. motor-generator set with switching equipment for charging separate battery cells	2,336.03
Cells, wiring, switches and instruments for two No. 4/0 split-conductor, 15,000-volt lines	8,400.00
Jumper bayonets for ten 4,000-volt circuits	750.00

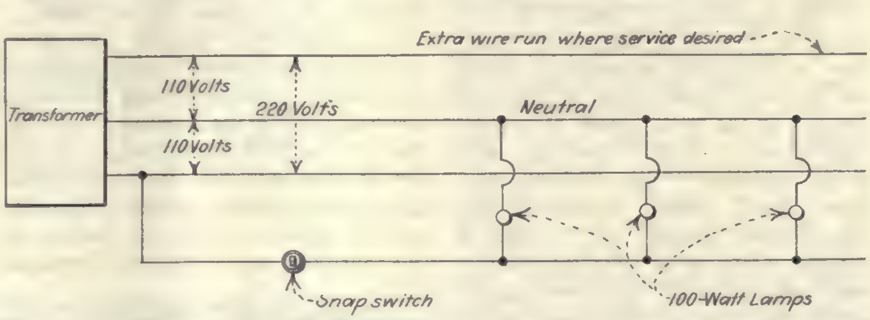
An Inexpensive Street-Lighting System

BY J. W. WALKER
Operating Superintendent Traction, Light & Power Company, Anderson, Ind.

THERE are many small communities in the Middle West that would like to install street-lighting systems did they not feel that the equipment is far too expensive for an unincorporated town to purchase. This feeling has often prevented these communities from receiving the benefits of street lighting. Confronted with this difficulty, the Traction Light & Power Company has adopted a novel but simple system to light the streets of several Indiana towns of 300 inhabitants and over. In some of these towns the most prominent business men have formed an agreement to pay for the energy consumed by the lamps which light the main business street. Most of them appreciate the value of a well-lighted business section both to bring business and as a protection against robbery at night.

Since these systems as a rule require hardly more than eight or ten 100-watt lamps, a fourth wire is run from the distribution transformer on the company's poles to the position of the last desired lamp. Then these lamps are connected in parallel by another wire going directly to the neutral, as illustrated in the diagram below. By using the fourth wire to the transformer the voltage on the regular three-wire system is not seriously affected.

A control snap switch is installed where it is most readily accessible and in some localities is worked by the telephone operator. When more lamps are needed a division can be made, improving the load balance. The costs on such systems have been low since it is only necessary to add new cross-arms, wire, lamp brackets and reflectors. The maintenance expenses of the system are borne by the power company.



THIS CONSTRUCTION AFFORDS STREET-LIGHTING SERVICE TO SMALL COMMUNITIES

Neat Design of Compact Polyphase Test Table

BY J. P. GALLAGHER
Superintendent of Meters, Erie Lighting Company, Erie, Pa.

IN THE design of polyphase test tables usually a great amount of apparatus is employed, but, contrary to this practice, a table embodying compactness of design and equipped to give the essential factors and cover the field of polyphase testing has been developed by the Erie Lighting Company, as illustrated herewith. The panel is of 1-in. slate, 34 in. x 44 in. in dimensions, with ammeters in each phase and a voltmeter for 110/220 volts. The panel is supplied from a 110-volt, three-phase source through the main switch, as shown in upper right of Fig. 1, with three banks of load switches providing current adjustment from 0.25 amp. to 10.75 amp. per phase. The phase shifter used is of the wound-rotor type and has a capacity of 10.75 amp. per phase at 8.5 volts. It is mounted off the panel at lower right. The necessary current and potential binding posts and the plug switch for changing 110 volts to 220 volts are connected in each phase and controlled from the front. To the left of the load switches there are three 2-amp. continuous-duty 143-step roller-contact rheostats, permitting very close adjustment of any load desired within range of the table, with independent regulation and operation of individual phases.

The wiring as seen from the rear, with the three banks of load resistance and auto-transformers for stepping 110 volts to 220 volts, is also shown. The American Institute of Electrical Engineers recommends that for three-phase markings *A B C* and *X Y Z* be employed; and, to avoid confusion, it is better that all prints follow this plan. Since with three-phase measurement it is necessary to deal with three electromotive forces and currents differing in phase by 120 deg., incorrect polyphase polarity markings may result in a number of complications, and for accurate results the phase relation and rotation should be carefully checked.

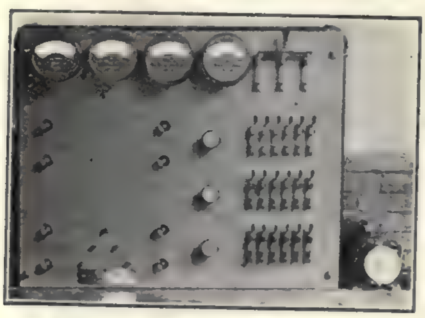


FIG. 1—POLYPHASE TEST PANEL USED BY ERIE (PA.) LIGHTING COMPANY

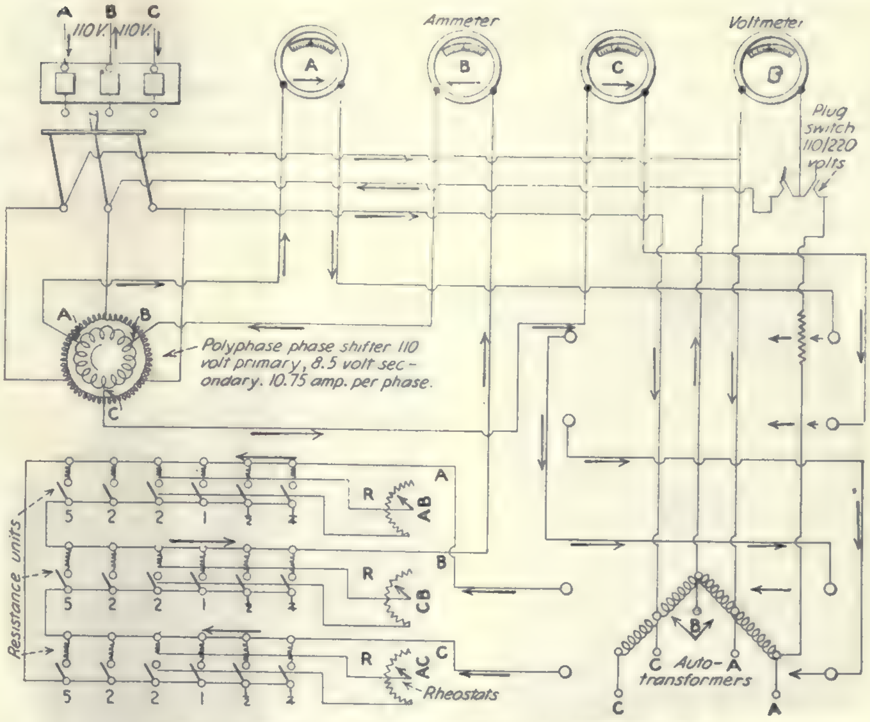


FIG. 2—WIRING AS SEEN FROM REAR OF TEST TABLE

Extracts from an Operating Code*

Miscellaneous Apparatus in Turbine Room

ROUTINE inspection methods and regular cleaning periods for all equipment in the turbine room aid very much in obtaining high plant efficiency. The following instructions relate to the routine care and maintenance of miscellaneous apparatus in the turbine room:

1. Machines should be cleaned and wiped twice each week.
2. The racks and pinions of valve gears should be scraped and cleaned monthly.
3. Clean the screens of the oil system of turbines weekly.
4. Oil should be changed when necessary.
5. The roller transmission bearings (gimbal bearings) of the governor should be cleaned and oiled monthly.
6. Inspect the needle-valve oil supply to the governor knife edge weekly.
7. Blow out the cooling coils of the oil-cooling system every four or five months, or oftener if necessary.
8. Clean the condenser at the ends of the tubes daily, if possible.
9. Examine the overspeed device on vertical turbines before each overspeed test and repair it, if necessary. On horizontal turbines this should be done every two months.
10. Examine the worm and gear of the governor every two months and repair if necessary.
11. Examine the knife edges of the governor every four months.
12. Inspect clearance every six months and make necessary adjustments.
13. Inspect the blading of turbines yearly and make necessary repairs.
14. Clean bearings and steps yearly.
15. Examine thrust bearings yearly and repair if necessary.
16. Examine turbines and impellers on auxiliaries every six months.
17. When necessary, clean the condensers by blowing through the tubes rubber disks with nails driven through them. If the deposit is of such a nature that this method is not effective, blow "bullet" brushes through the tubes.
18. Examine the interior of condensers for corrosion every six months.
19. Clean oil system and gravity filter tanks yearly, or oftener when necessary.
20. Examine motor-operated valves every three months and make necessary adjustments and repairs.
21. Motor-operated valves should be closed at least weekly.
22. Hydraulic quick-stop valves should be operated daily.
23. All water strainers should be kept clean.
24. Close and open the main valves of the forebay inlet and outlet monthly, being sure that adjacent valves are open as each is being manipulated.
25. Clean out débris from the bottom of the well of the screening basin and overhaul the apparatus approximately every six months.

*Abstracted from the operating code of the Philadelphia Electric Company.

First-Aid Kits Standardized by Malden Company

FIRST-AID kits for the individual employee and for overhead and underground line crews have been standardized by the Malden (Mass.) Electric Company, one of the Tenney properties in the Boston suburban area. In the preparation of these kits economy in the use of materials was sought as well as portability and compactness. Describing the kits, Harvey K. Brown, superintendent of the Malden company, states that the importance of caring for minor accidents as well as more serious ones influenced standardization along the lines illustrated.

FIRST-AID KITS FOR INDIVIDUAL EMPLOYEES AND FOR DISTRIBUTION CREWS

A kit for individual employees' use, denoted "No. 00 I. D. P.," is shown in the left of the illustration. The dimensions are 2⅝ in. x 4 in. x 1 in., the case being of 26-gage steel. Each kit contains one gauze compress about 3 in. square with attached bandage, two gauze compresses about 2 in. square with bandage attached, three ampoules of tincture of iodine, and one small collapsible tube of petrolatum. Each kit is recorded in a card index system and is inspected regularly. Kits are assigned to employees to be carried in bags or with other equipment, and the dressings, while not large, give adequate initial protection of sufferers from cuts, abrasions or burns.

The kit for line and underground crews, shown at the right and known as "No. 3 I. D. P.," is assembled in a container of 20-gage steel, 9 in. x 9 in. x 2½ in. in dimensions. The following supplies are included: twelve gauze compresses 2 in. square, eight compresses 3 in. square and two about 4 in. square, all twenty-two with bandage attached, twenty ampoules of tincture of iodine, ten ampoules of aromatic spirits of ammonia, six tubes of borated petrolatum, one compress of absorbent gauze, one bandage, one wire splint, one triangular bandage, one tourniquet of heavy webbing, one pair light steel forceps and one set for eye injuries. These kits are made by the Hygienic Fibre Company of New York City.

Rules for Unloading Poles

By E. A. Lindsley
President Lindsley Brothers Company, Spokane, Wash.

WITH a view of reducing serious and in many cases fatal accidents caused through ignorance and negligence on the part of workmen engaged in the unloading of poles, this company has formulated a set of rules which are in force in its yards and are advocated for use by all companies engaged in handling poles. The rules given below are the result of twenty-five years' experience in the cedar-pole business:

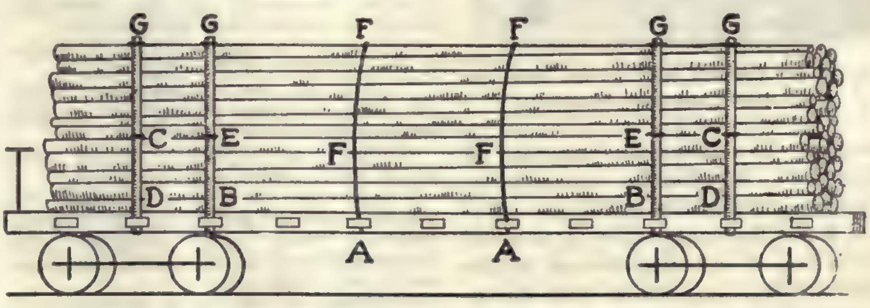
Never allow any one on top of load under any circumstances.

Never cut top wires (*G*).

Always unload car in same direction that it is leaning. If yard conditions necessitate a violation of this rule, place substantial props against the load on opposite side.

For absolute safety attach cables or ropes to pockets (*A*), throwing the cables or ropes over the car as per *F* of the illustration. The cables or ropes are then securely fastened to pockets on opposite side of the load in such a manner as to make it possible for them to be gradually released by snubbing. The following operations should then be carefully performed and followed in exact rotation:

1. Cut the two inside stakes at *B*.
2. Cut the wires at *E*.
3. Cut the outside stakes at *D* so that they are free at the pockets but both wires (*C*) are still intact.
4. Cut center wires (*C*), using a long-handled axe (an ordinary axe with a handle about 10 ft. long) so that a man standing at the end of the car will be out of danger. The stakes, having been previously cut, will swing out from the load, but the cables or ropes (*F*) will still hold the poles in position and make it impossible for the load to fall.
5. Release the snubs gradually until the poles reach the ground.



PROPER SNUBBING WHILE UNLOADING GOES FAR TO REDUCE HAZARDS IN HANDLING DISTRIBUTION POLES

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Results of Demonstrating Show-Window Lighting at Hartford

Thirty Merchants Use Model Window for One Week and Twenty-five Improve Their Own Illumination—Installation Gives Impetus to All Commercial Lighting

By W. D. Gorman* and Davis H. Tuck†

INTEREST in window lighting has been very active throughout the country during the past two years, largely on account of experiments conducted by the engineering department of the National Lamp Works at the Cleveland store of the Oppenheim-Collins Company. It was conclusively demonstrated there that the drawing power of a show window could be greatly increased by raising the intensity of the illumination. This increased interest has resulted in the following well-defined practices:

1. Average night illumination intensities have increased from 25 ft.-candles to 100 ft.-candles for a well-lighted window in the business section of a city.
2. Tests at Milwaukee and at Cleveland indicate that intensities up to and beyond 100 ft.-candles are a paying investment for the merchant.
3. The use of spotlamps and floodlamps in windows by daylight and evening has become popular in the past year.
4. Colored lighting in show windows is becoming more popular but is yet in its infancy. So far there has been little attempt at artistic color effects like those on the stage.
5. The method of installing window-lighting equipment has become highly standardized owing to the fact that three manufacturers of window-lighting reflectors have standardized on 100-watt and 150-watt lamps and two types of light distribution for deep and shallow windows. In general 100-watt or 150-watt "Mazda" lamps in angle-type prismatic or mirrored reflectors spaced on 12-in. to 14-in. centers along the entire glass front represent the best present window-lighting practice.
6. It is believed that the use of larger lamps (200 watts to 300 watts) to obtain even higher general intensities, larger and more powerful spotlamps and the more intelligent use of colored lighting will mark the coming year.

> METHODS employed to demonstrate the advantages of better window lighting are of particular interest to commercial men at this time of the year, when merchants are most receptive to suggestions for increasing the sales value of their window displays. In this article Mr. Gorman and Mr. Tuck have outlined a definite plan for obtaining this business which has proved its merit in actual practice.

About two years ago the need of better window lighting in Hartford was forcibly brought to the company's attention. Up to that time the company considered its own show windows well cared for, but after equipping them with modern display lighting it was realized that only the first step had been taken. The method of developing show-window lighting has been mainly by a store-to-store canvass, some newspaper advertising and on the backs of bills.

Attitude of Merchants

Because of increased competition and more careful buying by the public merchants are willing to listen to any arguments that will increase their trade. Engineering layouts of windows and light patrol switch service have helped to induce customers to utilize long-hour burning.

On the two main streets of Hartford colored lighting is required for distinctive store illumination. The company has been carrying a stock of color screens and spotlamps which it has loaned with good results.

Window a Sales Laboratory

Realizing the value of high-intensity window lighting, the company decided several months ago to design and install a show window embodying the most up-to-date methods and to offer merchants free display space in this window for stated periods. The results of the first seven months' work with this window are most gratifying.

The window is on Ann Street, in a part of a downtown substation. This street connects two of the principal thoroughfares of the city by a short block, and the window can be seen from either street. A "jog" was cut into the substation property so that glass could be put into two sides of the window. There are 12 linear feet of glass on Ann Street and 10 linear feet on the other side. The window is 10 ft. deep, 8 ft. high to the bottom of the transom, and has a floor area of 112 sq.ft. The trim is finished in a light-gray paint having a reflection factor of 70 per cent. There are three rows of reflectors (Fig. 1), spaced on 12-in. centers along each of the two glass sides, there being a total of fifty-two reflectors.

The reflectors are Holophane No. 922 and are mounted on Appleton No. 7319 holders and Crouse-Hinds JR-2-6 type condulets with type C-2 porcelain receptacles. Clear "Mazda" lamps of 150-watt size are used with a total wattage of 7,800, or 70 watts per square foot of floor area. When all lamps are burning without color filters, an illumination intensity of 400 ft.-candles is obtained on a horizontal surface. Color filters with gelatine refills of thirty-two colors are available for color effects. The fifty-four outlets are arranged on twelve circuits so that alternate lights of the same row are on one circuit. Provision is made for three spotlamps and two wall brackets. There are also three center ceiling

*Illuminating engineer Hartford (Conn.) Electric Light Company.
†Electrical engineer Holophane Glass Company, New York.

FIG. 1—THREE ROWS OF REFLECTORS WITH CIRCUIT SUBDIVISION FACILITATE DISPLAYS

outlets equipped with "elexits" so that special luminaires can be installed, such as a dining-room luminaire in displaying dining-room furniture. A Brink motor-driven sign flasher with ten circuits is installed in a metal cabinet, and it is provided that any combination of color effects or intensities can be obtained. With the flasher the contrast of a window underlighted with one well lighted can be obtained readily.

WINDOW BOOKED AHEAD FOR MANY MONTHS

In order to get the whole-hearted interest of the local merchants, they were personally interviewed and it was explained to them that their sales could be increased by modern window lighting. To prove this in a particular case, the Hartford company offered to loan its own demonstration window to them for one week without charge. The merchant trims the window with his merchandise in the best possible way (Fig. 2), and the company arranges the lighting to display it to the best advantage. The direct sales resulting from this display of one week per merchant are the best proof that modern lighting methods help the merchant increase his sales.

At the very beginning the window was booked ahead from February, 1923, to January, 1924. Each week when the window is changed a photograph of the display is taken and a reproduction of the photograph, together with an outline of the window with appropriate "copy," is inserted in the local press, thus calling attention to the display. A circular letter is also sent to all merchants who handle similar goods inviting their attention to the window.

After the display is removed the merchant is called upon with the idea of having him install window lighting in his store similar to that under which his display was shown during the previous week. The "prospect" is then turned over to an electrical contractor so that estimates of the cost of an installation can be made.

At this writing thirty merchants have used the window for one week each, and of these twenty-five have made more or less extensive improvements in their window lighting. These consist of complete new installations, additions to present installations, provision of spotlamps, keeping window lighting on in the daytime, and the use of a free turn-off service at midnight, thus increasing the hours of burning at night. Twelve other merchants installed new window lighting as a result of the circular letters sent out. The effect of the test window on the character of the window lighting in new buildings has been most gratifying, as without exception new store fronts have been lighted to conform to the best practice, i.e., 100-watt to 150-watt lamps on 12-in. to 14-in. centers.

The company has distributed a sixteen-page booklet to all the local merchants telling what has been done and inviting their co-operation. The Hartford Electric Light Company believes that the demonstration window has been an unqualified success, not only as a load builder but as a good-will builder. An accelerating interest on the part of local merchants and the public is anticipated this fall and winter and a prize contest is under consideration. Improvements in window-lighting equipment and methods will be featured by the company as they develop.

Guiding Principles in Seeking Interconnections

INTERCONNECTIONS that could be established to the benefit of every one concerned have sometimes been delayed because of a lack of appreciation of the fact that they must be considered as a mutual benefit and selfish interests should not be allowed to prevail. A member of the power survey committee of the Great Lakes Division, N. E. L. A., who has had wide experience in bringing about interconnections has adopted as a guide in initiating co-operation of this character the following principles, which other companies may find of benefit if they are followed in spirit:

Attitude of Companies.—No interconnection can be a success unless the attitude of the respective companies and their operating forces is based upon a mutual consideration of the interests of both companies in the service of the public.

Capacity.—The capacity of all interconnections should be ample to transmit

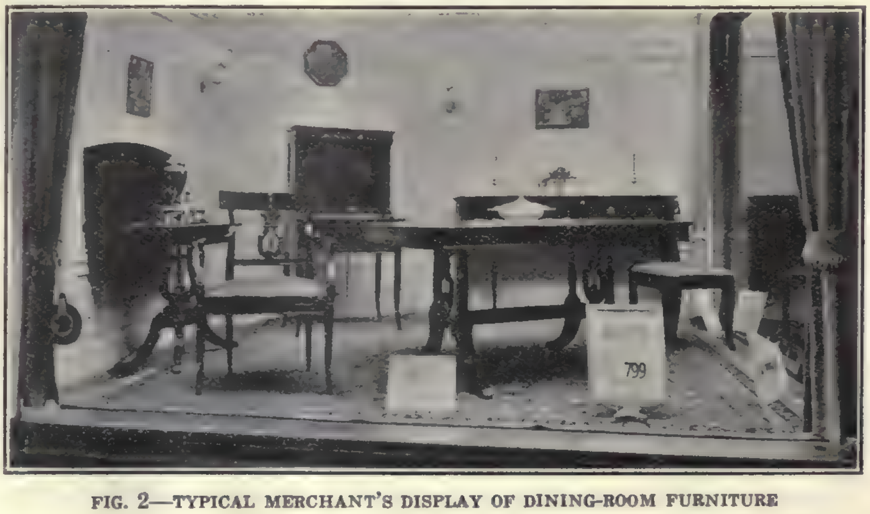


FIG. 2—TYPICAL MERCHANT'S DISPLAY OF DINING-ROOM FURNITURE

either way all of the capacity required for an emergency with an ample margin for reasonable future growth. We have seen a number of interconnections between companies which were practically useless because in time of emergency only a fraction of the emergency needs could be transmitted even though ample capacity was available in generating facilities.

Service Protection.—Any transmission system interconnected to another similar system should have sufficiently good service conditions so that the interconnection will not jeopardize the service of the other company.

Load-Dispatching Arrangements. — There must be complete co-operation between the load dispatchers of the two systems to be interconnected and an arrangement between the two companies so that the load dispatchers themselves can immediately order connections in case of emergency. Each load dispatcher should be sufficiently familiar with the adjoining system to protect service and provide ample capacity.

Maximum Load Limitations.—Where companies are interconnected and the supplying company for some reason must reduce the capacity, a notice should be given to the receiving company as far ahead as possible so that the service of the receiving company shall not be interrupted.

Rates for Service.—Most interconnections combine regular supplies for wholesale power with emergency service either way. In such cases there should be a rate for the regular service and a separate rate for the mutual interchange of energy in emergencies. In fixing the rates for interconnections the economic benefits of the interconnection should be shared between the parties, and any attempt of one company to secure for itself all of the benefits of an interconnection is sure later to defeat the purposes of the arrangement.

Diversity of Loads.—Generally speaking, there is a diversity of load between adjoining systems due to peculiarities of industries served or other conditions. The fullest co-operation should take place between interconnected systems in seeing that this diversity of load is taken care of so as to reduce the total cost of operation of both systems. This may take the form of interchange at certain seasons of the year on account of seasonal diversity, or it may be an interchange at different times of each day, owing to a difference in the load characteristics as between day and night loads of the two systems.

Construction Costs of Interconnections.—Generally speaking, the costs of interconnections should be shared equally by the parties, with the exception that the physical property up to the point of interconnection should be owned by the company in whose territory it is located. This may mean, however, an adjustment of fixed charges in some cases where the benefits of interconnection are to be mutual but where local reasons compel the location of a substation in the territory of one of the companies when it cannot be located satisfactorily at the point of connection. Maintenance of transmission lines should be done by each company up to the point of connection.

Public Relations. — Interconnections between adjoining companies aid public relations. They enable interruptions from transmission-line failures to be reduced, and the public should be aware of the fact that such interconnections are entirely in the public interest as they multiply the sources of power and use jointly the resources of several companies where one company without such interconnection would have to have invested large sums of money or spare units or duplicate transmission lines. Interconnections reduce the spares which can safely be carried in transmission systems if operated independently.

Range Survey to Be Made in Northwest

A THOROUGH investigation of every phase of the electric range situation among the member companies of the Northwest Electric Light and Power Association is to be the most important work of the Commercial Section during the coming year. The executive committee of the association at its first meeting in Seattle recently went on record as being in favor of making the survey. Last year's Commercial Section recommended that the association appropriate the necessary funds to carry on the work, but the executive committee decided that the expense should be borne by the central stations and the manufacturers. The Commercial Section was authorized to interest itself in the raising of the necessary funds in so far as the contribution to be made by the central-station companies is concerned.

A great deal of the proceedings of the Commercial Section at the annual convention of the association held in Seattle last June was devoted to a discussion of the electric range situation. The section suggested that a complete survey be made to determine whether this business is profitable to central stations under their various conditions of operation. It was pointed out that central stations were reasonably well satisfied that the range load helps the business as a whole, but it was felt that the most important consideration is to get definite figures from the experience of central stations and to determine the possibilities of a greater degree of saturation of this class of business. The investigations in the past have been largely devoted to proving the success of the electric range and its competitive advantages with other forms of fuel. The proposed survey will endeavor to ascertain the cost of service, the revenue derived and the maintenance cost of ranges. It is proposed to employ a special man on this work and to get the survey under way as early in the year as possible.

What Other Companies Are Doing

Hartwell, Ga.—A daylight kitchen campaign was carried on for six days by the Carter Electric Company of Atlanta and the Georgia Railway & Power Company with excellent results. One out of every three houses in that city was sold, thus proving that the small-town resident is as promising a "prospect" for good lighting as is the man in larger communities. A similar campaign is to be carried on by the power company in other cities throughout its territory.

Lewiston, Me. — Reconstruction of the steam auxiliary plant of the Androscoggin Electric Company, now a part of the Central Maine Power Company system, is being pushed under a fifty-two-day schedule to overcome threatened power shortages due to the long-continued drought. A 6,750-kw. unit will replace two units of 1,500-kw. combined rating installed in 1914, and the boiler plant is being enlarged and changed over to fuel oil. The work is being done according to a construction timetable. Recently a second tie line has been completed between the company's Deer Rips hydro-electric plant and the Lewiston station.

Boston, Mass.—All previous records for applications for electric service were broken on the system of the Edison Electric Illuminating Company of Boston, on Oct. 1, when 525 seekers of energy supply made known their desire to become customers. House-wiring business is extremely active in eastern Massachusetts; a large amount of new mercantile building construction is under way in Boston and vicinity, and interest in improving the electric service by increasing or remodeling old installations is growing from month to month.

Green Bay, Wis.—The Wisconsin Public Service Corporation, which is furnishing electric light and power, electric railway, street railway and gas service to the public in northeastern Wisconsin, has enlisted all of its employees in eleven counties in a campaign to dispose of 7,500 shares of its 7 per cent preferred stock, the proceeds of which will be used to finance extensions and additions to its properties. Since March 28, when the present plan was adopted, patrons and employees have purchased $720,000 worth of stock.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Hydro-Electric Development and Steam Equipment

Water Power of the Mamasa River.—P. M. VAN BOSSE.—An extensive description is given of a project for the utilization of the water power of the Mamasa river (Celebes, Dutch East Indies) for industrial purposes. A total of 180,000 hp. will be available during ten months of the year at a head of about 1,700 ft. Power will be obtainable at the seaport Polewali at low cost, estimated at thirteen one-hundredths of a cent per kilowatt hour.—*Ingenieur (Holland)*, Sept. 1, 1923.

Super-Power Plants and Coal Conservation.—E. DOUGLAS.—A discussion of the fundamental principles of fuel conservation and the relation of heat and power requirements.—*National Engineer*, September, 1923.

Losses Affecting Water-Power Developments.—W. T. TAYLOR.—Conclusions based on comparisons of water losses over a catchment area are, in general, as reliable as those based on either rainfall or run-off, and sometimes more reliable. If a study of the run-off and water losses of a given area indicates that these losses are abnormal, then a geologic investigation should be made to find the leakage. Water leakage in a power development may be expected to occur on areas covered by deep beds of sand, gravel and porous glacial deposits, through broken, seamy and fissured rocks, etc. Among the subjects discussed by the author are an investigation of hydraulic losses, seepage, capillarity and evaporation, estimating the probable run-off, operating records and their value.—*Canadian Engineer*, Sept. 25, 1923.

Oil Engines for Reducing Power-Plant Costs.—L. H. MORRISON.—The author relates how the addition of two Diesel engines at the 1,600-kw. municipal plant, Freeport, N. Y., effected a saving of $19,000 a year, based on costs with existing steam units.—*Power*, Sept. 18, 1923.

Generation, Control, Switching and Substations

Grounding. — L. SEKUTOWICZ. — This very elaborate paper of thirty-four pages deals with investigations of grounding problems and grounding arrangements, such as are used in transmission and distribution systems for the safety of operation, to carry atmospheric discharges to ground, to connect the neutral in alternating-current or direct-current networks to ground, etc. The first part of the article contains detailed theoretical considerations and a large amount of results from actual tests and measurements of the distribution of the potential around, between and near grounding points, made on a very large scale. Using a method similar to that employed in Weather Bureau isobar charts, giving the distribution of barometric pressure over a large area, the author shows isopotential charts of the area around a power-distributing center in France. These charts were obtained from a vast number of ground potential measurements, introduced into a topographical chart of the area, the points of equal voltage being connected with irregular curves closed into themselves. A chart of this nature shows the great irregularity of the conductivity of the soil and permits the finding at a glance in a given territory of the best location for an effective ground connection. The current distribution in the ground is studied theoretically and by means of measurements, and from their results the maximum permissible current gradient is determined for safe operation. The influence of chemical admixtures in the soil and the amount of humidity are investigated. The second part of the paper describes and criticizes practical grounding methods and means of measuring the ground resistance such as are being used today in central-station practice. A complete bibliography is a valuable addition to the article. *Revue Générale de l'Electricité*, Sept. 1, 8 and 15, 1923.

Insulators and Insulating Materials.—The issue of this magazine named below is devoted specially to the present status of problems of insulation and contains eight papers covering experiences and research work on this subject. Development, manufacture and testing methods are described for natural and synthetic insulating materials, the properties of oil as a dielectric are investigated, a new method of calculating a condenser bushing is given, and a detailed description of latest types of cementless disk-type insulators is printed, with many illustrations.—*Elektrische Betrieb*, Aug. 29, 1923.

Waterwheel Generators and Synchronous Condensers for Long Transmission Lines.—M. W. SMITH.—Under the subject of generators, the following points are discussed: Leading current drawn by transmission lines and its effect upon the stability and mechanical design of generators; characteristic curves of generators designed for operation at leading power factor; special winding connections which increase the capacity of generators for leading power-factor operation during temporary periods without increasing their weight and cost; description of general construction and ventilation of a 28,000-kva. vertical waterwheel generator. The following points are discussed with reference to synchronous condensers: Operation at leading and lagging power factor and how it affects the stability, cost and weight of the machines; special winding connections and their effect on stability; general mechanical construction with particular reference to damper winding design and the use of sheet-steel end bells; the importance of losses and a curve showing values it is possible to obtain on machines with the latest improvements in design; starting kva. and how it may be minimized by the use of oil pressure in the bearings. This paper was presented at the Pacific Coast convention.—*Journal of A. I. E. E.*, September, 1923.

Transmission, Substations and Distribution

Transmission Line for Oak Grove Development of Portland Railway, Light & Power Company.—H. R. WAKEMAN and W. H. LINES.—This paper covers the design of the 110-kv. transmission line to transmit energy from the new Oak Grove development of this company to the city of Portland, Ore., a distance of 54 miles. A detailed description of the line construction is given. The paper was presented at the Pacific Coast convention.—*Journal of A. I. E. E.*, September, 1923.

Ground Return for Power Lines.—G. VIEL.—To supply small customers like farmers with electrical service the installation of a double line is frequently found to be too expensive. The author claims that it is neither dangerous nor disturbing to telephone lines to carry to the customer only one galvanized iron or copper wire and to make the return through ground. Results from actual tests made with voltages as high as 11,000 seem to corroborate the author's assumptions. Figures for electric loss and cost are given in several instances to show the great savings which can be realized by a single-wire, ground-return, single-phase transmission system as compared with customary methods. Owing to the difficulties in providing a reliable grounding with low resistance it is not recommended that an attempt be made to transmit low-voltage (110 or 220) energy over one wire and ground return. French electrical standardization rulings at present forbid the utilizing of a ground return for light or power service, but the hope is expressed, based on the investigations made, that this ruling will be repealed soon in the interest of hundreds of small consumers.—*Revue Générale de l'Electricité*, Aug. 25, 1923.

Revision of Circular on Standards for Electric Service.—Several meetings have been held recently discussing the revision of Circular No. 56 on "Standards for Electric Service." The bureau has had the benefit of criticism by members of a committee representing the

N. E. L. A. and the Association of Edison Illuminating Companies. A new edition is being published.—*Circular No. 56 of the Bureau of Standards.*

Units, Measurements and Instruments

Development of High Efficiency in Centrifugal Pumps.—A. F. Sherzer.—A description is given of a recent program of experimental design carried out in the hydraulic laboratory of the University of Michigan. Specifications of centrifugal pumps, efficiencies of pumps with low specific speed and characteristic curves for several high-head experimental pumps are discussed.—*Engineering News-Record*, Oct. 4, 1923.

Radio-Frequency Tests on Antenna Insulators.—W. W. Brown. — After analyzing the design considerations for high-voltage radio-frequency continuous-wave antenna insulators, data are given on the heating, losses and flashover points of a number of sizes and forms of porcelain-rod insulators, both dry and wet. The effect of rain shields, electrostatic strain shields and "breathers" on the behavior of the insulators is discussed. The voltage distribution across insulators in series was determined and its effects on design are given. A study of visual corona point on conductors at radio frequencies is included.—*Proceedings of the Institute of Radio Engineers*, October, 1923.

Illumination

Incandescent Lamp Production in Russia.—A. P. Ivanoff.—In 1914 the total number of incandescent electric lamps required in Russia was estimated as 16,500,000 for homes and 500,000 for streets and public halls (100 cp. and up). Russian factories (four in number) at present cannot supply more than 4,000,000. Such conditions will endure for a considerable period of time, because the increase of production will not be sufficient to cover the increase in demand. Before the war all raw materials were obtained from Germany. At present there is a glass factory which can supply sufficiently good glass. Tungsten wire is still foreign.—*Electrichestvo* (*Russia*), No. 4, 1923.

Motors and Control

Operation of Induction Motors.—H. Cotton.—The ordinary induction motor suffers certain electrical defects leading to poor power factor and low loads. The component of the stator current which produces the magnetic flux lags in quadrature behind the stator-applied voltage, so that even at full load the power factor cannot reach unity. The magnetizing current is constant and independent of the load, so that the power factor drops at partial loads. This characteristic of the ordinary induction motor has led to numerous endeavors to improve power factor by impressing an external electromotive force upon the rotor circuits. The operation of induction motors under these conditions is dealt with by the author in a two-part article commencing in the issue named below. The author also considers in detail the series commutator motor and its modifications, illustrating his points with vector and circle diagrams.—*Beama* (*England*), September, 1923.

Squirrel-cage Induction Motor with High Starting Torque.—T. F. Wall.—In this motor the rotor conductors are built up as composite bars as follows: A central copper rod is surrounded by a steel sheath, and the outside of the steel sheath is copper-plated to a suitable thickness. Each rotor conductor is thus in effect a simple form of transformer, the central copper rod being the primary winding, the steel sheath being the magnetic core and the outer copper plating the secondary winding. In accordance with a well-known law in the theory of transformers, the desired result is obtained that the resistance of the rotor winding is automatically increased at starting, while when normally running it has the same value as for a standard type of squirrel-cage motor.—*Paper presented before the British Association at Liverpool, England*, Sept. 12-19, 1923.

Electrophysics, Electrochemistry and Batteries

The Effects of Weak Magnetic Fields on Polarization of Radiation.—R. W. Wood.—The resonance radiation of mercury vapor in a vacuum, at a pressure of about 0.0001 mm., is polarized to the extent of 90 per cent. This polarization is completely destroyed by a magnetic field of 1 gauss or 2 gausses, directed toward the observer. The magnetic field of the earth reduces the percentage of polarization to less than 50. Other orientations of field produce polarization of the radiation in directions in which it is normally absent, e.g., in the direction of the electric vector of the exciting light. Sodium vapor, similarly excited by D_1D_2 radiation, exhibits less than 10 per cent of polarization in the absence of any magnetic field. This small trace of polarization is destroyed under circumstances similar to those which obtain with mercury vapor, except that a field of about 100 gausses is required. With the field oriented in other directions, the percentage of polarization is increased to 30 or more. With the exciting light (electric vector perpendicular to the plane of paper) and the magnetic field parallel and in the plane of the paper, there results strong polarization in directions perpendicular to the plane of the paper. In the absence of magnetic field no polarization would be exhibited in this direction. If the field is rotated through 90 deg., remaining in the plane of the paper, the plane of polarization turns with the field, the electric vector of the resonance radiation being horizontal when the field is vertical. If, however, the electric vector of the exciting light is in the plane of the paper (i. e., vertical) the polarization diminishes as the magnetic field is rotated, becoming zero with the field at 45 deg., and rising to a maximum again when the field is vertical. These relations are difficult to describe without the aid of a diagram, but it seems quite evident that an orientation of the molecules in the magnetic fields is being dealt with.—*Paper presented before the British Association at Liverpool, England*, Sept. 12-19, 1923.

Electrochemistry of Gases.—S. C. Lind.—The present status of electrochemical action in gases is discussed and is compared with electrolysis. The necessity for indirect methods of investigation is mentioned and the gaseous reactions taking place under ionization by radioactive agencies are cited. Some new laws regarding ionization and chemical activation are stated which are supported by recent physical evidence. — *Paper presented before the American Electrochemical Society at Dayton, Ohio*, Sept. 27-29, 1923.

Telegraphy, Telephony, Radio and Signals

Improved System of Modulation in Radio Telephony.—C. A. Culver.—After describing the commonly employed absorption and constant-current systems of radio-telephone modulation, the author discusses a system of modulation wherein the resistance in the grid circuit of the power oscillator tubes is vocally varied, this resistance being itself the plate circuit of a suitable vacuum tube. Operating data on sets embodying this method are given. —*Proceedings of the Institute of Radio Engineers*, October, 1923.

Miscellaneous

Electric Ship Propulsion.—F. H. Clough.—The author discussed the following aspects of his subject: Consideration of power and speed of screws; propelling machinery — reciprocating steam engines, steam turbines, Diesel engines; reason for adopting steam turbines; need for speed-reduction mechanism; single and double reduction gearing; tooth pressures, lubrication, increased stresses due to acceleration and faulty alignment; electric transmission of power, alternating and direct current; comparison of size and weights of electlic motors and gear wheels; description of operation of electric generators and motors, magnetic forces; revolving fields; model showing action of forces and speed-reduction features; control operation of excitation and reversing switches; analogy with motor-car control; model to show operation of control; further considerations of electric transmission—efficiency, reliability, repairs, ventilation; effect of electric transmission on turbines and propellers, super-heated steam, reversing blades; use of double-ratio transmission for naval vessels; electric transmission for Diesel-engine ships; use of most suitable speeds; examples of electric ships and experience obtained with them.—*Paper presented before the British Association at Liverpool, England*, Sept. 12-19, 1923.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Girand License Up Again

Once More Decision Is Put Off—Weeks Must Align Himself with Work or Wallace

APPARENTLY with the idea of discussing the matter with the Cabinet, the Federal Power Commission deferred until next week its decision in the matter of the Girand license. At the meeting on Oct. 22 Secretary Wallace is understood to have favored the immediate execution of the license. Secretary Work is thought to have contended that the license should be withheld indefinitely until a definite policy may have been worked out for the development of the Colorado River as a whole. Secretary Weeks evidently was not ready to cast the deciding vote which might cause ill-feeling between Cabinet members.

It is recognized by close students of the Colorado River situation that the real influence which is delaying the development of the river is the incubus of public ownership. Those who are opposing the Girand license are those who want to see Uncle Sam go into business in a large way along that stream. There can be no doubt that a majority of the Cabinet will oppose a government enterprise when private capital is willing to undertake the development. There is every reason to believe that the commission will make its decision at its next meeting. The impression is quite general that the vote will be in favor of the execution of the Girand license.

First Unit of New Waukegan Plant in Operation

The first unit of the new Waukegan generating station of the Public Service Company of Northern Illinois—a 25,000-kw. turbine—has been put in operation. The energy developed is to be distributed throughout the North Shore district from the city limits of Chicago to the Wisconsin state line over four 33,000-volt transmission lines. The high-capacity steel-tower transmission line now under construction will be completed in a few months and will serve as a main tie between the Waukegan station and the company's system at Evanston, enabling large quantities of electricity to be transmitted both south from the new Waukegan station and north from Evanston. Handicaps imposed by the demand for electricity which heretofore occurred annually at this season of the year are now removed, and an immediate improvement in operation resulted when this additional energy supply became available for use.

In its present condition the new station has about half the capacity of the Blue Island plant, which was considered at the time of its erection to be something of an experiment. It is equal to the big Joliet station, although the new turbine now being erected in the latter will double its capacity. When the Waukegan station is completed it will have a capacity of 275,000 hp.

A little more than sixteen months elapsed between the time of letting the contracts and the time when the station was placed in operation. This is a record of power station construction which the owners believe has not been equaled. Marked aid in minimizing construction time was secured by the employment of electric power from the present station at Waukegan. It was used in the operation of electric cranes and for a number of other construction purposes.

The plant is built on a tract of 80 acres adjoining Waukegan on the north. The site constitutes the last piece of lake shore property available for power station purposes between Kenosha and the Indiana state line. The entire 80 acres is required for buildings, coal storage, railroad tracks and so on. A pond on the tract provides the water supply.

State Executives Discuss Superpower

At the West Baden (Ind.) Conference Governor Pinchot Presents Economic Reasons for Its Development—National Aspects of Interconnection Presented

SINCE the development of any superpower system would by economic necessity be interstate, it should be incumbent upon the federal government to see that troubles and difficulties similar to those growing out of interstate commerce in the past are avoided in dealing with the question of "power pooling," Governor Gifford Pinchot of Pennsylvania declared in his address on "Giant Power," which was the final subject before the fifteenth annual conference of Governors, held at West Baden, Ind., on Oct. 19. Governor Pinchot did not attempt to lay down any method by which this could be accomplished. He felt that the superpower problem should not be thrown directly at the federal government before it was taken up by the individual states.

After tracing the effect of power on the evolution of civilization, Governor Pinchot separated the superpower project into two parts. The first dealt with the question of how it was possible to develop such power, either by steam or hydro-electric plants, along lines that could assure private capital a fair return. The Governor felt that the project would be entirely too large for private control and that it must not be dominated by short-sighted individuals. He conceded that it was quite as important to the public that a fair return be obtained as it was to the investors.

Governor Pinchot's second point was the conservation of the nation's resources in order to safeguard the public interests of the future, and as this involves the use of hydro-electric power, he declared that greatest economy would be obtained by the unification of steam and hydro plants into one vast system such as the Atlantic seaboard superpower project. Since only 15 per cent of the available water power is now undergoing development, further steps should be taken to push this work. The Governor said that the provisions of the federal water-power act of 1920 were hostile neither to the state nor to private interests, but were a safeguard to future generations.

Regarding his own state, Governor Pinchot declared that the federal power act had been dovetailed into the power acts of Pennsylvania, thereby offering a double safeguard for conserving the resources of the state. He told of the plans to co-ordinate mammoth steam generating plants at the mines with the water resources of the Eastern States by means of high-tension transmission lines. Since this was an economic development, Pennsylvania could well afford to forget its boundary lines because of the saving in coal. He also held that power pooling would have a tremendous effect upon the economic condition of the farmers through whose territories these "lanes of power" would pass. These economic superpower changes the Governor held to be absolutely inevitable.

Governor John J. Blaine of Wisconsin in the discussion laid stress upon the state's protection of future generations in that it could not give away

any heritage of nature. In Wisconsin the state has no ownership of stream flows but has only a trusteeship over navigation and fishing. By giving indeterminate franchises the state can, as it sees fit, recapture these franchises, thereby preserving the public rights of the future. The Governor directed attention to the unfairness of rates charged in certain Wisconsin cities on the "loop system" as contrasted with the rates for the identical energy sold, across the state boundary, in the Twin Cities.

Reasons why Maine did not allow energy to leave its borders were expressed by Governor P. P. Baxter. He explained this as being due to a policy of self-preservation. Since the state is at the extreme end of the nation, there is virtually no cross-flow of industrial trade. Much of the material manufactured within the state is shipped out. In order to prevent the state from becoming entirely impoverished, every utility franchise has a clause restricting the exportation of power. Although the state has 700,000 hp. of undeveloped energy, only 460,000 hp. is actually in use. The Governor admitted that the state's right so to limit its own production of energy has never been tested in the Supreme Court, and the future might alter its course on superpower development.

Nine Indiana Municipal Plants Turn to Central Service

Another evidence of the passing of the small-community lighting and power plant is given in the announcement by A. C. Babson, vice-president and general manager of the Central Indiana Power Company, that contracts have been closed to supply electrical energy to nine towns and cities served heretofore by municipally owned and operated plants. These places are Covington, Veedersburg, Tipton, Montezuma, Kingman, Ladoga, Paragon, Argos and Etna Green—communities that will serve as connecting links in the state-wide power system now being built up by the Brewer interests. The Central Indiana company is now serving or has entered into contracts to serve more than 114 towns and cities in the central and northern portion of the state.

In each of the new contracts entered into the community has obtained service at a lower rate than under the old system of small unit operation, Mr. Babson said. The company is constructing a high-tension line from Noblesville around the eastern and southern limits of Indianapolis to a large substation in process of construction west of the city. This line, it is expected, will be "tied in" early next year with the high-tension line from the company's new superpower plant south of Terre Haute. Branch lines will extend north from Noblesville, connecting with other high-tension lines that will serve northern Indiana.

Program of High-Tension Conference

French, Italian, Spanish, Dutch and American Engineers Will Discuss Transmission Problems at Forthcoming International Gathering at Paris

As noted in our issue of Sept. 15, the second international conference on high-tension power lines will be held in Paris Nov. 17 to Dec. 1. This conference is given over almost entirely to the discussion of subjects connected with the design, construction and operation of high-voltage trunk lines, in which there is a growing interest in all parts of Europe. The general arrangements for the conference are in the hands of the Union des Syndicats de l'Electricité, of which J. Tribot-Laspière is the general secretary. The following reports have already been submitted:

Comprehensive Range of Papers

"The Operating Protection of a Large Hydro-Electric High-Voltage System," by F. M. Gillespie, superintendent of operation of the Ebro Irrigation & Power Company, Barcelona, Spain. The author describes the different devices employed on the Ebro system and shows the results for different loads when synchronous condensers are employed. He also discusses frequency regulation, voltage regulation and power-factor correction and isolation of faults.

"Relay Protective Gear for Large High-Voltage Networks," by F. Dejong, superintendent of testing department of the Ebro Irrigation & Power Company. The paper describes relay practice and experience of the Spanish company and shows how different kinds of relays have acted in cases of failure.

"The Insulator Problem from the Operating Man's Point of View," by C. E. Bennett, assistant chief engineer of the Ebro Irrigation & Power Company. The author points out the different factors to be considered when choosing insulators and reports on the experience of his company and the methods employed for testing and replacing insulators.

"A 900-Meter Crossing on a 130-Kva. Line," by Renzo Norsa, chief engineer of the Società Elettrica Interregionale, Milan, Italy. In this paper a description is given of the Po River crossing at Plaisance. The author explains the problem and shows the different solutions which were examined. He also describes the work and presents graphs illustrating the strains on the towers.

"Modifications Proposed to the Standard Rules Actually Used for the Construction of High-Tension Power Lines," by J. G. Bellaar Spruyt, president of the Association of Managers of Electric Plants in Holland. The author shows the disadvantages of the old specifications and explains the new rules which have been proposed by the Royal Institute of Engineers at the demand of the Ministry of Public Works.

"Outdoor Substations in the United States," by H. W. Young of the Delta-Star Company and Alfred Alsaker of Chicago. The development of small outdoor power stations in the United States is described by the authors, who also give data on their establishment and incorporate short descriptions of large power substations.

"Technical Specifications of Extra-High-Tension Power Lines in France," by Paul Meyer, engineer of the Compagnie Générale d'Electricité, Paris. The necessity for new specifications is emphasized, and the author enumerates the principal rules which because of derogations must be modified.

"Development in Insulator Practice," by R. P. Jackson, manager material and progress engineering department, Westinghouse Electric & Manufacturing Company, East Pittsburgh. In this paper the author describes the different types of insulators which are actually in use.

"Transmission Voltages," by F. C. Hauker, general engineer Westinghouse Electric & Manufacturing Company. The standardization of voltages is recommended by the author, who shows the increase of transmission voltages and points out the difficulties encountered with extra-high tensions. The A. I. E. E. standard voltages are recommended as possible international standards.

"American Practice in Oil Circuit Breakers," by B. MacNeill, engineer. The development of oil circuit breakers, especially for outdoor service, is traced and methods for testing the breakers are described.

"Lectures on the Use of Electricity and its Dangers," by J. G. Bellaar Spruyt. The paper is devoted to popular educational lectures for the purpose of warning people, especially children, of the danger of electricity.

Northern States' Jim Falls and Wissota Dams

Announcement is made by the Northern States Power Company of the completion of its hydro-electric power plant and substation at Jim Falls, Wis., on which work started in June and which has cost approximately $100,000. The plant will generate 16,000 hp., to be sent through the substation erected near by to the company's Wissota plant or direct to St. Paul or Minneapolis.

The company makes also a further announcement in connection with its plan to construct a great substation at the south end of Wissota Dam to cost approximately $1,000,000. The total area to be covered by the station will be 490 ft. by 210 ft., and it will be one of the largest stations of its kind in the country. There will be no buildings, the entire space being covered by steel towers carrying a heavy network of high-tension wires to transmit energy

from the hydro-electric plants at Jim Falls and Wissota. From this new substation energy will in turn be transmitted to the thirty-seven general stations supplied by the Northern States Power Company, which will eventually be distributed among 459 cities, towns and villages in Wisconsin and Minnesota. An outside substation was erected by the Wisconsin-Minnesota Light & Power Company to supply 121 towns and cities, but with the larger number to be supplied by the Northern States Power, after the merger of the two companies, the substation naturally proved inadequate.

Good Buying Marks New York City's Electric Show

The annual Electrical and Industrial Exposition of New York, commonly known as the "Electric Show," has been unusually successful this year from the exhibitors' standpoint. In the first eight days of the meeting an attendance of 100,000 had been recorded, and it was a buying crowd beyond the experience of former years. As usual, the departmentalized exhibits of the New York Edison Company and the large display of electric trucks on the upper floor were the two most conspicuous features. Naturally appliances dominated the show.

The New York Edison Company exhibited in twenty-odd booths scattered about the hall, devoted to lighting, power, cooking, signs, transportation and other applications of electricity and also displaying New York Edison advertising and graphically portraying elements in the electrified service which is offered by this central-station company. Notable was an exhibit of underground construction, showing models of manholes, materials used, methods of splicing, etc. The United Electric Light & Power Company, the New York & Queens Electric Light & Power Company and the Yonkers Electric Light & Power Company were also conspicuous in the show.

The General Electric Company and the Westinghouse Electric & Manufacturing Company occupied prominent space. The General Electric Company gave particular emphasis to radio battery chargers, machine-shop and industrial control material. The Westinghouse company also made a feature of battery charging and switchboard equipment. Both these companies, of course, made a very complete showing of household appliances. The Singer Sewing Machine Company occupied large space in an exhibit of electric sewing machines, to which a large share of this company's publicity is now being directed. The electric truck exhibit presented a large number of models and a very interesting diversity of truck equipment.

A canvass of the show brought forth a general record of good sales made and good contacts established. One booth reported orders for 900 toasters within a period of two days. A number of new model washing machines were on exhibition, and an interesting innovation was a display of Fulper pottery and porcelain novelties in the form of electric perfume lamps. The decorations of the show this year were extremely effective. The exhibits embraced a very large and striking variety of popular applications which have developed a great deal of public interest.

Engineers of West Virginia and Kentucky Meet

Great interest was aroused at the third annual convention of the West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers, held at Huntington, W. Va., on Oct. 19 and 20, by an informal discussion on the relative advantages of motor-generator sets and rotary converters for mine service. Mining, consulting and power-company engineers as well as representatives of prominent manufacturers canvassed the subject from many standpoints. Other discussions took place on papers presented, which included one on hoisting equipment by M. A. Maxwell, one on equipment records by J. H. Edwards and one on the manufacturer's service in supplying repair parts by F. M. Reigher.

The meeting this year was the largest so far held by the association, many new members having been attracted to the society by the important work it has accomplished within the short time it has been in existence. Officers were elected as follows: President, R. R. Webster, Elkhorn Piney Coal Mining Company, Weeksbury, Ky.; vice-president, F. M. Reigher, electrical engineer American Coal Company, Bluefield, W. Va.; secretary-treasurer, Herbert Smith, Huntington, W. Va. (re-elected).

Charleston (W. Va.) Electrical Men for Co-operation

Co-operation was the keynote of brief addresses made by representatives of electrical companies in Charleston, W. Va., and other cities in that state where they met last week at a dinner of the Electrical League of Charleston. Nearly one hundred men were present.

Bliss McCrum, secretary of the West Virginia Utilities Association, declared that West Virginia was leading all the states in its rate of increase in the production of electricity and that within ten years the state should become one of the wonders of the East in that regard. This was due, he said, to the abundance of cheap coal. The state had hardly begun to harness its water power.

Charles S. Dawson, the new manager of the West Virginia Water & Electric Company, told how the central station and the contractors could work together. Fire protection, insurance, inspection and standardization of equipment were other topics discussed. Similar meetings, including lectures, are to be held throughout the fall and winter.

For the Ferris Amendment

Prominent Engineers Regard It as an Essential Step in Developing New York's Power

SEVERAL prominent engineers have expressed views in favor of the much-debated Ferris amendment to the New York State Constitution, which would permit the erection of power houses and transmission lines in the state's Forest Reserve under the restrictions already set forth in these columns.

Gen. George W. Goethals states the terms of the amendment and, while not explicitly declaring for it, says: "The federal government has a settled policy for encouraging development of our water resources whereby streams are daily turning out energy which is running thousands of our industries. In the West, particularly, splendid progress has been made in hydro-electric development. I feel very strongly that we should take advantage of our natural gifts here in New York State. Wherever possible in the public interest streams should be utilized for the creation of energy and should not be permitted to continue undeveloped. While I do not look with favor on government ownership, if it be decided that the state itself should undertake the development, well and good; otherwise it should be done by private enterprise under safeguards and limitations which will protect the people."

William Barclay Parsons says: "If New York is to maintain its standing as a great manufacturing state, if the comfort and welfare of its inhabitants are to be preserved, every available unit of hydro power must be developed within the next few years. In a material way it is the greatest problem facing the people of the state. Its seriousness is recognized only by those who are called upon to find a means of meeting the public demand. The Ferris amendment is a step in this direction. To defeat it will mean a serious blow to public welfare."

Cooper Blames Estate Owners

Col. Hugh L. Cooper blames the opposition to the amendment on the owners of private estates, saying: "The whole situation resolves itself into just one question, namely: For the want of about 2,000 acres of leased land, under full state control, are the industries of the State of New York to continue to be taxed $20,000,000 a year by way of unnecessary coal bills in order that the millionaire owners of 400,000 acres of Adirondack lands will not have occasionally to look at a few minor transmission lines and a few well designed hydro-electric power stations?"

W. S. Murray, who prophesies that eventually the electric light and power companies will go out of the business of producing power and will instead receive wholesale electrical energy from great power companies which will be entirely outside of their corporate existence, thus leaving as the function of the electric utilities only the distribu-

tion of the energy so received to the customers within their franchise territory, asserts: "Development of water power in the Adirondacks is one of New York State's most important contributions to the superpower recommendations for the territory between Boston and Washington, and will bring the city of New York and other larger communities within transmission radius of this region. . . . The basic question really is this: Shall the water power of the state be allowed to run to waste or shall it be harnessed for the needs of all the people of the state? Ratification of the amendment simply paves the way for definite action. Its approval by the voters then allows the state to decide on the method of development. The Hudson, Raquette and Black River drainage areas are the primary sources of hydro-electric supply from this region. My investigation of the power possibilities here indicates that 2,710,000,000 kw.-hr. can be annually produced."

Contradicts Colonel Cooper

In making public a telegram from State Engineer La Du denying that the State Water Control Commission favors the Ferris amendment, L. B. Judson of Saranac Lake, a leader in the fight against the amendment, took occasion to deny Colonel Cooper's assertions. He said: "Colonel Cooper and every power man in the state know that under this proposed amendment the state forfeits its franchise rights in the new water power to be created, valued at millions of dollars. The amendment is so riddled with jokers that even the 'rights' of the state are stricken out entirely, leaving to the state not one penny of compensation for the increased value of water-power rights. There is absolutely no safeguard left to insure compensation to the state for the water power to be created, nor is there any safeguard or provision that this power will result in giving the public lower rates. The corporate interests under Amendment 3 get everything they have been seeking for thirty years."

Hoover Honorary President of Sesqui-Centennial Congress

Secretary of Commerce Hoover has accepted the honorary presidency of the engineering congress to be held in Philadelphia in 1926 in connection with the Sesqui-Centennial Exposition in celebration of the one hundred and fiftieth anniversary of the independence of the United States. Congress has indorsed the undertaking, the city has pledged $5,000,000 or more, and a similar amount is hoped for from the state, though not yet pledged. One million dollars in private subscriptions has already been raised toward a fund of five or ten millions. The total cost of buildings and grounds will reach $15,000,000. Fairmount Park and the neighboring region have been chosen as the site for the exposition, which will be open from April 30 to Nov. 11.

Mapping a Great Electrical Network

Pennsylvania-New Jersey Power System Prepares Chart for Public Use Showing Interconnections, Generating Stations and Proposed New Lines

Distribution lines and electric power generating stations of what is known as the Pennsylvania-New Jersey Power System of the General Gas & Electric Corporation, of which W. S. Barstow & Company, New York, are managers, are shown in a clear manner on the large map of the system prepared for display purposes and here reproduced. A glance is sufficient to show the wide extent of the territory covered by the system, and closer examination reveals the type of power stations now in operation or under construction.

The power companies composing this system are the Metropolitan Edison Company of Reading, Pa.; the York Haven Water & Power Company of York Haven, Pa.; the Pennsylvania Edison Company of Easton, Pa.; the New Jersey Power & Light Company of Dover, N. J., and the Hanover Power Company of Hanover, Pa. The high-tension transmission lines that link together the distribution systems of these companies extend from Hanover and Gettysburg, Pa., through York, York Haven, Middletown, Reading and Easton, Pa., to Dover, N. J., and beyond that point to within 30 miles of New York City. The system is so situated that it will eventually form a part of the Boston-Washington superpower project surveyed for the United States government.

The map was prepared by the Metropolitan Edison Company of Reading, Pa., and was first exhibited at the annual county fair held at Reading, where thousands of people viewed it. Sharply contrasting colors were used. On a white field the boundary lines, names of cities and towns and other companies' lines appeared in black. The present and proposed lines of the interconnected system were shown by heavy red lines, and around photographs of the power stations were green borders with a green arrow indicating the site of each station.

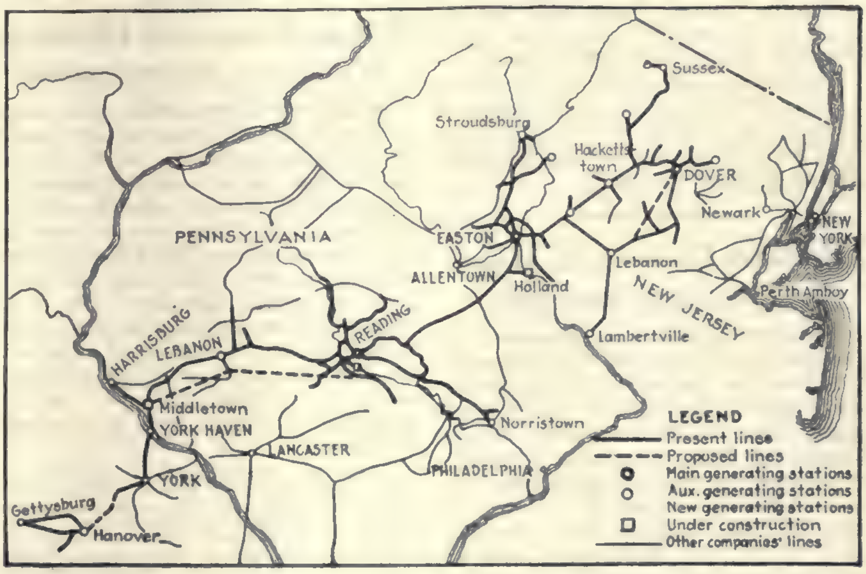


Chart of Pennsylvania-New Jersey Power System

The Middletown Station

Construction of most modern and approved type is represented in the new base-load generating station of the system now being erected at Middletown, Pa., on the Susquehanna River, about 14 miles below Harrisburg, by the Metropolitan Edison Company. Construction work started last April and has been pushed rapidly since that time. The new station will have an ultimate capacity of 180,000 kva. and will cost approximately $20,000,000. The first unit, on which work is well advanced, will represent an outlay of about $4,000,000 and is expected to be ready for operation late in the summer of 1924. It will have a rating of 30,000 kva., which is equivalent to more than 40,000 hp.

The first unit of the new station is 105 ft. by 196 ft. in dimensions. The foundations are concrete, carefully designed to withstand the upward pressure of water. More than 250 tons of steel reinforcing rods have already been placed in the foundations. The building will be of brick construction with pre-cast stone trimmings. For the first unit there will be two cement stacks, each 14 ft. in diameter and 200 ft. high. Five boilers with a capacity of 1,500 hp. will be required. They will be fired with pulverized coal, much of which will be dredged from the Susquehanna River.

Construction on a plant of equal capacity with the Middletown station has been started at Holland, on the

Delaware River, about 8 miles below Easton, Pa. The Middletown and Holland base-load stations are designed to carry the greater portion of the load requirements of the entire Pennsylvania-New Jersey Power System and are to be in constant operation at full capacity.

Plan to Store Coal for Philo Station in Abandoned Canal

An unusual feature of the power station being built by the Ohio Power Company at Philo, on the Muskingum River, near Zanesville, Ohio, is the method of coal storage. The bed of an abandoned canal is to be utilized for the bins. These will contain 300,000 tons, and to prevent spontaneous combustion of the coal they will be kept flooded. The power house, which is to have an ultimate rating of 300,000 hp., will be completed late next summer. It will be tied in with the western distribution system of the American Gas & Electric Company, of which the Ohio Power Company is a subsidiary, by a line to Crooksville, now nearly completed, and with the eastern system by a line to Canton. Both lines will be operated at 132,000 volts. The steam pressure of the plant will be 650 lb.

The plant was designed by Sargent & Lundy of Chicago, who are designing a plant of the same capacity to be erected near South Bend, Ind., by the American Gas & Electric Company.

Meriden Conference Hears of Kitchen Campaign

The annual "Meriden conference" of central-station merchandise managers was held on Monday and Tuesday of this week at the plant of the Edward Miller Company, Meriden, Conn. This is an outgrowth of a meeting of four utility sales managers held eight years ago to pool their purchases in order to derive the advantages of larger production. This year about sixty central-station men participated. Announcement was made that production on these joint purchases has now reached a total of close to 50,000, with nearly 500 companies buying. This affects portable lamp models principally.

R. D. Cutler, sales manager Hartford Electric Light Company, told the story of a kitchen-light campaign now in progress in that city. The company embarked on a thirty-day campaign in which it had been hoped to sell 5,000 "daylight units" for kitchens, and in less than three weeks 7,800 of these units, carrying 150-watt or 100-watt type C lamps, have been sold. Seven per cent of these orders have come in by telephone, 10 per cent by mail, less than 1 per cent through electrical contractors, and about 78 per cent through house-to-house selling by canvassers of the John A. Corcoran organization. The Hartford company figures on about 1,000 hours' actual use per kitchen, which, with a 5½-cent rate, will increase the annual income from these consumers by approximately $55,000 a year if 10,000 of the units are sold, which looks like a moderate estimate.

The sales managers were in conference for two days, discussing 1924 campaign methods on lamps and fixtures. The session closed with a banquet at the Highland Country Club tendered by Rex Cole, M. Schwarz, G. P. Norton and other officials of the Edward Miller Company.

S. E. D. Opens Pacific Coast Office in San Francisco

To render a more personal, intimate service to the electrical industry on the Pacific Coast the directors of the Society for Electrical Development have authorized the establishment of an office at 527 Rialto Building, San Francisco. Samuel H. Taylor, formerly president of the Electric Railway & Manufacturers' Supply Company of San Francisco, has been appointed Pacific Coast manager. Mr. Taylor will continue to serve as secretary of the Pacific Coast Electrical Association.

Edison Companies Object to Wrong Use of Designation

At the recent convention of the Association of Edison Illuminating Companies at Dixville Notch, N. H., it was pointed out by some of the executives present that several electric utilities not rendering Edison service were incorporating the word "Edison" in their corporate names. Complaint was made that this was misleading. The association felt so strongly on the matter that, following the report of a committee consisting of Samuel Insull (chairman), C. L. Edgar and J. W. Lieb, the following resolution was unanimously adopted:

Whereas it has come to the attention of the Association of Edison Illuminating Companies that in the incorporation of various companies throughout the United States for the creation, merger or combination of public utilities there is a growing tendency to make use, without apparent authority, of the name "Edison"; and

Whereas it is evident that the chief purpose of such use of the name "Edison" is to mislead by taking advantage of the significance which the name has acquired, in the first place from the illustrious achievements of Mr. Edison himself, which have made the name a household word in this country, and in the second place from the position enjoyed by the member companies of this association, which, striving from the first for the very highest standards in the electric light and power industry, have won the public's confidence and good will as reflected in the high place their securities hold in the esteem of the investing public; and

Whereas such unauthorized use of the name "Edison" is unfair both to the members of this association, which have contributed so much to maintaining the significance of that name, and to the investing public;

Now, therefore, be it resolved, that the officers and the executive committee of this association be, and they are hereby, directed to take such steps as may be practicable to stop further unauthorized use of the name "Edison," and that the member companies of this association in localities where such unauthorized use may occur be, and they are hereby, urged to do whatever may be in their power to aid and make effective the efforts of the officers and the executive committee with respect to carrying out the purpose and intent of this resolution.

Moore School Established

Independent Institution, Under the Control of U. of P., Devoted to Electrical Engineering

A CHANGE of much significance in the courses in electrical engineering at the University of Pennsylvania, Philadelphia, has taken place whereby in the future these courses will be given in an independent school, under the management of the university, instead of as part of the curriculum of the Towne Scientific School. The new school, as already announced in these columns, has been established under the provisions of the will of the late Alfred Fitler Moore of Philadelphia, who bequeathed his estate for the purpose of founding a school of electrical engineering as a memorial to his parents. Mr. Moore was the owner of the Alfred F. Moore wire-manufacturing plant and had developed the electrical end of that business. He was a director of the Bank of Northern Liberties and president of the Northern Liberties Gas Company.

By the terms of the agreement between the trustees under the will of Mr. Moore and the trustees of the university the entire estate, amounting to upward of $1,500,000, becomes in effect an endowment for this new school. For the present no new building will be necessary. The laboratories in the Engineering Building formerly occupied by the electrical engineering department, together with certain additional space in this building, will be sufficient.

Endowment Will Yield $70,000

The income from the endowment will be used primarily to develop undergraduate instruction in electrical engineering. A portion of it will be used for graduate instruction and to encourage research work on the part of both faculty and students. With the exception of approximately $50,000, which will be transferred to the university as payment for the present equipment of the electrical engineering laboratories, no expenditures will be made from the capital account. The endowment of the new school will therefore yield annually approximately $70,000. This, together with tuition fees, will be available to meet the operating expenses of the school. Dr. Harold Pender has been appointed dean, and Nicholas Minorsky and John B. Clothier, Jr., have been added to the staff.

In addition to the regular staff of instructors, the Moore School plans to have experts, regularly employed in the industry, give special courses of lectures during each term of the school year. For the first term of this year William Arthur Del Mar, chief engineer of the Habirshaw Electric Cable Company of New York, has been appointed special lecturer on wires and cables, and Dr. Albert W. Hull, research physicist of the General Electric Company at Schenectady, N. Y., has been appointed special lecturer on vacuum tubes and their applications.

Southern Power Firm

President Duke Reiterates the Demand for Higher Rates—If Granted, Will Spend $10,000,000

PRESIDENT J. B. DUKE of the Southern Power Company, who has recently returned from a trip abroad, has given out a statement on the policy of the company supporting strongly that made by Vice-president W. S. Lee and already reported in the ELECTRICAL WORLD. Mr. Duke says:

"I am ready to proceed to spend more money, to build more plants, to create more power for the further development of the Carolinas, but I am not willing to spend it on the basis of the returns which the Southern Power Company is now allowed. The company has averaged a return of not more than 4 per cent since it was started, and these small earnings have always been put right back into the company, and millions more. I have put approximately $6,000,000 of my own money into the Southern Power Company so far. I have never taken a cent out of it and never expect to. What I am to put into it in the future depends upon the attitude of the people toward this project as revealed through their representatives at Raleigh, the members of the Corporation Commission.

"We will lay the situation before the Corporation Commission. We will not go to Raleigh in person or engage in controversy with that body or any other about a rate increase. We will let the records speak for themselves. If the Corporation Commission allows an increase in the rate of wholesale power to 1.40 cents per kilowatt-hour, as against the 1.25 cents per kilowatt-hour now allowed us, I am prepared to build another plant that will cost $10,000,000, to supply the present demand for more electric power. Otherwise I am through."

Southern Power Service Is Curtailed by Drought

Curtailment of the use of electric power by industries in the Carolinas to the equivalent of a weekly shutdown of one day was requested by Charles I. Burkholder, vice-president of the Southern Power Company, in a letter to its customers made public Oct. 18. The basis for the request was the low water, caused by drought, in the streams from which power is developed. The curtailment, which began on Monday of this week, affected most of the textile industries in the two states.

Street lighting in Martinsville, Va., which has a municipal plant, was discontinued on several nights because of the low level in the Smith River, the power source of the town. An appeal made by the Martinsville textile company brought a supply of power from Charlotte, N. C., over the lines of the Southern Power Company, which also served to illuminate the Henry County (Va.) fair.

Southern California Edison Rates Reduced

A reduction in rates affecting all classes of consumers of the Southern California Edison Company has been ordered by the California Railroad Commission, effective Nov. 1, 1923. The reduction applies to all rates as follows: Domestic lighting, 18 per cent; street lighting, 11 per cent; industrial power, 10 per cent; agricultural rates for southern California, 10 per cent; agricultural rates for the San Joaquin Valley, 7½ per cent; railway power rates, 6½ per cent; power rates for resale, 7½ per cent.

The rate base fixed by the commission was $103,237,631, which was $8,600,000 less than claimed by the company. These sweeping reductions in rates are the fourth since the peak of high prices during and immediately following the war. The present reductions are attributed by the commission in a large measure to the reduction in the price of fuel oil, the rapid growth of the lighting business and concentration of business due to the development of the territory served by the company.

Agricultural Engineers to Discuss Electrification

One entire day—Friday, Nov. 9—will be devoted to the discussion of the rural electrification problem at the annual convention at the Great Northern Hotel in Chicago of the American Society of Agricultural Engineers.

The morning session will be given over to the reports of the rural power lines committee. Chairman C. A. Atherton, National Lamp Works, Cleveland, will open the program with a general statement relative to rural electrification. G. C. Neff, vice-president of the operating subsidiary companies of the Northwest Utilities Company, will follow with an address on the "History and Attitude of the Central Stations." A report on "Present Status of Electrical Machinery for Rural Purposes" will be given by C. M. Johnson, Westinghouse Electric & Manufacturing Company. E. A. Stuart of the University of Minnesota will talk on "Various Contract Forms," and an address on "Isolated Electric Plants" by W. H. Roberts, Electrical Auto-Lite Corporation of Toledo, will close the morning program. In the afternoon W. H. S. Stackhouse of Davenport, Iowa, will make an address, and J. W. Cloverdale, secretary of the American Farm Bureau Federation, will speak on the organization and work of the committee on relation of electricity to agriculture. An address on "The Relation of the Central-Station Service to Rural Electrification," by M. H. Aylesworth, executive manager National Electric Light Association, will follow. F. C. Fenton of the Iowa State College at Ames will close the program with a talk on "Electric Power from the Wind."

Labor Turnover and Wage Rates in Bituminous Mines

Three more voluminous reports have been added to the number made to the President and Congress by the United State Coal Commission. Two of these concern respectively "Labor Turnover in the Bituminous-Coal Industry" and "Wage Rates in the Bituminous-Coal Industry."

The study of labor turnover covers the year 1921 and shows extremes in individual mines ranging from 7 per cent to 450 per cent. For the country as a whole the degree of turnover for the industry does not appear to be greater than that which is accepted as the common experience of industries generally. The results for the 691 mines studied are as follows: Total average on rolls, 122,048; all separations from rolls, 121,840; turnover percentage, 99.9.

Two outstanding factors, the commission says, have exerted a profound influence on the character of the wage structure. The overdevelopment of the bituminous-coal industry has been the most important factor. During the

Alabama Power Company's 100,000-Ton Fuel-Storage Pile

FIGURES of the Geological Survey to the effect that most power companies have on hand a coal supply that will last only ten or eleven days have no application to the outdoor storage of the Alabama Power Company at its steam plant on the Warrior River. The illustration represents an accumulation of 100,000 tons as on Sept. 8 last.

past twenty years the annual working time in the industry as a whole has averaged more than 200 days. With the exception of the years 1917 and 1918, which reflected the stimulus of war conditions, the number of days lost annually has not been less than seventy-two, and in periods of market inactivity the number of idle days has frequently risen to more than 100, reaching a maximum of 150 days of lost operation in 1921. High tonnage rates for piece workers and high day rates for men paid by the day have thus been necessitated in an effort to secure an adequate annual wage during the days of the year on which employment is available. The wide difference in physical conditions of operation and of availability of markets has, however, entered into the fixing of wage rates and has been a second strong factor in fixing a differential in wages in different districts of the unionized fields. It has been a marked tendency of collective bargaining in some industries to bring about standard rates for organized occupations over large territories.

Still another commission report, one dealing with the wholesale and retail coal trade, was released last Monday. In this report the high margins taken by wholesale dealers came in for criticism. "The power to regulate," the commission says, "should include the power to limit to a definite maximum amount per ton the margins that may be taken by one or more wholesalers between the mine and the retailer or consumer, thus limiting speculative wholesaling. The maximum amount of margin should be the same whether taken by one or by two or more wholesalers."

Meetings and Chairmen of the A. M. E. S.

Section meetings of the Associated Manufacturers of Electrical Supplies will be held in New York on Nov. 7, 8 and 9, and there will besides be a general meeting of the association in the Engineering Societies Building at 2 p.m. and a meeting of the board of governors at 7 p.m. on Thursday, Nov. 8. In addition to the list of chairmen of sections published in the ELECTRICAL WORLD for Oct. 6, page 728, the election of the following, completing the number, has been announced:

Air Circuit Breaker Section—C. T. Evans, Cutler-Hammer Manufacturing Company, Milwaukee.

Attachment Plug Section—H. J. Morey, Pass & Seymour, Inc., Solvay, N. Y.

Fuse Section—A. W. Fox, Johns-Pratt Company, Hartford, Conn.

Industrial Lighting Section—W. D. Steele, Benjamin Electric Manufacturing Company, Chicago.

Knife and Inclosed Switch Section—J. H. Trumbull, Trumbull Electric Manufacturing Company, Plainville, Conn.

Line Material Section — W. G. Carey, General Electric Company, Schenectady, N. Y.

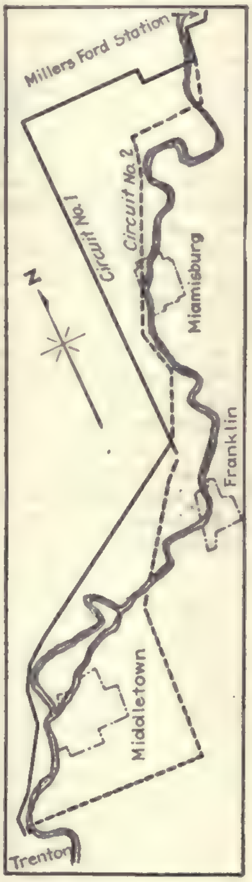
Panelboard and Switchboard Section—A. C. Streamer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Rigid Conduit Section—C. E. Corrigan, National Metal Molding Company, Pittsburgh.

Signaling Apparatus Section — Ray H. Manson, Stromberg - Carlson Telephone Manufacturing Company, Rochester, N. Y.

Dayton-Cincinnati Interconnection About Completed

In order to assist the Union Gas & Electric Company of Cincinnati in carrying an anticipated peak load over the winter, the Dayton Power & Light Company has nearly finished two 66-kv. lines from its Millers Ford station to Trenton, Ohio, whence the Cincinnati company will continue the line to its own Elmwood substation. Next summer the Cincinnati company expects to build from this substation to its West End generating station. The first two miles from the Millers Ford station south will have a double-circuit steel-tower line. At the end of this two-mile stretch the two lines branch out and continue on two separate single-circuit pole lines on different rights-of-way, as in the accompanying sketch. The first circuit goes due west to the Union Road, then south on the Union Road to the Baltimore & Ohio Railroad, following it into Trenton. The second or east circuit goes south along the river road to a point opposite Moraine City; then it crosses the Miami River and follows the west side of the Baltimore & Ohio to the Union Road, where it crosses to the south side of the "Big Four" Railroad. It follows a section line down the east side of Middletown and then turns west on a line parallel to and one-half mile north of Georgetown into Trenton.



This line is composed of 50-ft. butt-treated Western red-cedar poles spaced 300 ft. apart. Five units of Ohio Brass insulators are hung in suspension and six units in strain on wooden cross-arms, while six units in suspension and seven in strain are placed on the steel poles. Aluminum steel-reinforced cables of 477,000 circ.mil capacity are employed, which will carry a 4,500-lb. tension with a half-inch coating of ice and wind pressure of 8 lb. at zero temperature.

The first line, it is expected, will be completed and in operation by Nov. 1 and the second soon afterward. These lines will also serve the Ohio Gas & Electric Company and the Hamilton Service Company.

Brief News Notes

Long "White Way" Planned for Texas.—The cities of Dallas and Fort Worth, Tex., and the intervening towns of Grand Prairie, Arlington and Handley are working out details for making an electrically lighted "white way" out of the Dallas-Fort Worth pike, a concrete motor highway connecting the two cities, on which there is still a portion unlighted. If plans for lighting this highway are successful, it is said that the stretch of 32 miles will be the longest "white way" in the South.

Northern Indiana Power Seeks to Acquire Huntington (Ind.) Properties.—Petition for approval of the purchase by the Northern Indiana Power Company, a Brewer utility, of the Huntington Light & Fuel Company, the Bippus Utilities Company and the Wilkinson Ice & Coal Company has been filed with the Indiana Public Service Commission. The properties serve Huntington and surrounding towns and cities, and it is proposed to serve them from the superpower plant of the Indiana Electric Corporation near Terre Haute. Value of the properties is given as not less than $2,040,000.

Nebraska Company Expands.—The Nebraska Gas & Electric Company of Omaha and Norfolk, Neb., which has in operation a high-tension line between those two cities, furnishing retail and wholesale electric power to all towns en route, is about to build a line to Pierce. Present indications point to the carrying out of the plans projected by the Continental Gas & Electric Corporation, of which the Nebraska Gas & Electric Company is a subsidiary, for a large water-power plant at Genoa, on the Loup River, to furnish power to all parts of Nebraska. Lincoln will eventually be served from the line leading to Norfolk and connecting with the line that comes up from Fullerton.

Hollinger Gold Mines to Build Power Plant.—It is reported by the American Vice-Consul that the Hollinger Consolidated Gold Mines, Ltd., has placed a contract for a power house and dam at Island Portage, on the Abitibi River, in northern Ontario, with Sir William Arrol, Ltd., of St. Catharines, Ontario, and London, England. It is planned to develop 25,000 hp. at the above point and deliver power to the mine within a year. It is also said that this company contemplates the installation of Diesel engines capable of developing 1,200 hp. to serve as an auxiliary source of power at the mill. The steam plant in use at present is reported to develop power at a cost of $200 per horsepower, while with the use of polar-Diesel engines the cost would be reduced to $43 per horsepower.

Memphis Has New "White Way."—Memphis, Tenn., has just inaugurated a new "white way" on Union Avenue for a distance of about ten blocks. The concrete standards are 180 ft. apart and the lamps are 22½ ft. above the street level. Memphis had previously brilliant "white way" systems on Main Street and Madison Street, and several others are projected.

Reduction in Rates in Twenty-four Missouri Towns.—The West Missouri Power Company, operating in twenty-four Missouri towns, has announced a reduction of 1 cent per kilowatt-hour in its rates, to be effective from Nov. 10. It is estimated that this reduction in rates, which was announced after a conference with the Public Service Commission, will reduce the company's revenue about $30,000 a year.

Enid Substation Nearing Completion.—The new 2,600-kw. remote-control substation of the Oklahoma Gas & Electric Company at Enid, Okla., is rapidly nearing completion. Three 63,000-volt and three 13,000-volt transformers will be installed in this station to serve the fifteen cities and towns surrounding Enid. The remote-control apparatus will be operated by motors controlled from the push-buttons at the power house. Two sets of 63,000-volt circuit breakers, one connected with the transmission lines to the east and one with those to the south, are included in the station equipment. The plant is expected to be in operation within thirty days. Within a short time Enid will also be connected to the new line under construction to Drumright by way of Covington. When this work is completed the Enid system will be hooked up with the larger cities in Oklahoma as far east as Fort Smith.

Second Power Exposition Announced.—The entire first floor of the Grand Central Palace, New York City, has already been engaged by exhibitors for the second National Exposition of Power and Mechanical Engineering, which will be open in the week beginning Dec. 3, and the space for the exhibition has therefore been extended to include the mezzanine floor. More than 90 per cent of those exhibiting at the 1922 show have re-engaged space for 1923, and many of them are using larger areas. More than 200 firms have signed contracts, and the diversity of their products insures a well-balanced exhibition that will not fail to interest all subdivisions of the engineering profession. The conduct of the exposition is supervised by an advisory committee headed by Irving E. Moultrop of the Edison Electric Illuminating Company of Boston. Among his colleagues are Frank W. Smith, former president of the National Electric Light Association; C. F. Hirschfeld, chief of research department, Detroit Edison Company; N. A. Carle, vice-president of the Public Service Production Company; E. B. Katte, chief engineer of electric traction, New York Central Railroad; W. L. Abbott, chief operating engineer Commonwealth Edison Company; Fred R. Low, editor *Power;* John L. Harrington and Calvin W. Rice.

Wapsie Power Company Sold.—The Iowa Railway & Light Company of Cedar Rapids, Iowa, has purchased the controlling interest in the Wapsie Power & Light Company, which supplies heat and power to the towns of Tipton, Lisbon, Mount Vernon, Mechanicsville, Clarence, Springdale, West Branch, Stanwood, Cedarbluff and Wald, with headquarters at Mount Vernon. The purchase price is said to have been about $300,000. The Iowa Falls Electric Company, a subsidiary of the Iowa Railway & Light Company, has purchased the Emmet Power Company at Emmetsburg, Iowa, which supplies light and power to six of the surrounding towns. The purchase price was $80,000.

Caught in the Act.—One of the unusual causes of outage which are hard to find is shown in this picture of an oil switch pedestal—one of those by which service to certain blocks is split from the main feeders of the Nebraska Power Company at Omaha. The short-circuiting rat evidently entered the

underground system from a basement and worked his way up through the conduit into the switch pedestal, then completing the ground by placing his fore-paws on one of the connections of the switch.

Keeping Step with Aid of Electricity.—A new use for electric light was found recently in Columbus, Ohio, when the marshal of a large parade used it in an endeavor to maintain perfect step. For a distance of seven blocks along the right side and above the thoroughfare on which the paraders marched lamps were strung at intervals of fifty yards, each equipped with a reflector which directed the rays to the faces of the marchers. The incandescent lamps were on a special line connected with an electric sign mechanism at a point opposite the reviewing stands. This clockwork was regulated to sixty beats per minute, or half of the regulation step of the marchers. The plan was to flash the light at every step of the left foot. Complete success was not achieved, but this is attributed to the fact that only part of the marchers were aware of the arrangement, which had been put into effect on short notice.

The Westinghouse Scholarships.—It is announced by the educational department of the Westinghouse Electric & Manufacturing Company that the schools at which Westinghouse War Memorial men have been trained or are now in training include Carnegie Institute of Technology, six men; University of Pittsburgh, three men, and one each at the University of Cincinnati, Leland Stanford University, University of Pennsylvania, Pennsylvania State College, Cornell University, University of North Carolina, California Institute of Technology, Haverford College and the Ohio State University. Four scholarships, each carrying an annual payment of $500 per year, are awarded annually by the Westinghouse Electric & Manufacturing Company to employees and sons of employees on the basis of competitive examination.

Associations and Societies

Engineers' Society of Milwaukee.—At the annual meeting on Oct. 17 this society elected Fred H. Dorner president, F. C. Trubshaw vice-president, Robert Cramer secretary and Walter R. Mueller treasurer.

Commercial National Section, N. E. L. A.—Group meetings of the Appliance, Lighting, Power and Transportation Bureaus and the customer relations committee of this section will be held at Salt Lake City at 10 a.m. on Nov. 21. There will be a general meeting of the committee at 9.30 a.m. and an executive committee meeting at 2 p.m.

Georgia Electrical Association.—This association will hold its semi-annual convention in Atlanta on Nov. 7. A strong and attractive program has been arranged. James R. Strong, president Association of Electragists International; L. W. Davis, director of promotion, Association of Electragists International; A. L. Atkinson, advertising manager merchandising division, General Electric Company; Samuel B. Hibben, secretary Illuminating Engineering Society, and P. S. Arkwright, president Georgia Railway & Power Company, have promised to address the convention.

Active Winter Planned by New England Merchandising Bureau.—Diversified topical discussions combined with monthly luncheon meetings will feature the work of the Merchandising Bureau of the New England Division, N. E. L. A., during the coming winter. At an organization meeting in Boston, with L. A. Fiorani of the Union Electric Light & Power Company, Franklin, Mass., in the chair, the following subjects and dates were assigned, meetings to be held in Boston on the first Monday of each month: Nov. 5, "Stimulating Christmas Business"; Dec. 3, "Adver-

tising"; Jan. 7, 1924, "Demonstrations and Education of Salespeople"; Feb. 4, "Campaign Committee"; March 3, "Ranges and Water Heating"; April 7, "Refrigeration"; May 5, "Small Appliances." Sub-committee chairmen who accepted appointment at the organization meeting were: Frank J. Allen, Westinghouse Electric & Manufacturing Company, Boston, for Nov. 5; O. R. Underhill, appliance manager Worcester Electric Light Company, for Dec. 3; C. P. Myrick, New England district manager Edison Electric Appliance Company, Boston, for March 3, and R. J. Wilder, sales manager Central Massachusetts Electric Company, Palmer, Mass., for May 5.

Illuminating Engineering Society.—On Oct. 18 the New York Section of this society inspected the lighting and signal system of the steamship *Leviathan*. W. M. Zippler, electrical engineer with Gibbs Brothers, consulting engineers, read a paper describing the installation, which he designed and supervised. Among the subjects from which the section will select its topics at its coming meetings, on the second Thursday of each month from December to May, are lighting in large office buildings, lighting of omnibuses, display lighting in stores, theater lighting with high-power illuminants, lighting in the surgical, ophthalmological and dental professions, effects of better lighting on schoolroom work and on manufacturing and selling, industrial lighting and street lighting.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

American Society of Agricultural Engineers—Great Northern Hotel, Chicago, Nov. 8-10.

Associated Manufacturers of Electrical Supplies—Engineering Societies Building, New York, Nov. 8. Frederic Nicholas, 30 East 42d St., New York.

West Virginia Public Utilities Association—Hotel Kanawha, Charleston, W. Va., Nov. 9-10.

Electrical Supply Jobbers' Association—Hotel Statler, Buffalo, Nov. 12-15. Franklin Overbagh, 411 South Clinton Street, Chicago.

Electrical Manufacturers' Club — Hot Springs, Va., Nov. 14-18. F. L. Bishop, Hartford Faience Company, Hartford, Conn.

Arkansas Utilities Association—Pine Bluff, Nov. 15-16. R. I. Brown, Little Rock Railway & Electric Company, Little Rock.

Electric Power Club—French Lick Springs Hotel, French Lick, Ind., Nov. 19-22. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Southeastern Division, N. E. L. A.—Hillsboro Hotel, Tampa, Fla., Nov. 19-22. Charles A. Collier, Georgia Railway & Power Company, Atlanta, Ga.

Electrical Credit Association, Central Division—Hotel LaSalle, Chicago, Nov. 20-21. F. P. Vose, 1341 Marquette Bldg., Chicago.

American Society of Mechanical Engineers—New York City, Dec. 3-6. C. W. Rice, 29 West 39th St., New York.

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American Institute of Electrical Engineers—Midwinter convention, Philadelphia, Feb. 4-8. F. L. Hutchinson, 33 West 39th St., New York.

Commission Rulings

Variation of 7½ per Cent in Contract Load Permitted.—The Pacific Gas & Electric Company, as lessee of the Sierra & San Francisco Power Company, has been authorized by the California Railroad Commission to collect from the Coast Valleys Gas & Electric Company the regular rates fixed by the commission for the resale of electric power under its recent order fixing rates for the Pacific Gas & Electric Company. This order was issued by the commission on the application of the companies, as principals to a contract for the supplying of electrical energy to the Coast Valleys Gas & Electric Company under a load of 55,000 volts, for an interpretation by the commission of the terms of that contract. The companies were unable to agree upon the character of service and the charges therefor, and the commission has held that the uniform rates for resale of power shall apply under the contract, subject to reasonable conditions, including a maximum variation of load of 7½ per cent of the voltage of 55,000 specified in the original contract between the companies.

Amortization of Excess Purchase Price.—The duty of a commission, in passing on an application for approval of the sale of public utility property and the price to be paid therefor, to protect the interest of the public against building up property accounts in excess of the value of the property transferred was dwelt upon by the Missouri Public Service Commission in a case affecting the Public Service Company of Missouri and the Watts Engineering Company. The commission said: "Properly to protect the public in this instance, it appears that the transfer of the property under consideration herein should be authorized only on condition that the difference between the sale price ($130,000) and the fair value ($114,000) be amortized out of the net income of the Public Service Company of Missouri, available for return, surplus and contingencies, over a period of twenty years, and that no portion of such excess should be charged to the operating expenses of said company or to its capital accounts."

Two Aspects of Deferred Maintenance.—If a public utility, at a time when its rates are sufficient, neglects its property and diverts to other uses the money which it should spend for maintenance, it cannot, in an opinion rendered by the Illinois Commerce Commission *in re* Public Service Company, reasonably expect at a later period to provide funds for such maintenance at the future expense of the public. Under these circumstances the amount eventually needed for such deferred maintenance should neither be capitalized nor amortized by means of special charges imposed upon the consumer. But, on the other hand, the commission says: "Rates may become insufficient by reason of changing circumstances, and considerable time may elapse before new and adequate rates are established. If in that interval the rates are so constricted by public authority that normal maintenance must be temporarily reduced or abandoned, there would seem to be justice in the demand of the utility for a compensating allowance after the proper basis of its rates is finally ascertained."

Recent Court Decisions

Commission in Fixing Rates May Consider Experience of Neighboring Cities.—The Hardin-Wyandot Lighting Company appealed from a decision of the Public Utilities Commission of Ohio fixing gas rates in the city of Kenton. The Ohio Supreme Court, declaring that it will not substitute its judgment for that of the commission and will only interfere with commission findings in cases where the record shows the action of the commission to be unlawful and unreasonable, sustained the commission. Objection was made by the plaintiff to the method followed by the commission in taking into consideration the experience of neighboring cities under similar circumstances in making its findings as to what the amount of sales would be in the future, and it was held that wrong inferences had been drawn therefrom. The court held the method to be a reasonable one and the finding not against the rate of evidence. (140 N. E. 779.)*

Government Inspector an Invitee Entitled to Safe Place to Work.—A verdict against Barton & Company, meat packers of Seattle, sued for damages for personal injury by one Mitchell, has been affirmed by the Supreme Court of Washington State. Mitchell is a United States government inspector, and while inspecting defendant's plant he slipped on the floor and was injured by throwing up his hand in such a way that it came into contact with an unguarded electric fan used for ventilating purposes. The company held that the general rule regarding a safe place to work had no application as the man was not its employee; but the court decreed that, the plant being under the control of the government for the purpose of inspection, the victim was an invitee to whom the company was bound to assume a safe place to work. The defense of assumption of risk was not available and that of contributory negligence was for the jury. (217 Pac. 993.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

James Swinburne, London Consulting Engineer

James Swinburne, well-known consulting engineer and patent expert of Great Britain, has been associated with the electrical industry in England since 1881. Born at Inverness in 1858, he became an apprentice at the age of sixteen in general engineering works where marine, locomotive and colliery engines were made. After serving his

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JAMES SWINBURNE

apprenticeship he went to the South Shields company's gas works in Jarrow, but was soon attracted to the then infant electrical industry by Sir Joseph Swan, the inventor, who sent him to Paris in 1881 to organize an incandescent electric lamp factory in that city. A year later Mr. Swinburne built one of the first compound, constant-pressure machines, and his work in this connection soon brought him to the attention of the Brush company of Cleveland, Ohio, which invited him to Boston, Mass., on a similar mission. Mr. Swinburne spent 1883 and 1884 experimenting on electric storage batteries and succeeded in reducing sulphate by adding a sodium salt to the electrolyte.

The year 1885 found Mr. Swinburne designing dynamos for Crompton & Company of England, and he subsequently built transformers and instruments and made condensers for supplying idle current. In those years Mr. Swinburne also wrote a great deal on electrical subjects, especially on the theory of dynamo design, alternating-current work and electrical engineering in general. It was in an early article on the theory of multiphase machines that he coined the words "rotor" and "stator," which have been absorbed into several languages. In 1894 Mr. Swinburne opened an office as a consulting engineer in London, and he has since been in demand as a scientific and technical witness, especially in patent cases. He has testified before parliamentary committees for the last thirty-five years. The Institution of Electrical Engineers elected him president in 1902, and similar honors were bestowed upon him by the Faraday Society and the Junior Institution of Engineers. In 1907 Mr. Swinburne was elected a fellow of the Royal Society.

Sir Alexander MacKenzie, president of the Brazil Traction, Light & Power Company, arrived in New York last week. Sir Alexander reported that his company, which furnishes all the traction, light and telephone service to Rio de Janeiro and São Paulo, Brazil, is completing a new 160,000-hp. plant a hundred miles from the former city.

Thomas J. Lucas, electrical and gas engineer of many years' experience and widely known in the public utilities field, has been appointed chief engineer of the Illinois Power & Light Corporation, with headquarters at Chicago. For the last fourteen years Mr. Lucas has been associated with the William A. Baehr Organization, consulting engineers, Chicago. He has been active in the direction of the engineering work of the Illinois Power & Light Corporation since the organization of this company on June 1 of this year.

Dr. Pender to Be First Dean of Moore School of Electrical Engineering

Dr. Harold Pender, whom the provost and the board of trustees of the University of Pennsylvania have, in recognition of his energetic services as director of the department of electrical engineering for the past nine years, appointed as the first dean of the new Moore School of Electrical Engineering, possesses to an unusual degree the qualifications for this new and important post. He has not only had a wide practical experience in the engineering field in connection with varied engineering developments and investigations, but he has also had an extended and successful teaching experience.

Dean Pender was graduated from Johns Hopkins University in 1898. The next three years he spent in graduate work at that institution under Prof. Henry A. Rowland and obtained the degree of doctor of philosophy in 1901. This was followed by several months of important research work in France. Upon his return to this country, he took up practical work in engineering and was connected in turn with the Westinghouse Electric & Manufacturing Company at East Pittsburgh, the New York Central Railroad and with Cary T. Hutchinson of New York City. During his association with Mr. Hutchinson he was engaged in various lines of consulting work, particularly in hydro-electric developments and in the electrification of steam railroads. Following this five-year period in the practical engineering field, Dean Pender was appointed professor of electrical engineering at the Massachusetts Institute of Technology, becoming director of electrical engineering research at that institution in 1913. In 1914 he was called to the University of Pennsylvania as director of the newly created department of electrical engineering.

HAROLD PENDER

Dean Pender is a fellow of the American Institute of Electrical Engineers and has served on a number of its committees, notably as chairman of the standards committee. He has contributed articles on scientific and engineering subjects, is the author of several well-known text books and is the editor-in-chief of Pender's "Handbook for Electrical Engineers."

Nicholas Minorsky, who has been made assistant professor of electrical engineering at the University of Pennsylvania, obtained the degree of electrical engineer from the Imperial Polytechnic Institute, Petrograd, Russia, in 1914, having previously studied at the Naval College at Petrograd and at the University of Nancy, France. On the outbreak of the world war he entered the Russian navy. In 1917 he was the representative of that navy on the Interallied Committee for Inventions in Paris. After the Russian revolution he came to this country and was first employed by the Sperry Gyroscope Company as a consulting engineer and later by the General Electric Company as research engineer at Schenectady. Since December, 1921, he has been engaged in development work for the Bureau of Construction and Repair, U. S. N.

tising"; Jan. 7, 1924, "Demonstrations and Education of Salespeople"; Feb. 4, "Campaign Committee"; March 3, "Ranges and Water Heating"; April 7, "Refrigeration"; May 5, "Small Appliances." Sub-committee chairmen who accepted appointment at the organization meeting were: Frank J. Allen, Westinghouse Electric & Manufacturing Company, Boston, for Nov. 5; O. R. Underhill, appliance manager Worcester Electric Light Company, for Dec. 3; C. P. Myrick, New England district manager Edison Electric Appliance Company, Boston, for March 3, and R. J. Wilder, sales manager Central Massachusetts Electric Company, Palmer, Mass., for May 5.

Illuminating Engineering Society.—On Oct. 18 the New York Section of this society inspected the lighting and signal system of the steamship *Leviathan*. W. M. Zippler, electrical engineer with Gibbs Brothers, consulting engineers, read a paper describing the installation, which he designed and supervised. Among the subjects from which the section will select its topics at its coming meetings, on the second Thursday of each month from December to May, are lighting in large office buildings, lighting of omnibuses, display lighting in stores, theater lighting with high-power illuminants, lighting in the surgical, ophthalmological and dental professions, effects of better lighting on schoolroom work and on manufacturing and selling, industrial lighting and street lighting.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See **July 7 issue, page 56**, for latest list.]

American Society of Agricultural Engineers—Great Northern Hotel, Chicago, Nov. 8-10.

Associated Manufacturers of Electrical Supplies—Engineering Societies Building, New York, Nov. 8. Frederic Nicholas, 30 East 42d St., New York.

West Virginia Public Utilities Association—Hotel Kanawha, Charleston, W. Va., Nov. 9-10.

Electrical Supply Jobbers' Association—Hotel Statler, Buffalo, Nov. 12-15. Franklin Overbagh, 411 South Clinton Street, Chicago.

Electrical Manufacturers' Club — Hot Springs, Va., Nov. 14-18. F. L. Bishop, Hartford Faience Company, Hartford, Conn.

Arkansas Utilities Association—Pine Bluff, Nov. 15-16. R. I. Brown, Little Rock Railway & Electric Company, Little Rock.

Electric Power Club—French Lick Springs Hotel, French Lick, Ind., Nov. 19-22. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Southeastern Division, N. E. L. A.—Hillsboro Hotel, Tampa, Fla., Nov. 19-22. Charles A. Collier, Georgia Railway & Power Company, Atlanta, Ga.

Electrical Credit Association, Central Division—Hotel LaSalle, Chicago, Nov. 20-21. F. P. Vose, 1341 Marquette Bldg., Chicago.

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s' RESPONSIBILITIES

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The manufacturer, also, it seems, must continue national advertising in order to popularize appliances, as well as trade paper and newspaper advertising all over the country in order to promote sales and make retail distribution easier for the retailer. And the manufacturer, for the present at least, will have to continue doing extensive work to educate the retail sales clerks behind the counter, in order to enable them to make better salespeople of themselves and thus increase the sales of appliances at the lowest possible cost to the retailer. All these are and must continue to be important elements governing the price of electrical commodities.

Business Conditions

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Next to the Tokyo Electric Company in magnitude of operations is the Toho Electric Power Company of Nagoya, which has a capital stock of 140,000,000

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Distribution—the Manufacturer's Viewpoint*

A Discussion of Some of the Complexities That Confront the Man Who Must Develop Machinery for Distributing Electrical Products

By J. S. Tritle
Manager Merchandise Sales Department,
Westinghouse Electric & Manufacturing Company, New York

THE problem of distribution is, in my opinion, the greatest problem which faces the electrical industry today and is, of course, of the greatest importance to the consuming public. In 1910 there were approximately a thousand manufacturers of electrical devices of one kind or another. Today there are more than 4,600. The consequent result is that manufacturers of very large capacity are seeking in various ways a market for their products. This market, exclusive of central stations and non-electric stores, is formed as follows:

There are between 450 and 500 electrical supply jobbers—or, in other words, a jobber for every ten manufacturers.

There are between 15,000 and 20,000 electrical contractors and dealers—which means a jobber for approximately every forty contractors and dealers, there being so many manufacturers and so many jobbers, contractors and dealers that an exceedingly intensive competition has been developed to obtain a market for the product which each is handling.

J. S. Tritle

Loss Through Incompetence

The result is that a large percentage of business is being placed on price alone, very little attention being paid to quality or trade relations or in some cases to what might be called business ethics.

To obtain a contact with the public many concerns have entered the industry without any fundamental knowledge of it from the standpoint of ability to manage the business or knowledge of the cost of operating expenses. The men who go into the business with a limited knowledge often prove ultimately incompetent, thus staying in business but a short time, and add greatly to the cost of distribution.

For instance, records this year show that more than 3,000 electrical contractors, dealers and contractor-dealers have failed in business. Estimating the loss of their own capital and their indebtedness to creditors at the very lowest calculation as $1,000 each, there results a total loss to distribution of $3,000,000, for which the consumer ultimately must pay, and this represents only a fraction of the economic loss which comes to the industry because of taking the profit from those organizations with well-established credit and knowledge of the business. There is also a loss to the electrical industry in addition because of incomplete installations following the sale of many thousands of dollars' worth of electrical appliances.

The problem of the manufacturer is to obtain, through his wholesale and retail distribution, outlets to the public which must continue prosperous in order to continue the work of electrical development; for it cannot proceed through outlets which are not making money. To create a market for these goods the manufacturer needs outlets which can do constructive work, or, in other words, make two blades of grass grow where but one has grown before. In electrical terms, this might mean men who will install two convenience outlets where the incompetent would install but one. Through such outlets a greater market will be created to absorb the vast manufacturing capacity of the electrical industry, and only through such men, understanding their business and coming into contact with and instilling confidence into the public, will economic distribution at lowest selling costs be attained.

Loss Through Many Lines

An example recently came to our attention where a company said that it could not make money on its retail appliance business on account of the discount being too small. Investigation showed that this concern was handling irons with nineteen different trade marks and of more than twenty-five different styles and designs, making it not only necessary to carry this large investment, but absolutely impossible to secure a sufficient turnover to enable it to handle irons at a profit. This also necessitated the endeavor to educate the salesmen on the talking points of the different and various irons, and these salesmen, of course, were supposed to educate the consumers. It has been proved impossible in the past to educate salesmen to perform high and efficient sales service while endeavoring to sell a large number of different lines.

In the past investigations have shown that many failures have been attributable to carrying too many lines so that a sufficient turnover could not be made. Therefore it appears that in order to make a success it would be necessary to standardize on a limited number of lines,

*A paper presented before the Association of Electragists International, Washington, D. C., Oct. 11, 1923.

which would cut down the investment, increase the stock and capital turnover enormously, and ultimately yield a profit instead of a loss.

BURDEN OF RESELLING

The manufacturer is faced with many facts in arriving at his cost. In addition to the cost of labor and raw material, both of which have increased enormously, he must provide a certain percentage for development expense, in order to continue to bring out new and more efficient lines and also receive a fair rate of interest on his investment. In order to help the dealer—the one who sells to the public—there are many expenses, such as national advertising, periodical advertising, newspaper advertising, sales helps, education of jobbers and retail salesmen on his lines, contribution to electrical trade organizations and associations, and various other expenses necessary to develop the market and help the retailer sell to the ultimate consumer with the smallest amount of time and the least sales resistance.

Some manufacturers at the present time are selling appliances, one might say, three times—that is, first, to the jobber, necessitating the education of jobbers' salesmen; second, by helping the jobbers' salesmen to get retail outlets, and, third, by helping to educate the dealer and endeavoring to see that the right "set-up" is made to assist him to sell to the ultimate consumer. All this has apparently proved necessary, but one may wonder whether it is appreciated and is economically correct. Again, are the manufacturers who are doing this performing a service that is economically unsound?

It is felt that there is a strong obligation on the part of the manufacturer to cut the cost of distribution to the consumer and at the same time provide an adequate profit for the man who is wholesaling and retailing his product. The question is how this can be done if the present "spread" is not sufficient. There have been only three ways suggested. First, the establishing of a consumer cost which is sufficiently high to give a larger spread to the dealer. This would necessitate the raising of list prices, which certainly would have a tendency to curtail consumer demand. The second way would be to increase the discount on the present consumer prices—a step which, from our experience, cannot be taken today on account of the cost of labor, material and sales expense. The third possibility would lie in the direction of a reduction of selling expense by more intelligent application of the economic principles underlying retail business. There must be a better understanding on the part of the dealer of those fundamentals which govern the profitable conduct of retail business, such as stock movement, stock records and accounting methods, all of which should enable him to secure a rate of stock turnover on a given basis of present margin to yield a fair net profit.

MANUFACTURERS' RESPONSIBILITIES

In considering such possibilities, however, it must be remembered that there are some very definite responsibilities which the manufacturer must meet. The manufacturer must put on the market only devices of such a grade as will reduce the possibility of any trouble to an absolute minimum, and he must stand back of such apparatus in every way, so that the consumer will be entirely satisfied and not force the retailer to be burdened with the cost of replacements and the necessary time to keep the appliances sold. The manufacturer must continue—for the present at least—to spend large sums of money in order to promote the sale of his lines, ascertain the demand, demonstrate the applications and see that service is given to the consumer where necessary. All of the above requires not only a large investment but also a large sales and office personnel.

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Chicago reports brisk business, with no important price changes other than a 5 per cent increase in switch boxes. Conduit orders are growing. In the South the retailers say that the period of slow buying continues, but jobbers are busy and confident. Stocks are good, with excellent prospects for holiday trade. In the Far West business has also been quiet. Power-company buying is tapering off. Retail sales show improvement.

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Next to the Tokyo Electric Company in magnitude of operations is the Toho Electric Power Company of Nagoya, which has a capital stock of 140,000,000

yen, equivalent to $70,000,000 United States money. This company is preparing to construct a hydro-electric plant on a river at Najima, between the cities of Hakata and Fukuoka. It has placed an order for equipment with the Westinghouse company. The Toho company's expansion and improvement plans call for the expenditure of several million dollars, it is stated. The new plant will furnish power and light for a number of industrial centers. The Toho Electric Railway Company will also receive power from this source for the operation of several interurban electric railway lines which it plans to build.

In the city of Kobe the municipally owned electric railway system is to be extended, an appropriation of 12,280,000 yen having been made for the purpose. Involved in this project is the widening of several streets.

An expansion plan of much magnitude has been adopted by the Daido Electric Company of Osaka. Its principal plant is on the Kiso River, and from it power is brought to Osaka to the amount of 70,000 volts. At the time the earthquake came this company was working on the proposition of extending its power transmission system to Tokyo, 300 miles, and of entering into active competition with the Tokyo Electric Company.

In a number of the larger cities of Japan the tramway systems are municipally owned. The three tramways in Tokyo were purchased by the municipality in 1911 at a cost of 63,915,000 yen, equivalent to $31,957,500 United States money. The combined system had about 200 miles open to traffic at the time of the earthquake. Much of this will have to be rebuilt, it is stated. The municipality of Tokyo also operates the electric lighting system of the city.

Notwithstanding the fact that strenuous efforts are being made by German manufacturers of electrical machinery and equipment to regain their pre-war position in the trade of Japan, the situation there is such that American manufacturers will have the best of it for some time to come. Alliances or copartnerships have been entered into between the principal Japanese manufacturers of electrical machinery and equipment and foreign makers. The General Electric Company has formed a combination with the Shibaura Electric Works; the Westinghouse Electric Company has formed a combination with the Tokyo Denki Electric Works; the Western Electric Company has formed a combination with the Nippon Dento Electric Works, and the Siemens-Schuckert Company has formed a combination with the Furukawa Electric Works.

Generator Business Is Expected to Reach 30 per Cent Over 1922

ORDERS on the books of manufacturers of large generators show increasing business, which is expected to push the total yearly sales up to between 25 and 30 per cent over those of 1922. Deliveries are running at a more normal stride, between twelve and thirteen months. Deliveries in the heavy-generator business for July of this year were reported as running at from two to three months longer, because of labor conditions, and the total amount of business for the year 1923 was expected to show an even 20 per cent increase. The feature of the present market is the recent improvement in labor conditions, which is considered a most favorable situation for the makers as orders for 1924 and 1925 deliveries are record-breaking.

A gradual improvement in this business has been reported since the fall of 1922, when the central-station companies were receiving their first worthwhile appropriations for extensions and improvements after the depression of 1920. The earnings statements of the large manufacturers of heavy electrical machinery during the first six months of this year were only slightly higher than for the corresponding period of 1922, but, judging present business and the amount of orders received by the leading makers during the third quarter, earnings will be considerably larger than for last year because of the increased business as the larger volume is expected to do more than offset the slightly higher labor rates.

Radio Authority Says Trade Is Still Unsound

THE present situation in the radio field is still unsound from both an engineering and an economic standpoint in the opinion of W. E. Harkness, manager of the radio department of the American Telephone & Telegraph Company, as expressed at the recent meeting of the Radio Trade Association at the Grand Central Palace.

"It is generally conceded," Mr. Harkness said, "that there are an excessive number of broadcasting stations at present. It is, however, of interest to note that there is a marked falling off in the number of licenses issued by the Department of Commerce during the present year and also a decided decrease in the number of stations in service. A total of 847 licenses has been issued, and the total active is 565, or a decrease of 32.2 per cent. This is encouraging for future development of the art, as the principal reason for the decrease is the realization of the cost of installing, maintaining and operating radio broadcasting stations."

In reviewing the conditions in the radio trade during the past year, H. Gernsback declared that the year just past "has kept the trade busy cleaning up the wreckage left over by the boom which started early in 1922."

The meeting, presided over by Henry M. Shaw, president of the Radio Association, was one of the features of the Radio Exposition held from Oct. 6 to 13. About ninety manufacturers and dealers were represented at the exposition.

Value of Delinquent Accounts Was Lower in September

DELINQUENT accounts as reported by the National Electrical Credit Association for both the Central and New York Divisions decreased in September, 1923, from August, 1923. In the Chicago territory the total amount for the above-named period went from $114,261.15 to $95,252.94. However, the number of accounts increased twenty-one. For New York both the total amount and the average amount decreased, following a reduction in the total number of accounts of fifteen.

DELINQUENT ACCOUNTS IN SEPTEMBER

Branch and Month	Number of Delinquent Accounts Reported	Total Amount	Average Amount
Central Division:			
Aug., 1922....	773	$104,433.30	$153.94
Aug., 1923....	739	114,261.15	154.61
Sept., 1922....	882	98,818.90	112.04
Sept., 1923....	760	95,252.94	125 33
New York:			
Aug., 1922....	578	79,764.00	138.00
Aug., 1923....	380	70,770 00	186.00
Sept., 1922....	530	78,739.00	149.00
Sept., 1923....	365	61,731.00	169.08
Philadelphia:			
Aug., 1922....	258	37,013.70	143.47
Aug., 1923....	176	20,660.96	117.39
Sept., 1922....	264	39,060.19	147.96
Sept., 1923....	246	27,955.15	113.64
New England:			
Aug., 1922....	63	9,491.30	150.65
Aug., 1923....	54	5,117.10	94.76
Sept., 1922....	124	13,045.43	105.20
Sept., 1923....	56	8,156.49	145.65
Pacific Coast:			
Aug., 1922....	21	3,450.23	154.77
Aug., 1923....	17	2,583.80	151.99
Sept., 1922....	19	3,002.57	157.95
Sept., 1923....	26	6,998 20	269.16

In the Philadelphia territory the number of delinquent accounts for August and September of this year increased from 176 to 246, although the average amount was only $3.75 lower for September. In both the New England and Pacific Coast territories the total number of accounts, the total amount of money involved and the average amount increased in September over August, 1922. The accompanying table gives the complete record.

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb....	$0.0337	$0.0337	$0.0292
Cold finished shafting, per lb....	0.0433	0.0433	0.0378
Brass rods, per lb....	0.165	0.17	0 171
Solder (half and half), per lb....	0.262	0.276	0 2283
Cotton waste, per lb....	0.1225	0.1225	0 1458
Washers, cast iron (½-in.), per 100 lb....	4.66	4.66	4.33
Emery, disks, cloth, No. 1, 6-in. diameter, per 100....	3.08	3.08	2.96
Machine oil, per gal....	0.349	0.349	0 36
Belting, leather, medium, off list....	37%	37%	44½%
Machine bolts, up to 1-in. x 30-in., off list....	49½%	49½%	49%

Electrical Plants Produced 56.8 per Cent of Capacity in 1921

MANUFACTURE of electrical machinery, apparatus and supplies during 1921 was at a rate slightly more than one-half of the capacity of the industry. Had conditions been such as to make possible the maximum output, electrical machinery and apparatus to the value of $1,469,398,706 would have been manufactured in that year. Instead, the value of products at the 1,333 plants engaged in such manufacture was $833,985,443, or 56.8 per cent of the possible output.

The figures just have been made public by the Bureau of the Census. They were compiled as a result of recommendations by the committee on census schedules created at a conference of trade associations, which met in Washington in 1921 at the instance of the National Association of Manufacturers. Nathan B. Williams was chairman of the committee.

The percentage of possible output among all of the industries shown on the return was 56.8. This covers 194,194 establishments, with a combined value of products of $42,318,241,453. Had these plants worked at maximum capacity, they would have produced $74,123,930,736.

Other figures of electrical interest are included in above table.

Industry	No. of Establishments	Value of Products	Possible Output	Per Cent of Possible Output
Cars, electric railway*	10	$14,856,068	$40,165,004	37.0
Cars, electric†	560	87,312,426	99,719,090	87.6
Electric and gas fixtures	308	42,889,905	75,037,852	57.2
Signs‡	624	53,270,864	83,558,008	63.8

* Not including operations of railroad companies.
† Representing construction and repairs by electric railway companies.
‡ Not exclusively electric.

New England Electrical Manufacturers Busy Filling Orders

ELECTRICAL apparatus and appliance production on a large scale characterize this week's report from New England, with jobbers handling a substantial volume of business of diversified character. Collections are slowing up a little, and construction projects are not quite so active in coming to the contract stage. Some wholesalers state that their total volume of fall business has not come up to expectations, but fundamental conditions are strong, with comparatively little lack of employment, heavy railroad traffic, an immense demand for telephone and central-station service and a fine and expanding retail trade, especially in electrical lines.

Prices weakened on both rubber-covered and weatherproof wire over the week end. Heavy-appliance makers are showing some anxiety over electric range delivery prospects, and the demand for table appliances and fixtures is lively in the extreme. Loom sales to Maine are a noticable item. The new Boston ruling prohibiting opening streets for routine underground construction during the winter is quickening the efforts of utilities to complete as much of this work as possible before freezing weather.

Improvement Noted in New York Market After Buying Lull

MUCH improvement in this week's market is reported by New York jobbers. This betterment is decidedly encouraging because it is unanimously agreed that the buying which has developed during the last four days has been of a more permanent character, with orders in heavy amounts and very firm prices.

The bulk of the business, however, is that of appliances which manufacturers are advertising to the greatest extent in the history of the industry, and which are being manufactured at production records. Dealers are now taking larger amounts of all heating devices, especially hollow ware, which are selling at an unprecedented rate.

Wire prices are slightly softer, motor business is not improved, central-station orders are still strong, poles are moving quickly, and lamp sales are constantly increasing.

Chicago Buying Steady; Conduit Purchasers Coming Into Market

GENERAL business conditions remain about the same this week, and the electrical trade as a whole is anticipating exceptionally good business this fall. October started in briskly, and so far this month is surpassing September and August. No important changes in prices were announced this week, with the exception of an increase in switch boxes of about 5 per cent, which will go into effect some time next week. Sales of pole-line hardware, poles, high-tension equipment, etc., have been rather good, but no exceptionally large orders have been reported. Conduit sales have increased considerably, and indications are that buyers are coming into the market on this commodity. This is probably due to the fact that purchasing had been somewhat curtailed during the summer months.

San Francisco Retail Sales Stronger—Market Lags

RETAIL store business is much improved and sufficient ground for encouragement is found in the sounder methods everywhere prevalent, especially in the marketing of the larger household appliances. It is interesting to note that the holiday buying is not being unduly rushed, which is in strong contrast to the efforts of jobbers during the last three years.

Power company business is tapering off somewhat, but the year 1924 promises a tremendous volume through the construction of lateral lines and the sale of energy-consuming devices. Pole-line hardware is moving in good volume.

Unusually late weather has enabled building to be carried on without cessation. The long-predicted building slump has not materialized and conditions are improving every day. Next year's electrical business promises to be even better because of increased real-estate sales totaling a 50 per cent increase for San Francisco alone.

Atlanta Retailers Report Business Slowed Up Since September

ELECTRICAL retailers report that business has slowed up since the first of September, and this is attributed to the falling off in building activities and to the fact that purchasers are saving up for the holidays. While the retailers expect a good holiday business, they are hesitant about anticipating their requirements and placing orders accordingly. Instead, they seem to expect the jobbers to carry the stocks and be able to make immediate deliveries on their hand-to-mouth orders.

All jobbers believe business is unusually good, and the only change since last week is a price reduction of 2 cents per pound on weatherproof wire announced by one of the largest jobbers. Good stocks are the rule, except in flatirons, but large orders are placed for this item and shipments are expected shortly. The entrance of the central stations in the merchandising field has resulted in an excellent movement of all the types of domestic heating appliances.

The Metal Market

STRENGTH is noticeable in the copper, lead and zinc markets, owing principally to the strength of the London prices. All three of these metals advanced during the week in the chief European market, which has helped to check the decline in copper, to increase the demand for American slab zinc abroad and to remove the slightly softer tendency in the lead market.

Whether a definite turn for the better has taken place in the copper market is difficult to say. Sales have been light with only moderate tonnages bought. At the moment the tendency of the copper market is downward and much depends on the attitude of the London market.

NEW YORK METAL MARKET PRICES

	Oct. 17, 1923 Cents per Pound	Oct. 24, 1923 Cents per Pound
Copper, electrolytic.	13 00	13.00
Lead, Am.S.& R.price	6.85	6.85
Antimony	7.75	7.62½
Nickel, ingot	27.00 to 32.00	27.00 to 32.00
Zinc, spot	6 25	6 35
Tin, Straits	41.75	41.50
Aluminum, 98 to 99 per cent	26 00 to 27 00	26 00 to 27.0

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Western Electric Gains

In the first nine months of 1923 the Western Electric Company's billings totaled $178,750,000, which was $26,233,000 more than for the 1922 period. This is at the rate of around $235,000,000 for the year 1923, and compares with $211,000,000 for 1922. Orders booked in the first nine months total $211,185,000, or $77,064,000 more than in the 1922 period.

Carney Establishes Creosoting Plant and Pole Yard

A new creosoting plant and pole yard has been established by B. J. Carney & Company, producers of Western red-cedar poles, on the Soo Line in northwestern Minneapolis at Forty-seventh Avenue and Osseo Road. About ten acres of advantageously situated ground has been set aside for this work. Although the treating plant will not be ready for operation until about Dec. 1, poles are already being received daily so that the plant will be in a position to handle orders for treated poles at that time.

Range Campaign in Northwest

Ralph J. Cordiner of the Edison Electric Appliance Company, Chicago, is spending several weeks in Spokane in connection with sales of "Hotpoint-Hughes" electric ranges in that territory. Mr. Cordiner states that six of the leading power companies in the Northwest are now conducting range campaigns and that the sales already made indicate that a great success is to be attained.

This is the first time that such campaigns have been carried out in the autumn months, and the results confirm Mr. Cordiner's conviction that the market for electric ranges is one that is open throughout all the year and merely needs stimulation to be productive.

Electric Service League of Canada Enlarges Board

The Electric Service League of Toronto, Canada, incorporated to conduct electric homes in Canada, has enlarged its board of directors from five to twelve. It consists of the following men: A. S. Edgar, manager supply department, Canadian General Electric; E. M. Ashworth, acting general manager Toronto Hydro System; C. S. Barthe, Canadian General Electric; F. John Bell; W. R. Carr, editor *Electrical News;* R. A. L. Gray, contractor-dealer; J. Herbert Hall, Conduits Company; C. H. Hopper, Canadian Westinghouse Company; R. T. Jeffery, Hydro-Electric Power Commission of Ontario; C. A. McLean, Masco Company; W. R. Ostrom, district manager Northern Electric Company, and A. W. J. Stewart, Toronto Hydro-Electric System.

Doble Engineering Company Moves Offices

The Doble Engineering Company, Boston, has transferred its offices to 110 Brookline Street, Cambridge, Mass., where increased space for all phases of the company's business and close contact between office and factory will be available. F. C. Doble states that interest in live-line insulator testing is increasing throughout the country among both operating organizations and insulator manufacturers.

Business of Walworth Company Is Increasing

The Walworth Manufacturing Company, Boston, manufacturer of valves, is reported certain to show earnings of not less than $7 a share on its $4,000,000 common stock this fiscal and calendar year. While not up to the exceptional volume of the first half of the year, business is continuing at a satisfactory rate. Sales to date amount to about $14,400,000, compared with $9,500,000 for the same period a year ago and with $13,500,000 for all of 1922. The prospects favor at least $18,000,000 of gross business for the full 1923 year. Some departments of the business are slowing down, but others are unable to keep abreast of incoming orders.

Increase Telephone Output

The possibility of any let-up in the production of telephone apparatus required to continue the expansion of the country's communicating system seems out of the question for years to come, according to executives of the Hawthorne factory, Western Electric Company. Instead of easing up, the demands for new equipment continue to grow at such a rate that the works management is finding itself forced to extreme measures to live up to its output schedules.

The production of telephone transmitters this year, it is pointed out, will exceed 1,500,000—an increase of almost 40 per cent over the record output of a year ago. The transmitter is one of the most important parts of the subscriber's telephone. Increased deliveries in all the other branches of telephone equipment are also being recorded at Hawthorne.

General Electric Meter Convention

Fifty meter specialists, including commercial representatives, designing and other factory engineers of the General Electric Company, held a four-day meeting, beginning Oct. 2, at the New Ocean House, Swampscott, Mass., under the general chairmanship of F. G. Vaughen, sales manager meter department, Schenectady works. Three daily sessions were held and the following program of papers and subjects discussed was carried out:

Opening remarks, F. G. Vaughen; "Alternating-Current Meters," W. M. Howe; "Direct-Current Meters," H. G. Hamann; "Special Metering Problems," H. M. Witherow; "Magnets," I. S. Kinnard; "Oils," W. E. Porter; "Developments in Watt-Hour Meters," W. H. Pratt; "The Meter Specialist," B. P. Burleigh; "Methods of Business Getting," C. S. Kammerer; "Demand Meters," J. A. Laubenstein; "Development of Demand Meters," C. I. Hall; "Competition," L. E. Northshield; "Instruments," S. H. Bowman; "Instruments, Miniature and Refinements," W. E. Porter; "Development of Instruments," W. H. Pratt; "Instrument Transformers, and Air Insulators," L. Arnold; "Two-Stage Transformers," W. K. Dickinson; "Oil-Insulated Instrument Transformers," R. W. Francis; "Testing Methods," S. G. Hamann; "Production," A. W. West; "Manufacturing Methods, Lynn," W. J. Lloyd; "Manufacturing Methods, Fort Wayne," F. C. Morganthaler. In addition there was a general discussion of manufacturing problems in which shop foremen, leading men and others participated.

Apex "Money Talks" Contest Creating Many Sales

The Apex Electrical Distributing Company, Cleveland, manufacturer of household appliances, is holding a sales contest until Jan. 1. This is called "Money Talks Sales Contest," and with nine automobiles and cash bonuses as prizes, officials of the company say that records have reached a high mark since the contest began on Sept. 1. The chief reason for the intense interest by the salesmen, it is said, is the basis on which contest credit is given, the number of points per sale varying with the amount of "down payment" obtained by the salesman.

Two Ohio Signal Device Makers Announce Consolidation

Consolidation of the Tele-Call Company, Cleveland, and the Autocall Company, Shelby, Ohio, has been announced. These firms are manufacturers of signaling systems, and their products cover practically the same fields. The Tele-Call Company has confined its efforts almost entirely to paging service, while the Autocall Company is the maker of fire alarms and watchmen's local supervisory services.

For the present both plants will be operated independently, and the com-

panies will gradually become merged under the name of the Autocall Company, with headquarters at Shelby. W. W. Van Horn is president and C. C. Skiles vice president and general manager.

Japanese Plant Gains 10 per Cent

The Kawasaki plant of the Tokyo Electric Company reports that its present output is 10 per cent in excess of its capacity at the time of the earthquake.

This company, affiliated with the International General Electric Company, manufactures electric lamps, wiring devices and meters. Although seriously damaged in the recent catastrophe, it is now engaged in turning out electrical supplies immediately needed for reconstruction.

Valley Electric Appointments

The appointment of E. W. Martin as Chicago district manager has just been announced by the Valley Electric Company, St. Louis, manufacturer of single-phase and polyphase ball-bearing motors, rectifiers and other electrical products. Mr. Martin goes to the Valley organization from the Westinghouse Electric & Manufacturing Company, with which he has been associated for a number of years in various capacities.

Appointment of C. L. Krentz in the sales department of the home office in St. Louis is also announced by the Valley Electric Company.

Allis-Chalmers Company Order

The St. Louis office of the Allis-Chalmers Manufacturing Company has recently received an order for a 1,500-hp. rolling-mill motor from the Scullin Steel Company of St. Louis. It is to be installed in theManchester Avenue plant of the Scullin Steel Company, and it is expected that the motor will be delivered Feb. 1, 1924.

Westinghouse to Have New Warehouse in Kansas City

The Westinghouse Electric & Manufacturing Company recently awarded a contract for the construction of a new warehouse in Kansas City to Miller & Stauch, contractors, to cost $61,500.

The building is to be erected on an irregular tract of ground lying between Wyandotte Street and Scott Avenue just north of Milwaukee Avenue. The building is to be of concrete construction and will be three stories high, each floor having 30,000 sq.ft. of floor space.

Long Island Railroad Order for Electrical Equipment

As part of its program to improve service to provide for increased traffic anticipated next summer, the Long Island Railroad has given the Westinghouse Electric & Manufacturing Company an order for electrical equipment for sixty passenger cars. Each equipment consists of two 225-hp. motors and necessary multiple-unit control apparatus. The amount involved is approximately $600,000.

In addition to these cars, which will be ready for delivery next spring, fifty more, previously ordered, will be ready this year.

York Insulated Wire Extends Pittsburgh Territory

The York Insulated Wire Works, 1737 Broadway, New York City, have recently extended the territory of their Pittsburgh agent, H. Lee Reynolds, Oliver Building, to all of the State of Ohio as well as the Detroit district. The Reynolds firm has represented York Insulated in the sales of "Salamander" asbestos insulated wires for some time past. For the convenience of customers in Ohio, all mail addressed to 309 Plymouth Building, Cleveland, will receive prompt attention.

Motor Lecture in Spokane

On Oct. 5 the Spokane (Wash.) office of the General Electric Company gave a dinner at the Davenport Hotel attended by the leading men of the electrical industry in Spokane. S. E. Gates, local manager of General Electric, presided and introduced as speaker for the evening E. C. Fellows, motor specialist in the Seattle office, who gave an illustrated talk on the subject of improvements in General Electric motors.

W. L. Rose Equipment Company Moves Into Larger Offices

The offices of the W. L. Rose Equipment Company, St. Louis, were moved on Oct. 15 from the La Salle Building, at Olive Street and Broadway, to the New Planters' Building, at Fourth and Pine Streets. This company has had offices in the La Salle Building ever since organization ten years ago, and the business has grown to a point where larger quarters are necessary. This company is the manufacturers' agent in St. Louis for many standard lines of high-tension equipment.

Brandes Secures More Space in New York

C. Brandes, Inc., 237 Lafayette Street, New York City, announces the lease of another 5,000 sq.ft. of space in the building in Lafayette Street.

This is the third addition that the company has made in the past year. Early in March it leased the ninth floor, consisting of 5,000 sq.ft. of floor space. In August it purchased a new plant in Newark containing about 48,000 sq.ft. With the newly leased space, the company occupies four floors of the building. The main office will be continued at 237 Lafayette Street.

Western Union Telegraph Net Income Shows Increase

Net income for the nine months ended Sept. 30, 1923, of the Western Union Telegraph Company amounted to $10,000,504 as compared with $9,473,844 for the corresponding period of 1922. The detailed account of the earnings report of the company is as follows:

	1923	1922
Gross revenues, including dividends and interest	$84,878,754.00	$78,783,925.00
Maintenance: Repairs and reserved for depreciation	$13,679,844.00	$12,694,523.00
Other operating expenses, ncluding rent of leased lines and taxes	59,468,269.00	54,885,421.00
Total expenses	$73,148,113.00	$67,579,944.00
Balance	$11,730,641.00	$11,203,981.0
Deduct: Interest on bonded debt	1,730,137.00	1,730,137.00
Net income	$10,000,504.00	$ 9,473,844.00

The Standard Electric Stove Company, Toledo, Ohio, will remove its business to Goshen, Ind., where a portion of the plant of the Engman-Matthews Range Company has been leased. The capacity of this plant will be increased.

The J. P. Davis Company, 159 North State Street, Chicago, is now the exclusive selling agent of the American Enameled Magnet Wire Company, Muskegon, Mich., in Illinois and Wisconsin.

The Electric Appliance Company, Dallas, Tex., has been reorganized and merged with the Electric Specialty Company. The new company will be known as the Electric Appliance Company, and M. E. Martin will be president of the merged company. The merger results in the addition of $90,000 in new capital to the Electric Appliance Company, which will conduct a wholesale business in electrical supplies. Charles L. Martin is secretary of the company and general manager of the new organization.

The Ludlow Battery Service Company, 421 South Ludlow Street, Dayton, Ohio, has acquired additional property and contemplates the construction of an addition to its plant, to be built at Ludlow and Franklin Streets. J. C. Melat is president.

The H. T. Electric Company, 612 North Capitol Avenue, Indianapolis, has completed plans and will take bids at once for the construction of its proposed new plant on local site, estimated to cost approximately $30,000.

The Mazda Lamp Division of the General Electric Company has posted notices to its employees at Central Falls, R. I., that it will close its plant there within a month. The lamp making will thereafter be done at a new plant in East Boston. The company has been in business in Central Falls since 1907 and has employed from 350 to 600 persons. The payroll now approximates $8.000 weekly.

Foreign Trade Notes

FARM LIGHTING PLANTS IN CEYLON VILLAGES.—Plans are under way, *Commerce Reports* states, to provide electricity for lighting in certain small towns and villages of the island of Ceylon by means of oil-engine-driven self-contained generating unit (really the larger types of home-lighting plants). The scheme is being fostered by the government agent of the western provinces, where five such plants are being installed, following the success of the plant that has been operating in the village of Gampaha, which has gained much favor in the western provinces. It is expected that the system will be extended to other parts of the island. A list of the principal towns of the different provinces at which government agents are located may be obtained from the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., or through any of the bureau's district or co-operative offices by referring to file No. 106,994.

PROPOSED HYDRO-ELECTRIC PLANT AT PONT DE MONTEVERT, FRANCE.—Application has been filed by the Paris, Lyons & Mediterranean Railway Company for a concession to utilize the water at Mont Lozère and to build a 20,000-hp. generating plant at Pont de Montevert, with a view of equipping the railway from Langogne to Alais for electrical operation.

PROPOSED HYDRO-ELECTRIC PLANT NEAR MADRID, SPAIN.—Plans are being prepared by the Sociedad Electro-Metalurgica for a hydro-electric plant on the Aberche River, near Madrid. The power will be used mostly for industrial purposes.

PROPOSED HYDRO-ELECTRIC PLANT FOR CHRISTCHURCH, NEW ZEALAND.—A report giving the details of the proposed hydro-electric development on the Waimakariri River at Otarama Gorge, near Christchurch, has been submitted to the City Council of Christchurch by Charles B. Hawley & Company, Washington, D. C. The plans provide for an initial generating capacity of 15,000 kw., to be increased to 22,500 kw., and an ultimate capacity of 45,500 kw. The cost of the project is estimated at £838,600.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Bydgoszcz, Poland (No 7,974), of copper wire.

TRANSFORMERS AND CABLES FOR THE MORWELL (AUSTRALIA) POWER SCHEME.—Tenders will be received by the State Electricity Commission of Victoria, Melbourne, Australia, until Jan. 3, 1924, for aluminum steel-cored cable and accessories (Specification No. 24/1). Tenders will also be received by the commission until Dec. 15 for four 1,000-kva., single-phase transformers and spares (Specification No. 23/145) for the Morwell power scheme.

New Apparatus and Publications

SIGN FLASHERS.—The Reynolds Electric Company, Chicago, has issued bulletin No. 41, which gives general information on maintenance and installation of "Reco" sign flashers.

TACHOMETERS.—The Bristol Company, Waterbury, Conn., is distributing bulletin No. 317, covering its recording and indicating tachometers.

ELECTRIC DISHWASHER.—A new high-speed automatic dishwasher for hotels, hospitals, restaurants, etc., has been developed by the Crescent Washing Machine Company, New Rochelle, N. Y.

ELEVATOR MOTOR.—A two-speed alternating-current motor for use with high-speed elevators has been brought out by the Warner Elevator Manufacturing Company, Cincinnati.

CABLE BENDER.—A cable bender for bending and straightening large-size cable in underground construction has been developed by T. J. Cope, 2112 Sansom Street, Philadelphia.

ELECTRIC TRUCK.—A new type of industrial truck, known as the reel-handling truck, has been developed by the Automatic Transportation Company, Inc., 2933-2965 Main Street, Buffalo. This truck meets a great need in the wire industry and is built in capacities of 6,000 lb. and 10,000 lb.

CABLE AND CORD.—The Rome Wire Company, Rome, N. Y., is distributing two folders, one describing its superservice welding cable and the other its superservice junior cord.

ELECTRIC OVENS.—Catalog No. 4 issued by the Despatch Manufacturing Company, Minneapolis, describes and illustrates the "Despatch" electric ovens for all purposes.

RADIO APPARATUS.—A new piece of radio apparatus has been brought out by C. Brandes, Inc., 237 Lafayette, New York City, under the name of "Brandes Table-Talker," which is virtually a loud speaker.

GRINDING MACHINES.—Bulletin No. 1,305 distributed by the Hisey-Wolfe Machine Company, Cincinnati, covers the "Hisey" ball-bearing grinding machines.

MAGNETIC RELEASE VALVE.—The Penn Electric Machine Company, Des Moines, Iowa, has placed on the market a magnetic release valve for air compressor service.

MAGNETIC RELAY SWITCH.—The Trent Electric Company, 1,524 Chestnut Street, Philadelphia, has brought out a new magnetic relay switch.

ELECTRIC THERMOSTAT.—A new thermostat "Caliscope" has been developed by the American Teletherm Company, 1017 Summit Street, Toledo, Ohio, which may be placed in the basement of a building and will keep the person tending the furnaces and ventilators of a building informed of the existing temperature of each room without necessitating his presence in the room.

ELECTRIC LANTERN.—An electric lantern for exterior or interior use has been brought out by the Friedley-Voshardt Company, 733 South Halsted Street, Chicago.

MILK AND CREAM TESTER.—An electric milk and cream tester with capacities of eight, twelve and twenty-four bottles has been placed on the market by the Imperial Electrical Company, Union City, Ind.

SOLDERING MACHINE.—A jewelers' electric soldering machine controlled by a foot switch has been brought out by the Goodall Electric Manufacturing Company, Ogallala, Neb.

WASHING-MACHINE MOTOR.—The Emerson Electric Manufacturing Company, 2018 Washington Avenue, St. Louis, has placed on the market a $\frac{1}{4}$-hp., 110-volt, 60-cycle washing-machine motor.

TREATMENT OF TRANSFORMER AND SWITCH OILS.—The Sharpless Specialty Company, Twenty-third and Westmoreland Streets, Philadelphia, is getting out new bulletins describing the super-centrifugal treatment of transformer and switch oils for maintaining their dielectric strength, and also bulletins dealing with the continuous regeneration of Diesel engine lubricating oil and turbine oil.

CLOTHES DRIER.—A folding clothes drier, "Sunny Day," has been brought out by the E. W. Kriekard Company, Cedar Rapids, Iowa.

DEVICE FOR OPENING AND CLOSING DOORS.—The Allith-Prouty Company, Danville, Ill., is manufacturing an electrically operated device, "Electromatic," for opening and closing garage doors.

STORAGE BATTERY.—The Electric Storage Battery Company, Philadelphia, has developed a battery, known as type 1-KZR-5, for use with low-voltage tubes.

LIGHTING FIXTURE FOR HOSPITALS.—Edward Miller & Company, Meriden, Conn., have brought out a new "Duplex-A-Lite" lighting fixture, designed particularly for use in hospitals.

STARTING DEVICE FOR AUTOMOBILES.—The Kase Electric Company, Sherwood Building, Duluth, Minn., is manufacturing a cold-weather starting device for automobiles, known as "As-Ke-Fuemizer."

BATTERY CHARGER.—The Fansteel Products Company, Inc., North Chicago, Ill., has placed on the market a new "Balkite" battery charger.

LIGHTING EQUIPMENT.—The Benjamin Electric Manufacturing Company, Chicago, has placed on the market an interchangeable equipment for industrial lighting units, known as "Ben-ox."

COMMERCIAL LIGHTING FIXTURE.—A new commercial lighting fixture, "Focalite," has been developed by the Moe-Bridges Company, Milwaukee.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

NEWPORT, N. H.—At an election held recently the proposal to establish an electric light service in the village was carried.

WAKEFIELD, MASS.—Plans have been filed by the municipal lighting department for the construction of a new substation to cost about $25,000.

NEW BRITAIN, CONN.—Plans are being prepared for the construction of a one-story power and machine building, 60 ft. x 160 ft., at the works of the Donnelly Brick Company. Max J. Unkelbach, New Britain, is architect.

Middle Atlantic States

AKRON, N. Y.—Plans are under consideration for the installation of electrically operated pumping machinery at the waterworks.

GROVELAND, N. Y.—The Livingston-Niagara Power Company has secured a franchise and will install a local lighting system.

LEWISTON, N. Y.—The Niagara, Lockport & Ontario Power Company has been granted permission to take over the property of the Niagara River Power & Water Supply Company and plans to erect a substation here.

MEDFORD STATION, N. Y.—The Great Eastern Sugar Company contemplates building a power plant and mill, to cost about $1,500,000. K. Grunwald is in charge.

NEWARK, N. J.—Electric power equipment will be installed by the Port Newark Brick Company at its proposed plant at Port Newark.

BLAIRSVILLE, PA.—Electric power equipment will be installed in the new local plant to be erected by the National Plate Glass Works, to cost about $3,000,000.

CARLISLE, PA.—The Cumberland Valley Light & Power Company is negotiating for the purchase of the property of the Cumberland Paradise Light & Power Company and plans to merge with its system.

DUBOIS, PA.—The installation of an ornamental lighting system in the business section is under consideration.

HAWLEY, PA.—The Pennsylvania Power & Light Company, Allentown, plans to build a hydro-electric plant on Wallenpaupack Creek, near Hawley, where an artificial lake will be formed with a power dam at Wilsonville. The project, with transmission system, will cost about $8,000,000. The company has purchased property in the Upper Perkiomen Valley section and plans to extend its transmission line there.

PHILADELPHIA, PA.—An electrical instrument and dynamometer department will be established in the laboratory now in course of construction at the local naval aircraft station, League Island, by the Bureau of Yards and Docks, Washington, D. C.

PITTSBURGH, PA.—The West Penn Power Company has received permission to erect a transmission line in Plum Township.

TELFORD, PA.—The Telford Power & Light Company is being organized as a subsidiary of the Pennsylvania Power & Light Company to install and operate a local system.

TROY, PA.—The Troy Township Electric Company, recently organized, plans to erect a transmission line. William S. Montgomery is treasurer.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company plans additions to its electric plant on Gould Street to triple the present capacity. New equipment, including two 20,000-kw. turbo-generators, with auxiliary equipment, will be installed. The total cost is estimated at $3,500,000.

PORT DEPOSIT, MD.—The Port Deposit Quarry Company, recently formed, contemplates the installation of electric power and mechanical equipment at its local plant

WEST GRAHAM, W. VA.—Plans for the proposed local furniture manufacturing plant to be erected by R. E. Baldwin and K. B. Thomas include a power house.

WESTON, W. VA.—The installation of a new lighting system on the principal streets is under consideration. Andrew Edminston, Jr, is head of the committee in charge.

CHARLOTTESVILLE, VA—The installation of electrically operated pumps at the proposed municipal waterworks, to cost about $500,000, is under consideration. Fuller & McClintock, 600 Walnut Street, Kansas City, Mo., are engineers.

WASHINGTON, D. C.—Bids will be received by the general purchasing officer, Panama Canal, until Nov. 5, for one electric lighting outfit. (Circular 1566.)

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Oct. 30, for wireless equipment, including one motor-generator one keyboard perforator, one transmitter, 1,500 lb. of perforated tape, one signal recorder, 1,000 rolls of recorder tape, and one radio relay. Circular CP-16003-1.)

WASHINGTON, D. C.—Bids will be received by the Chief of Engineers, United States Army, Munitions Building, until Nov. 16, for water-tight lighting fixtures, including 400 ceiling-lamp fixtures, 200 wall-lamp fixtures, 75 portable hand lamps, 10 switch panel boxes, 500 glass globes, 6 gross screws and 25 snap switch handles (Advertisement 24-122); also for 2,000 ft. controller cable, nine-conductor, and 4,500 ft. controller cable, with reels. (Advertisement 24-121.)

North Central States

EDENVILLE, MICH.—The Wolverine Power Company has issued $1,570,000 in bonds to provide funds for the completion of four hydro-electric plants at Edenville, Smallwood, Sanford and Secords, with total output of 15,000 hp. Work is in progress on a substation at Edenville, and transmission system extension from Zilwaukee to Edenville, to cost about $800,000, under the direction of the Consumers' Power Company, which will take the entire output of the Wolverine company.

PORT HURON, MICH.—The Dunn Sulphite & Paper Company plans to build a power house at its proposed local mill, to cost about $500,000.

AKRON, OHIO—The People's Hospital Company plans to build a power house in connection with a number of new units at the institution on Cedar Street, to cost about $200,000. George J. Ball, Metropolitan Building, is architect.

BURGHILL, OHIO—Steps have been taken by local residents to secure electric lighting service for this district. E. O. Fitch is a member of the committee.

COLUMBUS, OHIO.—The Security Storage & Power Company, recently incorporated, has purchased the four-story building at 460 Dublin Avenue, and plans to convert it into a power building to accommodate a number of small manufacturing concerns.

ST. CLAIRSVILLE, OHIO.—The American Zinc & Chemical Company will install electric power equipment at its plant in connection with an addition, to cost about $200,000.

WILMINGTON, OHIO. — The Clayton Power & Light Company plans to install electrically operated pumps in connection with new local waterworks, to cost about $75,000.

AUGUSTA, KY.—The Kentucky Power Company is building a new power plant at Augusta, to supply electricity throughout this district.

HISEVILLE, KY.—The Hiseville Light & Power Company, recently organized, plans to erect a 2-mile transmission line.

WHITE PLAINS, KY.—The Kentucky Utilities Company has closed a contract for service with the White Plains Light & Power Company and will extend its transmission line here. Work will also commence on a new substation at Russellville for municipal service.

HUNTINGTON, IND.—The Northern Indiana Power Company, Kokomo, is negotiating for the purchase of the properties of the Huntington Light & Fuel Company and the Bippus Utilities Company, North Manchester. Bonds for $1,360,000 will be issued to finance the project and for extensions, including the erection of a transmission line to Huntington and vicinity.

LAFAYETTE, IND.—Bids will soon be called by the board of trustees, Purdue University, for the construction of the proposed electrical building at the institution, to cost about $100,000, with equipment.

HOBBS, IND.—The power house and canning factory of Frazier & Norris were recently damaged by fire, causing a loss of about $60,000.

MOMENCE, ILL. — The Public Service Company of Northern Illinois plans to erect a transmission line from Kankakee to Momence.

CUBA CITY, WIS.—Improvements will be made to the street-lighting system, including the installation of cluster lamps in the business district. Bonds to the amount of $15,000 have been approved for this purpose.

JIM FALLS, WIS.—The installation of a street-lighting system in Jim Falls, electricity to be furnished by the Wisconsin-Minnesota Light & Power Company, is under consideration by the local commercial association. A. L. Putnam is secretary.

MADISON, WIS.—A new power plant, equipped with oil engines, will be erected at the Madison Sanitarium, to cost about $15,000.

MARIENETTE, WIS.—The Pike River Granite Company contemplates equipping its Middle Inlet Quarry for electrical operation, at a cost of about $20,000.

MENESHA, WIS.—Extensions are contemplated to the municipal electric light and water plant, including an addition to the power house and the installation of an engine. Bids, it is understood, will be received by the city clerk for a 600-hp. oil engine.

MILWAUKEE, WIS.—A permit has been granted to the Pittsburgh Plate Glass Company to erect a power house on Oregon Street, to cost about $65,000.

ST. CROIX FALLS, WIS.—The St. Croix Falls Development Company, a subsidiary of the Northern States Power Company, plans to build a dam at Kettle River in connection with a hydro-electric development.

SHEBOYGAN, WIS.—The Eastern Wisconsin Electric Company is considering the development of additional power at Battle Island, on the Wolf River, near Elcho.

SHEBOYGAN, WIS.—The Eastern Wisconsin Electric Company has disposed of a bond issue of $1,150,000, part of the proceeds to be used for extensions and improvements.

SUPERIOR, WIS.—The City Council has authorized the installation of additional street lamps on Superior Avenue.

WAUSAU, WIS.—The Underwood Veneer Company plans to build a steam-driven electric plant to furnish electricity to operate its proposed new sawmill.

WAUTOMA, WIS. — The White River Power Company, recently incorporated with a capital stock of $100,000, contemplates the construction of a hydro-electric plant. When completed it will be connected with the local plant of the company, which will supply electric service in the villages of Coloma, Hancock, Plainfield, Almond and Wautoma. Messrs. Dahlke, Giese and Walker are the incorporators.

WHITEWATER, WIS. — Arrangements have been made by the Whitewater Electric Light & Power Company for extending its transmission line to Lauderdale Lake to furnish electrical service there.

MINNEAPOLIS, MINN.—The Northern States Power Company has acquired a power site on the St. Anthony River from the Pillsbury Flour Mills Company for a proposed hydro-electric development.

MINNEAPOLIS, MINN.—The Board of County Commissioners is considering plans for a county highway lighting system, with initial installation to be made on the Minnetonka Boulevard, from the city limits to Lake Minnetonka.

FARMINGTON, IOWA.—The Iowa Electric Company, Cedar Rapids, has acquired the municipal electric plant, and will extend its transmission system here.

HARRIS, IOWA.—An election will be held on Nov. 15 to vote on the proposal to sell the municipal electric system and to grant a franchise to private parties to operate an electric system here. A similar proposal will be submitted to the voters at Lake Park. John A. Reed, Cedar Rapids, and D. M. Sterns, Humboldt, are negotiating for the purchase of these properties. An option on the electric system at Ocheyedan is reported to have been secured by the above parties.

MARSHALLTOWN, IOWA.—J. O. Bisset has applied to the County Commissioners for permission to erect a transmission line in a certain section of the county.

WYOMING, IOWA.—The construction of a municipal electric light plant, to cost about $35,000, is under consideration.

CASSVILLE, MO.—M. L. Hardy, Maplewood, plans to build a power house at his proposed local lumber mill.

FLAT RIVER, MO.—The Federal Lead Company plans to rebuild its electric power plant, recently damaged by fire, with loss of about $20,000.

DEVILS LAKE, N. D.—The State Board of Administration, Bismarck, has rejected bids for extensions to the power plant at the local State School for Deaf. New bids, it is understood, will be called for at an early date. Shannon, Boyd & Boyd, Devils Lake, are architects.

FARGO, N. D. — The Great Northern Railway Company contemplates building a power house here.

MINOT, N. D.—The establishment of a municipal electric plant in Minot is under consideration by the City Commission.

WASHBURN, N. D.—The Central Light & Power Company plans extensions in its transmission system, including the rebuilding of the present line to McClusky.

CASTLEWOOD, S. D.—Bonds to the amount of $10,000 have been authorized for the construction of a transmission line, substation and a new distribution system in Castlewood.

SIOUX FALLS, S. D.—The Minnesota Electrical Distributing Company, Minneapolis, plans to erect a transmission line in Valley Springs Township and in other parts of Minnehaha County.

WHITE RIVER, S. D.—Plans are being prepared for a municipal hydro-electric plant on the White River, with distributing system. J. C. Jacobson, 1624 Harmon Place, Minneapolis, is engineer.

HASTINGS, NEB.—The purchase of a 400-hp. boiler for the municipal light and water plant is under consideration.

FREDONIA, KAN.—The Kansas Gas & Electric Company, it is understood, will soon ask for bids for the erection of a 60,000-volt transmission line from Fredonia to Cherryvale and also to build substations at Fredonia and Buffville. The cost of the work is estimated at $100,000. K. P. Horine, Fredonia, is in charge.

KANSAS CITY, KAN.—Bids will be received by Howard Payne, city clerk, until Oct. 30, for one 12,500-kva. turbo-generator, two 600-hp. watertube boilers and two six-retort underfeed stokers, for the municipal plant.

Southern States

ALBEMARLE, N. C.—The installation of electrically operated pumps in connection with extensions in the waterworks, to cost about $90,000, is under consideration.

WALNUT COVE, N. C.—A contract, it is understood, will soon be awarded for construction of a municipal hydro-electric plant on the Dan River.

CAMDEN, S. C.—Investigations are being made by the Yadkin Power Company, Raleigh, N. C., with a view of erecting a rural transmission line from Camden through the villages of Rambert and Hagood, to supply electricity to these villages and to farmers along the lines.

SENECA, S. C.—The installation of an ornamental lighting system on principal streets in the business district is under consideration by the Board of Public Works.

COLUMBUS, GA.—The Columbus Electric & Power Company plans extensions and improvements in its system, to cost about $110,000, including an underground conduit system in the business section.

MACON, GA.—The Schuster-Adams Company, recently organized, contemplates the construction of a power house at its proposed local chemical plant, to cost about $250,000. Hoke Smith is interested in the company.

BLOUNSTOWN, FLA.—Plans are being prepared for the installation of a municipal electric lighting plant, and electrically operated pumps at the waterworks, for which $50,000 in bonds have been voted.

FROSTPROOF, FLA.—Plans are under consideration for the installation of electrically operated pumps in connection with a new waterworks system, to cost about $100,000.

JACKSONVILLE, FLA.—An addition to the municipal electric plant, to cost about $51,300, and the erection of a substation are under consideration.

MIAMI, FLA.—The East Coast Improvement Company is considering the installation of an isolated electric plant on a tract now being developed. A. T. Barkdull is president.

BIRMINGHAM, ALA.—The Public Service Commission has granted the Alabama Power Company permission to issue $4,000,000 in bonds, the proceeds to be used for new construction work, additions and improvements.

MOBILE, ALA.—The installation of an ornamental lighting system in the business district is under consideration.

GULFPORT, MISS.—The installation of an ornamental lighting system in the business district is under consideration by the City Commission.

BAUXITE, ARK.—The American Bauxite Company plans to install electric power equipment in connection with plant extensions and improvements to cost about $150,000.

MORRILLTON, ARK. — The Arkansas Light & Power Company contemplates building a new local plant, to cost about $35,000.

BOGALUSA, LA. — The Union Bag & Paper Corporation, Woolworth Building, New York, contemplates building a power house at its proposed local plant, to cost about $500,000.

MONROE, LA.—The Sweet Glass Company plans to install a substation and electric power equipment at its proposed local plant, to cost about $85,000.

WASHINGTON, LA.—All bids submitted for the municipal electric plant have been rejected. Plans, it is understood, will be revised before new bids are called for.

WELSH, LA.—Bids will soon be asked for the construction of an addition to the municipal electric plant, for which $20,000 in bonds have been voted. John T. Smith is engineer.

COWETA, OKLA.—The Public Service Company of Oklahoma, Tulsa, plans to erect a high-tension transmission line from Broken Arrow to Coweta, via the Evans coal mines. The company has been granted a franchise in Coweta.

DALLAS, TEX.—The Dallas Power & Light Company is planning extensions to its underground system during the coming year, to cost about $200,000.

FORT WORTH, TEX.—The Southwestern Portland Cement Company, El Paso, plans to build a power house at its proposed local plant.

MARSHALL, TEX.—The installation of electrically operated pumps in connection with new municipal waterworks, to cost $80,000, is under consideration.

SAN BENITO, TEX.—The Valley Electric & Ice Company contemplates building a new electric plant here for service in the Rio Grande Valley section, where the transmission system will be extended.

SANGER, TEX. — The city has taken over the plant of the Sanger Light & Power Company and will make improvements to same.

TYLER, TEX.—The Texas Power & Light Company plans to erect about 200 miles of transmission lines, including a line to Palestine with branches, a line in the Powell oilfield and a 60,000-volt line from Hillsboro to Corsicana. The total cost is estimated at $1,000,000.

Pacific and Mountain States

SEATTLE, WASH.—The sale of $1,000,000 in bonds has been authorized, the proceeds to be used for the municipal light and power department.

TACOMA, WASH. — An ordinance has been adopted by the City Council providing for the installation of ornamental lamps on a portion of South Tacoma Avenue and a number of other streets in that section.

TACOMA, WASH.—Bids for the first unit of the Lake Cushman power project, it is stated, will be called in about sixty days. Estimates on generating machinery, etc., are being made, preparatory to naming the total amount needed in the bond issue. Ira S. Davisson is commissioner.

YAKIMA, WASH. — The City Commissioners have adopted an ordinance providing for the installation of ornamental lamps on twenty-seven blocks in the business district, to cost about $25,000.

OREGON CITY, ORE. — The Hawley Pulp & Paper Company plans to install electric power equipment in connection with the rebuilding of its local mill recently damaged by fire with loss of about $600,000.

LOS ANGELES, CAL. — The Board of County Supervisors is considering the installation of an ornamental lighting system for County Road Improvement District No. 50, using reinforced-concrete standards.

LOS ANGELES, CAL.—The installation of an ornamental lighting system on Washington Boulevard, consisting of 130 standards, to cost about $41,000, is under consideration.

LOS ANGELES, CAL.—The Weber Showcase Company, 316 South Los Angeles Street, plans to build a power plant at its proposed new factory at South Park and Slauson Avenues, to cost about $500,000.

LOS ANGELES, CAL.—Plans for the proposed plant to be erected by the Crescent Creamery Company on Slauson Avenue, to cost $115,000, include a power house and an electric traveling crane. Morgan, Walls & Morgan, Van Nuys Building, are architects.

SAN LUIS OBISPO, CAL.—Bids will be received by the County Clerk until Nov. 5 for equipment for the San Miguel Lighting District and for maintenance of same.

SAN MATEO, CAL.—The installation of a fire-alarm system, including underground lines in the business section and overhead system in the residential portion, to cost about $30,000, is under consideration. G. Stanley Whitehead is city engineer.

SANTA BARBARA, CAL.—The County Supervisors have authorized plans for a hydro-electric plant and irrigation system in the Santa Maria Valley. The project includes a dam on the Sisquoc River. The cost is estimated at $3,500,000.

TORRANCE, CAL. — A special election will be called to vote on a bond issue of $75,000 for street lighting and $175,000 in bonds for the purchase of a water system.

UPLAND, CAL.—Plans are under consideration for the installation of electrically operated pumping machinery in connection with new municipal waterworks.

PHOENIX, ARIZ.—Application has been filed with the State Water Commissioner by the Arizona Highline Reclamation Association for water and power sites for the proposed irrigation of 3,500,000 acres of land. The plans include the construction of a dam below Spencer Canyon about 150 ft. high and the development of 750,000 hp.

Canada

VANCOUVER, B. C. — The Maitland Portland Cement Company plans to build a power plant at its proposed local mill, to cost about $500,000.

PETERBOROUGH, ONT. — The Hydro-Electric Power Commission of Ontario has applied for permission to erect a 44,000-volt transmission line from the Auburn power station to the new municipal distributing station at the corner of Sherbrook and Aylmer Streets.

Electrical Patents

Announced by U. S. Patent Office

(Issued Oct. 9, 1923)

15,697 (reissue). METER; R. F. Schuchardt Chicago, Ill. App. filed Nov. 29, 1918. Indicating power-factor meter.

1,469,779. AUTOMATIC TELEPHONE DIAL SUPPORT; A. J. Curren, Elyria, Ohio. App. filed Oct. 20, 1919. For wall telephones.

1,469,784. TROLLEY WHEEL; R. W. Funk, Bellefonte, Pa. App. filed Aug. 10, 1921. Contact wheel for trolley wire.

1,469,794. TELEPHONE SYSTEM; L. D. Kellogg, Deerfield, Ill. App. filed Feb. 17, 1919. Automatic switches employed for completing connections.

1,469,807. AUTOMATIC TELEPHONE SYSTEM; R. G. Richardson, Chicago, Ill. App. filed Jan. 8, 1917. Full automatic system.

1,469,809. AUTOMATIC TELEPHONE SYSTEM; A. J. Ray, Chicago, and H. F. Obergfell, Austin, Ill. App. filed Sept. 20, 1920. Automatic party-line selective ringing system.

1,469,817. METHOD OF ELECTRICALLY MELTING METALS AND IN AN ELECTRIC FURNACE; I. Rennerfelt, Djursholm, Sweden. App. filed June 16, 1921. Method of melting iron and steel.

1,469,832. SELECTIVE CIRCUITS FOR MULTIPLEX SIGNALING; B. P. Hamilton, Brooklyn, N. Y. App. filed Sept. 23, 1919. Maintaining channels of multiplex system electrically separate.

1,469,847. AUTOMATIC TELEPHONE SYSTEM; W. W. Owen, Oak Park, Ill. App. filed May 20, 1918. Automatic switching.

1,469,869. CARRIER TRANSMISSION ROUTING ARRANGEMENT; H. A. Affel, Brooklyn, N. Y. App. filed July 24, 1919.

1,469,887. ELECTRIC ALARM CLOCK; E. N. Burleigh, Pittsburgh, Pa. App. filed Nov. 18, 1922. Sounds alarm at predetermined hour and lights electric lamp.

1,469,889. RECEIVING SYSTEM FOR RADIANT ENERGY; E. L. Chaffee, Belmont, Mass. App. filed April 25, 1918.

1,469,905. CIRCUIT-CONTROLLING MEANS; R. E. Hall, Chicago, Ill. App. filed Aug. 13, 1919. By means of a resistance element.

1,469,912. CIGAR OR CIGARETTE LIGHTER; A. Barna, Jr., Chicago, Ill. App. filed April 14, 1922. For use in motor vehicles.

1,469,913. PUSH PLUG FOR ELECTRIC SOCKETS; J. Blackburn, St. Louis, Mo. App. filed Dec. 20, 1920.

1,469,941. RECEIVER SUPPORT FOR SOUND AMPLIFIERS; C. W. Kuen, Chicago, Ill. App. filed May 1, 1922. Device for attaching radio receivers to phonograph or loud speaker.

1,469,989. LINEMAN'S GUARD; H. B. Bush, Bedford, Ohio. App. filed Aug. 16, 1920. Wooden guard to prevent lineman from coming in contact with energized lines

1,470,027. METHOD AND APPARATUS FOR ABSORBING RADIUM EMANATION; H. B. Palmer, Morristown, N. J. App. filed March 9, 1920.

1,470,035. TELEPHONE-EXCHANGE SYSTEM; F. J. Scudder, Long Island, N. Y. App. filed March 31, 1921. Mechanical switching devices.

1,470,043. RAILWAY CROSSING SIGNAL; C. Adler, Jr., Baltimore, Md. App. filed Sept. 29, 1920. Electrically operated.

1,470,047. ELECTRIC SADIRON; S. T. Arnold, Paducah, Ky. App. filed April 25, 1921. Thermostatic switch or control device to prevent overheating.

1,470,062. COMBINED BELL AND BUZZER; J. W. Cox, Baraboo, Wis. App. filed June 25, 1921. Two vibrating armatures.

1,470,088. ART OF WIRELESS COMMUICATION; F. Lowenstein, New York, N. Y. App. filed Nov. 29, 1918. Transmission and reception of signals by sinusoidal alternating-current impulses of relatively low frequency.

1,470,092. MAGNETO ELECTRIC MACHINE; G. Modigliani, Ivrea, Italy. App. filed June 11, 1919. For internal-combustion engines.

1,470,093. MAGNETO ELECTRIC MACHINE; G. Modigliani, Ivrea, Italy. App. filed Dec. 23, 1919. For internal-combustion engines.

1,470,127. VEHICLE SIGNAL; H. F. Taylor, Jr., Buffalo, N. Y. App. filed Jan. 2, 1920. Rear direction signal.

1,470,135. LAMP; J. H. Ballweg, Portland, Ore. App. filed Aug. 17, 1921. Small searchlight.

1,470,160. CHAIN-LINK WELDING; J. H. Gravell, Elkins Park, Pa. App. filed June 3, 1921. By high-amperage current with suitable forming dies.

1,470,195. ELECTRIC FURNACE; M. de Roiboul, Paris, France. App. filed Sept. 28, 1920. Method of fusing refractory metals.

1,470,202. SELECTOR RACK FOR AUTOMATIC TELEPHONE SYSTEMS; A. E. Stevens, Providence, R. I. App. filed Aug. 2, 1921.

1,470,214. ALTERNATING-CURRENT TRANSFORMER; J. R. Brueckner, Detroit, Mich. App. filed Aug. 23, 1920. For welding systems.

1,470,227. LIGHTING UNIT; M. Klein, New York, N. Y. App. filed Aug. 19, 1920. Semi-direct unit.

1,470,238. REPEATER SYSTEM; R. C. Mathes, New York, N. Y. App. filed April 26, 1918. For amplifying telephone currents.

1,470,300. PROCESS OF GRAPHITIZING PREFORMED CARBON BODIES; E. Szarvasy, Budapest, Hungary. App. filed June 3, 1920. Graphitizing electrodes in atmosphere of methane.

1,470,322. WIRELESS TIE INSULATOR; H. A. Frederick, Chicora, Pa. App. filed Nov. 18, 1919. Communication-line insulator with means for fastening wire thereto.

1,470,337. TERMINAL CONNECTOR FOR ELECTRICAL WINDINGS; C. H. Thordarson, Chicago, Ill. App. filed Jan. 30, 1922. Means for strengthening the winding structure.

1,470,389. RADIO PILOT-CABLE SYSTEM; L. Reilstab, Zeist, Netherlands. App. filed Aug. 23, 1921. For steamships.

1,470,406. SIGNALING DEVICE; F. B. Watkins, Los Angeles, Cal. App. filed Jan. 4, 1921. Rear direction signal for automobiles.

1,470,428. COMMUTATION OF DYNAMO-ELECTRIC MACHINES; J. W. Dorsey, Winnipeg, Manitoba, Canada. App. filed Feb. 14, 1920. Prevention of sparking or arcing on high-voltage direct current machines.

1,470,430. TELEPHONE AMPLIFIER SYSTEM; M. C. Ellison, Huttons, England. App. filed Oct. 16, 1922. For mine systems.

1,470,432. LANTERN; W. T. Evans, Mitchell, Neb. App. filed May 15, 1922. Battery lamp for strapping to chest, leaving hands free.

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Charles Proteus Steinmetz

AN ABLE engineer, a wonderful analyst, a brilliant scientist and philosopher has been lost to the world through the death of Dr. Steinmetz. When Steinmetz spoke, men's faces lighted in anticipation and glowed with appreciation at the breadth, depth and clearness of his thoughts, fluently expressed and illumined by a personality sympathetic, mellowed and ripened by a life of study and experience. Those qualities which fix the moral stature of a man—patience, kindness, generosity, courtesy, humility, unselfishness, good temper, sincerity—were possessed in large measure by Charles Proteus Steinmetz. That he was not a genius he himself was the first to admit. The mystic fire which flamed out of Edison, Tesla, Bell and others was not in Steinmetz. But what he did have was a thorough knowledge of fundamentals and a firm conviction which even those who did not agree with him admired. He was not free from error or misjudgment, no man is; but he was intensely human and likable, and his life, instead of being soured and thwarted by his physical handicap, was one of sacrifice, service and devotion to his fellow men. In this his socialism was ideal.

His career was crowned with brilliant success earned by unremitting effort; his contributions to the electrical art were of incalculable value; his sympathy encouraged and helped many, and his constructive, broad and friendly outlook on life was an inspiration and gripped the public as firmly as it did his fellow engineers.

The nation and the electrical industry have lost a great man—a man whose life and accomplishments will not be soon forgotten either in the electrical ranks, where he was so prominent a figure, or in the wider circles to which his public spirit, his optimism and his exemplification of how the mind of man can triumph over the body had carried cheer and courage.

Robert Sever Hale

An engineer whose exceptional analytical ability, unusual powers of co-ordination and untiring service to the industry have exercised a profound influence on electrical standardization

FORTUNATE is the man who has enjoyed a freedom from routine that has enabled him to assume a definite responsibility in discovering the less obvious factors, relationships and possibilities bound up with electrical problems. Such has been the career of R. S. Hale, marked by indefatigable and intensive work throughout an immense range of activity. As superintendent of special research for the Edison Electric Illuminating Company of Boston, Mr. Hale holds a post of unique opportunities among utility officials, and from this base he has served the entire industry through his ardent championship of standardized wiring for safety, good appearance and low cost, accompanied by a corresponding standardization of connections from service to wiring and from wiring to appliances. As chairman for years of the wiring committee of the N. E. L. A. and an active participant in association activities generally, and rate research in particular, his voice and pen have been the mediums of inspiring leadership and constructive service.

Recent standardization progress in plugs and receptacles, acceptance of the solid neutral and reductions in required fusing through simplified wiring, together with authorized increased current ratings of branch circuit fuses and the abolition of the so-called 660-watt rule, have followed a long period of persistent effort on the part of Mr. Hale and like-minded associates in the electrical industry who have grasped the economic value of uniform methods of utilizing electric service.

This many-sided engineer was born in Boston on Oct. 3, 1869. He was educated at Harvard and Cornell, receiving the latter's degree of M.E. in 1893. Until 1895 he was employed by the Boston Edison company, when he engaged in steam engineering practice with special interest in boiler insurance. From 1897 to 1904 he was a member of the engineering firm of Hale & Codman, Boston, then returning to the Edison company as assistant to the general superintendent and afterward superintendent of the sales department, from which post he passed to the research activities which have for some years so closely occupied him.

Mr. Hale's advisory suggestions on the ever-present question of rates have been a feature of Boston Edison and N. E. L. A. affairs for many years, and he was a pioneer in recognizing the place of demand schedules in American central-station practice. He has written many noteworthy articles upon engineering and public utility economics.

Editorial Comment

Electrical World, November 3, 1923

Volume 82 Number 18

Interconnection and Its Public Benefits

INTERPLANT tie lines are of great benefit to the electric light and power industry. This is freely admitted by the executives and operators of systems already interconnected and would be as freely acknowledged by the users of the service were they apprised of the circumstances. To impart this information is the duty of the electric light and power company. What if there are some in the community who already appreciate the benefits of tie lines? Are these so patent as not to need frequent reiteration, or is the industry's larder of good will so overstocked as to make its replenishment superfluous? The public welfare is generally well served by a carefully planned interconnection, economically justified, and the credit for such work should go to the utility having the foresight to undertake it. Normally people think there is not much public service worthy of praise, and how can they think otherwise if the utility manifests no pride in its accomplishments? The next best thing to doing a thing worth while is to let people know about it. Ears attuned to complaints need a little relaxation, and there is nothing more refreshing to a harassed operator than praise from a patron.

Enough Bee Loads Will Electrify America

IT IS an encouraging thing that central-station men are beginning to talk more these days about the essential nature of better co-ordination, better harmony between the various elements in the local electrical family. For if the job of getting all the homes, stores, offices and factories in any city adequately wired and equipped is to be carried forward, if electrical men are going to keep up with the cumulative growth of their market, they must develop and apply a more united effort than has been seen so far. Selling policies must be adjusted, destructive competition must be transformed and raised to the creative plane, and dealers, contractors and central-station men must organize their common purpose into a co-operative program that will actually make some progress with this task of electrifying America that is talked about so much. Actually, there is no reason why this job cannot be done with some show of speed.

F. M. Feiker tells a story of some bees on a farm up in New York State. Six tons of honey had been stored and locked in on the upper floor of a barn. But when the owners came for it less than one-half of it remained, and they discovered that bees had found an entrance through a hole beside a window and had carried off three tons in countless tiny bee loads. Organization and consistent work had done it, just as intelligent co-ordinated effort will carry to attainment this vision of the completely electrified community. But the work of it can only be carried out locally, and it will not be done until dissension between local electrical men has been reasoned away and the power of them all is organized into practical co-operation for progress. Those bees would never have moved three tons of honey had any part of their time been spent in stinging one another.

When to Stop Specifying and Start Advising

WHEN any radically new equipment has to be developed to meet an operating need the prospective users of that equipment, especially if they have broad experience in operation, are in a better position than manufacturers to specify the principal features of design which should be incorporated in the new equipment. Even then any broad-minded user will recognize that the specifications should be developed in close consultation with manufacturers in order to obtain a product which is practical and economical. Until experience with the new equipment is widely disseminated it is also readily conceivable that such operators are in the best position to specify how that equipment shall be modified to meet their operating requirements most satisfactorily. However, as time goes on and experience is gained, the manufacturer who keeps in touch with his various clients is in a more favorable position than any one of the users of his equipment to ascertain the relative merits and disadvantages of different designs for the purpose considered. Especially is this true if the manufacturer maintains close contact by studying the operating company's requirements and by voluntarily welcoming all suggestions which will help him to improve his equipment.

The time is therefore reached when it is technically unnecessary and economically undesirable for a user to specify special designs every time he has occasion to apply equipment, although he should continue to advise manufacturers of his needs. The demand for special equipment increases the manufacturer's overhead and operating expense because a larger engineering staff must be maintained owing to the special manufacturing procedure which the manufacturer is forced to establish. As a result the cost of manufacturing special equipment is considerably more than that of standard equipment for the same purpose, delays in delivery occur, and a serious burden is placed upon the user's system should hurried replacement be necessary. Not only does the purchaser of special equipment have to pay a higher price than he does for standard equipment, but he increases the price of standard equipment because of the overhead expenses, which

are in most cases spread to a great extent over both the standard and special equipment. The user of special equipment is not only penalizing himself but every one else in the industry. How much better it would be for all concerned, and particularly the purchaser, if more attention were given to how standard equipment can be applied to particular jobs than to what changes in existing designs are considered necessary.

In another part of this issue H. W. Young points out how seriously the ordering of special equipment has reacted on the purchaser and how he will benefit if standard products are used more extensively. Prices will become lower, deliveries will become more prompt, and replacement of broken parts or entire equipments will be decidedly facilitated.

Of course, if manufacturers have not kept pace with the demands for improvement from the operating field, it is their own fault that so much special equipment is required and it is the misfortune of users that they must stand the expense of this uneconomical practice. Where this is the case, operating companies will find it advantageous to decide among themselves and through technical committees of the national association upon what the desirable characteristics of the equipment under consideration are. These requirements, if discussed with the manufacturers' national associations, should lead to a situation where less special equipment will have to be demanded and where advantage can be taken of the benefits that come from ordering standard equipment.

Kilowatts and Kilovolt-Amperes

WITHOUT doubt, power factor—once principally a matter of scientific interest—has become one of the major problems of the central-station industry. The National Electric Light Association, the Association of Edison Illuminating Companies and many of the geographic associations are giving it a place of prominence in discussions and committee work. Engineers are fully aware of its significance, as are also many of the commercial managers. But there are still too many executives who do not appreciate that a satisfactory solution to the "power-factor problem" is of real importance and consequence in the complete success of the undertakings under their direction. However, the increasing amount of industrial load with its usual low power factor is bringing the question rapidly and forcibly into the limelight. The principal point is that low power factor costs a large amount of money to some one—and as things stand at present the biggest loser is the central station. The figures obtained from a survey on an actual system, presented elsewhere in this issue in the interview with W. A. Layman, should impress upon executives who do not already recognize it the importance of power-factor correction.

Engineers and commercial men have suggested various ways of eliminating power factor as a serious problem. Arrangements of equipment, new metering methods and rates have been suggested. But no equipment, no metering or rate method will be largely effective until some of the fundamentals of handling the low-power-factor situation with the customer are satisfactorily worked out and have executive approval. And this time will never come until the executive is fully aware of the cost of low power factor. It must be brought home to every one that only kilowatt-hours are revenue producers while kilovolt-amperes are the principal element of cost. Executives should be the first and not the last to grasp the seriousness of the problem and encourage their engineers and commercial managers to find an adequate solution.

What Is the Basis of a Power-Factor Solution?

THOSE who have made a real study of how to solve the power-factor problem have usually looked for the solution in the direction of making the customer pay for his low power factor or of inducing him to improve it. In general, no one has proposed any other solution. But the problem then becomes a double one of (1) finding a practicable and fair way to inflict a penalty or apply a bonus, and (2) producing a practicable and economical means for the customer to improve his power factor. A recent survey showed that there is a very general feeling that the customer should be penalized for low power factor by some rate schedule. But another survey indicated the rate chaos by showing that by applying various rates to the same kilowatt-hour consumption, at 50 per cent power factor, some bills were as much as 100 per cent larger than others. Few, if any, of these rate schedules penalized a power factor between 80 per cent and unity. And, what is more important, even in the power-factor range to which they applied none of them produced an adequate return on the investment charges necessary to carry the low power factor. Furthermore, no satisfactory metering plan has been devised except that based on measuring kva. demand, and no commercial kva.-demand meter has yet been produced!—though it will be soon, without doubt.

But, even if the customer is sufficiently penalized to cause him to sit up and take notice, means at his disposal to improve his condition are not numerous, nor are they particularly attractive from either the customer's or the central station's viewpoint. And yet it must be recognized that the fundamental of any solution to the power-factor problem is the equipment on the customer's premises. At present his choice lies largely between synchronous motors, synchronous condensers and static condensers. The limitations of all of these for general industrial applications are well enough known and inventors and manufacturers, spurred on by the growing necessity for it, have been working to produce equipment which would be really satisfactory.

It is with more than passing interest, therefore, that the electrical fraternity will view the recently announced "Fynn-Weichsel" motor, or "self-excited synchronous induction motor." Its characteristics indicate it to be a practically foolproof machine of the induction-motor type so far as the industrial user is concerned, but, like the synchronous motor, it has its own power-factor corrective ability as a part of its own equipment. It is not within the province of the ELECTRICAL WORLD to promote the equipment of any individual one of the manufacturers who have all contributed so notably to the advance of the industry. But neither can it fail to note the significance of a development which may have much bearing on a major problem of the industry and which must be judged on its own intrinsic merits. This piece of equipment lies

within that category, and the industry will be quick and glad to accord credit to those who have developed it. And, furthermore, if it proves in commercial practice to be accepted by the industry at large, there will doubtless result inter-licensing arrangements such as have followed many other notable achievements in the industry.

Of course no piece or combination of equipment offers the full solution to the power-factor problem—an incentive, rate or otherwise, is still needed to urge the user to make the correct installation. But it must be made practical to operate industry at high power factor. The more practical it becomes the more insistent will be the demand for a kva.-demand meter and a rate system or some other mechanism to provide the incentive. And the aim must always be toward a fundamental basis of solution, which is to have the user install correct equipment if it can be provided and not merely corrective equipment.

Improvements in Lightning Arresters

THE lightning arrester offers an ever-present opportunity for study and development. This is largely due to the wide variety of duty that it is called upon to perform. There is little definite knowledge as to the nature of the electric pulses which the lightning arrester must absorb, but it is certain that as regards frequency, voltage and energy content they extend over a very wide range of values. It is a great deal to expect that a single appliance, operating without attention, should have such a power of selection as to adapt itself to this wide range of attack. In recent years there has been particular study of the problem found in moderate voltage distribution and transmission circuits, particularly as related to the protection of transformers. It is not so very long since the announcement of the oxide-film arrester marked a considerable improvement in the offerings for this character of service. Within the last year or two the so-called autovalve arrester has been introduced for the same demand. In the former, as is well known, lead peroxide, ordinarily a conductor, is converted into an insulator on the passage of a discharge, thus resealing the arrester after it has discharged. In the autovalve type the high resistance properties of the metal disk serve to reduce the voltage across the spark as soon as it passes, thus giving it the extinguishing property.

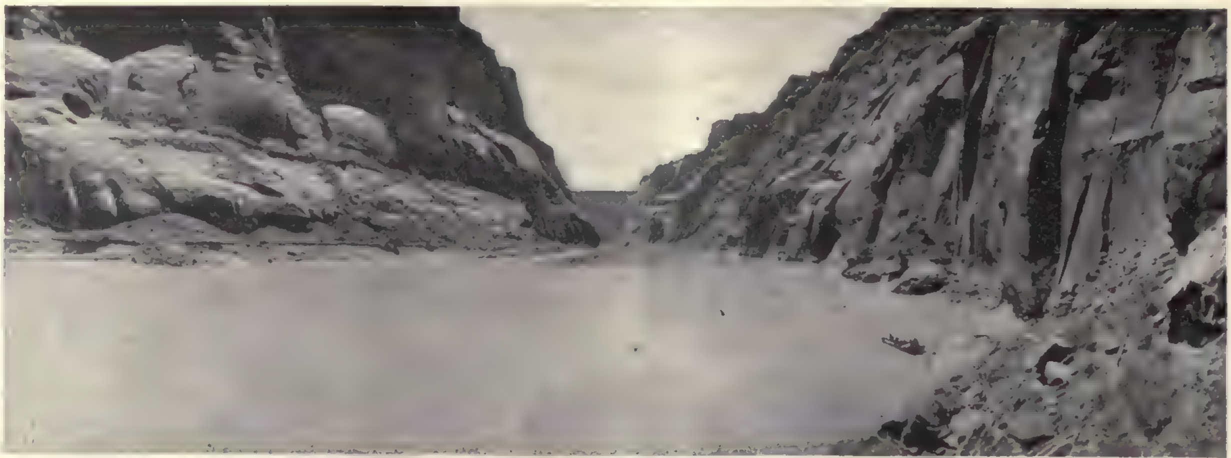
A new improvement in the oxide-film arrester is announced in a paper by N. A. Lougee, presented before the recent annual convention of the American Institute of Electrical Engineers and published in the October number of the *Journal* of that body. The original oxide-film arrester involved an insulating coating between the terminal electrode and the conducting lead peroxide. The new type aims at a simpler, more flexible and cheaper design. The single insulated film next the terminal electrode is absent. Instead the lead peroxide consists of a large number of small pellets about ⅛ in. in diameter, and these pellets are rolled in an insulating powder. These are poured into porcelain tubes of various sizes, with terminals at each end in contact with the pellets, and a series gap is added. The arrester thus contains a number of pellets both in series and parallel. The overvoltage discharges through the pellets, which have a low resistance, after the powdered film is punctured, and sealing occurs at the contact of the various pellets. The design seems to offer considerable advantages in the way of convenience of assembly and adaptation of arrsters of different rating. Data as to the behavior of the arrester in continued service are still lacking, but they will be looked for with interest.

When Daylight Costs More than Artificial Light

IN IMAGINATION one needs to look backward only a century to reach a period of inadequate artificial light from candles and other feeble flames, when light cost fifty times more than it does now. During that century development gradually gained momentum until within the last score of years the possibilities of artificial light have increased so rapidly that the general public has not been able to keep pace with them. Proper and adequate lighting is just as essential to human progress as clean and sufficient air. The public has a pretty full appreciation of the hygienic value of fresh air. The airtight bedchambers of a century ago have given way to ventilated rooms, but the old attitude toward lighting—a most natural inheritance of centuries of costly and inadequate artificial light—persists far too tenaciously. This attitude cannot be changed too soon in the interests of greater production, greater safety, greater efficiency and greater progress. Human eyes are the product of countless centuries of adaptation to daylight intensities which are more than a thousand times greater than artificial lighting intensities generally but erroneously considered sufficient. The psycho-physiological laws of vision are proof of this, and they are well supported by the results from installations of good lighting.

There is another interesting argument to be derived from recently published investigations (by M. Luckiesh and L. L. Holladay) on the cost of daylight. Daylight is free outdoors when it is available at all. By coming indoors mankind created conditions which not only decreased the intensity available for indoor activities but removed daylight from the free list. These investigations have shown that by charging to daylight the additional cost of windows and skylights, their maintenance, the additional heat losses, etc., natural lighting costs as much as and in many cases more than good artificial lighting. Owing to the growing complexity of our economic life such investigations cannot be ignored. The results are bound to have their influence on buildings in congested districts and perhaps on others.

However, without entering into a discussion of the economic phases, the central-station company and others interested in lighting progress should find much use for the knowledge that daylight indoors costs as much as artificial lighting. In order that the people shall enjoy proper and adequate lighting they must be relieved of the inhibiting attitude that artificial light is costly. That it is a very inexpensive necessity, or that its cost is insignificant as compared with its benefits, can be proved by actual data. But oftentimes an indirect argument is more effective. The simple statement that daylight in homes, offices and factories costs as much as proper and adequate artificial lighting, and sometimes more, is startling, true and convincing—three excellent characteristics for statements made for an educational purpose.



Hydro-Electric Possibilities of the Colorado River

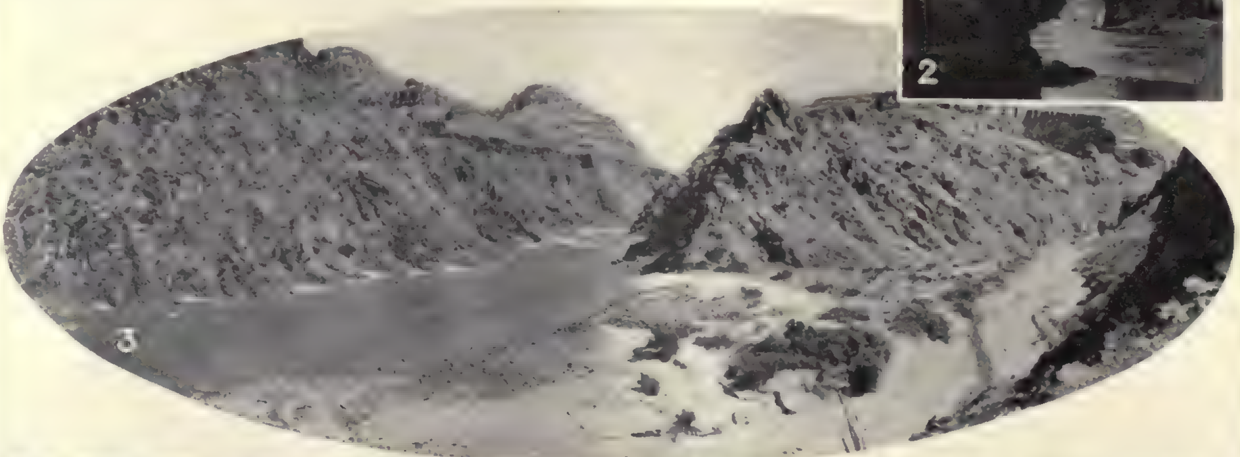
THE Colorado River is a possible source of great hydro-electric developments; but aside from the legal conflicts on questions involving state water rights, irrigation rights and federal rights, the terrain and the location of the dam sites are of a character to impose tasks of immense difficulty in the engineering development of the river. The accompanying views of sites on the Colorado bring out vividly the physical features of the country and give an idea of the great possibilities that proper development contains.

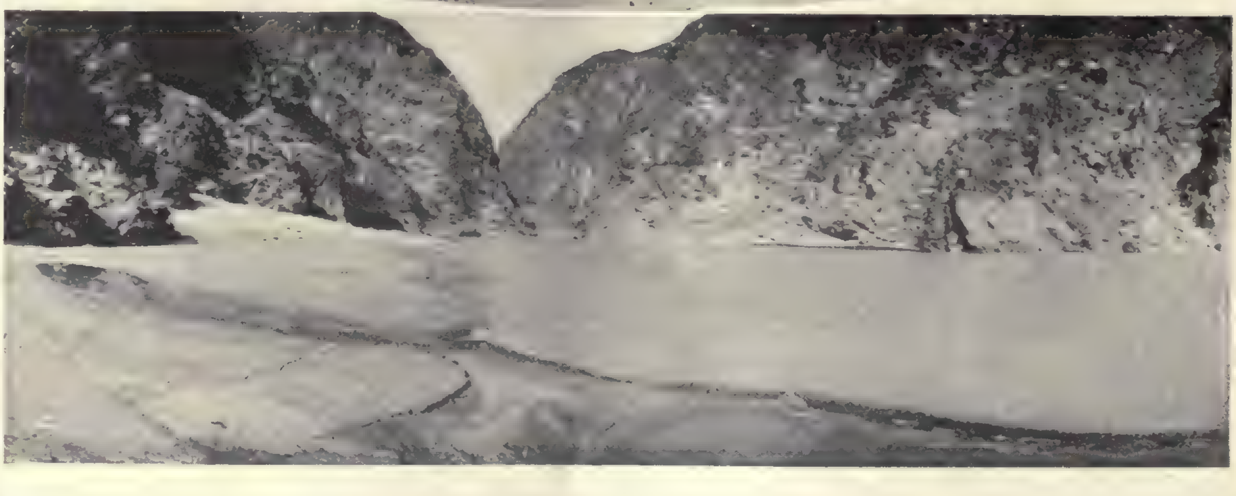
No. 1. Looking down stream through Lee Ferry dam site.

No. 2. Down-stream view of Black Canyon 1 mile below the dam site.

No. 3. Up-stream view of Girand dam site on the Colorado River at the mouth of Diamond Creek. Diamond Creek and power-house site on right.

No. 4. Down-stream view of Boulder Canyon dam site; depth of bedrock 135 ft.





Drying Transformers—I*

When Is It Necessary?—What Determines Method Used?—What Drying Equipment Should Be Used and What Measurements Should Be Made?—Answers to These and Other Questions that Arise in Practice Are Given

BY M. E. SKINNER

Assistant to Vice-President Duquesne Light Company, Pittsburgh, Pa.

THE most common reason for having to redry a transformer at its destination is on account of the size of the unit exceeding the limit of dimensions which can be shipped. Other conditions which may make it desirable to redry are:

1. Accidents during shipment which result in the entry of water into the transformer.
2. Accidents during operation or faulty operation, examples of which would be a leaky cooling coil or condensation of moisture in the transformer.
3. Rebuilding in the field to complete repairs or changes.

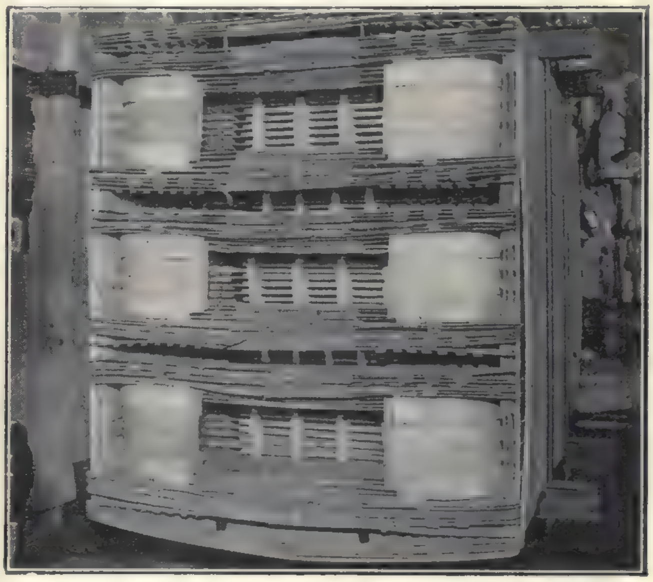
The following questions arise: Is it necessary to dry every oil-immersed transformer which is not shipped under oil? How can one tell whether drying will be necessary or not?

In general, it is rather a difficult thing to judge the condition of dryness of a transformer. Practically the only criterion available is the insulation resistance. This quantity undergoes tremendous changes due to variations in the several factors which influence it and must be used with a great deal of discretion. The most important factors which affect transformer insulation resistance are:

1. Type of construction; i.e., core or shell.
2. Size of the unit.
3. Voltage class.
4. Temperature.
5. Moisture content of insulation.
6. Character and condition of surrounding medium, air or oil.

The effects of these factors on the value of the insulation resistance will be discussed in detail later. At this time it is sufficient to point out that variations due to any one of the above factors may completely mask the difference between the insulation resistance under widely varying conditions of dryness.

The first step to be taken in cases where there is some doubt as to the necessity of redrying is to make sure that the oil in the transformer is in first-class shape. Oil that tests 22,000 r.m.s. volts or better in a standard test cup—i.e., 1-in. disk electrodes, 0.1-in. separation—is satisfactory. After the condition of the oil has been checked the transformer should be heated by circulating current through one winding with the other short-circuited until the whole unit has reached a temperature comparable to that during full-load operation. Then take insulation resistance measurements from high-voltage winding to low-voltage winding, from the high and low voltage windings to the iron. The measurements should be at least 75 per cent of the values measured at the factory prior to shipment before the transformer is fit for service.



HEAT GENERATED BY CIRCULATING CURRENTS IS INSUFFICIENT TO DRY ALL INSULATION IN HIGH-VOLTAGE TRANSFORMERS

With transformers whose highest voltage is less than 16,500 and which have been filled with oil of the proper dielectric strength it is questionable whether drying in the field will ever be necessary. In such units the strength of the oil alone will probably be sufficient to withstand normal voltages.

CHARACTER OF TRANSFORMER INSULATION STRUCTURE

In order to understand the proper drying of a transformer some knowledge of its insulation structure is desirable. The customary insulation from turn to turn or from layer to layer in large power transformers will consist of the insulation wrapped about the conductors, reinforced in certain cases with strips of fullerboard. The thickness of the insulation on the conductor and the separation between adjacent turns depends largely upon the line voltage and the stiffness

*One of the last manufacturing operations prior to the testing of an oil-immersed transformer is the vacuum-drying and oil-impregnation of the insulation. This is one of the most important steps in the manufacture, and much of the success or failure of the unit in operation depends upon the thoroughness with which it is carried out. This process is carried on in steam-heated vacuum chambers large enough to take the completely assembled core and coils. The temperature is maintained steadily at a value as high as is consistent with the life of the insulation material used, and at the same time a partial vacuum is maintained. The combination of long-continued and steady high temperature with low pressure draws out the last vestige of moisture and leaves the insulation in the best possible condition for oil impregnation. At the conclusion of the vacuum-drying period high-grade transformer oil is admitted to the chamber until the windings are completely immersed and, without opening the tank, pressure is applied to force the oil into the insulation until every portion is thoroughly permeated. Obviously, then, the proper thing to do is to place this transformer in its own tank, carefully fill it with oil of proper quality, remove the occluded air and seal up the unit. If the transformer in its own tank with oil meets railway shipping clearances and does not have to undergo sea shipment, it will normally be shipped in this condition. Exceptions would only be made in cases where facilities at the destination would not permit of handling the complete transformer with oil as a unit. That the desirability of this method of shipment has long been appreciated by the large manufacturers is shown by the fact that they control many special cars, constructed in order to extend the limit in rating of transformers which could be shipped complete with oil.

of the conductor and altogether constitutes a very small portion of the total insulation to ground. When the voltages are low the turns will be fairly close together, and heat generated within the conductors will maintain all this insulation at a temperature comparable with that of the conductors themselves. However, when the voltage is high the turns are so far apart that the major part of the insulation between them is far below the temperature of the conductor.

From coil to coil the insulation usually consists of barriers or washers of fullerboard or other insulating material. This may or may not be in direct contact with a coil. Sometimes the washer is placed directly against one face of a coil, but frequently an oil duct separates the washer from the coil on either side. In any event not more than one face of the washer is exposed to the heat of the coil.

The insulation from one winding to another and to ground is ordinarily completely separated from the coils. It consists of heavy insulating barriers interspersed with oil ducts. Heat from the windings penetrates only a very short distance into such insulation on account of the relatively poor heat conductivity of the insulation and because the oil ducts separate this insulation from the windings proper.

The foregoing should make it clear that satisfactory drying of transformers will be a long and uncertain task if circulating current in the windings is the only source of heat in the transformer, as heat generated within the conductors cannot effectively penetrate all parts of the insulation structure. This is quite different from the conditions in the armature of a rotating machine. In the latter case each conductor is insulated for the full voltage of the machine to ground and no other insulation is employed. Thus every portion of the insulation in a rotating machine has a conductor at its center capable of generating sufficient heat to drive all moisture from the insulation. This fact explains the generally used and satisfactory method of drying rotating machines by the use of a circulating current in the windings.

Methods of Drying

To dry a transformer various methods might be employed, namely:

1. By circulating current through the windings.
2. By the application of a partial vacuum in conjunction with the first method.
3. By blowing heated air through the transformers.
4. By a combination of the first and the third methods.

As already explained, method No. 1 cannot be expected to give completely satisfactory results on account of the character of the insulating structure. The only portions of the insulation that would be thoroughly dried by this method would be the insulation from turn to turn. In a high-voltage transformer even this insulation might not be sufficiently penetrated by the heat to drive all the moisture from it. As has been pointed out above, the turn-to-turn insulation constitutes only a small portion of the whole, so that this method cannot be considered satisfactory.

By attaching a vacuum pump to an opening in the case and partially exhausting it, great deal better results can be obtained. However, this method is rather difficult to use in most cases, and requires expensive air pumps which are seldom available and which are not applicable to other work. More serious than this, it requires very special construction of transformer cases, when they are of large size, to make them stand up against the vacuum necessary.

Another method which has been frequently used to dry large transformers is to blow heated air through the ventilating ducts of the transformer. With this method the transformer may be temporarily boxed in, or it may be tanked and suitable baffles arranged so that air entering at the main valve and leaving by the manhole in the cover will have to pass through ventilating ducts in the windings.

From the point of view of the equipment necessary, this method has a decided advantage over the other methods mentioned, and it can usually be carried out with a fair degree of success even with very crude equipment. It is open to somewhat the same criticism as the first method, but the difficulty lies in a different portion of the insulation. In this case it will be the insulation between turns which will be the least exposed to the heat and therefore the last to dry.

By combining the first and third methods—i.e., by circulating a small amount of current through the windings and at the same time blowing heated air through the ventilating ducts—the heat should be carried to every portion of the insulation. This method carries heat to every part of the insulation, provides a constant circulation of air to carry off the moisture as it is evaporated, does not involve anything but very simple apparatus, requires no special features of construction and affords the easiest and most reliable method of controlling the temperature. The discussion which follows will be limited to this method.

Drying in Tank Versus Drying in Temporary Housing

Some transformers may most conveniently be dried out by removing them from their tanks and providing a temporary housing. Others can be dried in their own tanks. The determining feature is the ease with which baffles can be placed so as to force the air through the ventilating ducts. With the shell type of construction it is a relatively simple matter to place baffles between the transformer itself and its tank so as to force all the air to pass up through the ventilating ducts in the coils. The heated air is admitted through the drain valve and allowed to escape through the manhole in the cover. Drying a transformer in its own tank has several advantages. First, it largely eliminates inflammable material other than the insulation of the transformer itself. Second, it permits of filling the transformer with oil and sealing very promptly after the completion of the drying, as all connections can be put in place before drying is started. Third, it conserves space. Fourth, it protects the windings from possible injury, this being especially important when plant construction is still in progress.

Practically the only objection which can be raised to this method is the loss of heat from the tank by radiation. Unless steps are taken to minimize this loss, it may be of considerable magnitude. For example, a tank 6 ft. in diameter by 10 ft. high, at a temperature of 40 deg. C. above that of the surroundings, would dissipate between 6 kw. and 7 kw. of heat energy. Fortunately, this loss can be greatly reduced by lagging the tank or wrapping tarpaulins about it. As the transformer is dried a considerable quantity of oil along with some water and dirt will collect in the bottom of the tank. This must, of course, be swabbed

out carefully. In most cases it can be reached through the main drain valve as the practice of locating the drain valve so that it is flush with the bottom of the tank is now fairly well established with manufacturers. In the case of old transformers, where the drain valve is not arranged so conveniently, the difficulty of satisfactorily reaching this condensate may work against drying the unit in its tank.

It is always necessary to cover the manhole so as to prevent dirt and construction material from dropping through the manhole into the transformer windings. It should be possible to construct this cover in such a way that it will act as a chimney and in so doing will materially aid the circulation of the hot air through the transformer. It has actually been found in practice that the use of a chimney from 2 ft. to 3 ft. in height, extending above the manhole of the transformer, will increase the circulation of air through the ducts of the transformer to such an extent that baffles may become unnecessary. It also will result in maintaining a higher temperature at the point where the air leaves the transformer bank as it decreases the radiation of heat from the tank wall. Cases have been observed where the addition of such a chimney has increased the temperature of the air leaving the transformer by as much as 15 deg. centigrade.

With a transformer of the core form of construction it will usually be desirable to construct a temporary housing to force the air through the ventilating ducts. This will most conveniently be made of wood and should be lined with asbestos in order to prevent its catching fire.

Electrified Copper Mine

Description of Installation of the United Verde Copper Company at Jerome, Ariz.—Underground Hoisting Stations Used—Flexibility and Economy of Electrification—Unusual Ore-Bin Selector

By J. B. JOHNSON* and C. L. GERHARDT†

PRIOR to 1916 the United Verde Copper Company at Jerome, Ariz., had operated its haulage system, pumping and ventilating plants and surface shops with electric power. The demonstrated economy and flexibility of this installation in combination with a desire to use steam shovels in the upper workings of the mine led the company to start a program of development in 1917 which contemplated the abandonment of the steam surface plant and surface hoists and their replacement by electrified hoists and compressors. It was decided to place both hoists, one for service and men and one for ore, in underground stations in order to permit surface steam-shovel and underground mining operations to continue simultaneously.

Previous to the decision to electrify, a careful study of the situation was made by the engineering staff to determine the merits of electrification. The greater over-all efficiency of the electrical installation, the flexibility of such an installation and its adaptability to many mine operations, the possible economies in operation, safety features and the possibility of using schedules and equipment for giving a fairly uniform load were deciding elements for electric operation.

Previous to 1916 large electric mine hoists were viewed with some trepidation. However, the large installation at Inspiration, Ariz., and later the North Butte and Elm Orlu installations in Montana had largely dispelled any doubt as to safety and ease of operation. It is noteworthy that during the two years of 1916 and 1917 more horsepower in such hoists with Ward Leonard and Ilgner-Ward Leonard control was installed than was installed altogether previous to 1916. The direct-current hoist motor supplied by a motor-generator flywheel set has largely solved the control and high-peak difficulties incident to direct-current motor drive.

*Chief engineer United Verde Copper Company.
†Electrical engineer United Verde Copper Company.

In the selection of electric hoists for the two main hoisting units the chief advantages considered, aside from power economy, over prime movers of the reciprocating type were:

1. The turning moment of the electric motor is uniform throughout each revolution, relieving the hoisting rope of high stresses due to jerking. This in turn does away with flapping and thus reduces the number of idler pulleys required. Hoisting ropes with a smaller factor of safety may be used. The life of the hoisting ropes is increased.

2. Owing to uniform torque of the motor, good speed regulation and greater safety of operation and higher operating speeds are permissible.

3. Owing to high efficiency, even at varying loads, cylindrical drums may be used for deep shafts, whereas with steam-driven conical drums a tail rope is necessary. The first cost is therefore lower and complicated rigging is avoided.

4. The electric hoist is adapted to installations underground as readily as on the surface.

5. The electric hoist is more easily adapted to automatic safety devices and automatic operation; therefore fewer skilled operators are required.

It is a fact that the over-all efficiency of the motor-generator flywheel set and hoist motor over a twenty-four-hour period, during which the hoist is idle for a large percentage of the time, is necessarily low. The steam hoist, however, under the same conditions of low-capacity factor, must necessarily bear a high standby charge for the steam plant. This results in a lower over-all efficiency for the steam hoist. It has been estimated in the case of the United Verde that with the old steam-plant generating steam at 125 lb. pressure 80 lb. of steam was consumed per shaft horsepower-hour. On the No. 5 hoist the power input to the motor-generator set over a period of a year has averaged 1.35 kw.-hr. per shaft horsepower-hour. To use the above figures for comparison of the actual costs at Jerome

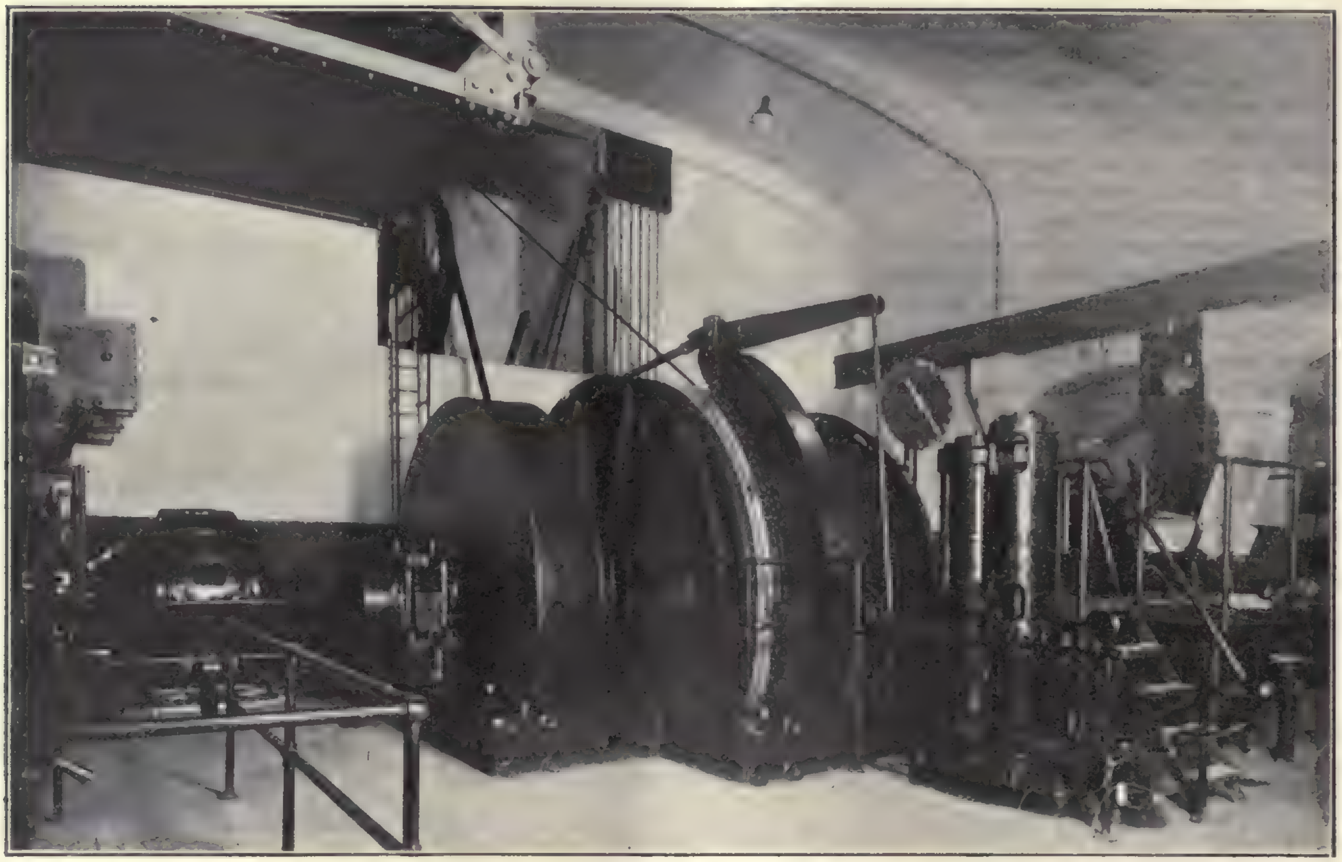


FIG. 1—GENERAL VIEW OF HOISTING STATION FOR ORE SHAFT

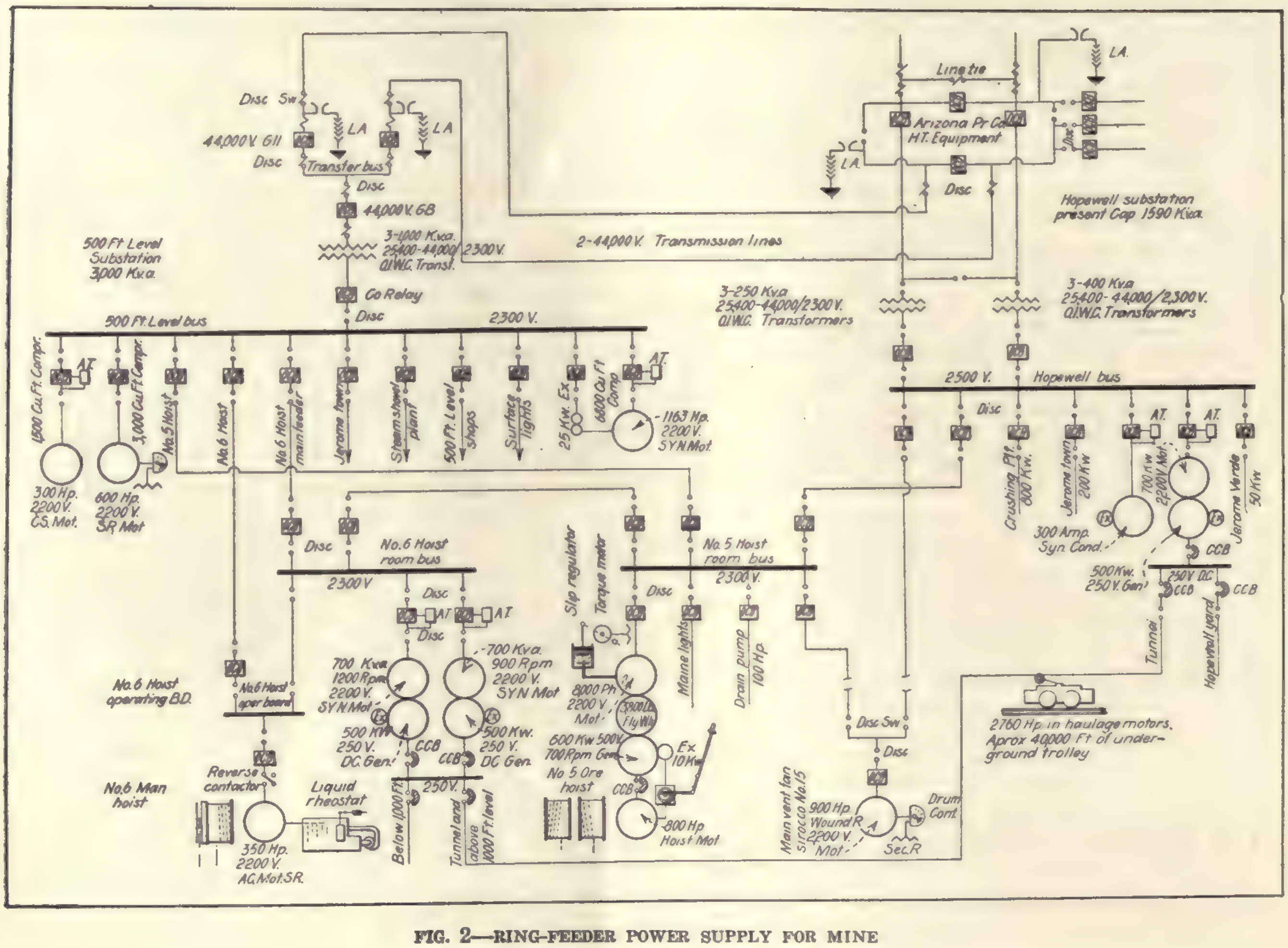


FIG. 2—RING-FEEDER POWER SUPPLY FOR MINE

would be misleading owing to the great discrepancy between steam costs based on oil fuel and low generating efficiency, on the one hand, and the price paid for electric power as purchased from the power company, on the other hand. A comparison of power economy can, however, be quickly made by converting the consumption of electrical energy as shown by the meter reading to steam consumption, using 20 lb. of steam, gross, per kilowatt-hour. This steam rate would compare favorably with that which could be obtained from the old steam plant at Jerome. On this basis the power consumption of steam hoists versus that of electric hoists will be in the ratio of 80 to 27. This indicates a decided saving in power in electric hoisting.

After preliminary considerations had resulted in a decision to adopt electric hoists the type of equipment was carefully considered. The Ilgner-Ward Leonard system of electric drive and control was selected for the No. 5 ore hoist. Later, induction-motor drive was selected for the No. 6 service hoist, which is controlled with primary contactor and liquid secondary resistance. Excessive peaks are avoided on the No. 6 hoist by means of a counterweight attached to a fixed reel on the drum shaft. Such a combination happened to suit the hoisting conditions admirably, as will be explained later. The combination of No. 5 and No. 6 hoists operating on predetermined schedules has worked out to good advantage as far as making a uniform load curve for hoisting is concerned. The service hoist has its period of high duty at the beginning and end of each shift, while the duty of the ore hoist is greatest between these periods. In addition, the rate of hoisting ore can be governed to utilize to the fullest extent the flywheel regulation. The periods of time during which the ore hoist is idle are scheduled beforehand, so that the motor-generator set may be shut down entirely during these periods to reduce the idle time of the generator.

POWER-DISTRIBUTING SYSTEM

The mine at present is supplied with power from the Arizona Power Company and uses an average of 1,000,000 kw.-hr. per month when mining 60,000 tons or ore per month, or 16.7 kw.-hr. per ton. Power is delivered at both the Hopewell and the 500-ft. level substations at 44,000 volts and stepped down to 2,300 volts. The transformer capacity at Hopewell is 1,950 kva. and at the 500-ft. level 3,000 kva. Direct current for the haulage system is supplied by two 500 kw., 250-volt motor-generator sets installed underground in the room adjoining the No. 6 hoist station. Either machine will normally handle the load, but as the peak load is quite large extra capacity is provided.

Fig. 2 shows the general connection diagram of the entire mine power scheme. It will be noted that the whole constitutes a ring feeder, permitting feeding through either the Hopewell tunnel or the 500-ft. level tunnel. The double-circuit high-tension steel-tower line from Hopewell substation to the 500-ft. level substation is particularly well built and insulated. Lightning arresters and selective relays are provided. The locality is subject to severe lightning storms during summer months, and every precaution is taken to insure continuity of operation. A shutdown in the mine means more than loss of working time. Interruption of service on ventilating fans, lights and hoists is a very serious matter.

The main feeders in the mine were a source of considerable trouble in the early days because of acid water. In dry places ordinary 5,000-volt varnished-cambric double-braid cable in iron conduit is used for 2,300-volt circuits on horizontal runs. For damp or wet places in the newer installations three-conductor varnished-cambric, lead-covered, band-steel-armored, jute-covered cables have been used for horizontal runs. These are sectionalized by potheads placed at intervals in waterproof concrete or steel boxes to facilitate replacing damaged sections. On the vertical runs in the shafts steel-wire armored cables are used. These are provided with tight tie bands spaced 15 ft. apart to prevent the copper conductor with its insulation from slipping inside the armor. The cables are suspended in fiber conduit set in the concrete walls of the shafts. Recessed concrete pull boxes are provided at main landings facing away from the shaft. From the bottom of these boxes the cables are suspended from the armor wires. The method of making the suspension is as follows: The armor wires are cut and banded and bent back 180 deg. and leaded into a socket. Under this socket a heavy split clamp is fastened on the cable over the armor. The socket rests on the clamp, which in turn rests on a steel sill in the bottom of the concrete pull box. The 2,300-volt cables are sectionalized by potheads placed in the pull boxes. A waterproof cover is fitted over the boxes.

SURFACE PLANT

The surface plant was completed in 1921 and consists of power house, substation, change house and time office, warehouse, machine shop, boiler and blacksmith shop, mine shop, electric shop and a complete complement of storage sheds, racks and accessory buildings. A uniform type of construction was carried out in all these buildings. They are of concrete, brick and steel construction, fireproof throughout. The machine-tool units in all the shops are of the most modern design, driven by individual electric motors throughout. All shops are equipped with overhead service cranes. The machine shop is equipped with a motor-operated locomotive jack capable of lifting a Mallet locomotive weighing 230 tons.

The change house has locker and dressing accommodations for 1,400 men. Shower baths and lavatory accommodations are provided. Adjoining the change room are the time and check offices and separate quarters for foremen and shift bosses. The entire plant is built on a wide bench on the hillside 500 ft. below the original surface plant. Construction of the surface plant began early in 1919 and was completed, including all the divisions enumerated above, at a total cost of a little over a million dollars.

UNDERGROUND ORE HOIST

The new ore shaft, known as No. 5 shaft, was sunk first. It is a three-compartment concrete-lined shaft, with 7-ton ore skips operating in balance. As all of the ore is taken out to the surface through the main haulage tunnel on the 1,000-ft. level, the hoisting station is located on this level and accommodates a large double-drum electric hoist and accessory equipment, described in detail later. A general view of this station is shown in Fig. 1. This hoist and shaft to the 1,950-ft. level was completed in the summer of 1918 and put into service immediately following. Previous to that time all ore was hoisted on cages in the old No. 3 shaft, a timber-lined shaft recently abandoned. A

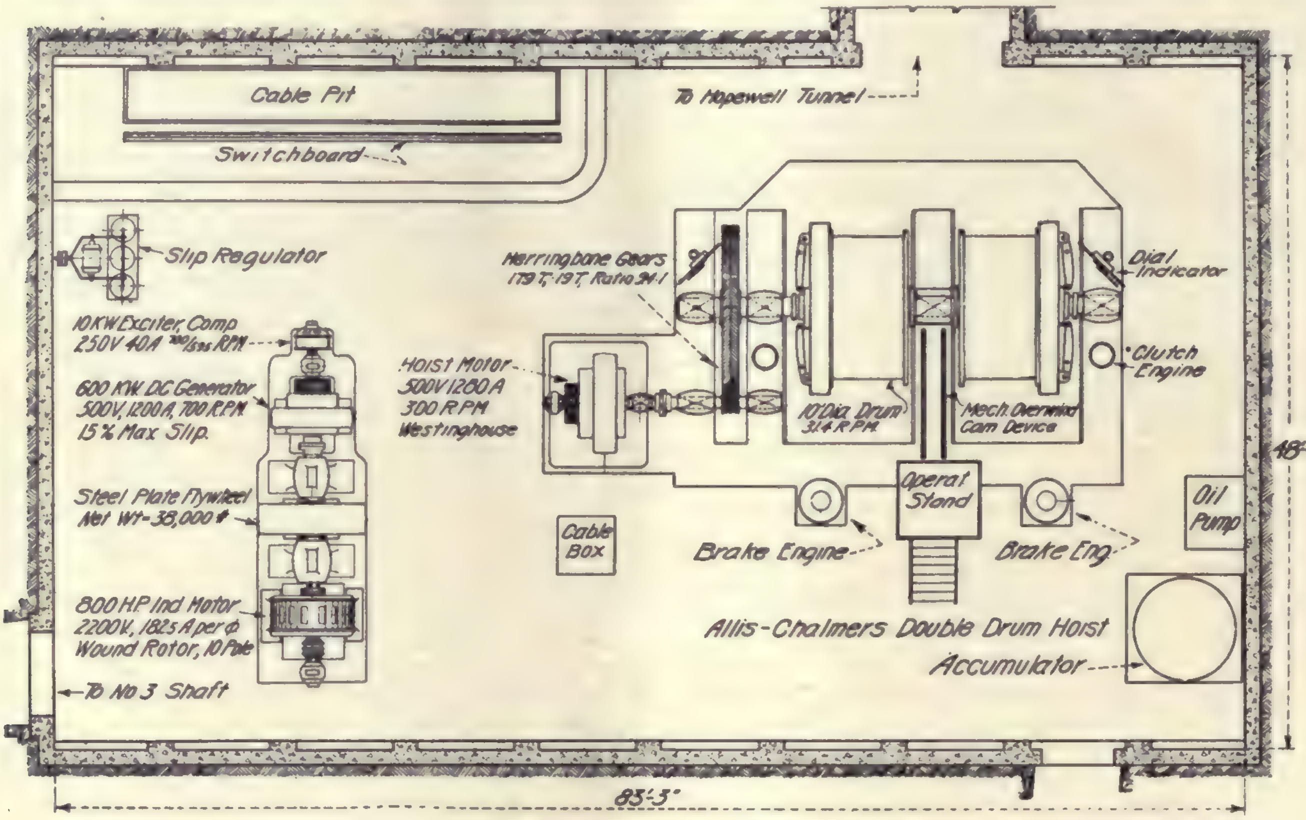
steam hoist served this shaft and the cages operated in balance.

A comparison between hoisting costs in 1917 with steam and costs in 1920 with electric power may be roughly considered as indicative of the economy of electric hoisting over steam. In 1917 average hoisting costs with steam were 23.3 cents per ton. In 1920 average hoisting costs with electric power were 1 cent per ton. The saving in power in this instance does not account for the great difference in hoisting costs. An important contributing factor was the automatic loading and dumping feature of the new shaft. This feature reduces enormously the labor cost involved as compared with the old way of handling cars in and out of the cages. An arrangement by which the ore dumps from the skips into any one of three bins under the control of the hoist engineer is also a novel scheme. This is operated by an electric motor with remote control. The push-button control is on the hoist engineer's platform. By pressing any one of three control buttons a swinging spout is spotted over the desired bin. This arrangement is described later.

When hoisting for three shifts this shaft has a capacity of 5,000 tons of ore per day. Up to date, however, not more than 40 per cent of its capacity has been realized. Much consideration was given to safety of operation in the design of hoist, shaft and accessories. Protection has been installed against overwind and overspeed. These safety devices operate to disrupt the current and automatically set the brakes. The equipment as a whole combines large capacity with safety of operation and ease of control.

The hoisting equipment is installed underground on the 1,000-ft. level. The station is cut out of solid rock and lined with reinforced concrete. Fig. 3 is a floor plan indicating the main units of equipment. This room houses the motor-generator flywheel set, switchboard, slip regulator, double-drum hoist, oil accumulator and the necessary signal apparatus. The room is well lighted and painted and presents a surprise to the visitor seeing it for the first time. The Ilgner-Ward Leonard system for load equalization was adopted, not because of any reservation on demand charge, but to secure better voltage regulation. Flywheel capacity sufficient completely to equalize the maximum-duty cycle met in balanced hoisting from the deepest level was provided. The shaft has recently been sunk to a depth of 2,700 ft., and ore is being hoisted from loading pockets 76 ft. below the 1,200, 1,500, 1,800, 2,100 and 2,500-ft. levels. Ultimately the shaft will be sunk to the 3,000-ft. level. The general characteristics of the hoist are given in Table I. The calculated duty cycles for various levels on which the capacity of the electrical equipment was based are shown in Fig. 4.

The hoist is of the double-drum, single-reduction, geared type. There are two drums 10 ft. in diameter



GENERAL PLAN NO 5 HOIST ROOM ON 1,000 FT. LEVEL

FIG. 3—FLOOR PLAN OF HOISTING STATION FOR ORE SHAFT

TABLE I—CHARACTERISTICS OF NO. 5 HOIST EQUIPMENT

Inclination of shaft with horizontal, deg	90
Present maximum lift, approximately, ft	1,100
Ultimate maximum lift, approximately, ft	2,200
Weight of skip, lb	12,000
Weight of ore per trip, lb	14,000
Weight of one rope (2,200 ft. 1⅜ in.), lb	7,500
Maximum speed of skip, hoisting, ft. per minute	1,000
Diameter of double-clutched cylindrical drums, in	120
Moment of inertia of revolving parts, ft.^{2}-lb	2,691,430
Maximum hourly tonnage (2,000-lb. ton) from 3,000-ft. level, tons	163.6

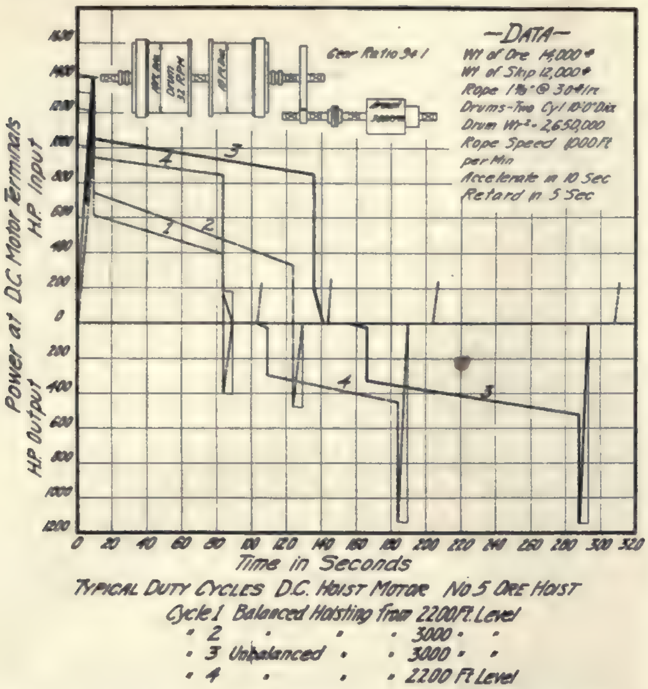


FIG. 4—THE CAPACITY OF THE EQUIPMENT FOR THE ORE-HOISTING STATION WAS DETERMINED FROM CALCULATED DUTY CYCLES

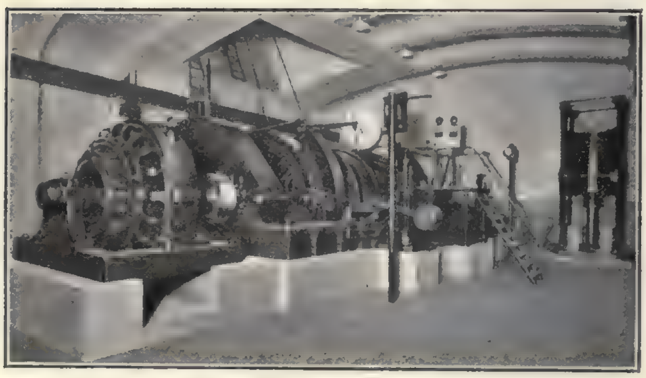


FIG. 5—GENERAL VIEW OF UNDERGROUND HOISTING STATION FOR SERVICE PURPOSES

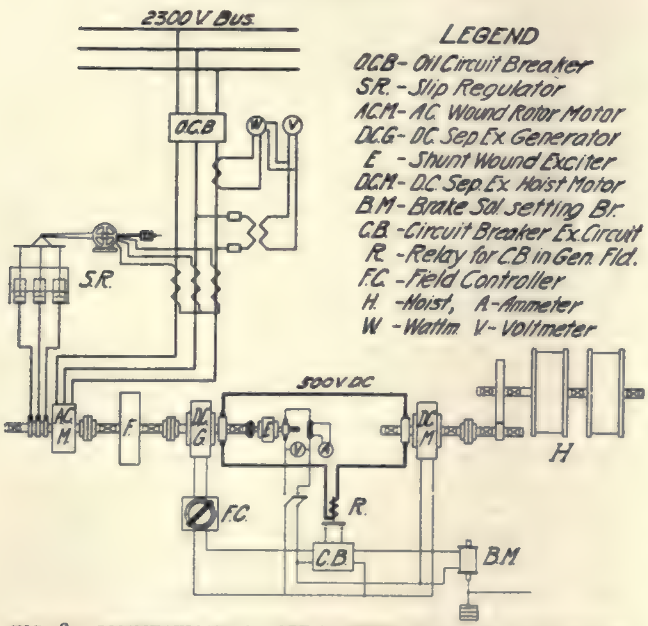


FIG. 6—CONNECTIONS OF ORE-HOISTING STATION EQUIPMENT

and with 5 ft. between flanges. The shell is made of $1\frac{3}{8}$-in. rolled open-hearth plate steel, machine-grooved after being assembled with a $1\frac{7}{16}$-in. pitch for $1\frac{5}{8}$-in. steel rope. The shells are bolted to cast-steel spiders. The brake wheel and clutch ring are of cast steel. The brake-wheel diameter is 12 ft. The clutches are of Brown patent double-disk multiple-arm friction type. Both clutches and the parallel-motion post brakes are operated by auxiliary engines 7-in. x 10-in. stroke, actuated by oil under a pressure of 200 lb. per square inch. The brake is set by weight and released by oil pressure. The post brakes are made from structural shapes and rolled open-hearth steel plate formed into a substantial box girder. The weights by which the brakes are set are in the form of cylinders moving in vertical guides formed by the brake engine frame. The drum flanges are extended to afford a large surface for spotting marks. The four drum-shaft bearings are of the two-part type, provided with gravity-feed lubrication. The outside bearings are 13 in. x 20 in. and the two middle bearings 16 in. x 28 in.

The drum shaft is connected through a flexible coupling to a Westinghouse 500-volt, 800-hp., 300-r.p.m., direct-current, separately excited, shunt-wound motor. The motor has ten poles wound for an exciter voltage of 250. The motor receives its armature current from a 500-kw., 500-volt, 595/700-r.p.m., separately excited, six-pole, direct-current generator. The generator is rated on a 40-deg.-C. temperature rise for full-load operation for twenty-four hours, followed by a four-hour run at 125 per cent load, during which time the temperature is not to rise over 55 deg. C. above room temperature. An 800-hp., 2,200-volt, 700-r.p.m., three-phase, 60-cycle, alternating-current slip-ring induction motor drives the generator and flywheel. A $7\frac{1}{2}$-kva., 250-volt exciter is directly connected to the motor. A general connection diagram is given in Fig. 6.

The flywheel is made up of separately turned steel plates riveted together. The weight of the wheel is 38,000 lb. and the diameter is 7 ft. 6 in. The peripheral speed of the wheel is 16,956 ft. per minute at synchronous speed. The total energy stored in the flywheel at 700 r.p.m. is 40,000 hp.-sec. Approximately 50 per cent of this energy is available in case of power failure, the limitation being the speed at which the direct-current exciter is no longer able to hold its voltage. The set is rated on the basis of a speed reduction of 15 per cent below 700 r.p.m. At this slip the flywheel will give up 3,030 hp.-sec. of energy.

The hoist motor is controlled by a face-plate field controller through a hand lever moved in a vertical plane. The induction motor driving the direct-current generator is controlled by a liquid slip regulator actuated by a torque motor, the current in which is proportional to the current in the main motor. Hatchway limit switches are provided to limit the skip travel positively in the mine shaft. In addition, a mechanical overwind device is geared to the hoist. A traveling electric crane serves all machinery in this station. Repairs, when necessary, can be quickly made, but so far the hoisting equipment has needed no major repairs.

ORE-BIN SELECTOR

A special feature of particular interest is the so-called selector. This consists of a movable hopper with a chute which swings through a horizontal angle of 120 deg. on a curved track. The skip discharges into this hopper, and in front of the hopper three separate

openings lead to grading bins just above the 1,000-ft. level. The drive for the hopper consists of remote-controlled equipment identical in principle with an automatic elevator. Push-buttons on the hoist operating platform make it possible for the operator to spot the chute over the proper bin while the skip is being hoisted and dumped. The equipment is entirely under the control of the hoisting engineer. It has proved reliable and unfailing during the three years it has been in operation.

No. 6 Service Hoist

The service hoist is on the 500-ft. level of the mine in an underground station. This station is connected with the surface plant on the same level by a standard-gage tunnel 1,650 ft. long. The tunnel makes a loop connecting also the cage and shaft collar station on the same level. The sheave station is about 100 ft. above the hoist level and houses the two main sheaves, one for the main hoisting rope and the other for the counterweight rope. The hoist station is a room 44 ft. x 45 ft. with an adjoining room 28 ft. x 22 ft. These are excavated out of solid rock and lined with reinforced concrete. The smaller room houses the direct-current generators which supply all direct current for the underground load. As the haulage load comprises the larger part of the demand, this location was chosen as the most central underground station. It also has the advantage of being in direct communication with the main surface plant through a short tunnel. Fig. 5 shows a general view of the hoist, looking at the reel side, which is also the driving end of the hoist. At the extreme left is shown a part of the control switchboard panels, and overhead is shown a part of the cage of the traveling overhead service crane.

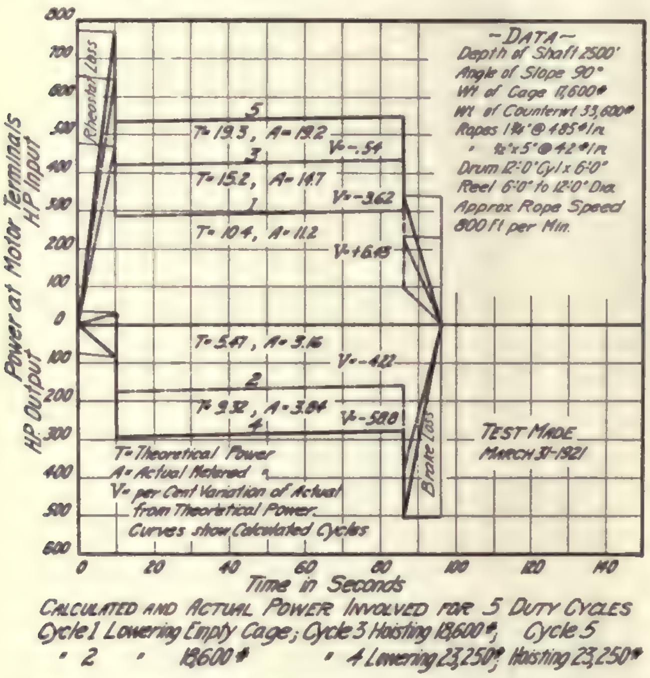


FIG. 7—COMPARISON OF CALCULATED AND ACTUAL DUTY CYCLES ON SERVICE HOIST

The hoist is a combination of a single cylindrical drum and reel, single-reduction-geared and coupled to the motor. The drum takes the main round hoisting rope and the reel carries the flat rope for the counterweight. This combination produces a remarkably flat load curve and cuts down the otherwise excessive acceleration peak. Mechanically the arrangement is unusually simple, since no clutch is necessary. The control is entirely through the motor and the mechanical brake. The drum is made in halves and constructed of steel boilerplate 1½ in. thick, not grooved. It is designed to wrap the rope in two layers on the drum. The end spiders are of cast steel and the brake drum and reel are cast in one piece. Circumferential rings of cast steel are placed inside the steel drum shell. The entire drum and reel are mounted on one solid 16-in. shaft having three main bearings each 16 in. x 27 in. The drum shell is bolted to the spiders with machined bolts through reamed holes. The main gear and pinion are of the herringbone type, which admits of a large gear ratio with high efficiency. The brake drum is 14 ft. in diameter. The brakes act in parallel, are wood lined and are operated by means of a hydraulic engine. They are set by dead weight and released by oil pressure in the hydraulic cylinder. Oil pressure is supplied by an accumulator with a loaded plunger. The general characteristics of the hoisting equipment are given in Table II.

The motor is a 350-hp. 2,200-volt twenty-pole wound-rotor motor with magnetically operated primary reversing switches and liquid rheostatic speed control. The motor is built for "plugging service," 40 deg. C. temperature rise on continuous operation at full load. The control is by hand lever operated through a vertical arc.

Power consumption on light-load lowering and empty hoisting, which represents average chaser conditions, is at a minimum. A comparison of calculated duty cycles and actual duty cycles was obtained by a test. The results of this test are shown in Fig. 7. It was found that the theoretical calculations were very nearly correct. The power-input curves from test showed little variation from the calculated values. The power output fell considerably below the theoretical values on regenerative lowering owing to the fact that negative slip was retarded by brakes. In this case the full energy of the descending load was only partially transformed into electrical energy, the rest being absorbed by brake lining. The test was made very soon after the hoist was put into operation, and the operator was unfamiliar with the equipment. Full regenerative lowering is more nearly approached now, and friction has been considerably reduced. The hoist has been in operation for a little more than three years and has given unusual satisfaction.

TABLE II—CHARACTERISTICS OF EQUIPMENT FOR NO. 6 SERVICE HOIST

Inclination of shaft with horizontal, deg	90
Depth of shaft, (present), ft	2,700
Weight of double-deck cage, lb	17,400
Weight of men or material (maximum), lb	15,500
Weight of 1¾-in. hoisting rope, lb	12,125
Weight of ½-in. x 5-in. counterweight rope, lb	8,232
Weight of counterweight, lb	31,600
Maximum hoisting speed, ft. per min	800
Diameter of cylindrical drum, in	144
Diameter of reel, minimum, ft	6
Diameter of reel, maximum, ft	12
Moment of inertia of revolving parts, ft.²-lb	2,500,000

Full protection is provided on this hoist against overwind, overspeed, failure of current and carelessness of hoist operator or cage tender. Duplicate protection is provided for overwind. One means is by hatchway limit switches placed in the shaft, the other by a mechanical device on the hoist itself. Cams are con-

nected to the hoist drum and operate to shut off the current automatically and gradually set the brakes at the end of the run. In case of overspeeding a centrifugal governor operates with the same result in stopping the hoist. In case of failure of current the hoist is immediately brought to rest. Any attempt to overwind or start the hoist in the wrong direction will result in the instant application of the brakes and shutting off of the power. A pull-out switch is installed on the hoisting engineer's platform, enabling him to cut in the current to move the hoist in case of overwind or other operation which results in shutting off the current. The mechanical safety devices operate each trip, thus insuring that they will be always in working order. However, they will not cause the hoist to stop if the operator wills at any time to handle the controller lever and control the hoist by hand in the ordinary safe manner. Protection against carelessness of the cage tender is obtained by door lock switches on all doors in the shaft at the different levels. The current is disrupted by any open door, so that the cage cannot be moved while a door is open at the landing or while any door above or below the cage is open. The cage is double-decked and will hold 125 men. Less than one-fifth as much time is required in getting the men in and out of the mine as formerly with the small cages in the No. 3 shaft. This effects a large saving in operating costs due to the conservation of working time.

The underground haulage system consists of approximately 40,000 ft. of narrow-gage and about 10,000 ft. of standard-gage track, with 250-volt overhead trolley. There is 2,760 hp. in haulage motors and locomotives working on the various levels. From the main loading bins on the 1,000-ft. level ore is loaded into 40-ton cars, ten of which are hauled by 25-ton Westinghouse-Baldwin two-motor locomotives through the Hopewell tunnel to the crushing plant at Hopewell. From here a steam road hauls the ore to the Clarkdale smelter. There is a locomotive repair shop at the mouth of the tunnel. Three-ton storage-battery locomotives of 18-in. gage are used on the 500-ft. level for drill-steel and miscellaneous service. Standard-gage 6-ton motors are used to haul the trains for the workmen between the portal and the shaft.

The high-pressure air-compressor plant is located with the rest of the surface plant on the 500-ft. level, about 700 ft. from the tunnel portal. The building is of modern steel and brick construction, 64 ft. x 126 ft. and 35 ft. high. A 20-ton traveling crane is provided to handle repairs to the compressors. The equipment consists of three two-stage Ingersoll-Rand compressors with capacities of 1,500, 3,000 and 6,800 cu.ft. per minute. The two smaller machines are driven by induction motors of 300 hp. and 600 hp. respectively and the large machine by a 1,163-hp. synchronous motor. Space is provided for one future compressor 6,800 cu.ft. or larger in size. This building also houses the main mine-power switchboard. This contains the distributing switches for all departments of the mine and surface plant and the town of Jerome.

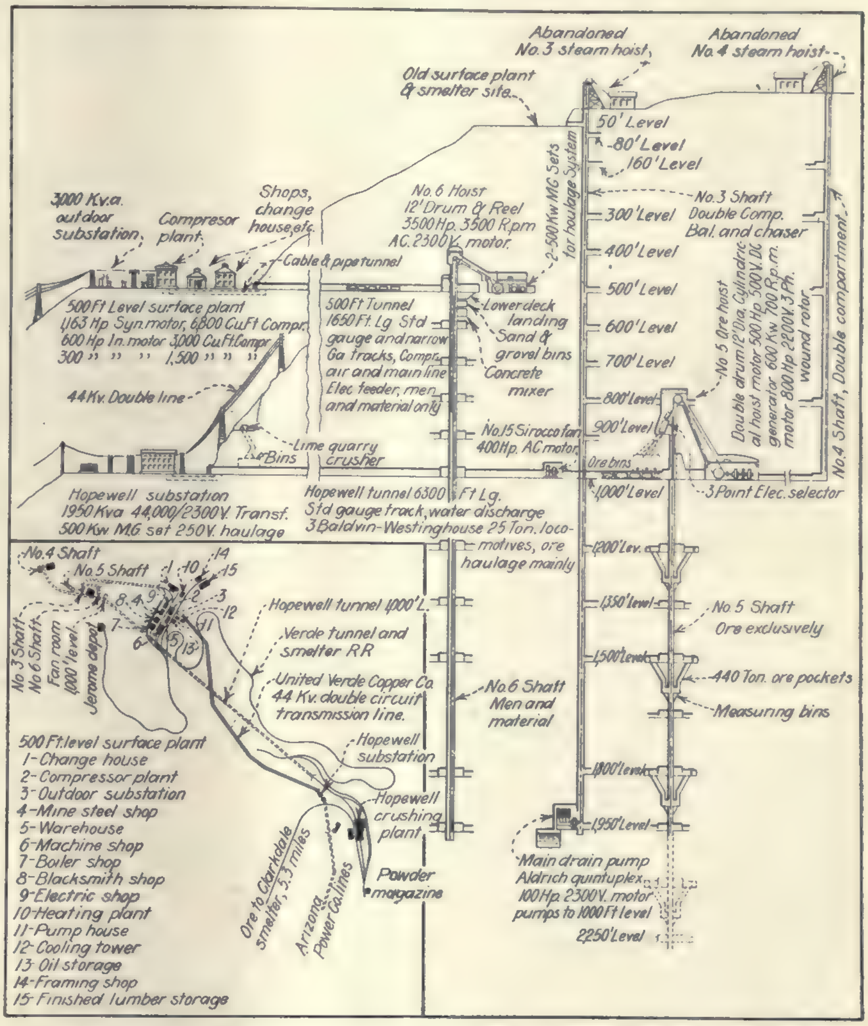


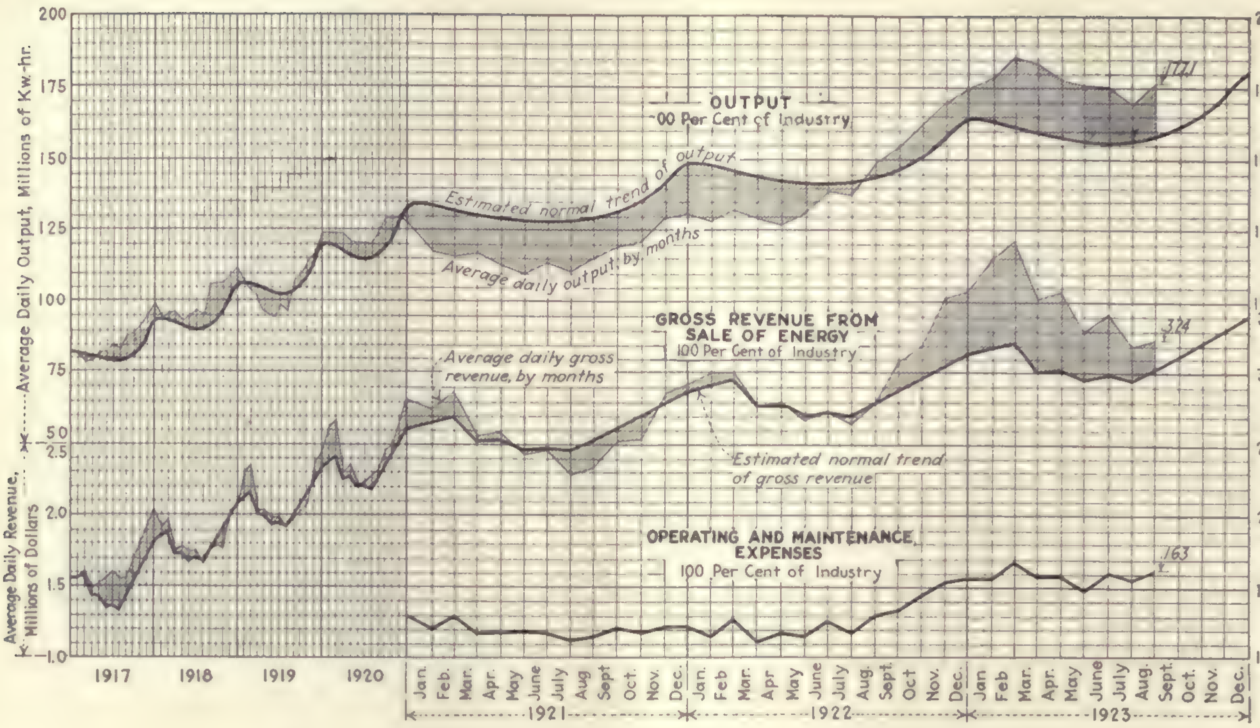
FIG. 8—VERTICAL SECTION THROUGH THE TWO SHAFTS AND THE RELATIVE LOCATION OF HOISTING STATIONS

No. 3 and No. 4 shafts, both of which have been abandoned for hoisting but will be kept open as air shafts, are also shown. No. 3 shaft has been used recently as an emergency shaft, the old steam hoist being operated by compressed air. The small-scale map of Fig. 8 indicates in a true proportion the surface plant, railroad, main power-transmission lines and the main underground haulage tunnels on the 500-ft. and 1,000-ft. levels. It also shows the four shafts above mentioned in their true respective locations and the underground hoist room and other equipment.

Table III gives test data on the power consumption of the air compressors. The cost in 1918 and 1919 with part steam-driven compressors in the old plant was 13.5 cents per ton of ore mined. For 1920, with all compressors run by electric power, in the new plant the average cost was 5 cents per ton of ore.

TABLE III—POWER CONSUMPTION OF AIR COMPRESSORS

	Kw.-Hr. per 100 Cu.Ft. Free Air Compressed to 100-Lb. Gage				Hp. per 100 Cu.Ft. of Air per Minute Compressed to 100-Lb. Gage			
Load	4/4	3/4	1/2	1/4	4/4	3/4	1/2	1/4
6,800-cu.ft. compressor	0.2205	0.225	0.283	0.385	17.65	18.18	22.85	31.90
3,000-cu.ft. compressor	0.264	.....	0.348	.....	21.2	.....	27.9	.....
1,500-cu.ft. compressor	0.239	0.241	0.319	0.489	19.2	19.35	25.6	39.5



CENTRAL-STATION OUTPUT DURING AUGUST WAS 11.9 PER CENT ABOVE NORMAL

Central-Station Output Shows Material Gain During August

REPORTS received by the ELECTRICAL WORLD for the month of August indicate that the average daily output of the central stations of the country was 177,090,000 kw.-hr., as against 169,438,000 kw.-hr. for July. August is the first month following the mid-summer season in which the increased demand for energy for lighting purposes is to be noted. This increase in energy sold to consumers is, therefore, perfectly normal. A study of the accompanying diagram indicates that the central-station output during August was about 11.9 per cent above what would have been the seasonal energy requirements if the industry had been normal. During July the industry was operating at 8.2 per cent above normal. A very significant fact to be drawn from the August returns is that while in January of this year the output was 28.6 per cent above the output of January, 1922, the output for August of this year was only 17.4 per cent above the output for August, 1922. The fact, therefore, that the output of the industry for the first six months of the year showed a gain of 25.4 per cent over a similar period for 1922 does not necessarily mean, in light of the returns for July and August, that the output of the industry can be said to be doubling every four years. It is very possible that by the time the full returns for this year are compiled the output for 1923 will exceed that of 1922 by about 20 per cent. The gross revenue from the sale of energy for the month of August also showed a slight gain over July, but not in proportion to the gain which was made in the output. The average daily revenue during August was $3,238,000, which is 7.4 per cent above what would have been the revenue if growth in the industry had been normal.

CENTRAL-STATION RETURNS FOR THREE MONTHS

Mos.	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting) 1923 Thousands	1922 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting) 1923 Thousands	1922 Thousands	Per Cent Increase
June..	75	3,965,060	3,321,108	19.3	69	$71,456	$60,215	18.7
July....	76	3,992,017	3,301,527	20.8	70	69,557	58,923	18 1
Aug...	76	4,172,310	3,554,873	17.4	70	70,319	60,991	15.3

Mos.	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies Reporting) 1923 Thousands of Dollars	1922 Thousands of Dollars	Per Cent Increase	Operating Ratio: Steam Plants 1923	1922	Hydro Plants 1923	1922	Combined Systems of Steam and Hydro 1923	1922
June..	58	28,016	23,749	18.0	50.2	54.2	28.0	26.4	43.7	44.9
July....	59	28,320	24,150	17.3	52.0	55.3	28.0	27.9	45.0	46.1
Aug...	59	29,797	26,024	14.5	53.1	55.8	29.1	29.2	49.3	49.3

Relative Safety of 440-Volt and 220-Volt Systems

IN THE article entitled "Steam Plant Auxiliaries," by C. G. Gray and M. M. Samuels, in the Oct. 13 issue of the ELECTRICAL WORLD, a few lines were accidentally omitted. At the top of page 751, in the left hand column, the article should read as follows:

"The apparatus available for 2,300 volts is safer than that available for 440 volts and less expensive for the same kva. because of the low amperage. Statistics seem to indicate that the percentage of accidents on 440 volts and the neighboring voltages is higher than on either much higher or much lower voltages, and the authors can testify from their own experience that in the majority of cases requiring resuscitation known to them the shock was caused by 440 volts or 550 volts alternating current. The most balanced system, therefore, seems to be one using 2,300 volts on all large motors and 220 volts on smaller motors which are not built for 2,300 volts, or where the cost of 2,300-volt starters would be too high."

New Solution of Power-Factor Problem

Account of an Interview with the Developers of the Fynn-Weichsel Motor, During Which Demonstrational Tests Were Witnessed and Observations of the Motor in Process of Construction Were Made

THE recent announcement by the Wagner Electric Corporation of a new adjustable power-factor polyphase motor having very desirable starting and running characteristics and the news article on this motor in the Oct. 20 issue of the *Electrical World* have caused so much desire among engineers to know further details that a representative of the paper paid a visit to the St. Louis factory of the company for the purpose of obtaining them. The construction of the motor in various stages of completion was observed, a demonstration of its operation under stipulated conditions was witnessed, and the general power-factor situation was discussed with W. A. Layman, president of the company; A. H. Timmerman, vice-president, and other members of the Wagner staff. An account of the observations made and the replies of the company's officials to questions asked them are printed here.

"ENGINEERS would like to know more about the construction of the new unity-power-factor polyphase motor which was recently announced by the Wagner Electric Corporation," said a representative of the ELECTRICAL WORLD a few days ago to W. A. Layman, president of the corporation, "because construction, as well as performance and cost, will largely determine their acceptance or rejection of the machine." "We shall be only too glad to show you the motors in various stages of construction and submit them to any tests you desire to make," Mr. Layman replied, "but we should prefer not to go into an elaborate engineering description of the motor at this time, since this is to be made the basis of an engineering paper in course of preparation by Mr. Weichsel for presentation to the American Institute of Electrical Engineers."

A walk through the shops with Mr. Timmerman and Mr. Weichsel disclosed the fact that the motor does not appear on first glance to be very different from other alternating-current motors. It has stator and rotor punchings of much the same construction as any wound-rotor motor. However, the stator has two windings, which may be of either concentric or distributed type (the first type is being used now). One winding, called the "starting winding," corresponds to the secondary of the usual wound-rotor motor, being connected during starting with external resistance which can be reduced and eventually short-circuited. The second winding, called the "operating winding," is displaced 90 electrical degrees from the first winding and is connected to brushes bearing on a commutator carried by the rotor. This winding carries the exciting current furnished by a commutated rotor winding and corresponds to the field of a synchronous motor.

The rotor also has two windings. One is a plain three-phase alternating-current winding which carries the load current, corresponding to the primary of a wound-rotor or synchronous motor, and is connected to slip rings. The other winding is very small, consisting of one or two turns per coil, placed in the same slots with the load winding, and is connected with the commutator to furnish exciting current to the "operating winding" on the stator. In general construction the motor is so closely analogous, both mechanically and in its windings, to construction of the older types of motors that assembly, winding and so forth, do not appear to entail much more of a job than in the case of an ordinary motor.

At this point the question was raised, "Will the user not experience commutator trouble?" It was very satisfactorily answered by the reply that the commutated current is only for excitation, the voltage being only 15 volts maximum. A demonstration later failed to disclose any sparking even when the motor was put through various antics such as starting and carrying 150 per cent of rating and even more. In fact, the commutator had a very desirable glaze on it. The slip rings carry all of the load current of the motor.

"The performance curves which were published in the ELECTRICAL WORLD of Oct. 20 should explain what the motor can do," admitted the ELECTRICAL WORLD representative, addressing Mr. Timmerman, "but what do you consider the outstanding characteristics of this motor?" "This motor has a combination of the good characteristics of slip-ring induction and synchronous motors," Mr. Timmerman replied, "with most of the undesirable ones eliminated."

OPERATING BEHAVIOR OF MOTOR

In explanation, demonstrations were made and results of tests shown which indicated that the motor starts in the same manner as a slip-ring motor. The starting current and torque were exactly similar. (See Fig. 1.) As indicated by the curves published Oct. 20 in the ELECTRICAL WORLD and demonstrated by test on this occasion, the motors are so designed that if the starting load does not exceed 125 to 150 per cent of rating the rotor will continue to increase in speed as a slip-ring motor, until very close to synchronous speed, when the commutated current from the "exciting winding" magnetizes the "operating winding" on the stator sufficiently to pull the rotor into step. It continues to operate as a synchronous motor until the load exceeds the synchronous pull-out value, which is about 150 per cent full-load torque. When this happens the motor automatically reverts to slip-ring induction-motor operation with about 3 per cent slip. If the load reduces again, the motor will automatically pull into step and operate at synchronous speed. This action was demonstrated by means of a stroboscope and instrument readings.

The slip is so small when the rotor pulls out of step and operates as a wound-rotor motor that the efficiency is not greatly affected, according to the test curves previously published. Of course, the line current is slightly affected when the motor changes from induction to synchronous action or vice versa, the variation being about 16 per cent. However, no motor can be expected to carry a load continuously which is hovering around this transition value. Most of these motors are de-

signed to develop 300 per cent full-load torque before they will stop entirely.

In the commercial design of the motor a wide range of power factor between unity and heavy leading values may be provided according to the conditions of installation. If a power-factor characteristic providing compensation for present lagging power-factor load is desired, the motor will be constructed to give heavy leading power factor; if for installation where no existing lagging load prevails, then the motor will be supplied to have virtually unity power factor at all loads.

"Is this motor a recent development or was it previously conceived and just announced as a commercially available machine?" Mr. Layman was asked. "We have been working in this field for many, many years," he replied, "but until a comparatively recent date the burden of poor power factor was not sufficiently appreciated by the distributing companies for them to be interested in the commercial development of a unity-power-factor motor. Then, too, the war, with the accompanying demand for quantity production of war supplies, sidetracked special development work, although power-factor corrective apparatus was even then greatly needed to release idle equipment for productive purposes. Since the war the conditions of the reconstruction period, while difficult, have permitted a resumption of development work, and this motor in commercial form is the fruit of the resumption of our development program.

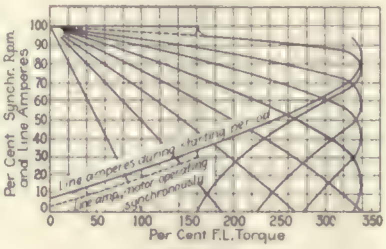


FIG. 1

Speed torque characteristics of 15-hp., 440-volt, three-phase, 60 cycle Fynn-Weichsel motor.

"Then, too, there has been a radical change in the central-station situation with respect to power-factor correction. Dating from the 1921 convention of the National Electric Light Association there has been a continuous and an urgent pressure from the Technical Section of that organization for the development of unity-power-factor motors, and the acceleration of our development program may be directly traced to this vigorous encouragement from that source."

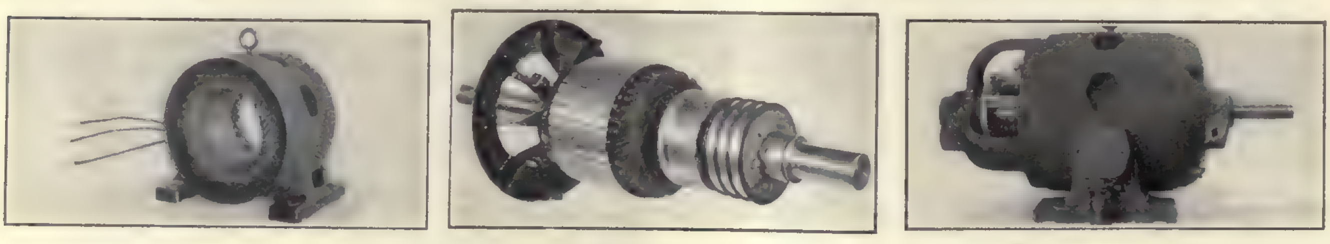
"Is the saving possible through power-factor correction really as stupendous as you were quoted as saying in the newspapers?" Mr. Layman was asked. As supporting evidence, he referred to a detailed study on one large utility company's system which had a peak load of approximately 269,000 kva. and 213,240 kw. The investment in generating stations was about $4,979,000, in transmission system about $12,270,000 and in distribution system about $27,123,000. The power factor of the transmitted load was relatively high, namely 79.3 per cent, while that of the distributed load was 72.7 per cent. Still, the energy losses due to power factor were 71,000,000 kw.-hr. per year out of a total energy loss of 269,000,000 kw.-hr. Evaluated at the low figure of 0.686 cent per kilowatt-hour, this meant a loss of $485,000 a year alone.

Looked at from another angle, the power factor required $3,576,000 more investment in generating and transmission equipment than necessary and $7,438,000 more in distribution, making a total additional investment of about $11,014,000, on which the fixed charges would be about $1,322,000 a year. Added to the total losses, the cost of low power factor was $1,807,000 a year or 19½ per cent of the total operating expense inclusive of fixed charges.

Possible Savings by Improving Power Factor

"These figures refer to only one system," Mr. Layman explained. "The total central-station investment in this country is approximately five billion dollars, and it will be noted that the total investment in this plant is less than 1 per cent of this total national investment. If the idle investment on the single system referred to is less than 1 per cent of the whole, and if it be assumed that the central-station industry as a whole is not operating under more favorable conditions than this one large unit, it will be seen that the broad statement made in some of the newspapers to the effect that there is a billion dollars of idle plant investment growing out of low-power-factor operation is not a wild flight of the imagination."

"While you advance good reasons why central-station executives should be interested in power-factor correction, how do you expect their customers to pay 25 to 35 per cent more for your motor than for a standard motor?" the Electrical World representative inquired. Mr. Layman replied: "When the fundamental economic conditions so strongly cry out for a corrective device such as this new motor, it may be taken for granted that practical policies insuring its rapid adoption will be adopted by the industry. What these policies are to be with respect to central-station practice is naturally a question for time to determine. It is our anticipation, however, that the near future will see a definite clarification of policy with respect to this question on the part of central-station companies along lines which will offer an incentive to the employment of this new type of motor. Over and above any incentive the central station may offer, however, there exists right inside the industrial customer's plant an actual money saving which may be sufficient to justify the additional capital investment in the new motor as compared with the old. I refer to the excess of losses within a customer's own plant in transformers, switching devices, meters and



VIEWS OF FYNN-WEICHSEL MOTOR

At left, stator with its two windings; in center, rotor showing both slip rings and commutator; at right, assembled motor.

distribution wiring, growing out of the idle current flowing in the system; also to the lower operating efficiency of motors due to poor voltage regulation arising from excess loss of pressure in the distributing system.

"The additional cost of the new motor as compared with the old will be a relatively low price to pay for power-factor correction," continued Mr. Layman, "when means heretofore suggested are taken into consideration. It must also be taken into account that the corrective effect is applied by the new motor at the source of the trouble. This is not generally true with other means heretofore employed. So the operating savings are larger. The new motor involves no sacrifice of space, which will in many instances be an important factor, and does not in any way increase the chance of accident or injury to plant operatives over that with the older types of motors."

Power-Station Lighting*

Recommended Intensities for Various Sections of Plant—Sources of Energy, Distribution System, Emergency Lighting and Equipment Discussed—Interesting Method of Lighting Water Column Described

By RAYMOND A. HOPKINS
Engineer, Stone & Webster, Inc., Boston

UNUSUAL problems are met in the lighting of power stations on account of individual arrangement of equipment, severe service conditions and exacting requirements. The successful lighting system must be reliable, economical, easy to maintain and adequately suited to the specific local requirements, which differ throughout the station. The most reliable and economical source of energy is usually the station auxiliary bus. The distribution wiring should be of the particular quality best suited to meet power-station conditions and should be designed to give the best possible voltage regulation consistent with economy. An emergency lighting system should be provided, and of several possible arrangements the one giving greatest dependability should be selected. All equipment, such as cabinets, switches, receptacles, lamps, globes, shades and reflectors, should be carefully selected to give maximum operating convenience, long life and high efficiency.

With regard to sources of energy, the main station bus in a direct-current station is generally the most reliable and economical source for the lighting and is usually chosen on this basis, although the voltage regulation may not be of the best. The main station bus in an alternating-current station is in itself a reliable source. When the potential of this bus is more than 2,300 volts, however, the transforming and switching equipment is expensive and also constitutes a possible hazard to the lighting system. Moreover, a voltage regulator is always required as the bus voltage may vary as much as 10 per cent above or below normal. The 2,300-volt station auxiliary bus, from which all motor-driven auxiliaries are fed, is usually considered the best source of energy for the lighting system. Since the continuous operation of the station auxiliaries is very important even under conditions of power interruption or voltage surge on the main bus, the station auxiliary bus is usually energized from at least two sources of energy, at least one of which is a prime mover. A voltage regulator is necessary only when the auxiliary bus for some reason does not carry a uniform voltage.

The storage battery is a most reliable secondary source, and with proper charging connections the voltage regulation is satisfactory. The cost of the battery and its poor efficiency prohibit its use for normal lighting, but it is very commonly used as a source of emergency lighting. When so arranged the battery size is determined by the demand of the emergency lighting system plus the demand of the control system. The latter is likely to be heavy during a period of emergency since at such a time considerable switching is done. A maximum allowance of one hour for demand on the emergency lighting system at any one time is considered ample to meet the most extreme condition. Since the control circuits constitute a very sensitive and important part of the station wiring, it is important that the emergency lighting system, if fed from the control battery, be kept free from grounds or other faults which may cause trouble with the controls.

EQUIPMENT ON CEILING OF ASH ROOM NECESSITATES SPECIAL LIGHTING LAYOUT

Important parts of the station to be covered by emergency lighting are water columns, boiler gages and

*Abstract of paper presented at the convention of the Illuminating Engineering Society, Lake George, N. Y., Sept. 24-28, 1923.

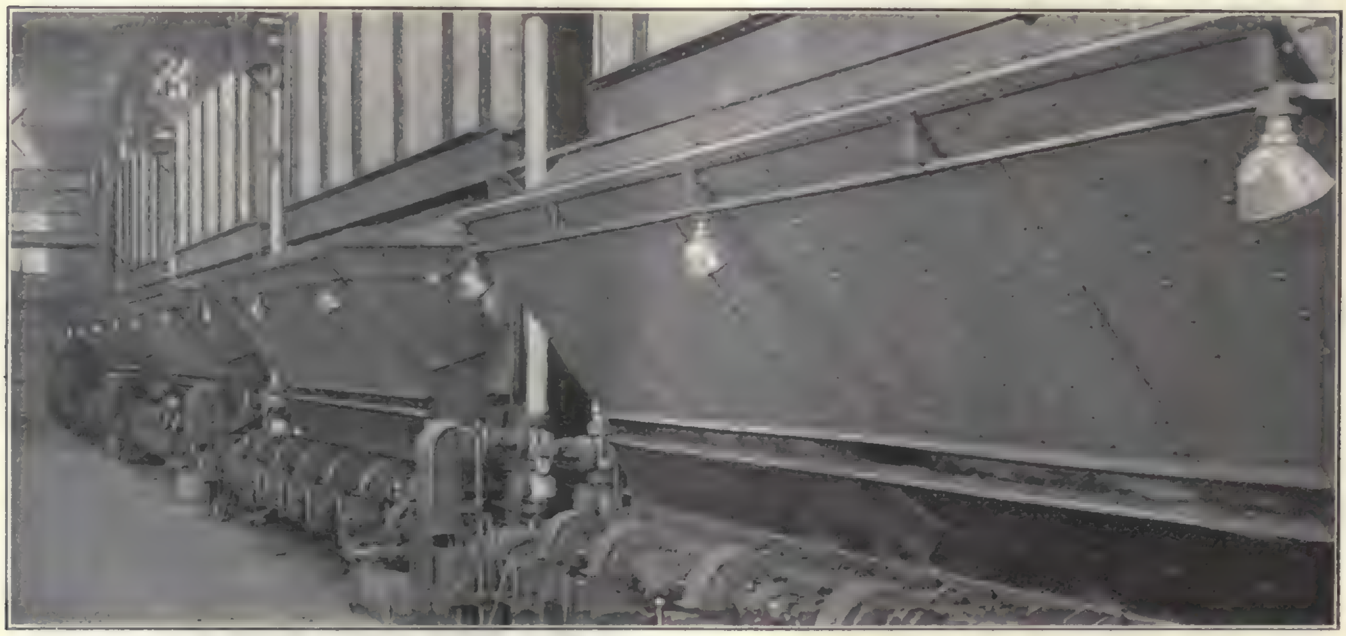
meters, stoker and fan controls, boiler-feed pumps, turbine gages and controls, turbine auxiliaries, valve controls, oil circuit breakers and disconnecting switches, lighting transformer and switch rooms, switchboard rooms, load dispatcher's office and all stairways and passages. The amount of lighting on the emergency system to be recommended is given in the last column of Table II.

Emergency Lighting Connections

There are three commonly used systems of emergency lighting connections. In each system the emergency wiring is segregated from the normal wiring by the use of separate conduits, cabinets and outlets. It is often found convenient, however, and perfectly satisfactory, to use combination cabinets with barriers separating the normal from the emergency circuits. The first system consists of a number of small auxiliary lamps arranged to burn normally and in emergency on the emergency source. Since the lamps are kept burning continuously and are always fed from the emergency source, the number and size of the lamps must be kept small so as to conserve energy. The lamps, therefore, cannot be used to supply any portion of the normal illumination, but must be considered as auxiliary or supplementary to the normal lamps. The emergency system, being supplementary to the normal system, is apt to be robbed of lamps and fuses and otherwise to become deteriorated, since under normal conditions its loss is not felt. The system, therefore, requires rigid routine testing and maintenance.

The second system consists of a number of small auxiliary lamps arranged to be normally dark but in emergency to burn on the emergency source. Somewhat larger lamps can be used than in the first system, since they burn only in emergency, but all gages and other vital points must have duplicate lamps. The main switch for the entire system consists of a contactor, normally held open by a potential coil energized from the normal source, but automatically closed by energy from the emergency source whenever the normal potential fails. This, being a supplementary system, requires the same rigid routine testing and maintenance as the first system.

The third system consists of a carefully selected portion of the normal lamps to be designated as emergency lamps and arranged to burn normally on the normal source and in emergency on the emergency source. The size and the number of lamps are only limited by the energy available at the emergency source for the short time that the emergency exists. Moreover, since the lamps burn normally on the normal source, no duplication of lamps is required at gages and other similar places. The main switch for this system consists of two contactors interlocked so as to form a double-throw switch. Normally the switch feeds the emergency lights from the normal source, but in the event that the normal source fails the contactor is automatically thrown over by energy from the emergency source so as to feed the lamps from that source. The action is reversed when the normal potential is restored.



ANGULAR REFLECTORS HUNG FROM HOPPERS ADEQUATELY ILLUMINATE STOKERS AND STOKER DRIVE MECHANISMS

In the distribution system special insulation is very desirable in boiler and condenser rooms where the wire is subject to conditions of severe heat and moisture. In these locations the ambient temperature is often above the safe temperature for rubber insulation, and escaping steam sometimes produces condensation which is liable to saturate the braid. Varnished-cambric insulation with lead covering is quite satisfactory but very expensive. The same insulation with braid covering gives very good results. None of the usual rubber compounds are suitable, but certain vulcanized compounds are available which are satisfactory for boiler-

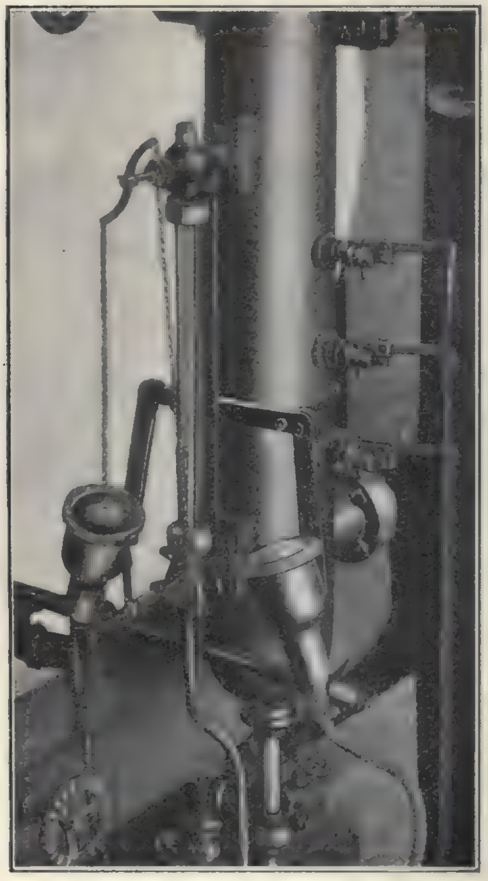
TABLE I—TYPICAL LIGHTING EQUIPMENT FOR A MODERN 100,000-KW. PLANT

	Boiler House	Turbine Room	Electrical Bay	Entire Station
Lighted floor area, sq.ft.	55,000	45,000	35,000	135,000
Number normal lights	300	250	400	950
Number emergency lights	120	50	140	310
Total number lights	420	300	540	1,260
Connected normal watts	31,000	49,000	33,000	113,000
Connected emergency watts	8,500	10,500	11,000	30,000
Total connected watts	39,500	59,500	44,000	143,000
Total watts per square foot	0.71	1.32	1.26	1.06

room use. Much trouble from excessive temperature can be avoided by carefully selecting the locations of conduit runs.

The intensity of the illumination for various sections of the power plant are given in Table II. The firing aisle is the most important part of the boiler house. Here are located the water columns, steam gages, draft gages and the controls for the larry, stokers, fans and auxiliaries. Normal lighting should be adequate for operation of the boilers both night and day, and the emergency lighting should be sufficient to allow full operation without normal lighting, which means that 25 per cent of the general lights and all of the local lights should be on the emergency system.

The water column, which is about 30 ft. above the floor but which requires constant watching by the operator, deserves very careful consideration. The light should preferably be directed from below so as to avoid specular reflection from the gage glass. Moreover, the lighting equipment must be very rugged in order to withstand the severe force of an exploding water glass. Being arranged to face upward, it must have some efficient means of removing the dust which quickly accumulates. One type of water-column illuminator in which two beams of light from two 40-watt lamps are focused by the lenses to impinge on the meniscus of the water column and cause it to glow so that it can be readily seen from any part of the firing aisle has worked out very successfully. A series of small holes on the casing around each lens are arranged for connection to the station compressed-air system or to the forced-air duct, and the streams of air effectively prevent the accumulation of dust. This device has proved its ability to withstand water-glass explosions. The steam gage, the clock and the load indicator should also be lighted from below, to avoid reflection. Excellent results are obtained by using a single 40-watt unit of the water-column illuminator just described. The gage board generally contains a group of indicators and gages and is successfully lighted by one or two 75-watt angular steel-reflector units. The stokers and drive mechanisms are generally placed under the hoppers. These are adequately lighted by 75-watt angular reflectors hung from the hoppers. The walkway over the hoppers and the tops of the hoppers themselves should be well lighted, since this walkway is provided for the use of the operator while inspecting the contents of the hoppers and breaking up masses of coal that may become clogged. Deep bowl or "RLM" units of 100-watt size are satisfactory. The larry requires one or more 75-watt deep-bowl or angular reflectors in the cab to light the controls and weighing scales. It is also desirable to supply one or two 100-watt angle-reflector units for each chute to light the end of the chute and the hopper during the dumping process. At the throat of the bunker one or more 75-watt reflector units may be used advantageously to assist the operator in opening the gates and discharging coal into the larry.



WATER COLUMN ILLUMINATOR THAT HAS PROVED ITS SERVICE

TABLE II—RECOMMENDED LIGHTING PRACTICE FOR MODERN GENERATING STATIONS

	Intensity Foot-Candles Recommended	Energy Required, Watts per Sq.Ft.	Size of Lamp, Watts	Emergency Lighting, Per Cent of Total
Coal pile and yard	0.7	0.1	1,000	None
Roadways	0.2	0.03	200	..
Coal bunker and conveyor	2.0	0.5	75–100	15
Firing aisle	(See text)			
Between boilers	3.0	0.6	100–150	20
Over boilers	...	...	100	50
Ash room	...	...	100–150	15
Turbine room:				
Normal operation	4.0	0.5	750	50
For repairs	8.0	....	750	25
Condenser floor	4.0	0.75	100–150	20
Battery room	4.5	1.00	75	25
Bus room:				
30-in. horizontal plane	3.0	1.25–1.75	75	20
Face of bus structure	1.5			
Switch room:				
30-in. horizontal plane	4.0	...	50–100	30
Front of cell top	2.0			
Disconnecting switches	1.5			
Switchboard room:				
30-in. horizontal plane	3.5–8.0	0.75–3.5	75–100	30
On instrument scales	2.5–3.0			

Census Bureau Issues Electric Railway Data

THE United States Census Bureau in announcing the result of its census of the electric railways of the United States, taken at the beginning of this year, brings out the fact that about 1,000 fewer miles of single track was operated in 1922 than in 1917. The miles of single track operated in 1922 aggregated 43,933.88 as compared with 44,808.31 in 1917 and 41,032.91 in 1912, showing an increase of 7.1 per cent for the ten-year period but a decrease of 2 per cent since 1917. These figures do not include electrified trackage of steam-railroad companies. The figures show decreases in track mileage in thirty-two states and small increases in sixteen states and the District of Columbia in 1922 as compared with 1917. The most important losses of trackage occurred in Massachusetts, 366.31 miles, and in Ohio, 260.27 miles. New York State leads in single trackage, with 4,792.35 miles, followed by Pennsylvania with 4,423.08 miles.

Significance of Electrical Shows

Observations on the Influence of the Modern Electrical Exposition and Opportunities It Brings

By Arthur Williams
General Commercial Manager New York Edison Company

FOR many years—happily now in history—there has been some complaint, probably largely justifiable, that adequate opportunity is generally not given to the public and the customers of the utilities to become practically acquainted with the various electrical appliances and their applications, new and old, in our industrial and home life. A sense of the justice of this complaint was probably an important factor in establishing New York's Electrical Show as an annual event. Several electrical shows had been previously held, but they occurred at irregular intervals and seemed to fail in attracting any general support on the part of the electrical industry or any general interest on the part of the public. For these reasons the experiment of again undertaking this form of educational and co-operative publicity was ventured upon with hesitancy and some doubt as to its effectiveness. The results, however, have been most gratifying, both from an industrial and a human point of view, the show of this year being the sixteenth of the series. The character of the attendance indicates the extent of the interest, and the purchases made by the visitors would appear to testify to a larger degree of appreciation than in any preceding year.


EXHIBITS IN THE 1923 NEW YORK ELECTRICAL SHOW WERE ATTRACTIVE AND EFFECTIVE FROM BOTH EDUCATIONAL AND SELLING POINTS OF VIEW

Valuable Contact

It would be exceedingly difficult to set forth with any completeness the many and various relationships made possible through such a gathering as this. Summing up the exhibits from year to year, one cannot but be impressed by their manifold application, their symmetry of design and the ease with which they can be placed in the service of the consumer. Undoubtedly this result, at least in part, has followed the bringing together in former shows, and in close juxtaposition, of the developments in the product of each manufacturer—an association which has led to the rejection of the bad or half-good and the permanent adoption of the good or of the best observable features of each article or invention. Thus each contributes something to the common good.

Again, there is an undoubted advantage to the manufacturers and the representatives of the utilities in coming together on occasions such as this and in being brought jointly into contact with great numbers of an interested, appreciative public of consumers. It is an opportunity for a joint meeting between these three important interests which probably could be brought about in no other way. Nowhere else can be found such an aggregation of modern appliances and devices exhibited and demonstrated under the best physical and psychological conditions, together producing a mass effect which, taken alone by itself, is a very desirable kind of publicity. The *tout ensemble*, if I may use the term, is one which cannot do other than create a lasting and most pleasing impression in the minds of all visitors, to the distinct advantage of the exhibitor, the utility, the industry at large and the visiting public.

Educational Influence

A very important feature of the New York shows has been the opportunty they have afforded to cooperate with the educational authorities and to bring the utilities into very close relationship with public and private schools. A great many thousands of the older students come to the exposition each year as guests. and, in a short time and under very pleasant conditions, they obtain a degree of familiarity with the world's electrical development and progress possible in no other way. Just as in all general museum effort, in natural history and in art, actual contact with the thing itself is considered the most effective means of impressing the memory and broadening the understanding, so it is thought that visiting the Electrical Show makes a corresponding impression upon the minds of the students.

The students of today are the men and women of tomorrow upon whom our industry must depend for its larger and better growth. Without doubt the scholar-visitors to the first show of sixteen years ago are to be largely numbered among the appreciative consumers of today, either in New York City or elsewhere. Though not always recognized in such an aspect, the public utility is one of the most important factors of any community's larger progress; and, vice versa, all that benefits the community must be, at least in some degree, beneficial to the utility. There are no more important points of contact from the civic standpoint than are made possible through the joint effort of the educational authorities of the community

and the electrical industry in bringing the students of the city into practical relationship with the manifold exhibits contained in the show.

There is another relationship through which the New York shows have created a great deal of favorable comment—the extent to which they have been used by the federal, state and municipal governments to bring to the attention of the public some of their activities in the interest of the public service. Electricity plays a very important part in the work of the navy, the army, the Signal Corps, the Department of Commerce, and probably in every other government activity. The fifteen or twenty governmental exhibits of this year attracted an extraordinary degree of public interest. Such a combination of effort would probably not be possible without an occasion like that the show affords. It is true that these exhibits probably have no commercial value in the usual sense, but as a factor in establishing good will toward the utilities that make these exhibitions possible and the government agencies in which we are all so vitally interested, in showing to an important element of the community to how great a degree our government is making use of the facilities offered by electricity, the value in obtaining public appreciation and good will can hardly be overestimated.

Furthermore, the working exhibits of such an exposition permit a demonstration of the practical applications of electrical energy in the form of light, power and heat which, again, would not be possible through any other agency. There is practically unanimous interest on the part of the visitors in any automatic or manufacturing process placed on exhibition at the show. It would seem, therefore, that there can be no doubt regarding the educational and commercial value of any such exhibits.

A Supplementary Activity

It must not be thought that those in New York look upon the Electrical Show as a sufficient means of informing the public of the methods by which electrical service is placed at its disposal. It is but one of a series of efforts to arouse public interest and advance to the utmost the use of electrical energy and to create in general the favorable public opinion concerning electric service which all so earnestly desire. Thus there is nothing in the Electrical Show which takes the place of publicity efforts in the technical and general press, no substitutes for the displays maintained in various showrooms, nothing which lessens in any degree the utilization of the printing press in the various and ever-increasing ways by which it is an effective medium of communication and publicity. Instead of taking the place of these important agencies, it seems but to stimulate and enhance their use and value. However, it is undoubtedly true that the advertising of the show, together with the close contact that it makes with great numbers of people, does in itself produce a publicity which has great value of the industry.

In the last analysis, the permanence of the Electrical Show as a beneficial educational and publicity agency must depend upon the extent to which it appeals, interests and is of value to the people of a city. That it now forms an important part of local informing and publicity efforts in New York, that it is attracting very universal and favorable attention to the subject of electricity in its unlimited applications of a useful nature, there can be no question.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Effect of Daylight Saving Upon Residential Consumption

To the Editors of the ELECTRICAL WORLD:

In a paper presented before the American Institute of Electrical Engineers on Feb. 18, 1920, the writer made an analysis of records of certain light and power companies in the northeastern part of the country, indicating that when clocks were advanced by one hour in the spring and retarded by one hour in the autumn, seven months later, the effect upon the lighting load was of the order of 8 per cent. This was supplemented by a study of monthly output for one light and power company in residential districts, indicating for the whole daylight-saving period of seven months a reduction of the lighting load of the order of 6 per cent.

A report presented in September, 1923, by the committee on residence survey of the Association of Edison Illuminating Companies and abstracted in the ELECTRICAL WORLD of Oct. 6, page 708, shows average seasonal variation of consumption in medium-class residences taken from monthly bills in several cities in the northeastern part of the country. A curve is plotted showing monthly residential consumption for the seven months of standard time, and an independent curve is plotted for the five months of advanced time popularly known as daylight saving. The extent to which the two curves are offset at the beginning and the end of the daylight saving period is about 7 per cent. This figure would appear therefore to represent with fair reliability the extent to which advancement of the clock by one hour in the summer time diminishes the consumption of electricity in homes in this part of the country.

Electrical Testing Laboratories,
New York City.

PRESTON S. MILLAR,
General Manager.

The Value of Standardization

To the Editors of the ELECTRICAL WORLD:

Standardization is looked upon by many as a check on progress, and in not a few instances it has so worked out in practice. However, it is not the unusual but the normal which should be considered as a guide, and standards are most appreciated by those who, having known of their advantages, no longer possess them. For example, the man who moves from one house to another and tries to use his reading lamp only to find that the plug does not fit the receptacle is instantly converted to the necessity of standardization of plugs and sockets. If, in addition, he discovers that his motor will not operate because it is wound for a different voltage or frequency, he may mutter some unprintable phrases about the public utility company which is a law unto itself. It is only through the use of unstandardized material that appreciation of the value of standards comes. We buy collars and shirts, shoes and stockings according to number or size and naturally expect them to fit. If they do not, the dealer hears from us and finds his goods on his hands again. Did like action follow the sale of all unstandardized electrical apparatus, the country would soon enjoy interchangeable material. J. S. SMITH.

Chicago, Ill.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Roomy Design for Small Hydro Development

BY R. R. ROBERTSON

Assistant Engineer Bureau of Power and Light, Los Angeles, Cal.

THE usual practice in installing a vertical hydro-electric generating unit is to concrete the turbine casing in solid in order to support a concrete pedestal which in turn carries the weight of the generator above. Because of lack of room this arrangement usually results in great inconvenience when it is necessary to repair the turbine.

To get away from this cramped design the Los Angeles Department of Public Service in the construction of its San Fernando power plant laid out its turbine room as shown herewith. This plant contains two 3,500-kva. General Electric vertical turbine-driven generators rated at 4,400 volts, three-phase, 50 cycles, 500 r.p.m., driven by two S. Morgan Smith reaction-type turbines rated at 4,500 hp. each.

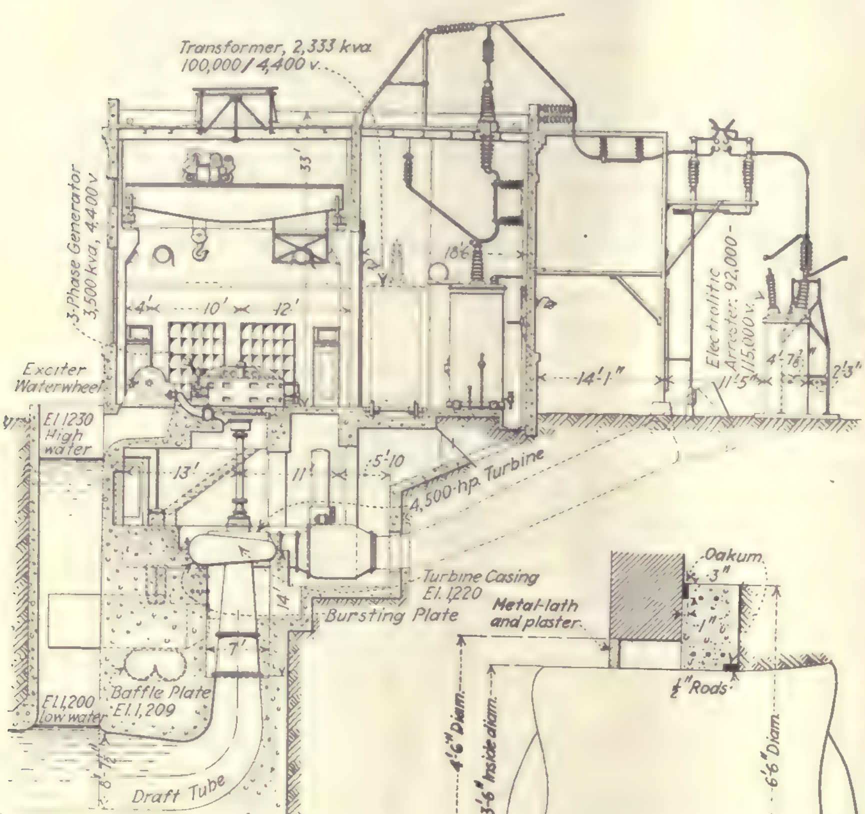
As will be seen by referring to the power-house cross-section, the turbine-room floor space is all available for use with the exception of the circular openings left for the purpose of getting at the turbine gate-operating mechanism. The turbine casing is not concreted in above its horizontal center line. This makes possible its complete removal if desired, simply by removing the nuts from the anchor bolts and disconnecting it from the draft tube and penstock. All pits in the turbine-room floor are covered by removable checkered-steel floor plates.

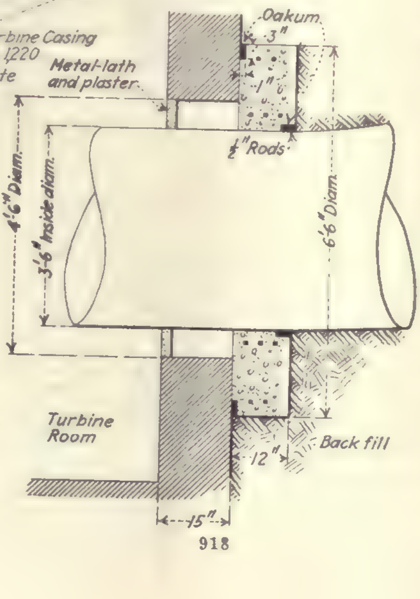
The generators and other equipment in the generator room are supported directly by the generator-room floor. This part of the building was designed with a system of beams, girders and column supports.

This plant has been in continuous operation at full load since its completion on Oct. 20, 1922. The foundation arrangement above described has given just as good satisfaction as have two other plants of the same system in which the equipment was installed in the usual way.

It will be noted from the power-house cross-section that there are two operating levels shown for the reservoir into which this plant discharges. The normal reservoir level is about as indicated as "low water 1200.0," but between the time the reservoir is filled to capacity and the time at which it is drawn down the water will stand very nearly at elevation 1230. This condition will put the walls of the turbine room under pressure from a maximum head of 7.33 ft. The only openings into the turbine room except from the generator-room floor above are where the two pressure pipes are brought in, so that these must be made secure against leakage.

In order to make a water-tight joint where the penstock enters the turbine room, and at the same time allow for a possible unequal settlement of the power-house building and machinery foundation, the pipe entrance was arranged as shown. The 12-in. x 6-ft. 6-in. concrete collar was put on the pipe the last thing before the backfill. The metal lath and plaster insert flush with the inside face of the wall was put in for the sake of appearance and also with the idea that any movement of the pipe with reference to the wall would be indicated by cracks in the plaster.





SPACIOUS LAYOUT A FEATURE OF THIS 7,000-KVA. HYDRO-ELECTRIC PLANT

The detail shown at the right is a water-tight joint where the penstock enters the turbine room. This allows for a possible unequal settlement of the power house building and machinery foundation. The penstock entrances must be made secure against leakage, because during high water the water below the power house is about 7 ft. above the turbine room floor.

Cable Entrances to Mines Require Good Design

By W. E. Boyle
Engineer, New York, N. Y.

WHAT is the best method of arranging cables from the generating transformer point before they enter mine shafts? Although this distance may be very short, here is a problem which needs close examination on account of the many possibilities of numerous faults.

When paper-insulated cables are buried in the ground there is continual danger from mechanical injury due to excavating, as this class of cable rapidly absorbs moisture. In most pit yards there are buried numerous steam and drainage pipes which heat the ground and keep the soil in a moisture-laden condition. On account of this fact the utilization of bitumen-insulated cables laid direct in the ground is virtually prohibited. The soil itself is liable to contain materials, such as ashes, which attack and corrode the armor and lead. Some of the methods by which this problem can be solved are given below:

1. The building of a culvert, say 2 ft. x 2 ft., from the power or transformer point to the edge of the shaft. This can be made of brick or cement, and a cover of boiler plating can be cut to size. The cables can then be cleated to the sides, a thorough draft for ventilation being assured.

2. The use of a catenary wire on which the cables can be suspended, thus always having them visible. This will eliminate all danger from steam pipes and acid-laden ground. A good covering is that made of lead sheathing and braided with waterproofed material. This lead sheathing forms an excellent protection against noxious gases. The width of the sling allows ample bearing surface and so protects the dielectric of the cable from damage due to lack of sufficient support. The hook and collar of the sling are made of galvanized steel.

3. The laying of the cable in iron, creosoted wood or earthware troughs on porcelain bridge pieces. The troughing is then filled with hot bitumen and covers made of the same material as the troughs placed in position. The final filling with the bitumen causes the covers to adhere.

Cleaning Transformer Cooling Coils

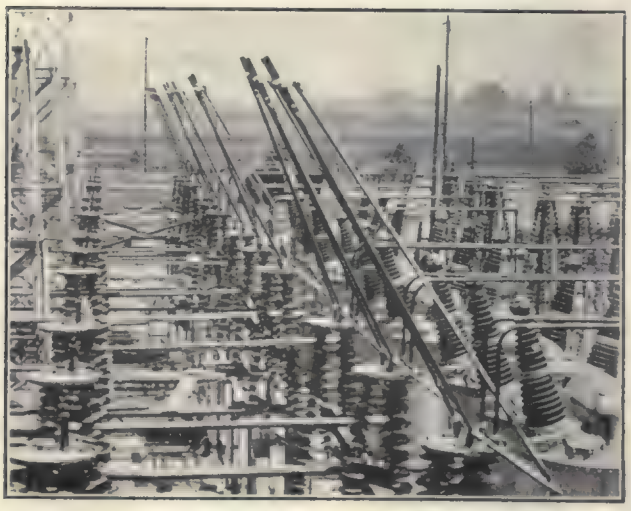
FOR the past year or so some trouble has been experienced with the water-cooling coils in the 25,000-volt transformers of the Pacific Power & Light Company at its Walla Walla (Wash.) substation due to the formation of scale. Soda and acid were used to clean the coils with but little effect. During the hot weather in July of this year the temperature rose to the danger point and it was necessary to do something to get more cooling water through the coils. They were taken out one at a time, and while a stream of water was passed through them they were tapped with a hammer. In this way two gallons of scale was washed out and about an equal amount of light material. After this treatment the discharge from the coils increased from 2½ gal. a minute to 15 gal. a minute.

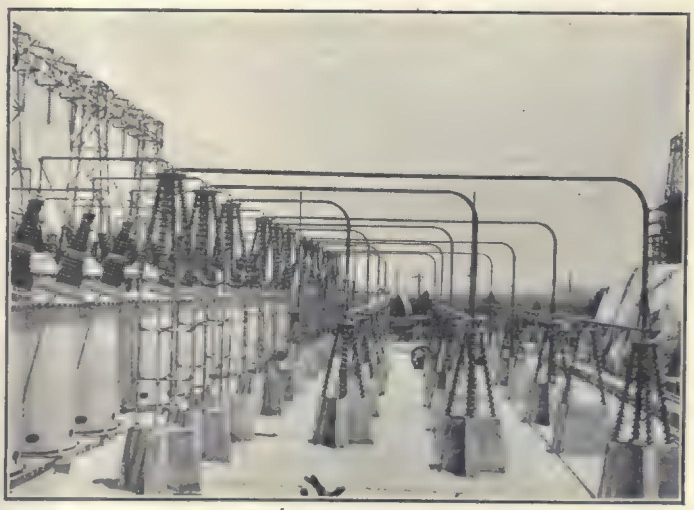
New Type of 220,000-Volt Bus Developed

INSTEAD of suspending the bus conductors from an overhead steel structure at the Laguna Bell 220,000-volt outdoor receiving substation, the Southern California Edison Company has developed the type of bus shown in the accompanying photographs. Four-inch wrought-iron pipe mounted on supports made up of pillar insulator posts is used for the conductors. This type of bus has an advantage in that it simplifies construction and in case of a flashover there is no overhead steel work to which the arc can travel.

The bus is supported by quadrupedal insulator supports which are spaced 45 ft. between centers. In the center between these supports are bipedal insulator supports all of which are set in concrete foundations. The take-offs are on the top of the quadrupedal supports. There are fourteen insulators in each stack and the stack is about 7 ft. high. The distance from the ground to the switch cross-overs is about 23 ft. There are cross ties bracing the supports after every third insulator. The spacing used between the legs of the bus is 11 ft. 9 in. between centers. The ground clearance is 12 ft.

To care for the expansion of the 4-in. pipe the center line of the bus saddle and the pedestal clevis should coincide at 70 deg. F. At the west end of each bus the bus saddle is fastened to the pedestal clevis so that it will not move, thus leaving the outer points of support free to expand and contract.





THE 220,000-VOLT LAGUNA BELL SUBSTATION OF THE SOUTHERN CALIFORNIA EDISON COMPANY

Left — Special - type disconnecting switch developed for 220,000-volt operation. Right —General view of the bus with oil switches showing at the left. In the foreground may be seen the type of support used at points where the leads top on to the bus. Each leg in these supports is made up of fourteen standard pillar insulator units topped by a piece of metal serving as a corona shield.

Estimating the Cost of New Substation Facilities

THE Gardner (Mass.) Electric Light Company distributes energy purchased from the New England Power Company from a substation having a present capacity of 4,875 kva. in two transformer banks. The load has already reached 4,700 kva., and with the early addition of 450 kva. from new customers and an expected 10 per cent increase in load from old customers amounting to 220 kva. the total aggregate load will shortly reach about 5,500 kva. This and further increases in load the company expects to handle by the installation of a bank of three 1,250-kva., 66,000/15,000/2,400-volt transformers at an estimated cost of $44,935, or $11.90 per kva. The itemized estimated cost is given in the accompanying table.

INCREASING SUBSTATION FACILITIES COSTS $11.90 PER KVA.

Three 1,250-kva. transformers (66/15/2.4 kv.)	$19,440
One 70,000-volt KO-36-A oil switch	6,480
Two 70,000-volt air-break switches	1,080
Disconnecting switches	432
Foundations	1,620
Pole structures	540
High-tension wiring and installation	4,320
Water piping	1,080
Remodeling of buildings	1,620
Converting 70,000-volt arrester to outdoor type	540
Temporary work	512
Conduit and control cable	810
Switchboard	540
Wiring for 2,300 volts	1,296
Field superintendence and tools	540
Engineering administration and general expense, 10 per cent	4,085
Total	$44,935
Per kva.	11.90

Extracts from an Operating Code*

High-Tension Testing

IT IS just as important to make the test for foreign voltage before proceeding with certain of the high-tension tests as it is in the case of the low-tension tests, because the preparation for these tests requires direct handling of high-voltage conductors by the operator.

Equipment

1. *Testing Equipment.*—Voltage for making high-tension tests is supplied either directly from a generator or from a testing set. The testing sets which are used for insulation and ground tests consist of transformers, a manually controlled indicating regulator and test leads. These sets are of two types, one in which the high-tension transformer is a two-phase transformer and the other in which the high-tension transformer is a three-phase transformer.

The test leads consist (a) of buses so arranged that any lines or generators can be connected to the bus and so that the test set can be connected to the bus, all these connections being made by means of disconnecting switches; (b) of insulated cables wound on reels and mounted on an iron framework so arranged that the testing cables may be unwound to reach from the test set to the apparatus to be tested.

2. *Equipment for Determining Phase Relation of Lines.*—This equipment, where installed, consists of synchronizing lamps or synchroscopes so arranged that they may be plugged in on the particular lines or apparatus. In locations in which this equipment is not installed phase tests are made by putting the apparatus to be synchronized on a dead bus and phasing it against an operating generator.

3. *Bus Grounding Equipment.*—In some locations bus grounding equipment is supplied on the main and test buses. This equipment consists of three fuses which may be connected between the individual phases and ground. These fuses can be short-circuited by disconnecting switches. The fuses are also arranged so that, when they are disconnected from the phases, they rest in contact clips which connect the fuses in series with incandescent lamps; if the fuses are continuous, the lamps will light when the circuit is energized from a grounded source of potential.

*Abstract from the operating code of the Philadelphia Electric Company.

Operations in General

1. Operators must keep away from equipment being given high-tension tests.
2. When making high-tension tests upon any station equipment, under no circumstances should the apparatus which connects the equipment to the test set be subjected to a higher voltage than that which would be used if the connecting apparatus itself were being tested.
3. While a high-tension insulation test is being made, the operator should observe the apparatus from a safe distance for visible or audible static.

Line Insulation and Ground Test

1. Make the test for foreign voltage.
2. If foreign voltage is indicated, report it to the load dispatcher and proceed no further until directed by the load dispatcher; then repeat the test for foreign voltage.
3. If no foreign voltage is indicated, connect the leads of the high-tension set to the conductors of the line and ground the A lead.
4. With the regulator adjusted to give minimum voltage, close the oil switch of the test set.
5. Slowly raise the voltage to the value specified by the load dispatcher, unless an excessive value of current is obtained at lower voltages, in which case stop the test and consult the load dispatcher.
6. Maintain the test voltage for one minute.
7. Reduce the voltage to a minimum and open the oil switch of the test set.
8. Disconnect the ground from the A lead.
9. Ground the C lead.
10. Close the oil switch of the test set.
11. Slowly raise the voltage to the value specified by the load dispatcher, unless an excessive value of current is obtained at a lower voltage, in which case stop the test and consult the load dispatcher.
12. Maintain the test voltage for one minute.
13. Reduce the voltage to minimum and open the oil switch of the test set.
14. Disconnect the test set leads from the conductors of the line.

Line Phase Test

1. The line to be tested must be connected at one end (the receiving end, when possible) to a source known to be in synchronism with the bus against which the line is to be synchronized. If the other end of the line does not extend to the synchronizing station, it must be connected through an intermediate station by separate buses and lines to this point.
2. At the synchronizing station connect the synchroscope and synchronizing lamps between the line and the bus. Proper phase relation is indicated by zero reading on the synchroscope and by the lamps remaining dark.

Transformer Insulation and Ground Test

1. Ground the secondary of the transformer bank as follows, with a wire no smaller than No. 12:

(a) 66,000/13,200-*Volt Transformer Banks.*—If energized from the 66,000-volt side, ground the B lead; if energized from the 13,200-volt side the 66,000-volt side need not be grounded.

(b) 13,200/6,000-*Volt Transformer Banks.*—If energized from the 13,200-volt side, ground the B lead; if energized from the 6,000-volt side the 13,000-volt side need not be grounded.

(c) 13,200/4,800-*Volt Transformer Banks.*—These shall be energized only from the 13,200-volt side and the neutral of each transformer winding shall be grounded, unless already connected to the system ground.

(d) 13,200/2,400-*Volt or* 6,000/2,400-*Volt Transformer Banks.*—These shall be energized from the high-tension side of the transformer only and the B lead of the transformer bank shall be connected to ground.

(e) On rotary-converter transformer banks the secondaries of which are connected delta or double-delta insulate all the alternating-current brushes from the rings and ground the B lead of each delta at the transformers.

(f) On rotary-converter transformer banks the secondaries of which are connected diammetrically two-phase or six-phase insulate all the alternating-current brushes from the rings and ground one terminal of each transformer at the transformer.

(g) On transformer banks whose secondary voltages are different from those specified ground connections shall be made according to the type of winding, as specified above.

2. Connect the transformer bank to a separate high-tension bus and line.
3. Test the transformer insulation from the generating station by applying a "line insulation and ground test."
4. Disconnect the transformer from the separate high-tension bus and line.

5. Remove the ground from the secondary of the transformer bank.

Transformer Phase Test

1. Connect the high-tension side of the transformer to a separate high-tension bus and line extending to the synchronizing station.
2. Energize the transformer from the low-tension side from a source in synchronism with the bus against which the transformer is to be synchronized.
3. At the synchronizing station connect the synchroscope and synchronizing lamps between the bus and line. Proper phase relation is indicated by a zero reading on the synchroscope and by the lamps remaining dark.

Reconstructing 60-Kv. Line for 110-Kv. Operation

BY E. S. BUNDY
Electrical Engineer Niagara, Lockport & Ontario Power Company, Buffalo, N. Y.

A SINGLE-CIRCUIT, 66,000-volt steel-tower line has recently been rebuilt and converted to a double-circuit line insulated for 110,000-volt operation by the Niagara, Lockport & Ontario Power Company. The line, 62 miles in length, was built in 1907 and consisted of square towers on concrete foundations, spaced on an average 550 ft. apart. The three power cables of 214,000 circ.mil seven-strand aluminum were mounted on pin-type insulators and steel pins, two pins on the cross-arm and one pin on the tower top giving a 7-ft. triangular spacing. The towers were of heights varying from 35 ft. to 75 ft. and were arranged for double-pin or single-pin construction, the double-pin construction being used on guyed towers where dead-ends occurred. All sharp angles were made by using three towers, two as dead-end towers and one between supporting two slack spans of approximately 100 ft. each.

The reconstructed line consists of two circuits of 336,400-circ.mil steel-reinforced aluminum cable mounted on suspension insulators, seven in a string on suspension towers and nine in a string on strain towers. New towers, ninety-seven in all (see accompanying table), were installed at all dead-end points, railroad crossings, angles and at one-mile intervals in straight sections of line. The new towers were installed on the old foundations where possible and guyed with ¾-in. galvanized-steel guy wire. New foundations were installed for all railroad-crossing towers and at other points where, owing to angles, etc., the location of the new towers had to be changed, or where unusual strains made larger foundations necessary.

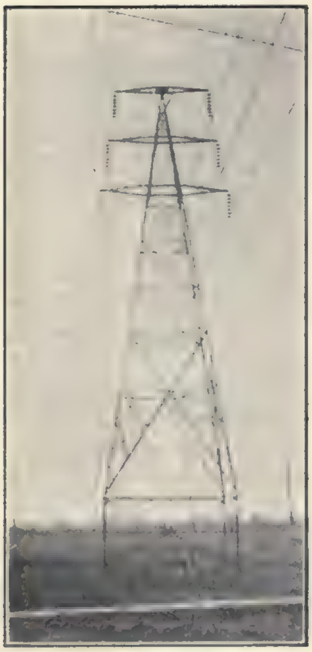
The reconstruction of the old single-circuit towers to take two suspension-insulator circuits consisted in installing three double-channel iron cross-arms as shown in the illustrations. The installation of three arms for two circuits made it necessary to raise a great many of these old towers on extensions in order to maintain the proper ground clearance.

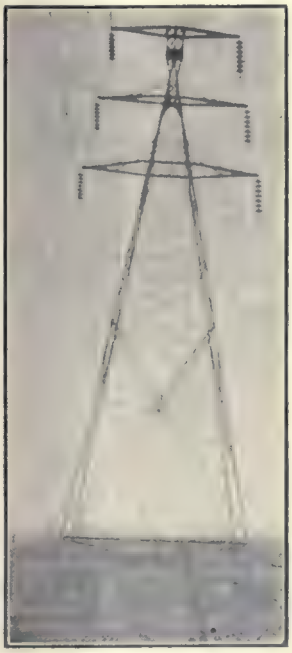
The line in general paralleled a branch railroad, making it possible to have the material shipped so that the average haul to the tower locations was approximately 3 miles. One crew took care of checking the material as received and delivering to the tower locations. An average weight of 1½ tons of material, which included steelwork, insulators, clamps, etc., was delivered to each location.

The construction work was divided between two main crews, with one crew working from each end toward the center of the line. Each of these main crews, under a general foreman, was divided into several

RECONSTRUCTED TRANSMISSION LINE OF THE NIAGARA, LOCKPORT & ONTARIO POWER COMPANY

The illustration at the right shows the tractor arrangement for pulling cables. The three old wires were pulled out at the same time as the new ones were pulled in, the latter being attached to the former. The illustrations below from left to right show a 57-ft. tower on a 10-ft. extension, a 52-ft. 6-in. semi-strain tower, a 49-ft. tower on 5-ft. extension and a 57-ft. tower of original construction and new railroad crossing tower on the reconstructed line.





smaller crews, each under an assistant foreman. These smaller crews were for excavating and foundations, new tower erection, extension erection, cross-arm erection, cable stringing and cable clamping. The crews went over the line in the above order, each doing its part of the work. The excavating and foundation crews put in all new anchors and foundations. The new tower erection crews took down the old towers at dead-end points, etc., which were to be replaced and then erected all new towers.

The extension erection crews erected all 5-ft. and 10-ft. extensions under the old towers. This work was done before the old cables were removed from the towers, which eliminated the necessity of temporarily guying the towers in the direction of the line. To install the extensions two gin poles with chain hoists were used, one on each side of the tower. The towers were guyed with rope at right angles to the line and raised vertically to the required height, after which the extension was assembled and bolted. One foreman, two linemen and four groundmen with one team could make an average progress of two extensions a day.

The cross-arm erection crews took off the old insulators, pins and arms, erected the new arms and hung the new insulators. They also hung the six. 10-in. wooden-roller snatch blocks to the arms for stringing the new cable. One foreman, four linemen and four groundmen could average four towers per day.

The aluminum wire as received was in lengths of approximately a mile. Twelve reels of cable were set up at intervals of two miles and six wires pulled each way. The three old wires were pulled out with the tractor arrangement shown and three of the new wires pulled in at the same time, the other three wires on the other side of the tower being pulled in with teams. The cable crew also made up the compression joints between lengths and took up any great amounts of excess sag.

The cable-clamping crews pulled the cable to sag, made up the clamps and took down the snatch blocks, leaving the section of line ready for service.

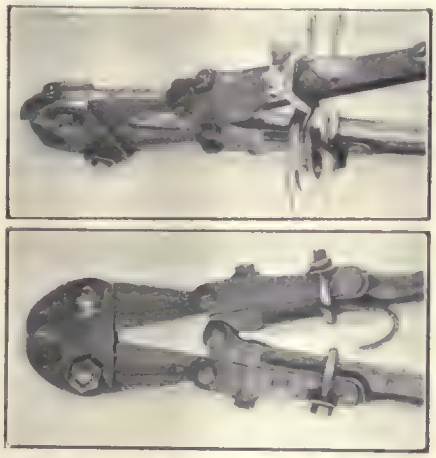
CONSTRUCTION NECESSARY IN CONVERTING 66,000-VOLT LINE TO 110,000 VOLTS

Old towers removed from line	186
Old towers moved to new locations	11
New towers:	
Railroad crossing	14
60-deg. angle	29
Dead-end	17
Semi-strain	37
Total new towers	97
5-ft. extensions	138
10-ft. extensions	81
Cross-arm attachments on old towers	539
New foundations	46
New guy anchors	111

Clamps and Thimbles Easily Attached to Guy Wire

By E. O. KEATOR
Consulting Civil Engineer, Dayton, Ohio

BY THE use of the simple bolt-cutter attachment shown herewith guy clamps may be applied to guy wires in an easier, quicker, less wasteful and less destructive manner than by the usual method. Usually when choosing a guy, a cable longer than necessary is selected to obtain a long loop at the anchor eye, for, with a full tension on the drawing-up block and tackle, it is impossible to draw the two parts of the guy wire together sufficiently to apply a clamp. With a long loop it is possible to draw the cables together with the handles of the pliers or splicing tool if the tool is applied as far as possible from the anchor eye. The clamp is then put on and driven down against the anchor eye with a hammer. Driving destroys the galvanizing and the distance driven represents just that much wasted cable.



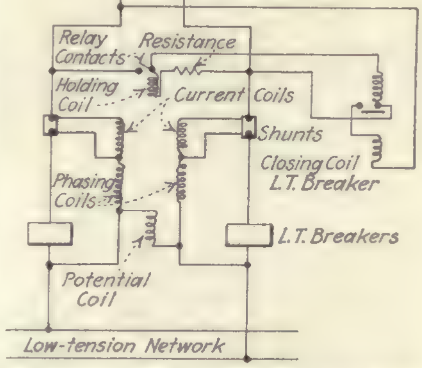
BOLT CUTTERS EQUIPPED TO DRAW CABLE TOGETHER FOR APPLYING CLAMPS

The improved method is as follows: To the handles of the bolt cutters apply two U-bolt clips as illustrated, and to one of the U-bolts attach a hook, the hook being bent out of a piece of $\frac{3}{16}$-in. or $\frac{1}{4}$-in. rod. No other equipment is needed. The hook is inserted in the eye of the anchor rod and the cutter handles can now be used to draw the cables together so that the clamps can be applied to their permanent position against the thimble without hammering. The leverage obtained with the long handles of the bolt cutters makes it easy to draw the cables together no matter how tight they are. The U-bolts prevent the cables from turning in the handles when pressure is applied, and the hook attached to the anchor eye prevents the nippers from slipping up the cable as is the tendency when the cables are bent around the thimble. The clamp can now be applied directly against the thimble.

Protectors for Isolating Lines in Network

FOR promptly isolating an individual line feeding into a network an automatic network protector shown schematically herewith has been developed according to the 1923 report of the N. E. L. A. electrical apparatus committee. This device has the following characteristics: (a) In event of reverse power, such as a fault on the high-tension feeder system, the low-tension breaker will open, and (b) the breaker will close automatically when conditions on the low-tension side are corrected.

The reverse-power protection is so sensitive that the breakers of each feeder open when the feeder switch is opened at the substation and close when the feeder switch is closed. This affords a means of disconnecting distribution transformers feeding the network during light-load periods.



AUTOMATIC NETWORK PROTECTOR FOR ISOLATING DEFECTIVE LINES

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Linking Public Relations and Sales

How the Commercial Organization and Sales Service Program of the Pacific Gas & Electric Company Operates Under Joint Supervision

By Don C. Ray
Manager Bureau of Public Relations,
Pacific Gas & Electric Company, San Francisco

COMMODITY sales are a vital factor in the success of all industry. The disposition of a commodity, however, is poorly made unless it has been sold with a view of rendering a real service to the consuming public, and upon the degree to which the public is adequately served depends the future progress of the industry. Service and sales are therefore interrelated and interdependent, and their development will best be accomplished when due recognition is given to that principle.

The formulation of the service sales program of the Pacific Gas & Electric Company as now in effect contemplates an orderly and definite plan successfully and speedily to accomplish one main objective—the maximum use and value to the consumer of the commodity served.

Many companies have established separate departments for the purpose of telling the company's story of its operations and selling its service message to its customers. These departments are of increasing importance and the scope of their work is rapidly broadening. Very logically such work falls into the sales category and in this company is directed by the vice-president in charge of sales. Such a department, organized and functioning under R. E. Fisher, vice-president in charge of public relations and sales, has made notable progress in the furtherance of public relations and has in addition made each employee of the company feel that he individually is responsible for the success of the entire department.

The program is predicated on enlisting the earnest support and co-operation of all those whose assistance is necessary to its successful accomplishment. This is outlined in the nature of self-interest appeals to the various component factors involved, namely, the employee, the stockholder, the consumer, the dealer and the public.

The employees of any industry, when properly educated and instructed, constitute a very important and tangible asset. The employee's attitude when meeting the customer or public reflects, or should reflect, company policies and provides the most direct expression of those policies. The importance, therefore, of a proper attitude on the part of the employee is paramount. It is obvious that if the employee is to perform his full function in this respect, he must be kept fully conversant with the company's basic aims and objects. It is the company's responsibility to see that this is done, and a brief description of the general plan followed is outlined herewith.

> ANNOUNCEMENT of the Pacific Gas & Electric Company's consolidating the supervision of its public relations and sales activities under the direction of a vice-president in charge of public relations and sales was made in the *Electrical World* of Aug. 11. In this article Mr. Ray now tells how the commercial program has been worked out and put into practical operation under the new plan of organization.

The practice of the company in performing this responsibility has been by means of short addresses by a competent company employee presented at group or sectional meetings of the Employees' Association, an organization 6,000 strong. Some idea of the character of the addresses may be had from the following list of subjects:

1. "Definition of Service."
2. "Fundamental Company Policies."
3. "Value of Courtesy."
4. "Proper Use of Telephone."
5. "Relation of Service to Good-Will."
6. "Advertising Value of Employee Contact with Consumer."
7. "Sales Possibilities of Employee."
8. "Ownership of Company Securities."

At the conclusion of these short addresses, the meeting is conducted as an open forum for a full discussion of the subject presented. The employee is impressed with his importance in the company organization and is encouraged to give complete expression to his individual views. As indicative of this the following pledge is suggested to each employee:

"I am at all times the individual personal representative of and for this company, regardless of my department or duties, and it is for me to see that the policy of this company—that of rendering service in its broadest sense—is carried on."

Each regular employee of the company is provided with a complaint and "prospect" booklet to be carried with him at all times and to be used for the purpose of reporting promptly to the interested divisional office any complaint or prospective business which may come to his attention in his contact with the customer. The complaint or "prospect" slip is signed by the employee and provides a record by which the activity of any particular employee may be appropriately acknowledged. All slips forwarded are at once referred to either the service or sales department, as the case may be.

Appeal to Stockholders

District stockholders' meetings at all central points on the company's system are held from time to time. Altogether about twenty-four of these meetings have been conducted. They are addressed by officers of the company, who present a general report on the company's activities, its accomplishments and its problems. The stockholders are urged to offer constructive suggestions and criticisms concerning the conduct of the company's affairs.

All stockholders are placed on the mailing list for the company magazine, a copy being forwarded them each month. In addition to this, they are from time to time circularized with informative literature pertaining to the company's activities.

Appeal to Consumer

All large customers are being circularized with a letter expressing the company's appreciation of their business, defining the service of the company in its largest sense and calling attention to the engineering service which the company maintains to enable them more efficiently to utilize its commodity.

Return postal cards are mailed to all customers, the return addresses being to the local divisional office. The following appears on the body of the postal card:

> We appreciate the opportunity of serving you, and it is our constant endeavor to make that service as nearly perfect as possible. If we have not fully accomplished this purpose, you are urged to make reply to the questions appearing on the return postal card attached and mail it promptly to this office. Either complaint or request, or both, will receive our best attention.

This card is signed by the local division manager. On the reverse side of the postal card the following questions appear:

1. Is the service being rendered you by this company satisfactory? If not, what suggestions have you for its improvement?
2. Have you made any complaints of our service that have not been given prompt and proper attention?
3. In dealing with you are all our employees courteous?
4. Do you desire any information concerning the various applications and use of our commodities?

Space is provided for the name and address of the customer. Replies to these postal cards are promptly referred to the interested department, and special attention is given to any requests or complaints received. A complete record of all postal cards issued and replies, complaints and requests received is kept in the various divisions and a monthly report forwarded to the head office.

Appeal to Dealers—Industrial Co-operation

The appeal to dealers is generally carried on through organized societies in the industry. By constant contact with those organizations they are kept advised of the company's policies as affects their particular needs. The representatives of the company meet with these respective organizations from time to time for the purpose of discussing any problems which may be of mutual interest. It is felt that it is only through free discussion of such problems that the fullest measure of service will redound to the public. Most encouraging results are secured through this co-operation.

A definite "tie-in" is maintained with the California Electrical Co-operative Campaign in its various endeavors for educational plans, such as the traveling show-window lighting exhibit, electric homes, public-school film exhibit, convenience-outlet campaign, demonstrations, etc. The results of this tie-in are obviously good.

Contact is also maintained with business organizations and associations, farm bureaus, etc. This contact includes presentation of lectures and educational talks regarding the company's properties and problems. These contacts have been instrumental in acquainting a large number of consumers with the company's policy and with the organization it has provided to serve the public.

Appeal to Public

Display advertising is carried in a large number of publications in the territory served. The advertisements consist of institutional and sales advertisements the character and nature of which it is not necessary to mention here. Demonstrations at representative fairs and expositions are maintained in addition to those carried on continually in the various divisions of the company. These demonstrations are primarily for the purpose of effecting sales, but are designed in such a way that a message of service is conveyed to all of those attending. A very large number of customers and the public are reached annually through the medium of those demonstrations, and their effectiveness from a standpoint of both service and sales is apparent.

Educational trips to company properties have become a regular feature of company activities. A large number of customers and representative men in all lines of business have been afforded the opportunity of first-hand observation of the company's properties and organization.

Unquestionably the magnitude of the various company developments is by this method much more easily comprehended, and the visitor almost invariably attains to a better realization of what the public utility companies have actually accomplished and the important part they are taking in the industrial development of the community.

This, in brief, is the outline of the service sales program of the Pacific Gas & Electric Company. No illusions are harbored that it is either perfect or entirely original. Modifications and expansion have been and will continue to be made as experience may dictate. Fundamentally, however, the plan is sound and its practical operation to date has clearly demonstrated the many advantages derived and possible of attainment in its careful and continuous application.

Interfitting Plugs and Sockets Illustrated

AT THE community electrical expositions being conducted in various suburban territories by the Edison Electric Illuminating Company of Boston an attractive display of interfitting plugs and outlets has been included under the supervision of R. S. Hale, superintendent of the company's special research department. The extent to which standard plugs now fit all sockets, convenience outlets and electric "plug-ins" is not appreciated by a large number of persons, who are also unaware of recent advances in plug design for use with electric tableware. The exhibit has aroused much interest among those attending the shows.

PLUG AND SOCKET DISPLAY SHOWS TREND TOWARD STANDARDIZATION

Central Station Separates Salesroom from General Office

SEPARATION of appliance sales activities from the main offices of the Malden (Mass.) Electric Company and affiliated gas companies has recently been effected with marked success. These companies serve an important suburban area north of Boston and have long been noted for their progressive management. The new sales department is housed two doors west of the main offices, and, as the accompanying illustration shows, it emphasizes the sales feature of the companies' activities instead of being classed as an appliance department only.

The new department occupies a floor area about 104 ft. x 30 ft., in addition to a commodious basement. Two show windows flank the entrance, which leads directly into an appliance display and supply service room about 84 ft. x 30 ft. in dimensions. At the rear is an office for the sales manager, and behind this is a consultation room, 20 ft. x 30 ft., with excellent facilities for salesmen's and demonstrators' meetings. In the basement are an appliance stockroom and repair division, offices for the local power engineer and service department, quarters for the advertising department and lockers for the use of appliance salespeople.

Compartments and drawers for the storage of domestic lighting supplies are built at one side of the room, with a convenient counter carrying outlets for lamp testing, an indicating meter showing the cost of operating appliances per hour, and facilities for clerical work. An extensive card index of customers and buildings is maintained, showing the names and addresses of occupants not having different types of appliances as well as those with known connected equipment. These "negative" cards are classified according to streets and are a great convenience in campaigns and drives on particular types of appliances. Appliance repairs are billed to customers, but repaired appliances are delivered from the sales department free and at the earliest feasible hour after their completion.

STORE USED EXCLUSIVELY FOR SALES PURPOSES

H. J. Walton, sales manager of the company, states that since the Malden sales department was opened a few weeks ago the public has taken most kindly to the idea of transacting all its appliance business at the new store instead of at the main office, and that the total number of visitors per day is larger than was the case when this department shared the office quarters of the Malden companies.

Georgia Railway & Power Territory in Relief

A LARGE relief map of north Georgia has just been made for the Georgia Railway & Power Company of Atlanta, showing the availability of abundant hydro-electric power for use of the industries in that section, where the company has during the past few years invested several million dollars in developments along the Tallulah, Chattanooga and Tugalo Rivers. The area covered is approximately 72 square miles, and the actual development already carried out produces hydro-electric energy which serves fifty-two municipalities and operates a majority of the industries in the district. The relief map was made to form a part of the company's exhibit at the International Textile Exposition, which opened in Boston on Oct. 29.

The exhibit itself, constructed in Atlanta, is a "live model," running water being used in the streams and electric lighting so used as to give an artistic and graphic effect. It is scaled one square foot to the square mile, thus being 72 sq.ft. in size.

What Other Companies Are Doing

Racine, Wis.—As a convincing index of the extent to which the Wisconsin Gas & Electric Company's business is growing in this city, this company will spend $4,500 to remodel the building immediately adjoining its present cramped office quarters, thus providing accommodations for more extensive sales facilities that have been imperative for some time. This improvement will not interfere, it is stated, with the company's contemplated plan to erect a new five-story office building on the present site.

Georgia.—Though authorized recently by the Georgia Public Service Commission to increase its rates for power and lighting, the Ware County Light & Power Company, Waycross, Ga., will not put the increased rates into effect, according to an announcement by R. E. Trexler, assistant treasurer of the company. Power company officials are inclined to the belief that this action establishes something like a precedent in Georgia public utility circles.

Boston, Mass. — Twenty lighting surveys in small stores made within a month by the illuminating engineering division of Charles H. Tenney & Company in New England properties operated by this organization have resulted in improved methods, adding an estimated annual energy consumption of 23,000 kw.-hr. to the service of these customers. At an average cost of about $110 per year per store the lighting will be much improved in quality. W. S. Wallace is in charge of this work.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Hydro-Electric Development and Steam Equipment

Pulverized-Fuel Developments.—A. J. T. TAYLOR.—A discussion of the development of pulverized-fuel equipment and of the question whether the coals mined in Canada can successfully be burned in pulverized form, a description of typical installations that have proved efficient and a definition of the advantages of pulverized systems are contained in this article. A table is given showing representative purchases of pulverized-fuel equipment. This table gives the number and make of boilers, the heating surface of each boiler and total rated horsepower.—*Canadian Engineer*, Sept. 18, 1923.

Condenser Records Show Air Leaks, Tube Scale or Good Performance.—S. THOMAS.—In a previous article, "Determining Efficient Condenser Operation and Causes of Low Vacuum," which appeared in the Sept. 11 issue, the author described in detail a convenient method of calculating results and interpreting condenser records. In this issue the method is shown and applied in practice to a 16,000-sq.ft. condenser serving an 8,000-kw. turbine.—*Power*, Oct. 9, 1923.

Generation, Control, Switching and Protection

Ventilation of Central-Station Buildings and Equipment.—Data and discussion of a general nature dealing with the employment or conditioning of masses of air have been included in this report for the sake of convenient reference in connection with the presentation of present practice. The report covers forty-six pages and discusses the equipment requiring artificial ventilation, substation ventilation and its many phases, various types of coolers, duct design for mechanical draft and various methods of ventilating electrical machinery.—*Report of Sub-Committee on Ventilation of N. E. L. A. Electrical Apparatus Committee*, October, 1923.

Magneto-Mechanical Loads on Bus Supports.—L. N. ROBINSON.—Current progress in electrical development and the increasing capacity of power systems have brought into prominence many factors of mechanical strength that were previously negligible in the design of electric stations and circuits. Heavy currents that may develop during short circuits in stations that are connected to large generating systems make it essential that bus and cable supports be strong mechanically as well as adequately insulated. Formulas are given for estimating the forces that may be developed under various conditions with different arrangements of the conductors and supports. The mechanical strength of bus and cable supports should be guaranteed by manufacturers and tested, as well as the insulating qualities. In order to facilitate the selection of bus and cable supports, it is desirable that uniform terms for expressing the various kinds of loads, standard methods of conducting tests and a minimum factor of safety for mechanical strength be adopted. This paper was presented at the Pacific Coast convention of the A. I. E. E.—*Journal of A. I. E. E.*, October, 1923.

Transmission, Substations and Distribution

Oil Bushing for 200,000 Volts.—F. PATZELT.—While there is no present, and probably no future, requirement for high-voltage apparatus of more than 100 kv. in Germany, the desire to compete in foreign installations has led to the development of high-voltage bushings for an operating voltage of 200 kv. with a test voltage of 450 kv. The lack of suitable paper of the required width and of coating machinery has made it impossible to build such a bushing as a dry condenser type. A design has therefore been chosen representing a combination of condenser type and oil-filled lead. The central part of the bushing is built up as a condenser, with paper as a dielectric. It is surrounded by a four-part hollow porcelain part closed on top and bottom by a tightly fitting metallic cap. Near the middle part of the lead, where it is held on the cover of the transformer, switch or wall, a pipe connection is provided, from which a flexible metallic hose leads to an external oil conservator. The complete bushing weighs about one ton. The great cost of this bushing is largely compensated by the possibility of arranging an annular current transformer as well as two metallic rings near the ground end for voltage measurements directly on the bushing. It is thus permissible to use the bushing as a complete measuring, ground-detecting, synchronizing and relay-operating device. The lead may be used straight or under an angle of as much as 30 deg.—*Siemens Zeitschrift*, August and September, 1923.

Electric Line Calculations.—W. T. J. ATKINS.—The type of network usually found in practice—i.e., one feeding scattered loads and having a complicated lay-out—is nearly always neglected, or at best receives summary treatment, in literature dealing with the subject of line calculations. The fundamental principles are here briefly reviewed, and methods based on the principle of superposition are described which permit problems of any degree of complexity to be solved by successive approximation. The work involved in the solution is much less than that necessitated by a direct method, as the limits of accuracy of the data are generally fairly wide. The calculation of short-circuit currents and of their heating effect is also described and examples are given.—*Journal of Institution of Electrical Engineers (England)*, September, 1923.

Converting Alternating Current to Direct Current by Mercury-Arc Rectifiers.—R. L. MORRISON.—The author discussed the subject under the following headings: (1) The need for a simple stationary converter that can be compared with the static transformer; (2) valve action of the mercury arc, with fundamental considerations underlying it; (3) the efficiency of this form of converter, high for high-pressure direct-current conditions, thus making it eminently suited to main-line electrification; (4) single-phase and polyphase rectifiers with wave forms; (5) special transformer enabling both halves of alternating wave to be utilized; (6) construction of large rectifiers; (7) sealing against atmosphere; (8) anode material and its effect on the continuous operation of the plant; (9) main auxiliaries, i.e., vacuum pump, ignition converter, etc.; (10) sizes at present manufactured; (11) operation in conjunction with other types of converter; (12) overloading; (13) rectifiers especially for high-tension direct-current work, with details of those at work on the Midi line of France; (14) upkeep; (15) automatic control; (16) advantages and general information.—*Paper presented before the British Association at Liverpool, England*, Sept. 12-19, 1923.

Floating Neutral n-Phase Systems.—L. A. DOGGETT.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. summer convention, July 7, 1923, page 18.—*Journal of A. I. E. E.*, October, 1923.

Units, Measurements and Instruments

Additional Losses in Synchronous Machines and Their Measurement.—R. RÜDENBERG.—When calculating the efficiency of synchronous machines the additional losses due to eddies in various parts of the machine have heretofore been neglected as accurate methods of measuring their magnitude have not been known. In the first part of this paper the author calculates the stray fields of synchronous generators, located mainly at the air gap, the coil ends and their surroundings, making it possible to predetermine these losses when the machine is designed. As the usual copper losses are always considerably smaller on high-speed machines than on the slow-running types, the author maintains that the relation between the additional losses and the usual copper losses is of no great importance on low-speed machines, but

may become of such decisive prominence on all high-speed generators or motors as to influence the design and the cooling arrangement. While the subject of this article would lend itself readily to most elaborate mathematical derivations, the author confines himself to numerical calculations on actual machines.—*Bulletin de l'Association Suisse des Electriciens*, September, 1923.

Study of Insulating Materials.—Two reports of the British Electrical and Allied Industries Research Association on this subject are given. The first report gives the directions for the study of vulcanized fiber for electrical purposes. It includes the various kinds of materials that fall under this classification, definition of terms and method of making both physical and electrical tests. The second report gives the direction for the study of electrical insulating paper for purposes other than the manufacture of cables. The papers covered are not varnished or impregnated with insulating compound. This report includes definitions, processes of treatment during manufacture, tests and schedule of uses.—*Journal of Institution of Electrical Engineers* (*England*), September, 1923.

Illumination

Short-Wave Radiation from Tungsten Filaments.—M. LUCKIESH, L. L. HOLLADAY and A. H. TAYLOR.—An investigation has been conducted by the authors to determine the change of actinicity of the radiation from incandescent tungsten with temperature of the tungsten and to determine the decrease of actinicity of the radiation after traversing specimens of glass, chiefly those used in tungsten-filament lamp bulbs. The description of the apparatus and method of procedure is preceded by a short introduction giving the results of former investigations on the subject.—*Journal of Franklin Institute*, September, 1923.

Motors and Control

Installation, Operation and Care of Electric Motors and Generators.—Detailed instructions for the proper installation, operation and care of electric motors and generators are given. The life and successful operation of these machines depend upon their proper installation and maintenance as well as upon their design and manufacture. While motors and generators require less care than almost any other type of power apparatus, neglect of the fundamental requirements may lead to serious trouble, if not to the loss of the equipment. Standard definitions referring to motors and generators are also given.—*Booklet of Electric Power Club*, September, 1923.

Tooth Frequency Iron Losses in Slip-Ring Induction Motors.—D. B. HOSEASON.—In high-speed slip-ring machines, especially those having open slots in the stator, it may occasionally be observed that the iron loss is lower with the rotor open-circuited and stationary than when the rotor is short-circuited and running light near synchronism, even though in the former case the rotor iron is subjected to the impressed frequency. In such machines the tooth frequency losses are of the same order as the stator fundamental frequency losses, and the two should consequently receive equal consideration when the machine is being designed. An examination of the condition existing in a machine having either semi-closed or open slots will show that it is possible, when choosing the slots, to eliminate pulsation losses completely from either the stator or rotor, but not from both. Surface losses will always exist to some extent in all machines.—*Electrician* (*England*), Sept. 7, 1923.

Heat Applications and Material Handling

Material-Handling Problems in Pier Design.—C. R. THOMPSON.—A review of the proceedings of several material-handling symposiums held by the A. S. M. E. to discuss material handling in its relation to port development. It discusses control and operation of facilities, local conditions, bulk and miscellaneous cargoes and tracks.—*Mechanical Engineering*, September, 1923.

Electric Heating Pad.—A. SCHERBIUS.—This electric heating pad is a bimetallic thermostat with an automatic break contact embedded in the pad itself. A special heating coil, separated from the main heating unit, controls the thermostat, so that a positive and fully reliable regulation of the heating-pad temperature is obtained. This arrangement, in connection with an additional fusible link of low melting alloy, will, it is asserted, prevent the danger from fire common to existing pads. A universal pad with two heat-controlled thermostats and two fuses is also described. This can be connected without any adjustments to either 110-volt or 220-volt systems, reaching with either voltage the same final temperature. The pad last mentioned is of particular advantage to the traveling public.—*Elektrotechnische Zeitschrift*, Sept. 13, 1923.

Electrophysics, Electrochemistry and Batteries

Recent Progress in the Production of Ozone with High-Tension Discharges.—F. E. HARTMAN.—The author deals with the production of ozone by the so-called silent discharge. Data are given which show that the energy density of an ozonizer is a straight-line function of the cycles and that the yield of ozone is a straight-line function of the energy density at atmospheric pressure. It is further shown that ozonizing at high gas pressures is conducive to better cooling of the electrodes, thus making it possible to produce high concentrations of ozone with high energy densities. A relationship is also established between high gas pressures and the efficiency of an ozonizer.—*Paper presented before the American Electrochemical Society at Dayton, Ohio*, Sept. 27-29, 1923.

Traction

Turbo-Electric Condensing Locomotive.—An experimental locomotive of the above type has been under development in England for the past two years and has been submitted to numerous stationary and road tests. The locomotive is 69 ft. 7½ in. long over all, weighs 293,000 lb. in working order and has a rated traction force of 22,000 lb. It consists of two sections connected together by a universal joint, each section carried on three pairs of driving wheels and a two-wheel truck. The front section contains the boiler, under which is placed the main turbine and generator and the auxiliary turbine and generator, while the back section contains the condenser with fan, water tanks and coal bunker. The main turbine is of the impulse type and contains nine stages, the mean blade diameter being 36 in. It is designed for a steam pressure of 200 lb. per square inch superheated 300 deg. F. and exhausting to a vacuum 27½ in. The turbine drives a three-phase generator rated at 890 kw. at 3,600 r.p.m. and 600 volts.—*Railway Age*, Oct. 13, 1923.

Suburban Electrification at Melbourne, Australia.—Important improvements in train service and operating expenses have resulted from the electrification of the extensive suburban system of the Victoria Government Railways at Melbourne, Australia. Notable features in this new installation are the operation of suburban electric and main-line steam traffic on the same lines, the high speed and better service at lower cost (resulting in increase in traffic and revenue) and the adoption of through routing instead of having all trains terminate at the city. All trains have American motor, electrical and brake equipment.—*Engineering News-Record*, Oct. 11, 1923.

Telegraphy, Telephony, Radio and Signals

Wireless Direction Finding in Steel Ships.—C. E. HORTON.—The problems of direction finding which are peculiar to ships are discussed. A method of observing the action of a ship on wireless waves is given, as well as means of correction for the deviations so produced. The precautions to be taken in the calibration of a ship direction finder are indicated. A laboratory method of investigating the action of metal structures is described, and the use of multiple-aerial systems is considered.—*Journal of Institution of Electrical Engineers* (*England*), September, 1923.

Three-Electrode Tubes Used for the Production of Continuous Waves in Radio Telegraphy.—M. LATOUR and H. CHIREIX.—The theoretical limiting efficiencies of vacuum-tube oscillators for various wave forms of plate current are mathematically investigated and discussed.—*Proceedings of the Institute of Radio Engineers*, October, 1923.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Supreme Court to Rehear West Virginia Gas Case

On the petition of the Attorney-General for West Virginia, the United States Supreme Court has taken a step very unusual with it in ordering a rehearing on Nov. 19 in the case in which the court by a six to three decision last June (see ELECTRICAL WORLD, June 16, page 1429) held that West Virginia could not refuse to supply industries and municipalities in Pennsylvania and Ohio with natural gas. The June decision said, in effect, that natural gas is a lawful article of commerce, that its transmission from one state to another for sale and consumption is interstate commerce, and that therefore West Virginia cannot refuse to sell natural gas to Ohio and Pennsylvania consumers.

From this decision Justices Holmes, Brandeis and McReynolds dissented. The bearing of the case on interstate transmission of electrical energy is obvious.

Drought in the South Hits Hydro-Electric Plants

Drought continues in the Southeastern States. The curtailment program of the Southern Power Company, which became effective on Oct. 22, was still in effect at last reports, with no immediate prospect of its abandonment. There has been some rainfall, but not enough to have any appreciable effect on the situation. The Piedmont Power & Light Company of Burlington, N. C., has bridged the situation for industrial users of Southern Power Company power in that city by furnishing power from its steam plant on the day curtailment is effective there.

The drought has also played havoc with the production of hydro-electric power at the plants of the Tennessee Electric Power Company, and as a consequence the company is operating its three steam plants at Parksville, Nashville and Knoxville at almost full capacity. These plants are producing 43,000 kw. The water plant at Hales Bar is down to 12,000 kw.

The Tennessee Electric Power Company is now indirectly furnishing power to the Carolinas, and in addition to this about 100,000 kw. is being furnished nightly to the Georgia Railway & Power Company.

Officials of the last-named company say that it is not likely any curtailment of industry will result in Georgia, the company being well equipped to supplement the hydro-electric power with steam power from its own plants and by means of interconnection. The rainfall in the district this year has been about 10 in. less than last year at this time, and in addition to this industries have been operating on a much more extensive basis, with the result that there has also been a considerably greater demand for electric power.

No Move on Diamond Creek

Federal Commission Again Postpones Action, Leaving Girand Project in Statu Quo

NO LICENSE will be issued to James B. Girand at this time by the Federal Power Commission, but the priorities attaching to this application for a license covering the large development at Diamond Creek on the Colorado River will remain in force.

In agreeing to postpone action on the license, it is believed that Secretary Weeks, who held the deciding vote, was influenced by the assurances of Senator Ashurst of Arizona that the Colorado River compact would be ratified by Arizona when the Legislature meets in special session in January. Secretary Wallace was in favor of granting the license immediately. Secretary Work was for indefinite postponement. Before taking final action it is understood the matter was laid before the President. Mr. Coolidge, it was said, was not disposed to intervene in the matter. The decision of the commission not to grant the license at this time does not mean, it is believed, that it may not take action should it become apparent that Arizona will refuse to renew Mr. Girand's state permit, which expires Dec. 26.

Owing to the fact that much weight has been given the opinion of R. E. Caldwell, the State Engineer of Utah, to the effect that Arizona will not ratify the compact if the Girand license is granted, Mr. Girand insists that Mr. Caldwell's opinion should be considered as an interested one. He points out that Mr. Caldwell is the engineer for the New York interests that are financing the Paradise Verde project north of Phoenix. While that venture is classed as an irrigation project, it includes the development of 90,000 hp. of hydro-electric energy. The logical market for that power is at the Arizona copper mines. Evidently no reflection on Mr. Caldwell is intended, but Mr. Girand feels that Mr. Caldwell's interest in securing a market for the power to be developed on the Verde would tend to warp his judgment.

High-Tension Line to Be Built from Keokuk to Galesburg

A double-circuit, steel-tower transmission line, carrying 66,000 volts, will be built from the big power dam at Keokuk, Iowa, to Galesburg, Ill., by the Illinois Power & Light Corporation, officials of the company announced this week. An extension of the line, carrying 33,000 volts, will also be built from Galesburg to Galva, a distance of 23 miles, making the entire length of the new line development 96 miles.

The new line will start at the dam owned by the Mississippi River Power Company at Keokuk. It will run up the Iowa side of the Mississippi River to Fort Madison, cross the river at this point and then extend in a northeasterly direction to Galesburg, following generally the main line of the Santa Fé Railway. The Galesburg power plant of the company is now up to its full rating of 4,500 kw. The new line will be capable of increasing its capacity to 10,000 kw., sufficient, it is believed, for the next ten years. The Galesburg and Galva power houses will be kept intact and used as standby plants. The improvement will cost $1,250,000.

Feather River Project's Ultimate Capacity 202,000 Hp.

The development program for northern California laid down by the recently organized Feather River Power Company includes six power plants and five large reservoirs on the Middle Fork of the Feather River and its tributaries and eventually will develop 202,000 hp. minimum output of electrical energy and provide irrigation for between 75,000 and 100,000 acres of land as a by-product of the power feature. To accomplish this will necessitate the building of about seven constant-angle arch dams and two multiple-arch dams. Lars R. Jorgensen holds the permit from the Federal Power Commission for the first power house and the reservoirs for the initial development. Two of the reservoirs probably will be completed during 1924, and construction on the first power house is to begin early in 1925.

The first power plant will generate 62,000 hp. from 942 ft. of effective head, 3½ mi. of tunnel, a diversion dam and about an eighth of a mile of pressure pipe from the forebay to the power house. This will be known as the Bean Creek power plant and will be built about 18 miles above Oroville.

Investment Bankers Meet

Need of Uniform State Regulation of Utilities in Security Holders' Interest Emphasized

THE need of uniform laws for the state regulation of public utilities was dwelt upon in the report of the committee on public service securities made at the Investment Bankers' Association convention at Washington on Tuesday, Oct. 30, by Henry R. Hayes of Stone & Webster, and it was recommended that the association urge, wherever lacking, that the state commissions be vested with authority over the valuation, rates, services and capitalization of privately owned plants and that there be published full financial reports of operation.

Pointing out that investors are disposed to withhold funds from business affected by "purely political" agitations, the committee said that such a situation "cramps a utility and the public is eventually not adequately served." "It has become more evident," the report added, "that a development of local sales of investment securities by operating companies direct to users of service will be helpful in preventing such unfair political attacks."

"When administered with the broadest powers and in a judicial manner, state-wide regulation of public utilities has been conclusively proved," the committee maintained, "to afford the best guarantees which investors can have in this country for a maintenance of that integrity of investment necessary for a ready flow of money into the business."

The report outlined the expansion of the public utility business in the last year and pointed to the sale within the last two and one-half years of nearly $2,500,000,000 in bonds, notes and stocks. This expansion, it said, was continuing. The task of raising funds for public utilities, the committee found, "has been made difficult because of the general systems of taxation throughout the country."

"Happily," the report continued, "in the interests of the industry and the public served, there is evident to a marked degree a steady broadening of the market for utility securities. It is noticeable in two ways—first, in an increased demand from institutions such as savings banks and insurance companies which gather in the small savings of the people; and, second, in the last three years especially, by sales of securities to the extent of many hundred millions of dollars direct by companies to the users of utility service."

The report drew attention to the rapid growth of the electrical industry, dwelling on its tendency to leap state boundaries by means of interconnected and superpower systems.

Secretary of Commerce Hoover spoke at the banquet on Wednesday evening, urging the investment bankers to find the money for forwarding electrical interconnection. The function of the investment banker, he said, is to find money for the advancing equipment of the nation. It is the duty of the engineer to bring the case before the investment banker.

Osgood and Skinner A. I. E. E. Presidential Nominees

C. E. SKINNER and FARLEY OSGOOD have both been placed in nomination by petition for president of the American Institute of Electrical Engineers for the presidential year 1924-25. Both Mr. Skinner and Mr. Osgood are well known in Institute circles and both have a record of accomplishment and service to the Institute to their credit.

FARLEY OSGOOD

C. E. SKINNER

C. E. SKINNER is best known as the director of research of the Westinghouse Electric & Manufacturing Company, which position he held for a great number of years. He recently became assistant director of engineering, devoting most of his time to the work of standardization both in America and internationally.

Mr. Skinner is a native of Ohio, born in 1865, and is a graduate of the Ohio State University. He has been with the Westinghouse organization ever since graduation, and his record there is one of continuous accomplishment. It was he who organized the research division in 1906. Mr. Skinner is a fellow of the American Institute of Electrical Engineers and has represented the A. I. E. E. on the International Electrotechnical Commission, having been chairman of the American delegates to the Brussels meeting in 1920. He also has represented the Institute on the American Engineering Standards Committee, the Engineering Council and the American Engineering Council. He is a member of the Franklin Institute, the American Technical Society and the American Society for Testing Materials. He was a member of the National Research Council in 1917 and 1918. In Institute activities he has served on the following committees: Edison medal, editing, education, electrophysics, executive, public policy, research, safety codes, standards. He was a manager of the Institute in 1915-1919 and vice-president in 1919-1920.

FARLEY OSGOOD is best known as an operating man, he having been for the last six years vice-president and general manager of the Public Service Electric Company of New Jersey. Mr. Osgood was born in Boston in 1874 and was graduated from the Massachusetts Institute of Technology in 1897. He spent five years with the American Telephone & Telegraph Company and then became chief engineer and general manager of the New Milford Power Company in Connecticut, four years later becoming general superintendent of distribution for the Public Service Electric Company. His advance in that organization was rapid.

Mr. Osgood is a fellow of the A. I. E. E. and has always been active in association work. He was a representative of the A. I. E. E. in the formulation of the National Electrical Code. He has served as chairman of the New York Section and also was manager of the Institute in 1911 to 1914 and vice-president from 1914 to 1916. In addition, he has served on the following committees: Standards, Edison medal, overhead and underground line construction, executive, finance, joint power - factor and safety codes (chairman). He has also been active in N. E. L. A. committee work.

According to the Institute procedure, the membership at large will vote on nominations next spring.

Death of Charles P. Steinmetz

Career of Internationally Famous Engineer Is Suddenly Ended at His Schenectady Home—His Writings and Inventions—Romantic Incidents of His Life

Charles P. Steinmetz

ANNOUNCEMENT of the sudden death from heart trouble at Schenectady, N. Y., on Friday morning, Oct. 26, of Charles Proteus Steinmetz came as a shock not only to the men of the electrical industry but to the adoptive nation of which he had become an outstanding citizen. He had a week or two before returned, somewhat exhausted, from a trip to the West, where he had been greeted with enthusiasm in half a dozen cities and had participated in the Pacific Coast convention of the American Institute of Electrical Engineers.

To the great public, familiar through scores of newspaper articles with the romantic incidents in his life, Dr. Steinmetz was the "electrical wizard," the crippled and penniless German immigrant, passing with difficulty the United States inspectors, who rose to be a sort of diminutive Jove, enthroned in an Olympian laboratory, launching thunderbolts at will, emitting widespread prophecies of future electrical elysiums, in supposed receipt of a fabulous salary, and yet clinging doggedly to the Marxian social philosophy to which a too practical devotion had driven him from his native land, and ready at any time to break a lance for socialism or run for office on its ticket.

To technicians and engineers, on the other hand, he was the mathematical expert, the accomplished chemist, the brilliant electrophysicist whose reputation had spread wherever science has its votaries, and yet withal the practical electrical engineer with about two hundred patents and many indispensable treatises to his credit. His inventions are not, to the lay mind, sensational, like Edison's. His books are not for the multitude. He had the gift of popular exposition—as was evidenced only a year ago when he published his last work, four lectures on the Einstein theory, portions of which contained possibly the clearest explanation of that hypothesis and of non-Euclidean geometry ever presented to lay readers, though the author soon began joyfully to thread a mathematical labyrinth where only the learned could follow—but he wrote in the main for technical scholars.

His Technical Career

To the "human interest" of his career, with the emphasis put on episodes and incidents perhaps slightly apocryphal, the daily newspapers all over the land have done full justice. The story of his long connection with and splendid accomplishments for the electrical industry remains to be told. It can here be recounted only in brief.

Charles P. Steinmetz was born on April 9, 1865, in Breslau, Germany. His father was not without means, and young Steinmetz received a thorough scientific training in his native city, in Berlin and in Zurich, Switzerland. Electrical science was then in its infancy, but Steinmetz mastered what of it there was, studying besides mathematics, chemistry, physics, mechanical engineering, astronomy and even medicine.

When he emigrated to America in 1889 he was, perhaps as one result of his socialistic activities, dependent entirely on his own exertions, though he bore with him a letter of introduction from the editor of the *Elektrotechnische Zeitung*. He soon found employment with the Osterheld & Eichemeyer Manufacturing Company of Yonkers, N. Y., first as draftsman, then as electrical engineer and designer, and finally on research work in charge of the Eichemeyer laboratory.

With the absorption of the Eichemeyer interests by the General Electric Company, Steinmetz joined the latter and was attached to the calculating department in Lynn, Mass. On the transfer of General Electric headquarters to Schenectady in the spring of 1894 he organized and took charge of the calculation and design of the company's apparatus and also interested himself in its research and development work. For virtually all of the thirty years of his connection with the General Electric Company he was its chief consulting engineer, for much of that time in charge of vast and intricate work.

His Hysteresis Research

How rapidly Dr. Steinmetz was able, concurrently with the acquisition of the English tongue, to master the new art and science and to keep pace with its phenomenal growth is shown by the fact that in 1890, a year after his arrival in America, he was making hysteresis tests and designing a single-phase commutating motor. In December of that year he published "Notes on the Law of Hysteresis" in the *Electrical Engineer*. In January, 1892, and again in September, he read papers on hysteresis before the American Institute of Electrical Engineers and was seen to be a coming man.

Early in his career Dr. Steinmetz was appointed professor of electrical engineering at Union College, in Schenectady, a post which did not involve the severing of his relations with the General Electric Company. Later his title was changed to professor of electrophysics, and this chair he held up to the day of his death.

As a writer and an instructor he was equally at home in pure and in applied science, and no one did more than he to bridge the gap between them. Harvard granted him an honorary A.M. in 1902, and Union an honorary Ph.D. in 1903. Other honors that fell to his lot were the presidency of the A. I. E. E. in 1901-2 and the presidency of the Illuminating Engineering Society in 1915-16. He was a member of many other engineering and technical societies and always ready to do his share in their work.

His inventions were concerned largely with the transmission of power and the design of alternating-current machinery, although they also covered the magnetite-arc and other electric lamps, as well as elevator motor appliances and electrically propelled vehicles. Smoke elimination processes and similar matters of this practical sort shared his attention with research into transient phenomena, development of the symbolic method of alternating-current calculations and other abstruse occupations. While out in the open air he is said to have solved difficult problems by mental computation without pencil and paper.

Dr. Steinmetz was the author of the following books, all classics in their field and recognized college texts: "Theory and Calculation of Alternating-Current Phenomena," 1897; "Theoretical Elements of Electrical Engineering," 1901; "General Lectures on Electrical Engineering," 1908; "Theory and Calculation of Transient Electric Phenomena and Oscillations," 1909; "Radiation, Light and Illumination," 1909; "Electrical Engineering Mathematics," 1910; "Electric Discharges, Waves and Impulses," 1911; "Theory and Calculation of Electric Circuits," 1917; "Theory and Calculation of Electrical Apparatus," 1917. The dates given are those of the first editions. He was, in addition, the author of whole series of papers and records of investigations and of many articles for the technical press, some of which first appeared in the ELECTRICAL WORLD.

Proof of Dr. Steinmetz' versatility is found in his additional authorship of a work in German on "Astronomy and Meteorology" (1889), of "America and the New Epoch" (1916) and of the lectures on the Einstein theory already mentioned. He was in demand as a popular lecturer on varied topics. He became president of the Schenectady Board of Education in 1912 and of the Schenectady Common Council in 1916. He took delight in nature study and the culture of plants and was an ardent canoeist.

FUNERAL CEREMONIES

Many hundred persons viewed Dr. Steinmetz' body as it lay in state at his home or gathered at the cemetery on Monday afternoon, when it was interred. The services themselves, in accordance with his character, were of the simplest description. They were held under Unitarian auspices and attended only by relatives by blood or adoption and a few intimate friends. The honorary pallbearers were Chairman Owen D. Young, President Gerard Swope and Honorary Chairman E. W. Rice, Jr., of the General Electric Company, President Charles A. Richmond of Union College, Dr. Ernst J. Berg and Lieut.-Gov. George R. Lunn. Five minutes of silence was observed at all the plants of the General Electric Company in Schenectady and elsewhere.

Tributes to the Man and the Engineer

Leading Members of the Electric Fraternity Estimate the Achievements of Dr. Steinmetz and Express the Sense of Loss His Associates Feel

IT WOULD be impossible to print more than a few of the tributes to Dr. Steinmetz as a man, a scientist and an engineer that his death has called forth. Those that follow, prepared for the ELECTRICAL WORLD, will be of especial interest to its readers.

From **Herbert Hoover,**
Secretary of Commerce:

"The death of Steinmetz marks the passing of an outstanding figure in the world of electricity. He combined the imagination of genius with an uncanny ability to visualize practical applications resultant therefrom. His mathematical reasoning broke the path for many of the advances in electrical engineering in recent years and solved problems that were vital to the progress of the industry. In his writings he has left engineers a heritage of mathematics that will endure, and as a man he has set us all an example of physical courage and of devotion to our life work."

From **E. W. Rice, Jr.,**
Honorary Chairman of the Board, General Electric Company:

"Steinmetz was a prolific inventor, a skilled mathematician, a trained engineer and an inspiring teacher. Our generation has produced men who have equaled or excelled him in some one of his fields, but no one has arisen who to such a superlative degree combined the qualities of an inventor, mathematician, engineer and teacher. His most important scientific and mathematical contributions to the electrical industry may be regarded as the investigation of magnetism, especially the determination of the law of hysteresis, the development of a symbolic method of alternating-current calculations and researches in the general field of electrical transients. Of his inventions, which are set forth in some two hundred patents, perhaps the most important are the induction regulator, a method of phase transformation (as from two-phase to three-phase) and the magnetite-arc lamp. He possessed a marvelous insight into scientific phenomena and had unequaled ability to explain in simple language the most difficult and abstruse problems. He was patient, sympathetic, cheerful and ever willing to share his great gifts with all those who sought his advice."

From **Elihu Thomson,**
Consulting Engineer, General Electric Company, Lynn, Mass.:

"Dr. Steinmetz came into our organization thirty-five years ago, and from the start showed very high and exceptional ability in applying mathematical principles to electrical problems, such that he became the recognized leader in that field all over the world. His unflagging industry is seen in the many papers and books from his pen embodying his original studies in this field. His loss will be severely felt in the scientific and engineering circles of the electrical world. We who have known him intimately and were in a position to recognize his great and exceptional ability as an investigator and teacher will best understand the vacancy in the ranks which has been created by his unexpected death."

From **Prof. Harris J. Ryan,**
President American Institute of Electrical Engineers:

"Through life from early youth Dr. Steinmetz was a profound student of the sciences, industries, linguistic arts and humanities. He worked constantly for their co-ordinated understanding in preparation for the solution of problems defined for progress. Through a decade he led the advance of electrical engineers to the modern understanding of the electric circuit, the transformer, induction motor, alternator and high-voltage phenomena. Dr. Steinmetz assisted his brother engineers to an untold degree by his books, papers and discussions, by his profoundly intelligent vision and by his example of persistent, ably directed enthusiasm."

From **A. E. Kennelly,**
Professor of Electrical Engineering, Harvard University:

"Dr. Steinmetz was one man in many millions in his unique personality and extraordinary comprehension of both theoretical and applied electricity. He was a great genius, thinking and acting in his own peculiar way, blessed with a keen sense of humor and of many-sided interests. The best of Steinmetz appears in his professional papers and discussions rather than in his books. The breadth of his understanding resembled that of Lord Kelvin. Contrary to a widespread impression, Steinmetz' great mathematical powers were subordinated in his writings to the use of comparatively simple mathematics. It was a hopeful circumstance that his keen mind had been led to study the pressing problems of high-voltage cable design and operation with due comprehension of their importance to the central-station industry, and the loss of this rare being leaves a gap which cannot be filled in the ranks of great men."

From **Charles F. Scott,**
Professor of Electrical Engineering, Yale University:

"Steinmetz was an extraordinary man from every viewpoint. He had a profound influence in the national organization of his profession. His presidency of the American Institute of Electrical Engineers a score of years ago inspired new life and interest; it was the beginning of a rapid growth in membership and in activity. Not only his administration of its affairs, but the many notable and fundamental technical papers he contributed, the marvelously lucid and clarifying summary which he often gave to audiences confused by abstruse papers and discussions, his discriminating counsel in the early years of the standards committee —all this and more make him the outstanding member in the life of the Institute."

From **S. W. Stratton,**
President Massachusetts Institute of Technology:

"Dr. Steinmetz was perhaps the ablest man in America in theoretical electricity. His great mathematical talents were combined with an insight into engineering that enabled him always to keep his feet upon the ground. He contributed richly to research, espe-

cially in the field of high-voltage phenomena."

From **R. A. Millikan,**
Director of Physics, California Institute of Technology:

"The passing of Dr. Steinmetz is a great loss to the electrical industry of the world. He was one of the few electrical engineers who understood the importance of the application of modern mathematics and physics to engineering problems. He has performed a great service in impressing these values, through his books and his lectures, upon the younger generation of American electrical engineers. In addition, Dr. Steinmetz was extraordinary in his breadth of human sympathy, his devotion to ideals and in his continual effort to improve human society. America and the world lose irreparably by his death."

From **Dugald C. Jackson,**
Consulting Engineer, Boston:

"One of the most trenchant and fascinating minds in electrical engineering was that of Dr. Steinmetz. He showed great originality in methods of attack upon problems, accompanied by remarkable clarity and effectiveness in the presentation of points. He had very unusual keenness of judgment upon the engineering value of inventions. Many patents were taken out by him, but his work as a whole dealt with the broader problems of electrical engineering. Our profession owes the fundamental analysis of machine design by vectorial methods to Steinmetz's Institute paper of 1892, and to his championship of three-phase distribution the electrical industry is greatly indebted. His was a master philosopher's mind in electrical science."

From **B. A. Behrend,**
Consulting Engineer, Brookline, Mass.:

"Dr. Steinmetz had a great methodical mind, without, however, a versatile imagination. He was less of an originator than a teacher. His great encyclopedic textbooks show the consistent systematic application of one method to the phenomena of electricity. He became the foremost instructor and guide to the great class of official teachers at our colleges, and justly will this achievement be remembered as one of his greatest next to the ever-stimulating influence of his personality."

From **F. B. Jewett,**
Vice-President Western Electric Company and Past-President A.I.E.E.:

"Dr. Steinmetz exhibited an untiring and almost incredible energy in making concretely effective the workings of his fertile brain and his vivid imagination. Throughout practically his entire life in America he was looked upon as one of the outstanding leaders in the field of electrical research. Because of the fact that his scientific interests were so varied and catholic it is difficult for his contemporaries to appraise justly Dr. Steinmetz's works. It seems clear, however, that among his many contributions to electrical engineering his work in adapting simplified mathematical tools to the needs of a new and complex art alone is sufficient to entitle him to a place in the front rank. He did much to raise the Institute to its present high place as one of the great professional engineering societies of the world. His work in this connection was never primarily that of an organizer of other people's activities. It was always that of a true scientist and engineer who by performance and precept worked ever to raise the standard of technical excellence in his chosen profession."

From **B. G. Lamme,**
Chief Engineer Westinghouse Electric & Manufacturing Company:

"I deeply regret the loss of Dr. Steinmetz as a personal friend and because his death means the passing of a brilliant and analytical engineer. He was a very able man who contributed much to the electrical industry. He was a witty, sociable man, quite human in his dealings with his fellow men. The public, to which he was known as a man of mystery, would have found as I did in personal contact a real human being. He and I entered the electrical business within a month of each other in 1889, at the start of what engineers call the analytical period, when mathematical analysis took the place of cut-and-try experiment. His greatest fame was achieved during this period of rapid electrical expansion, during which he contributed greatly to scientific analysis of electrical phenomena. Unlike many brilliant engineers, he left a record of his work in his numerous writings, so that his contributions to science will live in engineering journals. His keen mind was nowhere more clearly displayed than in these contributions."

From **Martin M. Foss,**
Vice-President McGraw-Hill Book Company:

"To those who have known the range of Dr. Steinmetz' activities and accomplishment it is a twofold marvel that he was willing to devote so much time to the production of new books and that he faithfully and constantly revised the older works so that they might stand always, as they do today, ahead of present-day practice and in the van of theoretical research. Dr. Steinmetz clearly regarded his books in the same light as his technical researches. They were part of his professional activity. Their wide use as textbooks in this country and abroad, and especially the quantities used by Japanese universities, interested him greatly. Many of them have been translated into both French and German and so made available to engineers throughout the world."

Among personal tributes paid to Dr. Steinmetz at a meeting held under Socialist auspices in New York last Sunday was one from a close associate, a consulting engineer in the General Electric Company, D. B. Rushmore. Mr. Rushmore, in recalling incidents in the life of Dr. Steinmetz, said the dead inventor believed in a future life, was a very devout man, one of Schenectady's best citizens, a lover of children and had paid for the education of large numbers of young men and women.

Steinmetz as a Mathematician

By Vladimir Karapetoff
Professor of Electrical Engineering, Cornell

Dr. Steinmetz' mathematical mind corresponded more closely to the biblical man with one talent rather than to him with ten talents, in the sense that Steinmetz used comparatively elementary mathematics only, hardly ever beyond ordinary calculus and linear differential equations. But within these means he had complete mastery of the subject and endeavored to give exact or approximate quantitative relations in every problem that came within the range of his attention. In other words, whatever he knew of mathematics he used unstintedly and with remarkable skill for the benefit of the profession.

His mathematical fame rests rightly on the boldness and acumen with which he always picked out the salient features of a seemingly complicated phenomenon and wrote mathematical formulas expressing it. Nor did he ever lose sight of the physical nature of the phenomenon or of the relative order of magnitude of the quantities entering into it. Therefore, his results were usually correct, and, moreover, in his writings he almost always supplemented the general deductions by carefully selected numerical examples and curves, as a double assurance that his theory did work.

Because of his consulting connection with a large manufacturing organization he was often called upon to give an opinion or an estimate on rather complicated and untried propositions. He, therefore, developed a remarkable ability of quickly estimating the order of magnitude of "uncalculable" phenomena. It was an inspiration to hear him compute (even without a pencil) the probable voltage or frequency of a lightning stroke, the energy involved in a complicated short circuit, and so on.

Steinmetz's "Alternating Current Phenomena" was a pioneer book in which he gave the now universally used mathematical methods for use in computations relating to alternating-current circuits. Moreover, he used a terminology, such as "impedance," "susceptance," "admittance," etc., that has proved to be generally acceptable. Later he generalized these methods in several brilliant A.I.E.E. papers which resulted in his best work, "Transient Electric Phenomena and Oscillations," a monumental original treatise which will retain its value for many years to come.

Americans as a nation are not a mathematically inclined people, and, owing to poor teaching of mathematics in secondary schools, American engineers have been and still are timid and averse to the use of formulas. So much more credit is due to Steinmetz for keeping on the mathematical path, in spite of a comparatively narrow early circle of readers of his Institute papers, until by his persistence he has almost forced the younger generation of engineers to think in terms of his mathematics and of his terminology.

Protest Made Against Project on New River

Railroads and seven public utilities operating in the territory contiguous to the Virginia-West Virginia border have joined in a protest to the Federal Power Commission against issuance of a license to the West Virginia Power Company for its project on the New River, 5 miles from Hinton.

The commission has granted a preliminary permit with the statement that final action will depend upon a careful survey of the development to determine the effect upon topography of adjacent land. Plans filed by the power company include construction of a dam 140 ft. high which would form a lake extending several miles from Virginia. The Norfolk & Western, Chesapeake & Ohio and Virginian Railroads have asserted that this lake would overflow and irreparably damage their rights-of-way, and power companies already in existence assert that their sites would be submerged.

Electric Light Speeds up Plant Growth

In a six weeks' test just completed by the Westinghouse Lamp Company in co-operation with Peter Henderson & Company, seedsmen, at the Henderson proving grounds at Baldwin, Long Island, N. Y., the value of electric light for accelerating the growth of a variety of plants is reported to have been conclusively proved. Many of the specimens subjected to electric light grew during the test upward of twice the size of similar plants receiving daylight only and were considered by experts to be from fourteen to twenty-seven days in advance of normal growth. Of the plants selected for testing, flowers and vegetables having large leaf surfaces, such as lettuce and endive, responded most readily to the stimulating effect of the light. The tests indicate that electric light will be useful to florists and gardeners in forcing flowers for definite dates, such as Christmas and Easter.

Preliminary tests on forcing plants by the use of artificial light were conducted by the Westinghouse Lamp Company at Columbia University, under the auspices of Prof. Hugh Findlay of the department of agriculture of the university. The results on such plants as Boston fern, calla lillies, rose geraniums and others which are much in demand by florists were extremely favorable. In almost every case the plants grew taller, continued in bloom longer and were sturdier than those that did not receive the benefit of the artificial light.

Two Westinghouse 110-volt, 2-hp. farm-lighting plants were used in the Baldwin experiments to generate power, in order to bring these tests within the reach of communities where central-station power is not available as well as those where energy can be purchased.

October Utility Financing Active

ELECTRIC light and power public utility financing during the month of October reached a total of $64,414,500, a figure which more than doubles September's total and brings the total for the ten-month period to $570,203,900 as compared with $521,584,990 for the same ten-month period of 1922. The recovery from the summer slump was not unexpected in financial circles, where a reaction had been looked for even earlier in the fall. The rate of return yielded the investor advanced to 6.25 from 6.16 in September, and the largest single item was the $11,500,000 issue of the Southern California Edison Company offered at 98½ and yielding 6.12. Long-term issues continued to predominate, but a few short-term issues also appeared during the month.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN OCTOBER

Name of Company	Amount of Issue	Period, Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Queens Borough Gas & Electric Co. (N. Y.)	$2,000,000	30	Refunding mortgage gold bonds, series 1953	Additions	6	99½	6.05
Public Service Co. of Colorado	5,000,000	30	First mortgage and refunding gold bonds, series A	Construction and other corporate purposes	6	93	6.55
	2,250,000	10	Sinking-fund convertible gold debentures	Construction	7	98½	7.25
Northern Ohio Traction & Light Co.	380,000	24	General and refunding mortgage gold bonds, series A	To reimburse for property expenditures	6	93	6.59
Continental Gas & Electric Corp. (Neb.)	1,000,000	25	Refunding mortgage bonds, series A	Additions	6	93½	6.63
Standard Gas & Electric Co. (Ill.)	2,500,000	2	Gold notes	To provide increased working capital	7	100	7
Toledo Edison Company (O.)	900,000	24	First mortgage gold bonds	To reimburse for property expenditures	5	90	5.78
Kentucky Utilities Co.	2,265,000	25	First mortgage lien gold bonds, series D	Construction and other corporate purposes	6½	98½	6.63
Pennsylvania Power & Light Co.	4,000,000	30	First and refunding mortgage bonds, series C	Construction and to reimburse for capital expenditures	6	99	6.07
Metropolitan Edison Co. (Pa.)	500,000	29	First and refunding mortgage gold bonds, series B	To reimburse for capital expenditures	6	98	6.15
Ottawa Light, Heat & Power Co., Ltd. (Ont.)	500,000	30	Refunding mortgage and collateral trust bonds		6	100	6
Western United Gas & Electric Co. (Ill.)	510,000	5	Collateral trust notes	To reimburse for additions	6	97.89	6.50
American Public Service Co. (Ill.)	$1,500,000	19	First lien gold bonds	To reimburse for extensions and expenditures	6½	96.80	6.80
Italian Power Co.	2,000,000	5	Collateral trust gold bonds, series A	Refunding and additions	6½	99	6.75
Consolidated Power & Light Co. (W. Va.)	1,039,500	20	First mortgage and refunding lien sinking fund gold bonds, series A	Refunding	6½	99½	6.50
Alabama Power Co.	6,000,000	28	First mortgage lien and refunding gold bonds	Additions	6	99	6.07
Southern Oklahoma Power Co.	160,000	19	First and refunding mortgage gold bonds, series B	Additions	6	92	6.75
Wolverine Power Co. (Mich.)	1,570,000	20	First mortgage sinking-fund gold bonds	Construction	7	100	7
Portland Railway, Light & Power Co. (Ore.)	2,000,000	24	First lien and refunding mortgage gold bonds, series B	Construction	6	92½	6.63
Houston Lighting & Power Co. (Tex.)	2,000,000	30	First lien and refunding mortgage gold bonds, series B	Extensions and other corporate purposes	6	98½	6.10
Southern California Edison Co.	11,500,000	20	Refunding mortgage gold bonds	Refunding	6	98½	6.12
Philadelphia Electric Co.	10,000,000	30	First lien and refunding mortgage gold bonds	Additions and extensions	5½	98½	5.60
Iowa Railway & Light Co.	1,000,000	9	First and refunding (now first) mortgage gold bonds of 1912	Additions	5	93	6
North Missouri Power Co.	300,000	3	First and refunding mortgage collateral convertible gold notes		7	100	7
Quebec Power Co.	3,540,000	30	First mortgage sinking-fund gold bonds, series A	Refunding and additions	6	95	6.38
Total	$64,414,500						

Power Board Activities

Numerous Licenses and Permits Granted—Plan to Facilitate Handling of Minor Projects

AT THE Oct. 22 meeting of the Federal Power Board a license was authorized for Hutton, McNear & Dougherty of New York City and San Francisco covering a 29,000-hp. project on Cascade Creek, 22 miles from Petersburg, Alaska. The power is to be used in the manufacture of pulp and paper. The license is conditioned upon a contract with the Forest Service for the purchase of timber.

Licenses covering minor projects were authorized as follows: Roy Carson, Mono Lake, Cal., covering a project at Silver Lake on the South Fork of Rush Creek in the Mono National Forest; Mount Reubens Mining Company of Grant's Pass, Ore., project on Reubens Creek in the Siskiyou National Forest; Southern California Edison Company, transmission line crossing a portion of the Angeles National Forest; Idaho Power Company, transmission line between Shoshone and Richfield, Idaho; Southern Sierras Power Company, transmission line in the Cleveland National Forest; Winino Mineral Springs Company, development on Salt Creek in the Cascade National Forest, Oregon.

To facilitate the handling of minor projects, the commission authorized the executive secretary to issue licenses for ten years covering projects with a capacity of less than 100 hp. Field officers of the three departments were authorized to issue licenses for ten-year periods covering projects of 40 hp. or less. If there is a possibility of the small projects conflicting in any way with a larger project, the license is to be limited to five years.

The license previously granted to the Freshwater Bay Lumber Company of Seattle was rescinded. The company had not complied with the condition to start work before May 31, 1923, on its project on Chichagof Island, Alaska. The application of the Utah Power & Light Company for a license covering its Mink Unit on Bear River was also rescinded, at the request of the company. Investigation had shown poor foundation conditions at the site. A new application will be submitted when it is known to what extent the plans must be changed.

PRELIMINARY PERMITS

Preliminary permits were authorized for Mary Ives Crocker and J. W. Preston of San Francisco, covering a project on the Mokelume River in Amador County, Cal.; for the West Virginia Power Company of Charleston, project on New River, 5 miles above Hinton, involving the erection of a dam 140 ft. high; for the Consolidated Gold Mines-Alaska, a Spokane company, whose project is on Archangel Creek near Wasilla, and for the Pigeon River Lumber Company of Wisconsin Rapids, Wis. The last-named permit was granted with the understanding that no license will be issued until the project has been approved by the authorities of the Dominion of Canada and by the International Joint Commission.

The permit of the Alaskan Development & Mineral Company was extended for one year, as was a permit granted to the town of Petersburg, Alaska, and a permit granted to the Pacific Power & Light Company of Portland, the last-named covering a project at the reclamation site on the Deschutes River in Oregon.

Merger of Kansas and Nebraska Companies Looked For

Purchase of the United Light & Power Company system by the Continental Gas & Electric Corporation and the transformation of the two into one of the most extensive utility systems in the Middle West looms as the result of the negotiation of a contract option by officials of the two companies last week. Consummation of the deal depends on the findings of the Continental's engineers and accountants.

The United system serves 150 towns and cities in Kansas and southern Nebraska and includes eighteen generating plants, several gas plants, ice plants and about 22 miles of electric interurban railroad. The Continental serves 175 towns and cities in Nebraska, Iowa, Missouri and Canada and has an extensive system of steam and hydro-electric generating plants and of transmission lines.

The two systems are now within 15 miles of each other at several points. If the purchase is completed, transmission lines will be constructed at these points, connecting the two companies' holdings into one great four-state electric system.

Electric Lines Club Discussion on Bare Wire

A general discussion of the possibilities of doing away with weatherproof line wire on primary circuits was the feature of the regular meeting of the Electric Lines Club at East Providence, R. I., Oct. 25, R. S. Hale presiding. The article by S. C. Lindsay, "Why Use Weatherproof Line Wire?" in the ELECTRICAL WORLD for Sept. 22, page 609, served as a text. No final decision was reached at the meeting, but it was the general opinion that new construction with ample spacing between conductors offers the most attractive field for the present application of bare wire; that weatherproof insulation offers some protection against short circuits by swinging contact, and that in handling weatherproof wire linemen should take the same precautions as in handling bare conductors, utilizing to the full safety devices of proved value.

The Electric Lines Club was founded to provide a forum for the discussion of field problems in distribution system maintenance by line foremen and superintendents in eastern New England.

Brief News Notes

Northwestern Ohio Light Company to Move Headquarters.—The general offices of the Northwestern Ohio Light Company will be moved from Lima to Delphos soon in order to have the offices, central supply station and chief power plant in the same location.

Dothan (Ala.) Municipal Enterprise Enjoined.—A permanent injunction has been granted by the Alabama Circuit Court, on the application of five prominent citizens of Dothan, forbidding the city of Dothan, Caldwell & Company of Nashville, Tenn., and the Brooks-Calloway Construction Company of Atlanta to proceed with the erection of a hydro-electric plant on the Choctawhatchee River, about 20 miles from Dothan, for which the voters of the city granted $750,000 in bonds in 1921. The court ruled that the sale of the bonds was illegal and that the letting of the contract was irregular.

Recent Achievements of Radio.—Among recently recorded achievements in radio transmission are the receipt in Melbourne, Australia, of remarkably strong signals from American amateur radio stations and the receipt on Santa Catalina Island, Cal., of a message direct from the McMillan Polar expedition, now ice-bound within 11 deg. of the North Pole. According to a press dispatch from Omaha, the Arctic explorers heard a church service from Council Bluffs, and a message from Capt. McMillan has been relayed from Prince Rupert, B. C., asking for more.

Charleston (S. C.) Electrical Show Scores Success.—The electrical show held under the auspices of the Electrical Contractors and Dealers' Association of Charleston, S. C., on Oct. 15-20, scored a success beyond the expectations of that body. About 12,500 persons visited the show, which was the first event of the kind ever held in Charleston. Valuable prizes were offered, and awards were made for attractive displays. The leading electrical manufacturing companies of the country were represented by exhibits, and Charleston manufacturing, jobbing and contracting firms supported the show enthusiastically.

Washington-Idaho Company Fights Against Foreclosure.—A fight is being waged in the federal courts of the State of Washington in behalf of the Washington-Idaho Water, Light & Power Company, which seeks to prevent the American Power & Light Company of New York City from foreclosing mortgages totaling a million dollars on the property of the former company. The Washington-Idaho company, which operates in Clarkston and Winlock, Wash., asserts its solvency, while the

plaintiff company—which last winter, the defendant says, purchased the 6 per cent and 8 per cent bonds of the Western utility and subsequently brought receivership proceedings in Massachusetts —claims that the Washington-Idaho company is in default.

Nebraska Power Company's Plans.—More than $3,000,000 is to be spent on improvements by the Nebraska Power Company of Omaha in the next eighteen months. The plans include a new central substation at Twentieth and Howard Streets, new "distribution headquarters," a substation at Twenty-third and Vinta Streets and various line extensions and other plant additions.

Equipping Boilers for Three Kinds of Fuel.—The Dallas (Tex.) Power & Light Company is going ahead with construction of the addition to its power plant in Dallas, which will cost in excess of $2,200,000, according to C. E. Calder, president of the company. The 15,000-kw. turbo-generator with the auxiliary equipment represents an outlay of $700,000. The boilers, four in number, are being equipped to burn coal, crude oil or gas, and the fuel that is the cheapest at the time will be used, Mr. Calder said. The cost of installing the boilers is $675,000. It is estimated by officials of the company that the new plant will be adequate to care for the needs of the city until 1926 or 1927.

Hagerstown Waiting for Decision on Municipal Plant or Central-Station Service.—Whether the people of Hagerstown, Md., shall float a bond issue of $300,000 for the erection of a new municipal electric plant or whether they shall purchase energy from the Potomac Public Service Company is soon to be determined by the Public Service Commission. The Potomac Public Service Company has made an offer by which it would furnish energy to Hagerstown cheaper than the city could manufacture it, but many of the taxpayers want a municipally owned plant regardless of the cheaper rate. As recounted in the ELECTRICAL WORLD of Aug. 4 (page 251), the Potomac company recently erected a modern switching station at Hagerstown to enable it to supply energy there from its new central station at Williamsport, Md.

Northern States to Control St. Anthony Falls Water Power.—The Northern States Power Company has purchased the Pillsbury interest in the St. Anthony Falls development at Minneapolis. In addition to the intrinsic value of this water power, it is a particularly important link in the Northern States Power Company's chain since it is near its load center. St. Anthony Falls is one of the most valuable hydro-electric sites in Minnesota, having a drop of 65 ft. and a capacity of 60,000 hp. Power now being developed at the falls furnishes energy for operation of the Pillsbury flour mills, which have a connected load of 32,000 hp., and the Minneapolis Street Railway system, with a connected load of 22,000 hp. The rest of the power generated at the falls has hitherto been sold wholesale to the Northern States Power Company.

Wenatchee Line Goes Into Service.—The Wenatchee transmission line between the White River power station of the Puget Sound Power & Light Company and the Columbia River Valley, a total length of 120 miles, was placed in service on Oct. 14. The construction of this line was begun in July last year, and the first 100 miles was placed in service in May this year. Since then the White River plant has been enlarged and new transformers installed. The company has recently begun the construction of two 110-kv. outdoor substations at Cle Elum and Wenatchee, Wash., which will complete the entire high-tension distribution system in connection with the Wenatchee line.

Kickapoo River Project.—Another hydro-electric project will be developed and placed in operation in Wisconsin to cost at least a million dollars if the Wisconsin Railroad Commission approves the application of the Kickapoo River Power Company calling for the construction of a dam with a drop of 30 ft. across the Kickapoo River near Wauzeka, as well as a new power plant. The project is conceived primarily as a summer resort venture because the back water accumulated will form the only lake in that part of the state, with a total length of 10 miles and nearly a mile wide, but the plant when completed will develop 1,700 hp., and transmission lines will be erected, substations constructed and interconnections made with the hydro-electric plants at Gay's Mills, Soldiers' Grove, Readstown, Viola and La Farge, which are overloaded and have been forced to install auxiliary steam equipment.

Associations and Societies

Commercial National Section, N. E. L. A.—The general and executive committee sessions of this section's group meetings at Salt Lake City this month will be held on Nov. 22, not Nov. 21, as stated last week. They follow the bureau meetings on Nov. 21.

Electric Utility Men to Meet at Tulsa.—Nov. 15 will be the date of the second annual conference of the first district of the electric light and power division of the Oklahoma Utilities Association. The meeting will be held at Tulsa and will be representative of eastern and northeastern Oklahoma. S. J. Smallwood, president of the Hominy Ice Light & Power Company, is chairman and H. N. Bates, district manager of the Public Service Company of Tulsa, is secretary of the first district organization. Leading representatives of the industry in the state will take part.

Cincinnati Electric Club Reorganized.—At a reorganization meeting of the Cincinnati Electric Club held on Oct. 24 these officers were elected: President, M. A. Curran; vice-presidents, Major Sam D. Heed, J. A. Brett and Charles Beltzhoover; secretary and treasurer, P. G. Wondersmith.

Central Division, C. E. A., to Meet on Nov. 20.—A two-day session of the Central Division of the National Electrical Credit Association will be held at the Hotel La Salle, Chicago, Nov. 20 and 21. Various trade group conferences will be held on the following subjects: Experiences with the E. C. A. service, effectiveness of "Model Letter A," use of E. C. A. forms, collection troubles and cures, trade conditions, creative credit management, proposals of improvements in system and service, credit work and credit letters. President Shepard will make a broad survey of credit and collection conditions with respect to the entire electrical industry and will endeavor to determine wherein the N. E. C. A. meets these conditions and where it falls short.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

American Society of Agricultural Engineers —Great Northern Hotel, Chicago, Nov. 8-10.

Associated Manufacturers of Electrical Supplies—Engineering Societies Building, New York, Nov. 8. Frederic Nicholas, 30 East 42d St., New York.

West Virginia Public Utilities Association —Hotel Kanawha, Charleston, W. Va., Nov. 9-10.

Electrical Supply Jobbers' Association—Hotel Statler, Buffalo, Nov. 12-15. Franklin Overbagh, 411 South Clinton Street, Chicago.

Electrical Manufacturers' Club — Hot Springs, Va., Nov. 14-18. F. L. Bishop, Hartford Faience Company, Hartford, Conn.

Arkansas Utilities Association—Pine Bluff, Nov. 15-16. R. I. Brown, Little Rock Railway & Electric Company, Little Rock.

Electric Power Club—French Lick Springs Hotel, French Lick, Ind., Nov. 19-22. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Southeastern Division, N. E. L. A.—Hillsboro Hotel, Tampa, Fla., Nov. 19-22. Charles A. Collier, Georgia Railway & Power Company, Atlanta, Ga.

Commercial National Section, N. E. L. A.—Group meetings, Salt Lake City, Nov. 21-22.

Electrical Credit Association, Central Division—Hotel LaSalle, Chicago, Nov. 20-21. F. P. Vose, 1341 Marquette Bldg., Chicago.

American Physical Society—Ryerson Physical Laboratory, Chicago, Nov. 30-Dec. 1. H. W. Webb, Columbia University, New York.

American Society of Mechanical Engineers —New York City, Dec. 3-6. C. W. Rice, 29 West 39th St., New York.

National Association of Railway and Utilities Commissioners—Miami, Fla., Dec. 4-7. J. B. Walker, New York Transit Commission, New York City.

American Engineering Council (F. A. E. S.) —Washington, Jan. 10-11. L. W. Wallace, 26 Jackson Place, Washington.

American Institute of Electrical Engineers —Midwinter convention, Philadelphia Feb. 4-8. F. L. Hutchinson, 33 West 39th St., New York.

Commission Rulings

Company Ordered to Reimburse Customers for Equipment Necessitated by Change in Distribution System.—The New York Public Service Commission has directed the Plattsburg Gas & Electric Company to make certain payments to sixteen power users who incurred expense in making changes in their electrical installations when the company in 1921 made changes in its electrical distribution system. The company made adjustments with some of its customers, but declined to pay these sixteen claimants, alleging that it was not liable for the expenses which they had contracted.

Oregon Commission's Rules for Rural Electric Service.—As the outcome of a rehearing held at the request of certain electric utilities upon provisions of a commission order affecting rural extensions, and also upon certain provisions of an order affecting urban extension policy, the Oregon Public Service Commission consented to substitute for both orders a new set of extension rules embodying material modifications. The new rules prescribe that: (1) The operation percentage to be applied to the investment in extensions for which a customer pays should be confined to the actual cost of operation required by and pertaining to such kind of investment as controlling maintenance, superintendence and miscellaneous distribution expenses, but commercial utilization and other expenses not applicable to the operation of the portion of the extension covered by the excess investment should be excluded. (2) A total deficit percentage may be fixed without injustice to any utility charging customers for extension cost, in view of the fact that the extent of the development period is at best only an estimate of future growth. (3) A rule requiring a rural customer to pay only the excess cost of the investment in an extension and to pay monthly, in addition to the regular tariff rate, as a rural charge, the accruing carrying charges thereof, any subsequent development resulting in a refund of a proper proportion of the excess cost with a corresponding reduction of the monthly rural charge, is reasonable and reflects the actual development when it occurs. (4) A common development period may be used in computing charges to rural and city consumers for the excess cost of extensions when such period is not in excess of twelve years, but where it is impossible to comply with such a requirement for a common development period, the average development periods for the urban district should not be greater than eight years and the correspondingly much longer time for the development of rural districts should be as short a period as the prospective development thereof will permit.

Company Ordered to Restore Gas Service Discontinued Because of "Meter Jumping."—The Wisconsin Gas & Electric Company has been ordered by the Wisconsin Railroad Commission to restore gas service in a case where the meter was removed because it was found that a "by-pass" had been put in which prevented the meter from registering more than a part of the gas that passed through it. The company wished to make the payment by the customer of an estimated bill for gas not registered a condition precedent to restoration of service, but this the commission refused to permit, inasmuch as the customer and his family protested their entire ignorance of the existence of the "by-pass." The commission, saying that it was not the proper tribunal to decide whether or not a penal statute had been violated and that the consumer must be presumed innocent unless a proper court declared otherwise, said that to insist on the payment of the bill would be to presuppose guilt. The company was, however, authorized to collect from the customer the cost of disconnecting and reconnecting the meter.

What Constitutes Equitable Schedules?—Bills of electrical customers showing a large percentage variation in increase per kilowatt-hour of energy consumed under a new schedule are not conclusive evidence that the schedules are improperly constructed, according to a decision of the Board of Public Utility Commissioners of New Jersey in passing upon a complaint made by Louis Shapiro against the Consolidated Gas Company of New Jersey, which does an electrical business in Long Branch and other places. All costs of an electrical company are not accrued in strict relation to the number of kilowatt-hours consumed by the customers, but costs of service fall into three general classes—capacity-of-demand costs, customer costs and energy consumed. The board said: "It is apparent, therefore, that a very large portion of the charge to each customer will have no direct relation to the kilowatt-hours of energy consumed and that the fact that the cost per kilowatt-hour has varied so greatly among the different complainants has no conclusive evidential value. An illustration of this may be given by the customer charge of $1 per month made to commercial regular customers. If such a customer used 1 kw.-hr. of energy, the customer cost of $1 would increase by $1 the other kilowatt-hour costs of energy consumed. If he used 5 kw.-hr. per month, it would add but 20 cents per kilowatt-hour; if he used 50 kw.hr., it would add but 2 cents per kilowatt-hour, and if he used 100 kw.-hr. per month, it would add but 1 cent per kilowatt-hour. Short-time use of facilities requires larger costs per kilowatt-hour by reason of the lower base on which to distribute the fixed costs such as the customer costs above referred to." Schedules for residential and commercial electric lighting are not unusual and inequitable, the commission said, when based upon a variation of the Wright demand rate, in form similar to the block meter rate, but with the difference that the blocks are not determined by a fixed number of kilowatt-hours but by relating the customer's kilowatt-hours used to the customer's demand, making the blocks not energy or current blocks but load-factor blocks.

Recent Court Decisions

Excessive or Exorbitant Penalties Provided for Violation of Commission Orders Not Ground for Injunction.—That a violation of a rate-fixing order of the Louisiana Public Service Commission may involve an excessive or exorbitant penalty affords no ground for an injunction to restrain the enforcement of such order, according to a decision of the United States Court for the Western Division of Louisiana, in a suit brought against the commission by the receivers of the Texas & Pacific Railway Company, since the penalties are separable from the order of the commission, and the court is not required to pass judgment on the penalty provisions in advance of an attempt to enforce them. A preliminary injunction to enjoin the enforcement of a rate-fixing order of the commission may properly be denied where there is no conclusive proof offered to show that the rates provided are unreasonable or violative of either state or federal constitution. (200 Fed. 1008.)*

Only Arbitrary or Unreasonable Action Justifies Interference with Commission Decisions.—Declaring that only clearly arbitrary or unreasonable actions on the part of a state regulatory commission could justify the reversal or setting aside of its rulings by the courts, the Supreme Court of Louisiana declared, in Vicksburg, Shreveport & Pacific Railway Company vs. Railroad Commission: "In the case before us we see nothing arbitrary in the action of the commission, nor do we see therein anything so clearly unreasonable as to amount to arbitrary action. We do not think the constitution intended that all the details of operating a railroad should be justiciable in a court of law, and whoever appeals to the courts to set aside an order of the commission issued in good faith and after due hearing should come prepared, not to show by a mere preponderance of evidence that the commission may have erred, but even to show by a strong preponderance of evidence that the action of the commission is so clearly and grossly unreasonable as to be purely arbitrary." (96 So. 832.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Sir John Snell, the Chairman of British Electricity Commission

Sir John Snell, chairman of Great Britain's Electricity Commission, was born at Saltash, Cornwall, Dec. 15, 1869. For nine years after his graduation from Kings College, London, he was engaged in electric light and power work, chiefly with Crompton & Company at the Kensington Court and Notting Hill power stations and at Stockholm, Sweden. Sir John was appointed borough electrical and tramways engineer of Sunderland in 1896, which post he relinquished in 1906 to engage in private practice as a consulting engineer at Westminster, London. In 1910 he amalgamated with and became a partner of Preece, Cardew, Snell & Rider, consulting engineers, London. Nine years later he accepted the position of electrical adviser to the Board of Trade and chief electricity commissioner (designate). One year later he was appointed chairman of the newly appointed Electricity Commission.

SIR JOHN SNELL

Sir John Snell is a past-president of the Institution of Electrical Engineers, a member of the council of the Institution of Civil Engineers, a past-president of the Incorporated Municipal Electrical Association, a past-member of the main committee, past-chairman of the sectional electrical committee of the British Engineering Standards Association, a fellow of the American Institute of Electrical Engineers, a fellow of the Geological Society and a member of many other British organizations. During the war he devoted considerable time to very important national war committees dealing with engineering matters in Great Britain. Besides numerous articles in the scientific and technical press, Sir John Snell has written a book on "Distribution of Electrical Energy" and one on "Power-House Design."

General Guy E. Tripp, chairman of the board of the Westinghouse Electric & Manufacturing Company, who left for Japan early in October, has been decorated by the Japanese government with the Second Degree Order of the Sacred Treasure, one of the highest honors which can be conferred on a civilian foreigner. General Tripp's visit to the Far East is in connection with reconstruction work in cities destroyed by the recent earthquake.

E. S. Hight, an electrical engineer well known in the field in Illinois, has been made general operating engineer of the Illinois Power & Light Corporation. For a number of years he was chief operating engineer of the Illinois Traction Company, with headquarters at Peoria, Ill. He will be responsible for the efficiency and operation of the various power plants of the company he has just joined and will finish construction of the Topeka (Kan.) power house, the transmission line from Topeka to Atchison and the construction work under way at the Venice (Ill.) power house. His headquarters will be Chicago.

W. H. Ude has been appointed director of the newly organized public relations department of the Washington Water Power Company at Spokane, Wash. Mr. Ude has been in the transportation field for the past twenty-five years, having resigned as assistant general passenger agent of the Northern Pacific Railway to accept this new position. In addition to the public relations work he will have charge of the sale of company securities, a work which is already well under way, and beginning the first of the year a monthly magazine for employees will be issued by his department.

S. G. Gassoway became the assistant manager of the commercial department of the Oklahoma Gas & Electric Company on Nov. 1, according to an announcement of J. F. Owens, vice-president and general manager. Mr. Gassoway has been a pioneer in introducing electricity into the oil fields. Following his graduation from the University of California in 1904, he served with the General Electric Company at Schenectady, in the testing department and as construction engineer. From 1909 to the present time he has been identified with the oil industry. Mr. Gassoway is credited with installation of the first modern electric plant for oil-field drilling in California and is largely responsible for the development of the two-speed oil well and drilling motors which followed.

Dana R. Bullen Receives Promotion

At a meeting of the executive committee of the General Electric Company held Oct. 26 Dana R. Bullen was appointed assistant vice-president on the staff of the vice-president in charge of the sales of general apparatus and supplies.

Mr. Bullen will direct the relations of the company with all outside commercial, manufacturing and engineering associations and also individual membership in such organizations on the part of the company or its representatives, as well as undertake such additional executive duties assigned him as occasion requires.

D. R. BULLEN

Mr. Bullen first became identified with electrical interests in 1887, when he joined a construction gang at Webster, Mass., which was doing work for the Thomson-Houston Electric Company. He was soon transferred to Atlanta, and upon the opening of the Thomson-Houston office he became associated with its organization. He installed central-station equipment in Georgia, Florida and Alabama, and later took up sales work. In 1894 he organized the supply department at the Philadelphia office of the General Electric Company, into which the Thomson-Houston Company had been merged two years before. In 1900 he was made head of the supply department of the Boston office, and in 1904 was transferred to the general office at Schenectady, where he acted as assistant to J. R. Lovejoy, who at that time was manager of the railway, lighting and supply departments. Subsequently he was made assistant manager of the supply department and later manager, which position he occupied at the time of his recent promotion.

William Ungrodt, formerly connected with the Interstate Power Company at Cresco, Iowa, has recently been appointed to the staff of electrical service inspectors of the Wisconsin Railroad Commission. Mr. Ungrodt was previously associated for many years with

the Medford (Wis.) Light & Heating Company, whose service he left to go to Cresco.

W. W. Nichols, assistant to the president of the Allis-Chalmers Manufacturing Company, was elected president of the American Manufacturers' Export Association at the convention held Oct. 24-26 in the Waldorf-Astoria Hotel, New York City.

J. R. Lovejoy, a vice-president and director of the General Electric Company, who sailed from Vancouver, B. C., for Japan soon after the catastrophe, to assist in relief and reconstruction, will remain in that country for some time to promote rehabilitation, particularly of electrical projects. Mr. Lovejoy has for many years been interested in the foreign activities of the General Electric Company.

William F. Abely has been appointed credit manager of the Western Electric Company, Inc., Boston. Mr. Abely's service with the company covers about fifteen years, the past three of which have been spent as assistant manager in the New England territory. For ten years he was sales manager of the company with headquarters at Boston. He is one of the best known men in Eastern electrical supply jobbing circles and has worked untiringly for the upbuilding of the electrical industry through co-operation between its several branches.

C. S. Taylor has been appointed deputy engineer-in-chief and manager of the Shanghai (China) Municipal Electricity Department, succeeding A. H. Blagden, who resigned after twenty-one years' service. Mr. Taylor joined the department in 1913 and at the time of his promotion to deputy was holding the position of power engineer. He is a member of the Institution of Electrical Engineers (British) and also of the American Institute of Electrical Engineers.

Otto M. Rau, power specialist of Philadelphia, has been appointed in a consulting capacity to the staff of the Giant Power Survey for Pennsylvania, begun at Governor Pinchot's instance. Mr. Rau is to be in the Philadelphia office and to have charge of studies of power requirements, stations and transmission lines. He has done considerable rate and valuation work for public utility companies. His early experience was with the engineering department of the Edison General Electric Company, New York, whence he was assigned as resident engineer for the electrification of the street railways in Milwaukee. Later he was appointed chief electrician and general superintendent of the lighting and power department of the Milwaukee Electric Railway & Light Company. At the close of the war he became affiliated with Day & Zimmermann and more recently with the Stotesbury-Mitten management of the Philadelphia Rapid Transit Company, making special studies and investigations on superpower development and on pulverized fuels.

Frank Caspar Wagner, for the last twenty-eight years a professor of engineering at Rose Polytechnic Institute, Terre Haute, Ind., and acting president since the resignation of Dr. Philip B. Woodworth last May, has been elected president of the school by the board of managers. Professor Wagner was born in Ann Arbor, Mich., Oct. 5, 1864. After completing a high school course he entered the University of Michigan, from which he was graduated at the age of nineteen with the degree of master of arts. He began the study of engineering in the last years of his course at the university and also received the degree of mechanical engineer. He was an assistant instructor in physics in the University of Michigan and later entered the employ of the Thomson-Houston Electric Company of Lynn, Mass. He was sent by that company in 1888 to Mexico City, where he had charge of the company's engineering work. In addition to engineering work in Mexico City, he erected a street-lighting plant which was operated by water power at Pueblo. He resigned from the Thomson-Houston company in 1889 and took up experimental and university work at Ann Arbor, going to Terre Haute in 1895, as associate professor of steam and electrical engineering. His work has commanded attention throughout the country and he has been called on frequently to give expert testimony on engineering subjects in federal courts. He is a member of the A. I. E. E. and other scientific and engineering societies.

Obituary

George H. Moseman, for the past twenty-five years New England sales agent for the Weston Electrical Instrument Company, Newark, N. J., with headquarters at Boston, died suddenly Oct. 28 at his home in Brighton. Mr. Moseman was born at Bridgeport, Conn., about seventy years ago.

John Grimmins, assistant electrical engineer Malden (Mass.) Electric Company, was accidentally killed on Oct. 24 at the Everett substation of the company during an inspection trip of the New England System Operators' Club. He had removed the cover of an oil-switch cell and apparently put his hand within striking distance of a 22,000-volt circuit. The scheduled meeting of the System Operators' Club was terminated at once as a result of this fatality.

Leonard Eugene Voyer, assistant sales manager of the Edison Lamp Works in San Francisco, died of pneumonia on Oct. 27. Mr. Voyer entered the students' training course of the Edison Lamp Works of the General Electric Company on Aug. 1, 1911, and was connected with the Harrison (N. J.) office of that concern until 1914, when he went to the San Francisco office. At the time of his death Mr. Voyer was, in addition to being assistant sales manager of the San Francisco office, the street-lighting specialist for the San Francisco territory. He was a member of the San Francisco Bay Cities chapter of the Illuminating Engineering Society and also of the San Francisco Electrical Development League.

William J. Lloyd, general superintendent of the West Lynn works of the General Electric Company, died suddenly at Swampscott, Mass., Oct. 28. He was born at Philadelphia in 1866 and in 1883 was graduated from Lehigh University with the degree of mechanical engineer. For a time he was employed by the Westinghouse Electric & Manufacturing Company and about twenty-five years ago joined the General Electric organization. For five years he was at Rugby, England, with the British Thomson-Houston Company and later was at the Pittsfield (Mass.) works of the American organization. About fifteen years ago he was sent to Australia to establish the General Electric Company's plant in that country, being transferred to Lynn about three years later. He was promoted to his late post two years ago.

R. J. Morrisson, general manager of the Poughkeepsie & Wappingers Falls Railway Company, Poughkeepsie, N. Y., was found dead in his apartment on Monday evening, Oct. 29. The autopsy performed showed he had been overcome by carbon monoxide. Mr. Morrison had been in the public utility business since 1914. At the age of 17 he was secretary to Charles S. Banghart and purchasing agent when Mr. Banghart was vice-president and manager of the Binghamton (N. Y.) Railway Company. This position he held until May, 1917, when he enlisted. After his return from France he became assistant manager of the Augusta-Aiken Railway & Electric Corporation at Augusta, Ga., which position he held until the fall of 1920, when he was promoted to be private secretary to Mr. Pardee, president of the J. G. White Management Corporation. In October, 1922, he was made manager of the Poughkeepsie & Wappingers Falls Railway Company.

William M. Eaton of Jackson, Mich., died recently after a few days' illness. Mr. Eaton entered the public utility field in 1887, when he was made superintendent of the Jackson Gas Light Company. In 1903 he went to Grand Rapids in the capacity of vice-president and general manager of the gas company, but one year later he was selected to fill the office of vice-president and general manager of the Rochester Railway & Light Company at Rochester, N. Y. In 1907 he became affiliated with Hodenpyl, Hardy & Company, in which connection he served as a member of the operating committee for the gas and electric properties of the Commonwealth Power, Railway & Light Company. On Jan. 1, 1914, he resigned and returned to Jackson, retiring from active business life. Mr. Eaton was an ardent advocate of the interconnected power system and he supported W. A. Foote in his efforts to utilize the water power available in the Au Sable and Muskegon Rivers.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

High-Tension Standardization Paramount

Equipment Design Should Be a Manufacturers' Activity, Although Operators Can Advise Regarding Problems—Demand for Special Designs Expensive

By H. W. Young

President the Delta-Star Electric Company, Chicago

A SERIOUS situation has arisen in the high-tension equipment field which closely parallels that which formerly existed in the motor, turbo-generator and insulator fields. It is that too many central-station engineers are trying to design their own high-tension equipment or at least to specify the design that manufacturers shall develop. Some are directing more attention to this part of their work than they are to meeting operating problems by applying equipment already available. This is a stage through which other parts of the industry have passed with serious results. There was a period when engineers felt that they should write out specifications on practically all equipment used. Particularly was this so in the insulator field, where engineers would specify types of insulators according to individual ideas without a full knowledge of porcelain manufacture, and the porcelain manufacturers were, therefore, obliged to make a great variety of designs, many of which were failures for which the porcelain manufacturers were unjustly blamed.

However, as the manufacturers' business grew, the burden of these special designs was recognized, and they developed their own designs, declining to make freak combinations. The result is that insulator designs are now condensed to a few standards and the quality has been greatly improved.

A similar situation exists today in the high-tension equipment field. It is decidedly worse than it was five years ago, and although undoubtedly this condition will subside, as it has in other industries, there are many reasons why engineers should leave the specification of designs to the manufacturer. Among these reasons, for instance, if an operating engineer insists upon a special equipment he will very materially lengthen his delivery time, increase the cost of manufacture and, lastly, place a serious burden upon his system should hurried replacement be necessary. Few men care deliberately to design and lay out the specifications of an automobile when there are so many types for sale on the market now. This should be equally true in the high-tension industry, where there are enough manufacturers to meet all requirements necessary.

H. W. Young

Let the manufacturer worry about the design feature. That is his job. Of course, he is always open to suggestions which will enable him to meet operating problems more effectively, but a keen-minded public utility man now does not design turbines or motors. Then why should he deliberately specify special high-tension equipment? This industry has been in operation long enough to shake down to certain fundamental principles which have become standardized. Take, for instance, the average air-break switch. In laying out a substation why should an engineer call for a breaking distance between contacts of 16 in. when a standard 15,000-volt air-break switch can be obtained with 15-in. breaking distance If he wants the greater breaking distance, why does he not select the next higher voltage above that at which the switch is to operate in order to be safe? The 15-in. breaking distance is one which manufacturers have determined from long experience is best for the conditions intended. It is a function of the ratio of the breakdown distance between contacts with respect to the breakdown distance of the insulators to the supports. All this has become standardized with the manufacturer, whereas the central-station engineer and design engineer merely think they want something special.

Costly Design Work

All the specifications of high-tension design are results of long and tedious experimental work. How can an average central-station designing room hope to compete with a manufacturer who is continually designing high-tension equipment and who uses many engineers continually kept at this specific work? The special design work required is not only costly but pregnant with trouble. A manufacturer is in a much better position to rectify troubles before production than is the utility. And since the major problem of the utility is continuous operation, any outage due to special equipment has a decidedly annoying effect upon public relations in that community.

Since manufacturers have established a standard equipment which is adapted to meet all operating conditions, why should not the central-station designing men co-operate with these manufacturers and use their equipment? Results from such standardization will follow the same economic laws as have appeared in

the turbine and motor fields. In other words, prices will become lower, the deliveries will become more prompt, and the replacement required by additions will be decidedly facilitated. It is time for central-station designers to "quit playing with toys" in the high-tension field. They should use the service offered by the manufacturers.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

THERE has been no marked change in the condition of the electrical market this week. The only conspicuous movement in commodities was that affecting wire, which has seen a general reduction in the Chicago district affecting practically the entire range, with steady conditions on the Eastern coast. The volume of business in New England was good, with larger stocks in evidence and active buying of poles and pole-line hardware by the central stations.

Buying in New York was conservative but solid. Small motors are selling actively, particularly in the textile industry, all through the Eastern coast. Poles have been coming in in considerable quantities. In the Southeast range sales are growing materially, and there is much activity in radio, with a decided trend toward the higher-priced sets.

Business has been generally good in Chicago and on through to the Pacific Coast, where collections are improved. The appliance market there showed a strengthening influence. Japanese orders for lumber have stimulated the situation, and direct orders from Japan for line materials have made their appearance.

Nothing Definite Yet as to Japanese Purchases

OFFICIALS of the Japanese government as yet have not definitely decided upon a plan for making electrical and other construction material purchases in connection with the rehabilitation of the earthquake area. The Capital Restoration Board is working out such a plan at the present time, but its recommendations will have to be passed upon by the Diet, which is to convene about Nov. 10, and until that time nothing definite will be made public.

At first it was proposed to make all purchases through a centralized agency, but later developments indicate that only such materials as will be required in bulk will be so handled, leaving the remainder of the purchasing to private individuals. As a matter of fact, purchases of generators, insulators, cables and wires are being made in that manner at the present time.

According to recent reports, the Japanese government has also placed large orders in the United States for iron and steel and lumber, and private firms have been making purchases in foreign markets in the usual way. Judging from this procedure, Japanese firms making electrical purchases here will probably follow the plan that is to their best interests. If they find that they can buy cheaper through government agencies than they can by dealing direct with foreign exporters, they will certainly use that method, all other considerations being equal. A good part of Japan's needs, however, such as electrical material entering into new buildings, street railways, transmission lines, etc., will be bought on government account, and without question will be purchased through the Restoration Board.

Satisfactory Improvement Seen in Wooden-Pole Deliveries

SATISFACTORY improvement in the deliveries of all kinds of wooden poles has been brought about during the last three weeks both because of improved transportation along the Pacific Northwestern railroads and because of greater available stocks in the woods, where cutting and butt treating have progressed greatly as a result of a slightly better labor supply during the last two months.

This situation is decidedly heartening when compared with the difficulties encountered by the pole interests last summer. Although the wooden-pole business then was on a sound basis regarding demand and labor, some troubles were experienced in forest fires and greatly reduced transportation facilities. Since that period demand likewise has improved with ready supplies, and there is no difficulty in securing enough flat cars for shipments from sources in Canada and the United States.

Wooden-pole manufacturers are of the opinion that the bulk of output is now proceeding to utilities in Ohio, Indiana, Illinois and Pennsylvania, the greater amounts to the first two named states, with a decided falling off in demand in the Pennsylvania territory during the last month. Last week marked a great flow of poles to the Atlantic seaboard states.

Pole agents believe that approximately 55 per cent of their business is being done in new line construction and 45 per cent for replacements and short extensions. Authorities in the field state that there is a gradual falling off in replacement orders which is due to the fact that the present butt-treated product is lasting from six to eight years longer because of more efficient methods arrived at during recent years.

Prices are apt to remain steady for at least another year, say the pole makers, and they add that only severe forest fires or extreme labor troubles could have any immediate effect on present quotations. No changes have been made in Western cedar prices since April 24 last. The last change in Northern cedar was on May 28, 1923. Both of these were advances and were made to keep pace with demands of labor.

Waterwheels at 30 per Cent of Production Capacity in 1921

WATERWHEELS were manufactured during 1921 at a rate only slightly greater than 30 per cent of the capacity of the industry. Had conditions been such as to make maximum output possible, these products would have been manufactured to the value of $630,603,513. Instead, the value of the output of the 296 plants engaged in this type of work was $199,498,575, or 31.6 per cent of the possible output.

These figures have just been made public by the Bureau of the Census. They were compiled as a result of recommendations by the Committee on Census Schedules, created at a conference of trade associations, which met in Washington in 1921 at the instance of the National Association of Manufacturers. Nathan B. Williams was chairman of the committee.

The percentage of possible output among all of the industries of the country was 56.8. This covers 194,194 establishments, with a combined value of products of $42,318,241,453. Had these plants worked at maximum capacity, they would have produced the sum of $74,123,930,736.

Conservative Buying for Present Needs Seen in New York

MANUFACTURERS in New York and New Jersey sections say that some new signs of improvement have appeared, but that there is no marked gain in recent electrical business other than in the appliance field. There is a conservative feeling in the market which jobbers think is due to purchases for only immediate needs by the contractors and central-station companies.

It is said that the present reluctance in buying is mostly due to the heavy commitments made in April and May of this year, when many requirements by the utilities and industrials were covered for months ahead, and some operations are being postponed because it is believed in some circles that advantages may be had by waiting. In spite of this hesitant market, retail buying is showing continued improvement, which is expected to have much sustaining influence on the wholesale market in the near future.

During the week wire showed some softness in price, and it was not until last Tuesday that this commodity recovered its balance at the present

levels. Small motors during the last few days have shown added strength in the textile manufacturing districts of the metropolitan area, which, in turn, has greatly helped the second-hand establishments. Large amounts of poles are coming into the Eastern territory for replacements and early winter extensions. Considerable interest is being shown in all classes of line material.

Power Curtailed by Drought in Southeast; Business Holds Up

THE unusually long spell of dry weather has resulted in power curtailment in certain sections of the Southeast, but as yet the situation has not reached serious proportions. The volume of business in electrical jobbing lines continues to hold up, and one of the largest jobbers reports that his October sales will exceed the total for any month in the past two years. The electric range business is being followed up closely and sales are increasing steadily.

The movement of radio equipment is going excellently, and the largest jobber in this particular line states that the orders are far in excess of the supply. Last year the greater portion of the sales was for equipment going into amateur sets, but this fall the growing tendency is toward complete sets, with the sets ranging from $250 to $350 proving the most popular. However, deliveries on these sets are very unsatisfactory.

New England Jobbers Report Diversified Orders

LEADING jobbers in the Boston district are handling an increased volume of business as compared with a year ago. Stocks in some establishments have accumulated considerably of late, although a shortage in higher-grade radio sets is beginning to be felt here and there.

Prices were unsteady on wire all last week, and the recent advance in cotton is expected by some distributors to result in firmer quotations. Central-station buying of pole-line hardware is above normal in view of the prolonged mild season.

Buying for jobbers' stocks is rather cautious at the moment, but appliance manufacturers are pushing production at top speed against the pre-holiday demand. Interest in textile-motor drives took on new life this week from displays at the International Textile Exposition in Boston.

Wire Drops a Bit in Chicago District

THE electrical trade in Chicago continues to enjoy excellent business, and unless something unforeseen happens October will be one of the best months of the year. Prices remain generally firm, with the exception of rubber-covered code wire. The slight drop in copper has influenced prices a little, and this, together with the price war which is going on in this district, has caused a decline in code wire prices. No. 0 and smaller were reduced 3 per cent, Nos. 2/0 and 3/0 4 per cent, No. 4/0 and 250,000-circ.mil 5 per cent, 300,000-circ.mil and larger 6 per cent. Lead-covered cable was very slightly reduced, in some cases a matter of 20 cents to 60 cents per 1,000 ft. Certain wire companies feel that now is the time to corral this business and have made the slight reduction to load up with as much business as possible.

Chicago building permits up to Oct. 26 were a shade under the $23,000,000 mark, as announced by the "citizens' committee to enforce the Landis award." The committee's announcement asserts that the total for the year to date on building construction amounts to $277,108,729, compared with $227,741,970 for the entire year of 1922.

September Electrical Exports Gained $687,216

TOTAL exports of electrical machinery, apparatus and appurtenances for September were $5,925,529, an increase of $687,216 over September, 1922, when the total amounted to $5,238,313. In August, 1923, total electrical exports amounted to $6,183,186. The accompanying figures are supplied by the Bureau of Foreign and Domestic Commerce.

The Metal Market

QUOTATIONS of copper during the week reached the lowest levels in more than two years, sinking down to 12.37½ cents, delivered, with reports that even this figure had been shaded. Second hands were offering the metal quite freely at all times at quotations below the regular market. At times there were indications of demoralization in the copper market. The price is now down to a point where it has become a serious matter with some of the smaller producers whether they can continue operating.

NEW YORK METAL MARKET PRICES

	Oct. 24, 1923 Cents per Pound	Oct. 31, 1923 Cents per Pound
Copper, electrolytic.	13.00	12.50
Lead, Am.S.& R.price	6.85	6.75
Antimony..........	7.62½	8.27½
Nickel, ingot........	27.00 to 32.00	27.00 to 32.00
Zinc, spot..........	6.35	6.67½
Tin, Straits.........	41.50	42.12
Aluminum, 98 to 99 per cent..........	26.00 to 27.00	25.00

As it is, domestic consumption has gained to an unusual extent, while the buying from abroad has been about unchanged from pre-war years, with the result that more copper is available now than can be disposed of. How long this will continue until curtailment is decided upon remains to be seen.

ELECTRICAL EXPORTS FOR SEPTEMBER, 1923, COMPARED WITH CORRESPONDING MONTH A YEAR AGO

	Value September 1922	Value September 1923
Mechanical-drive turbines..	68,370	$8,745
Generators:		
Direct-current:		
Under 500 kw.........	59,272	51,341
500 kw. and over.......	102,417	25,109
Alternating-current:		
Under 2,000 kva.......	7,668	4,816
2,000 kva. and over....	24,870	211,391
Accessories and parts for generators............	30,680	98,784
Self-contained lighting outfits	48,339	18,354
Primary batteries..........	88,552	89,556
Storage batteries..........	142,387	172,743
Power transformers........	521,381	286,126
Other transformers.........	58,764	52,549
Rectifiers, condensers, double-current and motor-generators, dynamotors, synchronous and other converters..............	119,157	88,346
Switchboard panels, except telephone............	365,348	39,297
Switch and circuit breakers above 10 amp.	131,359	127,910
Fuses and fuse blocks.......	15,812	24,485
Watt-hour and other measuring meters............	24,270	48,304
Volt, watt and ampere meters and other recording, indicating and testing apparatus.............	66,915	58,106
Lightning arresters, choke coils, reactors and other protective devices........	66,567	42,919
Motors under 1 hp..........	78,829	142,566
Stationary motors, 1 to 200 hp....................	188,390	348,318
Stationary motors over 200 hp....................	25,320	67,513
Railway motors...........	35,251	150,487
Railway locomotives.......	132,498	260,000
Mining and industrial locomotives..................	28,297	66,452
Other motors..............	12,847	19,577
Rheostats, controllers and other starting and controlling equipment.......	106,414	150,499
Accessories and parts for motors..................	112,015	168,963
Electric fans.............	59,537	58,886
Incandescent carbon-filament lamps............	7,019	3,260
Incandescent metal-filament lamps.............	99,893	72,441
Other electric lamps........	19,793	25,704
Flashlights...............	29,630	34,934
Searchlights and projectors	22,247	35,431
Motor-driven household devices.................	49,920	61,948
Domestic heating and cooking devices..............	56,748	82,379
Industrial electric furnaces and ovens..............	24,988	27,367
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	46,278	64,888
Radio and wireless apparatus	207,535	258,967
Telegraph apparatus.......	34,261	21,668
Magneto telephones........	*	9,818
Other telephones..........	296,025	73,249
Magneto switchboards.....	*	232
Other telephone switchboards	*	29,960
Railway signals, switches and attachments.........	25,469	69,800
Bells, buzzers and annunciators..................	7,162	6,540
Spark plugs, magnetos and other ignition apparatus..	96,984	210,450
Insulating material........	90,048	77,635
Metal conduit, outlets and switch boxes..........	23,434	25,136
Sockets, receptacles and lighting switches.........	65,735	83,994
Other wiring supplies and fixtures................	158,818	138,806
Other electrical apparatus...	422,211	756,642
Globes and shades for lighting fixtures............	37,495	34,630
Electrical glassware, except for lighting.............	18,278	16,629
Electrical porcelain........	129,241	109,802
Electrical carbons, carbon brushes and electrodes....	109,724	232,151
Insulated wire and cable (iron or steel)	25,403	73,324
Other manufactures of aluminum................	63,411	75,232
Copper wire (bare).........	161,493	97,962
Insulated copper wire and cable..................	187,544	232,408
Total..................	$5,238,313	$5,925,529

* Not separately stated prior to Jan. 1, 1923.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Acquires Turbine Business of Wellman-Seaver-Morgan

An arrangement has been effected between the Wellman-Seaver-Morgan Company of Cleveland and Akron, Ohio, and the Newport News Shipbuilding & Dry Dock Company of Newport News, Va., whereby the latter company has taken over the future hydraulic turbine business of the Wellman-Seaver-Morgan Company, including the patterns, drawings, data, patents, patent applications, developed and undeveloped inventions and complete records, the results of years of experience in the hydraulic turbine business. All these have been transferred to the Newport News Shipbuilding & Dry Dock Company.

The staff of the Newport News Shipbuilding & Dry Dock Company is experienced in the successful handling of large engineering projects of the most exacting requirements. With the reinforcement of its staff by the additional engineering talent acquired from the Wellman-Seaver-Morgan Company, it will be able to carry out any undertakings in the hydraulic turbine field.

Duncan Electric Appointments

The Duncan Electric Manufacturing Company of Lafayette, Ind., manufacturer of meters and distribution transformers, announces the appointment of two new district sales agents. Walter W. Gaskill, 141 Milk Street, Boston, has been appointed district sales agent for the New England territory, and A. F. Blecksmith of 534 Bryson Building, Los Angeles, has been appointed district sales agent in territory comprising California, Nevada and Arizona. E. H. Albrecht of 310 Lewis Building, Portland, Ore., continues as district sales agent in the Washington-Oregon territory, to which place he was appointed several months ago.

Exporters Demand World Parley

The American Manufacturers' Export Association on Oct. 26 brought its three-day annual convention to a close in New York City with the adoption of resolutions reiterating its demand for the calling of a world economic conference, with the expression of an opinion that a remission of foreign debt payments would not be detrimental to American export trade, provided it is proved that all concessions made are adequately offset and guarantees are provided to equal in value whatever may be conceded in meritorious cases; favoring a privately owned and privately operated American merchant marine; recommending improvement in harbor facilities, and an improvement in harbor laws here and abroad by mutual agreement. The electrical groups were well represented.

Anaconda Copper Wage Cut

The wage cut of 50 cents a day at the Anaconda Copper Mining Company's Butte mines and Anaconda and Great Falls reduction works, Anaconda, Mont., will affect 14,000 all-day employees and will take effect Nov. 1. The reduction brings the pay of miners back to $4.75, which is the scale before the raise was granted last March.

Under the cut the minimum scale for common labor at the Anaconda reduction works will be $4.25, while the crafts' scale, which varies according to various classifications of labor, will average $5.50.

Further Hearing on Habirshaw Cable Set for Nov. 9

At a hearing in the United States District Court in New York City on Oct. 25 Judge John C. Knox declined to pass on the reorganization committee's motion for a receiver's sale of the properties of the Habirshaw Electric Cable Company until all dissenting creditors and stockholders could be heard.

Following the argument, in which the counsel for the dissenting group charged that there was question as to the need of from $1,500,000 to $2,000,000 of additional capital, which under the plan would be raised by the issue of preferred stock, Judge Knox set Nov. 9 as the date for further hearing.

No objection was made by any of the many creditors and stockholders at the hearing to the proposed settlement of $379,000 cash of government claims against the company and subsidiaries, which originally amounted to $1,125,000. The claims grew out of war-time contracts, and against them were claims by the companies against the government amounting to about $500,000, making the net amount of the government's claims approximately $625,000, which has been reduced to the cash payment mentioned. Judge Knox approved of the settlement being made on this basis.

The operating profits of the Habirshaw Electric Cable Company and its affiliated companies for the nine months ended Sept. 30 exceeded $649,000, it was reported last week. Sales were over $8,000,000, and unfilled orders amounted to $1,298,000. Bookings received in the third quarter totaled $2,478,000.

Allis-Chalmers Third Quarter Profits $756,981

The Allis-Chalmers Manufacturing Company, Milwaukee, for the quarter ended Sept. 30, 1923, reports sales billed aggregating $6,865,443, against $5,479,925 in the same quarter last year.

Net profits for the quarter amounted to $756,981, equal, after preferred dividends, to $1.82 a share on the $25,770,750 capital common stock outstanding. In the second quarter of this year the company reported profits equal to $1.30 a share on the common stock and 62 cents a share on the common in the third quarter of 1922.

For the first nine months of the current year net profits of $1,854,089 are reported, which, after allowing for dividends on the preferred, is equal to $3.83 a share on the company's common stock, against 63 cents a share earned in the same period last year. The statement of earnings for the September quarter compares as follows:

	1923	1922
Sales billed	$6,685,443	$5,479,925
Net profits (after deduction of federal taxes)	756,981	450,415

On the basis of the company's quarterly reports, earnings for the nine months ended Sept. 30, 1923, compare as follows:

	1923	1922
Sales billed	$18,169,305	$14,930,390
Net profits (after deduction of federal taxes)	1,854,089	1,028,944

General Electric Outlook Good

M. F. Westover, secretary of the General Electric Company, says that the company's outlook is good and that he can see no slackening in business He reports that incoming orders are running at the rate of over $5,000,000 weekly.

Pettingell-Andrews Becomes Axcess Distributor

The Pettingell-Andrews Company, Boston, has become exclusive distributor in New England for the "Axcess" industrial lighting system, manufactured by Sampson & Allen, Lynn, Mass. These devices will be sold by both the electrical department and the automobile division of the company. Milton Riley will supervise these sales for the company.

Carney Appoints Dawson Brande Manager at Minneapolis

Announcement is made that Dawson Brande has been appointed general sales manager in charge of the Minneapolis creosoting plant of B. T. Carney & Company, producers of Western red-cedar poles, Minneapolis. During 1909 to 1915 Mr. Brande was employed by the Carney firm as inspector and buyer of cedar products at Spokane, and from 1915 to 1919 he was assistant manager at the office at Grinnell, Iowa.

Terms of Sale of Canadian G. E. Announced at Toronto

Following the announcement last week from New York that the directors of the General Electric Company had approved the proposal to purchase control of the Canadian General Electric Company, President A. E. Dyment of the Canadian company made public the terms of sale in Toronto on the following day.

Present holders of the common shares of the Canadian General Electric Company are to receive, in exchange for each fully paid $100 share, the sum of $62.50 in cash, New York funds, and one fully paid $50 share of an open issue of new preference stock of the Canadian company, bearing a fixed cumulative dividend of 7 per cent and having a fixed preferential claim to repayment of capital in event of a winding up of the company. It is further provided that the present preferred stock of the Canadian company be retired at a premium of 15 per cent.

In order to secure the funds necessary to complete the purchase, the American General Electric Company has agreed to purchase an equal par value of common stock now in the treasury of the Canadian company at a premium of 15 per cent. The outstanding preferred stock totals $2,000,000, and on the basis of $115 per share some $2,300,000 will have to be raised by the sale of common stock to the parent company.

Of the $18,000,000 common authorized $10,800,000 is paid up, the balance being in the treasury of the Canadian company. The carrying out of the proposed arrangement will bring the outstanding common stock up to $12,800,000.

The agreement also provides that the common stock of the Canadian company may be converted to the extent that the respective holders so elect into a $50 share of new preference stock and a $50 share of common stock for each $100 share of common now held. The offer will remain open for acceptance until Dec. 15. On the acceptance by a sufficient amount of stock, the directors of the Canadian General Electric Company will proceed to call the necessary meetings of shareholders to ratify and complete the transaction.

In a special letter to the shareholders President Dyment calls attention to some of the advantages to be derived by the Canadian concern by the closer relationship with the American company. "Such a community of ownership," he points out, "will result in a very much more intimate and effective co-operation between the two organizations and, in the opinion of the directors, is essential to the maintenance by the company of a foremost position in its field of activity. The experience of the two companies over a long period has indicated clearly the importance of bringing about such closer relationship, and efforts have been made in that direction on different occasions during the past ten years, but until now no plan has been devised which appeared practicable from the standpoint of both companies."

The carrying out of the proposed plan is contingent upon the acceptance of its provisions by a sufficient number of holders of common shares to enable the General Electric Company to secure a majority.

Mr. Dyment stated that the personnel of the staff management and directorate would remain as at present. This new connection with one of the largest and strongest companies in the world will tend to facilitate financing of plant and other extensions for the expansion of business.

Westinghouse $500,000 Contract

The Westinghouse Electric & Manufacturing Company has been awarded a contract for motor-generator sets by the Brooklyn Edison Company. The contract is valued at about $500,000.

Copper & Brass Body Has Largest Budget in Its History

The Copper & Brass Research Association has proposed expenditures in 1924 amounting to $557,572, which is the largest budget in the history of that organization. Of the total, $231,000 is to be spent on newspaper, trade-paper and magazine advertising. This calls for twenty insertions in 136 papers in 108 cities for twenty weeks from Feb. 15 to June 30.

The research work will consume about $30,000, and literature, publicity bulletins, pamphlets, etc., will cost $181,500. Other items in the budget are: Salaries, $54,760; traveling expenses, etc., $95,812.

L. B. Underwood & Company, Inc., Pittsburgh, recently organized, will act as manufacturers' agent and now are representing Durham & Company, the Cole Metal Box Company, the Nyelec Switchboard Company and the Auth Electric Specialties Company. The firm's address is 451 Frick Annex.

The Lyvewyre Manufacturing Company, Indianapolis, has leased property at 20 South Capital Avenue and will establish works for the manufacture of batteries and parts.

The Westinghouse Electric International Company announces the appointment of Benjamin Soby as assistant to the manager, promotion of sales department.

The Remy Electric Company, Anderson, Ind., has started the construction of a one-story addition, containing 12,500 sq.ft. of floor space, to cost $25,000.

The Colonial Insulator Company, 973 Grant Avenue, Akron, Ohio, is planning the erection of a one-story addition, 30 ft. x 150 ft.

The C. R. Electric & Machine Company, Boston, has leased space in the building at 169 Harrison Avenue for the establishment of a local works.

The Western Electric Company intends to manufacture loop cable in its Kearny (N. J.) works on a larger scale than previously planned and is placing contracts for additional machinery. The cable buildings will soon have a capacity for manufacturing 210,000,000 ft. of loop cable per week.

The Conlon Corporation, Cicero, Ill., manufacturer of the new "Incomparable Conlon," has announced the appointment of C. G. Flatt as Rocky Mountain representative, with headquarters in Denver. Mr. Flatt was formerly a salesman with the Western Electric Company, and more recently has been associated with Alex Hibbard, Inc., Denver.

The Electric Storage Battery Company, Philadelphia, will soon commence excavations for the first unit of its proposed branch plant at Chouteau and Vandeventer Avenues, St. Louis. It will be one-story, 130 ft. x 245 ft., and used as an assembling and distributing works. It will cost approximately $100,000.

Harry Ross & Company, Inc., recently incorporated with $20,000 capital, will engage in the manufacture of electrical appliances at 142 West Thirty-first Street, New York City.

H. G. Overbeck has resigned as assistant manager of the electrical department of the Mine & Smelter Supply Company at Denver to represent the Meadows Manufacturing Company in the Rockey Mountain territory. The "Meadowlark" washing machine is soon to be featured by the Meadows firm.

The Miller-Seldon Electric Company, 1259 West Park Place, Detroit, manufacturer of electrical apparatus, will take bids at an early date for the construction of a two-and-three-story addition to its plant, 60 ft. x 225 ft., at McGraw Avenue and Twelfth Street, estimated to cost about $75,000.

The Russ Elektroofen A. G., Cologne, Germany, has been established and financed by the banking houses of Saasen & Company, in Bonn, and Stenger & Hoffmann & Company, in Essen. The primary object of the enterprise is the exploitation of the electric furnace patents of Mr. Russ. The exploitation will cover both the manufacture and selling of furnaces, as well as the granting of licenses.

The Western Electric Company, will soon commence excavations for a new warehouse and distributing plant on Kostner Street, near Ogden Avenue, Cicero, Ill., to cost approximately $1,000,000.

The Reliance Electric Company, Chicago, has foundations in progress for the erection of its proposed two-story-and-basement plant addition at 1313 Moorman Street, estimated to cost $60,000.

The Cook Electric Company, 360-64 Jelliff Avenue, Newark, N. J., has filled plans and will commence the immediate erection of a new two-story addition to its electric equipment plant, estimated to cost about $50,000.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Basse-Terre, Guadeloupe (No. 7,998), for a thirty-passenger electric auto bus and electric touring cars.

Purchase is desired in Algiers, Algeria (No. 8,008), for high-grade passenger cars, spark plugs and accessories.

An agency is desired in Brisbane, Australia (No. 8,003), for electric motors and generators, alternating current, 415 and 240 volts, 50 cycles; electric generators and motors, direct current, 220/240 and 440/480 volts, electric heating appliances, accumulators, etc., air compressors, fans and blowers and refrigerating machinery.

Purchase and agency is desired in Sydney, Australia (No. 8,000), for electrical supplies, including cooking and heating appliances, small wireless sets, lighting supplies and usual stock for electrical contracting supplies on a fairly large scale.

TENDERS FOR ELECTRICAL EQUIPMENT FOR MORWELL (AUSTRALIA) POWER SCHEME.—Tenders will be received by the State Electricity Commission of Victoria, Melbourne, Australia, until Dec. 15 (Specification No. 23/145), for four, only, 1,000-kva., single-phase transformers and spares; also until Jan. 3, 1924 (Specification No. 24/1), for aluminum steel-cored cable and accessories, and also until Jan. 19, 1924 (Specification 24/2), for transformers, switchgear and accessories for substation "B." For details see Searchlight Section.

PROPOSED ELECTRIC PLANT AT GUAYAQUIL, ECUADOR.—Plans have been prepared, according to *Commerce Reports*, for a municipal electric plant at Guayaquil, Ecuador, for which, it is expected, bids will be asked later.

NEW ELECTRIC PLANT FOR BLOEMFONTEIN, SOUTH AFRICA.—A proposal to build a new power station with a capacity of 7,000 hp., it is reported, is under consideration by the Corporation of Bloemfontein. The cost is estimated at £180,000.

New Apparatus and Publications

POWER PLANT INSTRUMENTS.—"Cambridge Instruments for the Power Plant" is the title of a booklet issued by the Cambridge & Paul Instrument Company of America, Inc., Ossining-on-Hudson, N. Y., in which it describes and illustrates the "Cambridge" instruments, including electrical CO_2 apparatus, thermometers, pyrometers, stator and rotor outfits, etc., for power plants.

BOILER TRIMMINGS.—Bulletin No. 500 issued by the Wright-Austin Company, 315 West Woodbridge Street, Detroit, covers the safety alarm water columns and boiler trimmings manufactured by the company.

ATTACHMENTS FOR ELECTRIC CLEANER.—The United Electric Company, Canton, Ohio, is distributing a folder calling attention to the new model attachments for use with either the model 4 or new model 5 of the "Ohio" electric cleaner.

OIL DRYING AND PURIFYING OUTFITS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has developed a special type of oil drying and purifying outfits for use in central stations and industrial plants using transformers, oil circuit breakers, feeder voltage regulators, etc., to dehydrate and purify oil.

FLOOR SURFACER.—The Globe Manufacturing & Distributing Company, 319 West Chicago Avenue, Chicago, has brought out a new electrically driven "Lightning" floor-surfacing machine, which is equipped with a 1½-hp. motor.

NON-MAGNETIC CAST IRON.—Ferranti, Limited, Hollingwood, Lancashire, England, is distributing five leaflets covering its "non-magnetic" cast iron for use in connection with electrical machinery.

ELECTRIC VALVE GRINDER.—A new low-speed, light-weight electric valve grinder has been developed by the Black & Decker Manufacturing Company, Townson Heights, Baltimore.

LOCK-OUT SWITCH.—The Cutter Company, Philadelphia, is now manufacturing, to be sold as a separate device, the "I-T-E" synchronous actuated lock-out feature for use in connection with the "I-T-E" rotary starting and running switches and circuit breakers.

TRANSFORMERS.—The Pittsburgh Transformer Company, Pittsburgh, is distributing bulletin No. 2,026, entitled "Transportation of Pittsburgh Transformers over Sierra Madre Mountains in Mexico." Bulletin No. 2,027 issued by the company describes the installation and operation of some "Pittsburgh" 15,000-kva. polyphase transformers.

LIGHTING FIXTURE.—The Edwin F. Guth Company, 2615-25 Washington Avenue, St. Louis, has developed a new standardized lighting fixture, known as "Mazelite."

LIGHTING UNIT.—"Electric Daylight for Your Kitchen" is the title of a leaflet distributed by the F. W. Wakefield Brass Company, Vermilion, Ohio, covering the "Red Spot" daylight kitchen unit.

New Incorporations

THE UNION STAR (MO.) ELECTRIC COMPANY has been incorporated with a capital stock of $10,000 by L. E. Martin, O. L. Perkins and others.

THE WHITE CITY POWER & DEVELOPMENT COMPANY, Montrose, Col., has been incorporated with a capital stock of $250,000 by Felix Baranowski, E. L. Young and P. C. Wills.

THE ARTHUR (IND.) ELECTRIC LIGHT & POWER COMPANY has been chartered with a capital stock of $700 by T. C. Young, Lawrence W. Skinner, Joseph Cox and James Willis.

THE MARION (WIS.) LIGHT & POWER COMPANY has been organized with a capital stock of $25,000 to furnish electricity in Marion and nearby towns. The incorporators are: F. H. Jossiyn, J. H. and E. B. Driessen.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BIDDEFORD, ME.—The Cumberland County Power & Light Company, Portland, is erecting a double-circuit, 60,000-volt steel-tower transmission line between the Bonny Eagle power station and Biddeford and Saco, with a view of doubling the power service in this section.

LIMERICK, ME.—The Western Maine Power Company is planning to build a new hydro-electric power station on the Little Ossipee River at South Limington.

MARLBORO, N. H.—The Keene Gas & Electric Company is building a hydro-electric power plant here, to cost about $300,000.

PORTSMOUTH, N. H.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Nov. 6 for 50,000 attachment plug terminals, for use at the local navy yard. (Schedule 1503.)

WEYMOUTH, MASS.—The Edison Electric Illuminating Company, Boston, plans to install coal and ash-handling machinery, and other equipment at its local electric plant, now under construction.

PAWTUCKET, R. I.—The Imperial Printing & Finishing Company plans to construct a power house at its local plant.

PUTNAM, CONN.—The Putnam Woolen Company plans to build a hydro-electric plant for service at its local mill. The textile plant will be equipped throughout for electrical operation.

Middle Atlantic States

MIDDLETOWN, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Nov. 28 for construction, heating, sanitary and electric work of restoration of main building, laundry building, additional accommodation for chronic patients (north building and connecting corridor (east group); laundry equipment for laundry building, etc., at the Middletown (N. Y.) State Homeopthic Hospital. Sullivan W. Jones, Capitol, Albany, is state architect.

ROCHESTER, N. Y.—Electric power equipment will be installed in the proposed addition to be erected by the Rochester Refrigerating Company, to cost about $150,000.

SHUSHAN, N. Y.—Surveys have been made by the state for a dam to create a lake 7 miles long in Battenkill River, for regulating water in Hudson River and furnishing water for a hydro-electric development 1 mile north of here. H. L. Cooper, 101 Park Avenue, New York City, is engineer.

VISCHERS FERRY, N. Y.—Bids will be received by Edward S. Walsh, Commissioner of Canals and Waterways, Capitol, Albany, until Nov. 8 for constructing the superstructure of a power house, etc., at Vischers Ferry dam.

CLIFTON, N. J.—Bids will be received by the Passaic Valley Sewerage Commissioners, Chamber of Commerce Building, until Nov. 13 for three electrically operated centrifugal pumps, each with daily capacity of 6,500,000 gal., for the local Yantacaw station, including one engine-driven electric generating set, with switchboard.

KEASBEY, N. J.—The power house and factory of the Raritan Hollow Tile Company were recently destroyed by fire, causing a loss of about $100,000.

ALLENTOWN, PA.—Plans have been authorized for extensions in the ornamental lighting system on Tenth and Sixth Streets. Other additions will be made in the business section later.

CHELTENHAM, PA.—The power house and plant of the Rowland Shovel Company, Central Avenue, were recently damaged by fire, causing a loss of about $18,000.

LANCASTER, PA.—The Clay-Lancaster and Penn-Lancaster Electric companies, recently organized, are planning to install power plants and systems in various sections of Lancaster County. L. D. West and J. H. Bucher head the companies.

PHILADELPHIA, PA.—The National Biscuit Company plans extensions in its power-house and baking plant at Broad Street and Glenwood Avenue, including the installation of equipment.

PHILADELPHIA, PA.—Bids will be asked at once by the navy supply officer, U. S. Navy, for one high-frequency apparatus (M. and S. req. 36); also, for two indicating annunciating gages (N.S.A.F. req. 279).

PHILADELPHIA, PA.—A power house will be erected by Amos H. Hall & Son, 2915 North Second Street, at their proposed plant on Erie Avenue, near F Street, to cost about $100,000.

PITTSBURGH, PA.—Plans have been authorized for the installation of a new street-lighting system on Penn and Liberty Avenues from Eleventh to Sixteenth Street. Later the new system will be extended to Thirty-fourth Street.

ROBBINS, PA.—The West Penn Power Company will extend over the Youghiogheny River here, its transmission system consisting of six 132,000-volt lines, three 22,000-volt lines, ground wires, telephone lines, etc.

CHARLESTON, W. VA.—The Federal Power Commission has granted the application of the West Virginia Power Company, a subsidiary of the Virginian Power Company, to build a 140-ft. dam in New River, 5 miles above Hinton, W. Va. The cost of the project is estimated at about $10,000,000.

ROANOKE, VA.—The Roanoke Water Works Company contemplates the installation of electrically operated pumping machinery in connection with extensions and improvements in its plant.

North Central States

DETROIT, MICH.—Plans have been filed by the Detroit Aero Metals Company, 657 Lycaste Street, for building the initial unit of its plant, consisting of a building and power house, to cost about $75,000.

FLINT, MICH.—The City Council has authorized the hospital board to issue $65,000 in bonds for the construction of a new power house and laundry for the Hurley Hospital and the new nurses' home.

HIGHLAND PARK, MICH.—The Ford Motor Company contemplates the construction of a power house at its proposed lead-

producing plant in Washington County, Mo. The works will cost about $200,000.

LANSING, MICH.—Electric power equipment will be installed in the printing plant to be erected by the Franklin-Lansing Company, recently organized, to cost about $160,000.

COLUMBUS, OHIO.—Electric power equipment will be installed in the proposed ice-manufacturing plant No. 2 of the Grocers & Butchers' Ice Company at Oakland Park, to cost about $150,000.

LIMA, OHIO.—The Ohio Power Company plans to build a substation in the Rockhill section, to cost about $216,000.

MASSILLON, OHIO.—The Massillon Water Supply Company is planning extensions, including the drilling of several new wells, installation of a 2,000,000-gal. pump and laying transmission lines, at a cost of about $50,000.

NEW BURLINGTON, OHIO.—Work will soon begin on the construction of a new power house for the St. Francis School. Kunz & Beck, Carew Building, Cincinnati, are architects.

NORWOOD, OHIO.—Steps have been taken by the Norwood Retail Merchants' Association for the installation of an ornamental lighting system in the business section of the city.

TILTONVILLE, OHIO.—Electric power equipment will be installed in the proposed local plant of the New Jersey Zinc Company, 160 Front Street, New York, to cost about $250,000.

LOUISVILLE, KY.—A substantial increase in the appropriation for street improvements and lighting, including the installation of additional ornamental lamps, will be asked by the Board of Works in the budget for 1924.

MADISONVILLE, KY.—Electric power equipment will be installed by the Madisonville Ice & Laundry Company, in connection with the rebuilding of its local plant, recently destroyed by fire with loss of about $100,000.

NOBLESVILLE, IND.—The City Council has approved the petition of the Home Telephone Company to place its cables underground. Plans are under consideration to require all electric wires to be placed underground.

VALPARAISO, IND.—The Valparaiso Lighting Company has arranged for an increase in capital to $200,000, for proposed extensions.

CHICAGO, ILL.—Electric power equipment will be installed in the new plant to be erected at 715-23 Kedzie Avenue by the Operators' Piano Company, 16 South Peoria Street, to cost about $150,000. H. E. Gallup, 110 South Dearborn Street, is architect.

CHICAGO, ILL.—The Commonwealth Edison Company has filed plans for the construction of a generating plant at 3601 South Crawford Avenue, to cost about $900,000. Graham, Anderson, Probst & White, 80 East Jackson Boulevard, are architects.

CHICAGO, ILL.—The Public Service Company of Northern Illinois has acquired the Interurban Public Service Corporation, which furnishes electrical service in Roselle, Cloverdale, Itasca, Meachan, Bartlett, Ontario and other towns, from a central station at Roselle. The Public Service Company will supply electricity to these towns from its high-tension lines.

BARRON, WIS.—Plans have been completed by the Electric Light and Power Commission for the erection of a high-tension transmission line between the power station at the city dam and the new plant at the Taylor dam.

EAU CLAIRE, WIS.—The Dells Pulp & Paper Company has applied to the Wisconsin Railroad Commission for permission to build a hydro-electric plant including a dam on the Chippewa River, to cost about $1,000,000.

MADISON, WIS.—Surveys are being made by the Wisconsin Power, Light & Heat Company with a view of extending its transmission line to Silver Lake to furnish service there.

NEW HOLSTEIN, WIS.—The Municipal Electric Light and Power Commission has applied to the Wisconsin Railroad Commission for permission to extend its transmission line to Maryville to furnish electricity there.

WAUZEKA, WIS.—The Kickapoo River Power Company, recently incorporated, has applied to the Wisconsin Railroad Commission for permission to construct a dam across the Kickapoo River and a power plant near Wauzeka. The plans call for a development of 1,700 hp., to cost about $1,000,000. E. E. Dillon, consulting engineer, Madison, is interested in the company.

WOODMAN, WIS.—At a recent election the proposal to establish a municipal electric system was carried.

ALEXANDRIA, MINN.—Plans are in progress for extensions in the electric lighting system, for which bids will be asked in the near future. The Charles L. Pillsbury Company, 1200 Second Avenue, South, Minneapolis, is engineer.

BRONSON, MINN.—The Minnesota Electric Distributing Company is erecting a transmission line to furnish electric service at Bronson, Kennedy, Hallock, Halma, Greenbush, Karlstad and vicinity. Electricity will be secured from the plant of the Crookston (Minn.) Water Works, Power & Light Company.

MINNEAPOLIS, MINN.—Electric power equipment will be installed in the new plant to be erected by the Buzza Company, 16 South Eighth Street, at Lake Street and Colfax Avenue, to cost about $150,000. Magney & Tusler, Inc., 126 South Ninth Street, are architects.

OWATONNA, MINN.—A special election will be held Nov. 6 to vote on the proposal to issue $350,000 in bonds for a municipal electric plant.

ST. CLOUD, MINN.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 21 for one electric passenger elevator and one hand-power freight elevator for buildings at the United States Veterans' Hospital, St. Cloud.

ST. PAUL, MINN.—The Ford Motor Company plans to build a 10,000-hp. auxiliary steam-driven electric plant at its local automobile works, supplementing a hydro-electric generating plant of 18,000 hp. on the Mississippi River. Four generators of 4,500 hp. each and waterwheels will be installed. Stone & Webster, Inc., 147 Milk Street, Boston, is engineer.

BURLINGTON, IOWA.—Plans are under consideration for the installation of an ornamental lighting system on Jefferson Street.

ROCKWELL CITY, IOWA.—The local plant of the Iowa Light, Heat & Power Company was recently destroyed by fire, causing a loss of about $100,000. At present the city is without electrical service.

HOLLIDAY, MO.—Bonds to the amount of $6,000 have been voted for the erection of an electric transmission line from Holliday to Paris.

NORBORNE, MO.—Bonds to the amount of $33,428 have been voted to establish a municipal electric light plant. R. R. McBride, Kansas City, is engineer.

SPRINGFIELD, MO.—Electric power equipment will be installed in the proposed local plant to be erected by the Missouri Rubber Products Company, of which Laurence Schmitt, Colonial Hotel, is head, to cost about $350,000.

FARGO, N. D.—The plant of the Union Light, Heat & Power plant was recently damaged by fire.

GENOA, NEB.—Plans have been completed by the Nebraska Gas & Electric Company, Omaha, for a local hydro-electric power plant, to cost $750,000, to supply electricity in this district.

HUMPHREY, NEB.—The Continental Gas & Electric Corporation, Omaha, has acquired the plant and distributing system of the Humphrey Electric Light & Power Company. The former will install a substation and serve the town from its Norfolk-Fullerton high-tension line. The old 220-volt direct-current system will be rebuilt for 110 volt alternating current.

TEKAMAH, NEB.—The Nebraska Gas & Electric Company plans to erect a transmission line and furnish service here. When completed the municipal electric plant will be discontinued.

WEST POINT, NEB.—The Nebraska Gas & Electric Company plans to build a transmission line to West Point.

Southern States

PILOT MOUNTAIN, N. C.—The installation of a light and power system is under consideration, for which $20,000 in bonds have been issued.

RALEIGH, N. C.—The stockholders of the Carolina Power & Light Company have authorized an increase of capital stock of $3,500,000, part of the proceeds to be used for further extensions to its systems.

SANFORD, N. C.—The installation of electrically operated pumps in connection with waterworks extensions to cost about $55,000, is under consideration.

ATLANTA, GA.—Plans for the proposed Stone Mountain City resort and hotel include an electric plant. An electrically operated pumping plant will also be installed. The cost is estimated at $1,000,000. O. F. Whittle, Nashville, Tenn., heads the project.

WOODBURY, GA.—The Council is considering rebuilding the electric light plant, recently destroyed by fire, causing a loss of about $10,000.

TAMPA, FLA.—Electric power equipment will be installed in the proposed cold-storage plant to be erected by the Interstate Investment Company in connection with a group of buildings, to cost about $800,000. Lockwood, Greene & Company, Atlanta, Ga., are engineers.

KNOXVILLE, TENN.—Extensions contemplated in the municipal water system, to cost about $2,000,000, include the installation of electrically operated pumping machinery.

MEMPHIS, TENN.—The Memphis Power & Light Company plans extensions to its generating plant and transmission lines. A 20,000-kw. turbo-generator and auxiliary machinery will be installed. The cost is estimated at about $1,000,000.

BIRMINGHAM, ALA.—The Alabama Power Company has issued $6,000,000 in bonds, part of the proceds to be used in connection with three hydro-electric power plants now under construction.

NEWTON, ALA.—The Houston Power Company plans extensions, including the construction of a 50-ft. dam across the Choctawhatchee River and the installation of two electric generators of 1,500 kw. capacity each. The Southern Engineering Corporation, Albany, Ga., is engineer.

TEXARKANA, ARK.—The Texarkana Water Corporation plans to install electrically operated pumping machinery in connection with extensions and improvements, to cost about $300,000.

CROWLEY, LA.—Bids will be received by the Board of Aldermen until Nov. 16 for municipal improvements, including a fire-alarm system (Schedule G). Merrill Bernard, Crowley, is engineer in charge.

NEW IBERIA, LA.—The Council is considering issuing bonds for rebuilding the municipal light and power plant.

PONCHATOULA, LA.—Bids will be received by E. D. Parker, city clerk, until Nov. 20 for two electrically operated centrifugal pumps and auxiliary equipment for the municipal waterworks. Swanson-McGraw, Inc., United Fruit Building, New Orleans, is engineer.

BOKOSHE, OKLA.—The installation of a street-lighting system has been authorized by the voters. Electricity will be furnished by the Oklahoma (Okla.) Gas & Electric Company.

HOWE, OKLA.—The citizens have voted to install a street-lighting system. Electricity will be furnished by the Oklahoma (Okla.) Gas & Electric Company.

RINGWOOD, OKLA.—Plans are being prepared for the erection of a transmission line for municipal service, with substation and distributing system. The State Power Company, Enid, will be joint owner with the municipality. J. D. Bomford, Masonic Temple Building, Enid, is engineer.

BEAUMONT, TEX.—The Voth Hardwood Company, operated by the Kirby Lumber Company, Houston, contemplates building power houses at its proposed two new hardwood mills, to cost about $300,000.

EL PASO, TEX.—The Elephant Butte Irrigation District contemplates the construction of a hydro-electric plant about 20 miles south of the present development, with initial output of 20,000 hp., to cost about $3,000,000.

MERCEDES, TEX.—The Valley Electric & Ice Company has been granted a fifty-year franchise in Mercedes.

Pacific and Mountain States

PORT ANGELES, WASH.—The installation of electrically operated pumping machinery at the proposed waterworks, to cost about $500,000, is under consideration. The Burns & McDonnell Engineering Company, Interstate Building, Kansas City, Mo., is consulting engineer.

SOUTH CLE ELUM, WASH.—The construction of a local substation to cost about $100,000, is reported to be under consideration by the Puget Sound Power & Light Company, Seattle.

ANTIOCH, CAL.—The Paraffin Companies, Inc., 40 First Street, San Francisco, contemplates rebuilding its power house and plant, recently destroyed by fire, with loss of about $400,000.

GILROY, CAL.—The installation of electrically operated pumping machinery at the waterworks, in connection with extension to cost $87,000, is under consideration. Charles Sloan, Santa Fé Building, San Francisco, is engineer.

HEALDSBURG, CAL.—Extensions and improvements in the territory served by the California Telephone & Light Company, involving an expenditure of about $25,000, have been approved by the Pacific Gas & Electric Company.

LOS ANGELES, CAL.—Bids will be received by the County Supervisors until Nov. 19 for the installation of an ornamental lighting system in the Graham Lighting District.

NATIONAL CITY, CAL.—The Atchison, Topeka & Santa Fé Railway Company plans to build a power house at its proposed local creosoting works, to cost about $275,000. D. L. Murray is in charge.

OROVILLE, CAL.—Plans for the proposed power development of the Feather River Power Company, recently organized, include six power plants and five reservoirs on the middle fork of the Feather River and its tributaries, which will eventually develop 202,000 hp. and provide water to irrigate between 75,000 and 100,000 acres of land. The first power plant, which will be known as the Bean Creek power plant will be located 18 miles from Oroville and will have an output of 62,000 hp. Lars Jorgensen holds the permit for the initial development. Construction of the first power house will begin early in 1925.

SACRAMENTO, CAL.—Plans are being prepared for the installation of an ornamental lighting system on Thirty-seventh Street from J Street to the Folsom Boulevard. A similar system is contemplated on Thirty-seventh Street south of Y Street. Albert Given is city engineer.

SALINAS, CAL.—The Coast Valleys Gas & Electric Company contemplates extensions to its system in this section.

SAN FRANCISCO, CAL.—Thomas A. Clarke, 424 Chronicle Building, and associates have applied to the State Water Department for permission to build a hydro-electric power plant on the South Fork of the Merced River, Mariposa County, for service at the properties of the Little Wonder Mines Company.

SAN LEANDRO, CAL.—Electric power equipment will be installed at the proposed new canning plant of the H. G. Prince Company, to replace the works recently destroyed by fire with loss of about $100,000.

STOCKTON, CAL.—Work will soon be started on the construction of seven of the buildings, including a power house, of the College of the Pacific in Stockton.

SPARKS, NEV.—Plans are under consideration for the installation of an electric fire-alarm system, to cost about $15,000.

Canada

VANCOUVER, B. C.—The British Columbia Electric Railway Company has tentative plans for the construction of a hydro-electric power plant, with transmission system, to cost about $4,000,000.

VERNON, B. C.—The municipal electric plant was recently damaged by an explosion, causing a loss of between $30,000 and $40,000. S. H. Excell is manager.

VICTORIA, B. C.—The erection of a second transmission line from Jordan River to Victoria is under consideration by the British Columbia Electric Railway Company.

BLYTHE, ONT.—The bylaw providing for the installation of Hydro-Electric power has been approved by the ratepayers.

BRUSSELS, ONT.—The ratepayers have passed the bylaw providing for the installation of Hydro-Electric power.

CAP ROUGE, QUE.—The St. Regis Pulp & Paper Company, Quebec, plans to build a power plant at its proposed pulp and paper mill at Cap Rouge, to cost about $3,500,000.

LACHINE, QUE.—Plans are being prepared by the Montreal Light, Heat & Power Company for the construction of a 16,000-hp. power plant at Lachine, to cost about $2,000,000.

QUEBEC, QUE.—The Quebec Power Company has issued $3,540,000 in bonds, part of the proceeds to be used for further extensions to its hydro-electric plants, transmission lines and distribution systems.

RIVIERER DES PRAIRIES, QUE.—Work, it is reported, has started on the proposed local development of the Back River Power Company, 35 Common Street, Montreal. The company, it is understood, will soon call for bids on the remainder of the work.

Electrical Patents

Announced by U. S. Patent Office

(Issued Oct. 9, 1923)

1,470,433. BATTERY CONNECTION; A. Fretschel, Almena, Wis. App. filed Feb. 28, 1921. Terminal post.

1,470,451. TELEPHONE EXCHANGE SYSTEM; T. Korthäuer, Siemensstadt, Germany. App. filed Dec. 9, 1921. Interconnection construction for stations having different systems.

1,470,466. DUMB-WAITER SIGNAL; W. Misiak, New York, N. Y. App. filed Feb. 21, 1921. General signal for all floors combined with individual signal.

1,470,518. BATTERY SEPARATOR; H. A. Yarnell, Escondido, Cal. App. filed April 28, 1921. Plates arranged face to face and provided with transverse corrugations.

1,470,523. SWITCH FOR ELECTRIC IRONS; H. Benvie, Meriden, Conn. App. filed March 25, 1922. Circuit closed when handle is gripped.

1,470,577. REENFORCED PLATINUM ANODE FOR PRODUCTION OF PER-SALTS; O. Liebnecht, Frankfort-on-the-Main, Germany. App. filed Aug. 27, 1921. Platinum reinforced with metallic zinc.

1,470,582. AUTOMATIC RECLOSING CIRCUIT-BREAKER SYSTEM; O. C. Traver, Schenectady, N. Y. App. filed Dec. 20, 1921. Controlled by electron tube.

(Issued Oct. 16, 1923)

1,470,594. SECRET SIGNALING SYSTEM; D. E. Branson, Danville, Ind. App. filed Sept. 13, 1918. System of telegraphic communication.

1,470,611. TELEPHONE EXCHANGE SYSTEM; R. S. Bailey, Montclair, N. J. App. filed Oct. 15, 1919. Method of connecting automatic to manual exchange.

1,470,628. DEVICE FOR HIGH-FREQUENCY SIGNALING; M. Latour, Paris, France. App. filed July 17, 1920. High-frequency telephone system in which high-frequency alternator is used as current source.

1,470,632. EQUALIZING TRANSMISSION; W. H. Martin, New York, N. Y. App. filed April 21, 1921. For telephone systems.

1,470,664. AUTOMATIC TELEPHONE EXCHANGE SYSTEM; F. R. McBerty, Evanston, Ill. App. filed Nov. 12, 1903. Full automatic system.

1,470,681. REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, and R. E. Cullings, Wilkinsburg, Pa. App. filed Aug. 10, 1918. By field control of generators.

1,470,682. VOLTAGE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Nov. 9, 1918. Automatic regulator.

1,470,691. RECORDING DEVICE; C. H. Marshall, Jr., Wilmerding, Pa. App. filed Dec. 13, 1919. Electrically operated graphical record for Olson testing machines.

1,470,695. STRUCTURAL STEEL FRAME FOR DYNAMO-ELECTRIC MACHINES; C. B. Mills, East McKeesport, Pa. App. filed Nov. 16, 1918.

1,470,696. TELEVISION; A. McL. Nicolson, New York, N. Y. App. filed Dec. 7, 1917. Method of transmitting and receiving records or pictures.

1,470,725. SELECTIVELY OPERATED CIRCUIT-CONTROLLING DEVICE; F. M. Goddard, Brooklyn, N. Y. App. filed July 12, 1919. Step-by-step type.

1,470,730. ELECTRIC REGULATOR SYSTEM; F. C. Hanker, Wilkinsburg, Pa. App. filed June 25, 1920. Equalizing voltages of generator and feeder circuit before connecting generator to feeder circuit.

1,470,733. SOUND DETECTION; H. C. Hayes, New London, Conn. App. filed June 25, 1919. For use under water.

1,470,758. RHEOSTAT; G. M. Little, Pittsburgh, Pa. App. filed Nov. 29, 1920. Slide-contact type.

1,470,759. SYSTEM OF CONTROL; F. M. Parks, Murrysville, Pa. App. filed Dec. 21, 1920. For crane or hoist motors.

1,470,774. PORTABLE LAMP; W. J. Spence, Lynn, Mass. App. filed May 15, 1922. Desk or reading lamp.

1,470,781. ROLLED CONDENSER; P. Thomas, Edgewood Park, Pa. App. filed Oct. 3, 1917. Method of attaching leads to terminals.

1,470,786. DYNAMO-ELECTRIC MACHINE; H. H. Wait, Chicago, Ill. App. filed Aug. 22, 1917. Field construction for high-speed machines.

1,470,788. BALLAST TUBE; P. T. Weeks, Caldwell, N. J. App. filed July 2, 1921. Electrical resistance device for maintaining constant current.

1,470,834. ELECTRIC HEATER; A. E. Hasselbach, Detroit, Mich. App. filed Dec. 30, 1920. Heating water to produce steam for cooking.

1,470,855. CHANDELIER; G. Ludwig, Chicago, Ill. App. filed Aug. 5, 1921. Provides ready passage for wires through chandelier.

1,470,883. CATHODE FOR THE ELECTROLYTIC REFINING OF METALS; C. H. Schuh, Brooklyn, N. Y. App. filed Nov. 22, 1922. Applied particularly to copper refining.

1,470,899. ELECTRICAL WAFFLE IRON; C. F. Wells, San Francisco, Cal. App. filed March 3, 1922.

1,470,912. ELECTRIC SOLDERING IRON; J. F. Coehille, Paris, France. App. filed Feb. 21, 1922. Heated by inclosed electric arc.

1,470,915. DRY CELL; H. de Olaneta, New Haven, Conn. App. filed June 18, 1920. For flashlights.

1,470,917. BATTERY CABINET; H. C. Goss, Beach Haven, Conn. App. filed June 6, 1922. For radio B batteries.

1,470,933. TRIP LEVER FOR OSCILLATING MAGNETOS; A. Rosner, Springfield, Mass. App. filed Jan. 18, 1922.

1,470,939. SYNCHRONOUS DYNAMO-ELECTRIC MACHINE; H. Silo, Nisikasugai Gun, Japan. App. filed May 29, 1919. Acts as synchronous motor or converter.

1,470,948. AUTOMATIC ELECTRIC GENERATING SYSTEM; A. R. Van Horn, Philadelphia, Pa. App. filed May 7, 1919. Engine-driven generator set.

1,470,954. REPEATING METHOD AND SYSTEM; W. E. Beatty, Bayside, N. Y. App. filed Dec. 11, 1920. Two-way repeating system uses elements of "push-pull" type.

1,470,955. ELECTRICAL WAVE TRANSMISSION SYSTEM; W. E. Booth, New York, N. Y. App. filed Nov. 22, 1919. Radio transmitting and receiving system.

1,470,956. PLUG RECEPTACLE; C. H. Bissell, Syracuse, N. Y. App. filed June 21, 1918. For electric conduits.

1,470,964. LIGHTING FIXTURE; C. C. Dose, Seattle, Wash. App. filed Oct. 20, 1920. Dust-proof inclosed fixture.

1,470,965. TRANSMISSION SYSTEM; G. W. Elmen, Leonia, N. J. App. filed Aug. 2, 1918. Magnetic repeater for telephone systems.

1,470,982. REPEATER CIRCUITS; J. S. Jammer, New York, N. Y. App. filed Oct. 29, 1920. Two-way repeating systems.

1,470,984. SIGNALING CIRCUITS; E. D. Johnson, East Orange, N. J. App. filed Feb. 7, 1918. Relates to telephone repeaters.

1,470,985. SIGNALING SYSTEM; K. S. Johnson, Jersey City, N. J. App. filed Sept. 5, 1919. Circuit arrangements for signaling systems in which repeaters or amplifiers are employed.

1,470,986. MEANS AND METHOD FOR SIGNALING; K. S. Johnson, Jersey City, N. J. App. filed Sept. 5, 1919. Three-wire telephone system.

1,470,991. TELEPHONE EXCHANGE SYSTEM; A. E. Lundell, New York, N. Y. App. filed Sept. 8, 1920. Link circuit with which repeating coil is associated used for extending connections.

1,470,992. TELEPHONE-EXCHANGE SYSTEM; A. E. Lundell, New York, N. Y. App. filed Sept. 8, 1920. Automatic exchange system of large capacity.

1,470,993. HOLDER FOR MAGNETO CONTACTS; L. A. Loundagin, Crane, Ore. App. filed Dec. 19, 1919.

1,471,013. TRANSMITTING DEVICE; J. B. Speed, New York, N. Y. App. filed Nov. 19, 1919. Telephone transmitter responsive to certain frequencies only.

1,471,017. TELEPHONE-EXCHANGE SYSTEM; S. B. Williams, Jr., Brooklyn, N. Y. App. filed Nov. 25, 1919. Employs machine switching.

1,471,018. TELEPHONE-EXCHANGE SYSTEM; S. B. Williams, Jr., Brooklyn, N. Y. App. filed April 17, 1918. Type employing automatic switches for distributing calls from telephone lines to the connecting circuits of operators' positions.

1,471,058. PROCESS FOR THE MANUFACTURE OF ACETALDEHYDE OR ACETIC ACID; H. Plauson, Hamburg, Germany. App. filed Jan. 13, 1921. By passing acetylene through the pores of conductive porous electrode.

1,471,064. TROLLEY WHEEL; J. S. Roncati, Los Angeles, Cal. App. filed April 8, 1922. Means for preventing wheel from leaving wire.

1,471,067. DYNAMO-ELECTRIC MACHINE; H. K. Sandell, Chicago, Ill. App. filed Aug. 3, 1917. Rotary converter.

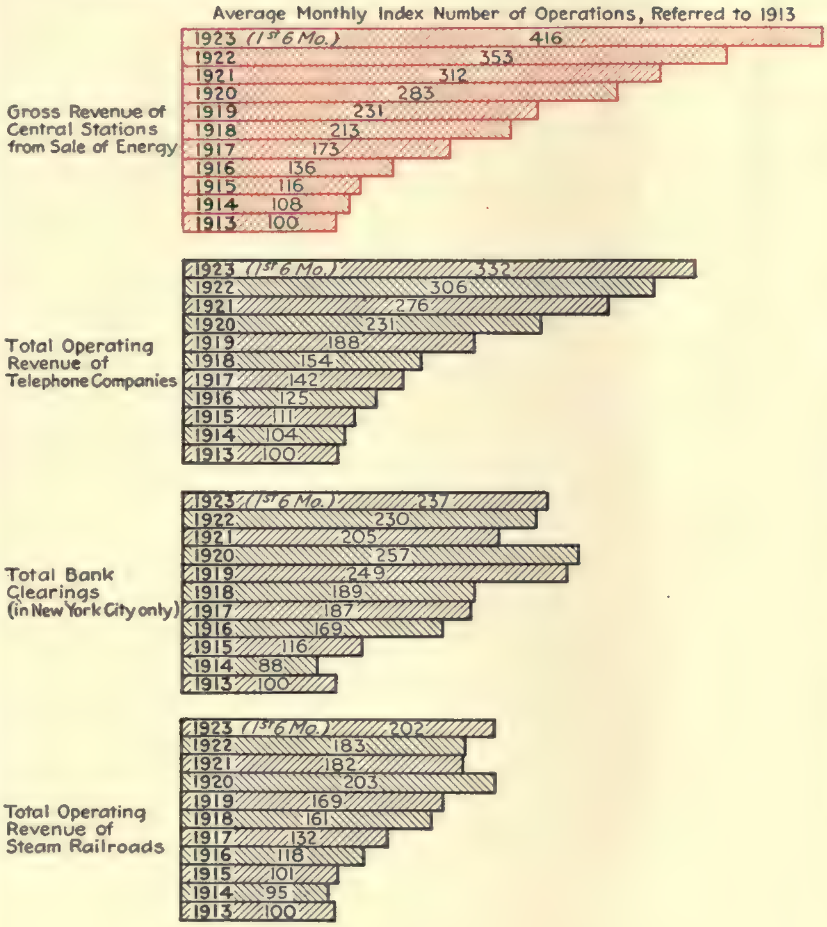
1,471,081. VIBRATING BUCKEY DIAPHRAGM FOR SCATTERED X-RAY RADIATION; H. F. Waite, New York, N. Y. App. filed Sept. 28, 1921. For producing clear-cut pictures.

1,471,093. SYSTEM OF ELECTRICAL DISTRIBUTION; W. L. Bliss, Niagara Falls, N. Y. App. filed June 3, 1916. Lighting of railway cars in which two storage batteries are used.

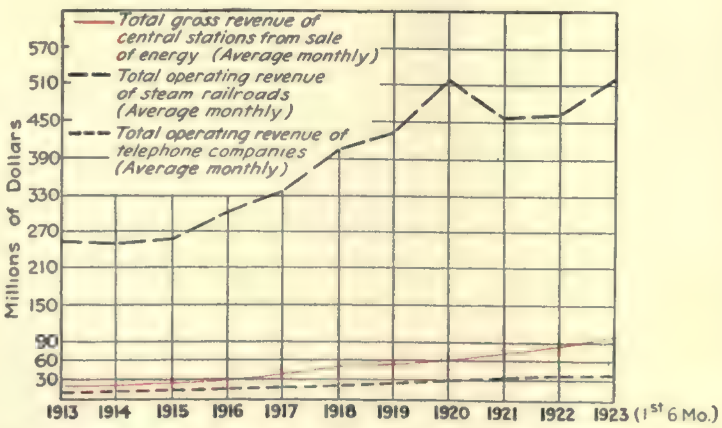
Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

The Electric Light and Power Industry Has Led All Public Utilities in Relative Growth Since 1913



The Central-Station Yearly Gross Revenue Has Never Decreased Under Any Previous Year



Central-Station Revenue Quadruples in Ten Years

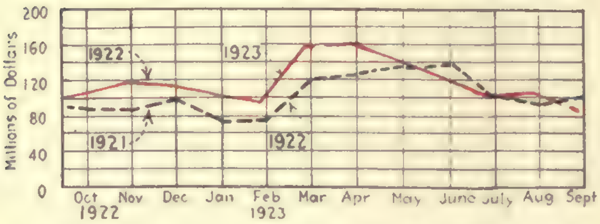
GROWTH and prosperity are largely matters of relativity. In studying the recent growth of industry reference is commonly made to conditions as they existed in 1913, the year immediately preceding the opening of the World War and subsequent abnormal conditions in American industry at large. In such a study the electric light and power industry stands out in bold relief in comparison with other public utilities and is one of the very few primary industries of the country which during the past ten years of chaotic economic conditions were able to report increased revenue year by year. In fact, the central station as a whole has never reported a decrease in yearly revenue since its establishment.

As is clearly shown in the accompanying diagram, the annual gross revenue of the central-station industry has more than quadrupled since 1913, the data indicating an almost uniformly accelerated annual growth during that ten-year period. Comparison with two other public utilities for which data are available—telephone companies and steam railways—accentuate this marvelous expansion of the central station. The operating revenue of the telephone companies, despite the nation-wide extension of telephone service, has only slightly more than tripled since 1913, but, like the central station, has always shown an annual increase in revenue. The steam railroads of the country have only just about been able to double their operating revenue during the ten-year period, and during 1921 and 1922 the yearly revenue showed a decrease under the previous year.

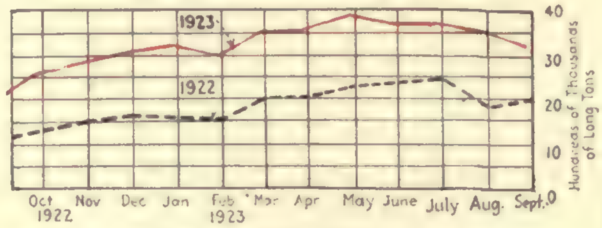
It is such outstanding facts as these that have placed central-station securities upon the highest plane as conservative investments and have made it possible for efficiently managed companies to borrow money at comparatively low rates of interest.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those using these statistics would credit the ELECTRICAL WORLD.

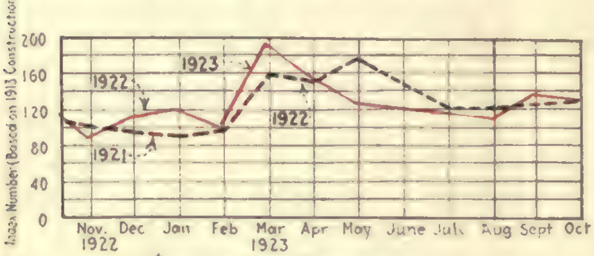
How the Primary Industries Are Trending



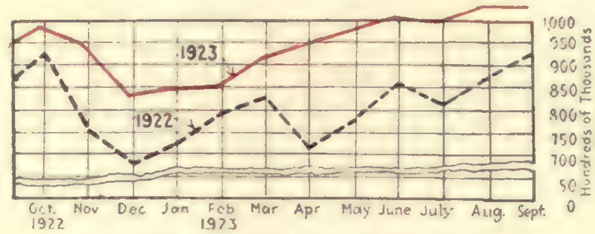
Contracts Awarded for Residential Buildings



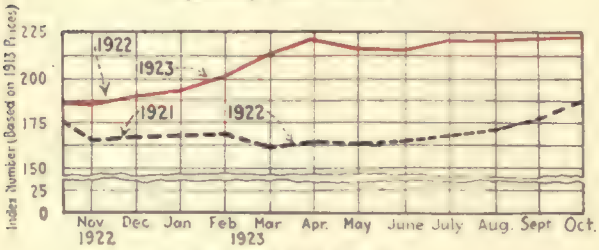
Pig-Iron Production



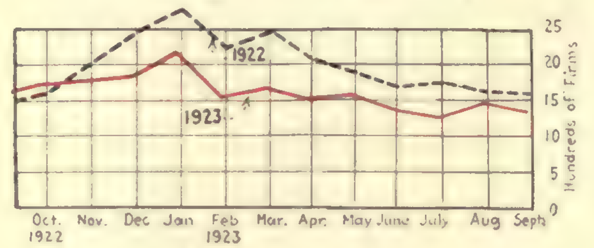
Construction Volume Index
(Engineering News-Record)



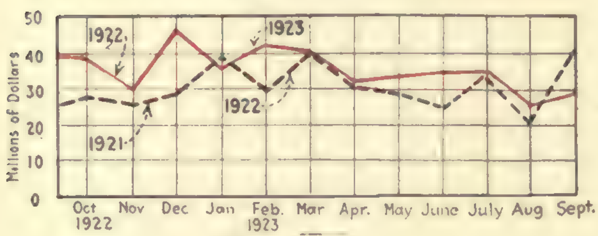
Total Average Weekly Freight-car Loading



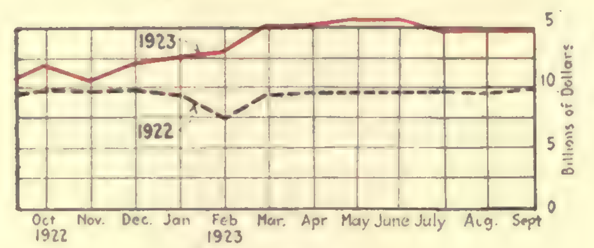
Construction Cost Index
(Engineering News-Record)



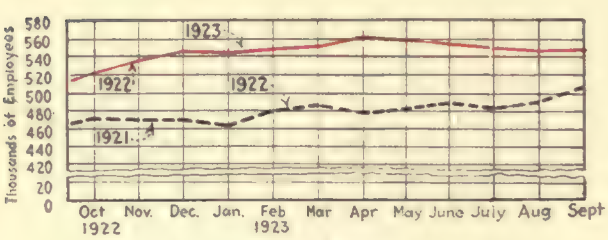
Business Failures



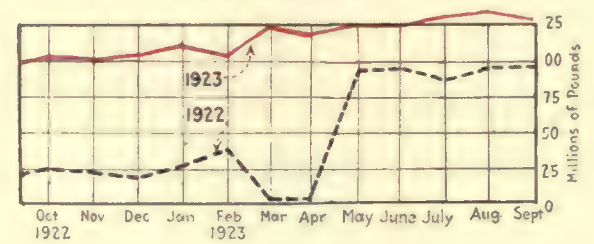
Fire Losses



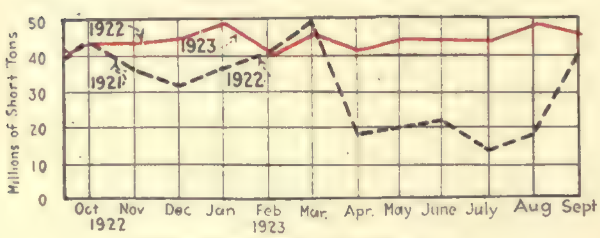
Bank Clearings
(Outside of New York City)



Employees in Factories of New York State



Copper Production



Bituminous Coal Production

Fall Trade Will Be Large

PRELIMINARY data on industrial activity indicate that the volume of fall trade will be large. General conditions remain sound. Distribution, as indicated by the record car loadings, has been active, while stocks have not been reported as excessive. These conditions, taken in conjunction with the large purchasing power of consumers throughout the country at the present time, presage fall trade on a high plane.

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W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

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Making a Smoke Screen of Superpower

SUPERPOWER in the public mind is the monkey gland that will invigorate the country mechanically by making electricity available in such abundance and at such a price that even "father" won't have to work any more. Like radio in its heyday, superpower appeals to the imagination of the public, and countless enthusiasts have begun to preach the popular gospel and lead their converts to dazzling heights in the clouds of fantasy.

When the great day of superpower comes, it is made to appear, the turning of a switch will force electrical genii to serve all human needs. They will fructify the soil, waft men and materials hither and yon, turn darkness into light, metamorphose toil into silken repose, change hovels to palaces and, in fact, flagellate Elysium into existence with St. Elmo's fire.

THE flatulence and looseness of newspaper treatments of superpower should excite neither surprise nor resentment in the minds of electrical men. It is but natural that they should be attracted principally to the dramatic aspects of this new phase of the ever-fascinating subject of electricity, and that they should be writing largely in ignorance of the very technical considerations which underlie every advance in engineering and invention.

The interpretations of self-seeking politicians but add fuel to the flames of popular credulity and emit smoke screens behind which naked selfishness can work. Good and bad, conceptions and misconceptions, true and false — all are inextricably associated in popular fancy, and this condition may bode good or ill for superpower.

Initiated as an essential act of evolution by the electrical industry, promising a great expansion to the public service, superpower must not be permitted to become a boomerang. The very term "superpower" is perhaps misleading and unfortunate. It suggests superintensity rather than a great massing of power resources through the interconnection of existing systems supported by the development of new ones. This must all be made clear to industry, to the press and to the public.

IT IS a responsibility upon all electrical men. Armed with truth and inspired by understanding, the men of the industry can bring the real superpower past all pitfalls and properly enthrone a national electricity supply as the greatest source of national prosperity and human well being. But no passive policy can be expected to prevail. If superpower is to be appreciated by the people and adequately protected against the perverted purposes of politicians, those who have the practical conception of superpower and its worth must preach the true gospel. It would be no less than a national calamity if superpower through misrepresentation were to be misjudged and condemned to obstruction and delay.

George N. Tidd

An executive who combines an unusually thorough knowledge and appreciation of the engineering, economic and human problems involved in the generation, transmission and utilization of electric power.

IN THIS age of specialization there is still given to some men the happy faculty of obtaining a full view of an entire field and mastering every section of it. The field of electric public utility management and operation has such a man in George N. Tidd, president of the American Gas & Electric Company.

Born in 1874, Mr. Tidd early entered the electric power industry, filling positions in various capacities and obtaining at the same time a complete grasp of every phase of the work. Managing successfully at first one of the smaller and then one of the larger properties, Mr. Tidd, through his progressiveness and his ability to inspire those working under him with his zeal, made himself so felt throughout the then young and relatively weak American Gas & Electric Company's organization that by 1909 he was called to be its active operating executive, being made vice-president and general manager.

Firmly convinced that the foundation of successful electric central-station management is an economical generating unit, Mr. Tidd on assuming the general managership began and carried out the construction of a series of modern and efficient steam-turbine plants. Around these as nuclei the American Gas & Electric Company system was built. In the process of building he developed or caused to be developed and utilized many of today's accepted schemes and principles of sound operation, often being the first to do so. Among these are high steam pressures, the mouth-of-mine base-load plant, high voltage as a primary with half of that value as a secondary transmission voltage, and high-voltage outdoor substations and extensive interconnection between plants of the system or with other systems where economies could be gained thereby. That he planned and built well is attested by the fact that from an almost insignificant group the company, under his guidance, has become one of the leading public utility holding comoanies, supplying electrical energy to 328 towns and cities in New Jersey, Pennsylvania, Illinois, Michigan, Indiana, Ohio, Kentucky and West Virginia. Further, the properties in the last five states are not isolated but have been or are in the process of being connected into a sectional superpower system.

In this development of the system and of the man the human side of the relationship between him and the men employed by him has at no time been subordinated. He himself having risen from the ranks, Mr. Tidd has always insisted that the men with the organization shall have the opportunity of growing with it.

Electrical World, November 10, 1923
Volume 82 Number 19

Editorial Comment

The Job of the Utility Manager

OFTENTIMES operating engineers wonder what a manager of a public utility property does besides issuing orders. To many of them the manager appears to have a sinecure. Public relations work seems an easy and simple thing to those who have never dealt with it seriously, and as for financing, all that the novice feels the manager does is to get in touch with "Wall Street" and the problem is solved. Of course, those who have tried to raise money know how hard it is to get people to part with it even for gilt-edged securities, and many a man in the public utility business sees no connection between finance and rates. It is there, nevertheless, and a careful manager may save the community more at times than his operating engineer. For example, the American Telephone & Telegraph Company has just issued $100,000,000 of twenty-year sinking fund 5½ per cent gold debenture bonds, with which to retire $90,000,000 of short-term 6 per cent notes. By this one transaction the company effects a saving of $450,000 annually in interest charges alone, besides providing funds for additions and betterments. Wouldn't an operating engineer have some difficulty to make such a saving with his present equipment? And yet financing is only one of the jobs that fall to the lot of a public utility manager.

The Electrical Industry's Place in the Chorus

SOMEWHERE between the two extremes of Brewster with a million to spend in a year and the poor widow who does housecleaning to support a family there are thousands of homes where the annual income necessitates a tax return. There are well over seven million families in the United States reporting an income in excess of $2,000. These are families that live in electrically wired homes, drive automobiles, enjoy piano and victrola music and live, not in terms of necessities only, but in terms of necessities plus convenience plus pleasure. They are receptive to the good things of life.

There has been competition for the business of these families. They constitute the market not alone for electric service and electrical household appliances, but also for kitchen cabinets, New England codfish, correspondence courses, saxophones and Persian rugs. The electrical industry, therefore, must sell its wares, and the electrical service idea which it is promoting, in keen competition with all the appeal of music in the home, convenience in the kitchen, comfort in the bedroom, enjoyment out of doors, better food, better equipment, better everything.

All these experienced competitors are persistently clamoring for attention and everlastingly keeping at it. They are telling their stories dramatically and appealingly, and that is one reason why phonographs, gas ranges and metal beds outsell clothes washers, electric ranges and ironing machines. They will continue to outsell electrical products until electrical men stop assuming that because they themselves understand the value of electrical equipment General and Mrs. Public must appreciate it also.

One of the great lessons of business which most utility men have still to learn is that their story cannot be told once or intermittently. The chorus of competing ideas ceaselessly intrudes its many voices. The electrical idea cannot hope to drown the others out. It is compelled to sing with them, and if it is to be heard it must sing well and loud and long.

A Real Impetus to the Advance of Engineering Education

THE announcement this week that the Carnegie Corporation has appropriated the sum of $108,000 to be devoted to an intensive study of engineering education must give concrete encouragement to those interested in substantial advance in that most important phase of engineering interest. The study is to be under the direction of the Society for the Promotion of Engineering Education, and the active work is to be conducted by a competent director whose appointment is thus authorized and made possible.

Engineering education has been discussed for many years. It has been diagnosed by many doctors. Engineering graduates have been analyzed and criticised. Industry has been accused of making unwise use of graduates or else of demanding too perfect a product. Industry has in turn accused the schools of not knowing the specifications that should govern the manufacture of its product.

The present investigation should do much not only to clarify the facts in the case to all concerned, but also to effect really constructive modifications in the practices of engineering education if they are needed. As pointed out in the correspondence leading up to the Carnegie Corporation's action: "The investigations of this society [will] be directed to a study of the objects of engineering education and the fitness of the present-day curriculum for preparing the student for his profession. It will study the process by which the curriculum of fifty years ago has come to its present form; it will seek to set forth the nature and the weakness of the curriculum as at present administered, and it will indicate such modifications or developments as would seem to make for a sound, well-balanced and fruitful course of study for engineering students." It is also proposed that a necessary part of the director's work shall be to make first-hand investigations of European engineering education to see what methods developed in Europe are applicable here.

It is definitely encouraging as pointing to tangible results that the Carnegie Corporation, known for its

integrity of purpose and adherence to concrete problems, should see opportunity in this program to perform a substantial piece of work. To Prof. C. F. Scott and to his co-committee workers, who with him have given definiteness to this program and have thus made possible a study the results of which will have far-reaching beneficial effect, engineers of all branches will be more than grateful. The work will be watched with interest and its results awaited with eagerness. But meanwhile, as the work progresses during the next three years, engineers should take every opportunity to co-operate in order to make the result of the study of greatest value to their profession and to industry.

Compartment Interlocks Subject of Debate

HOW to interlock bus compartments in such a manner as to remove hazards to operators in generating stations and substations has troubled engineers, but no company has yet proposed any generally accepted satisfactory solution. Despite the many schemes that are in use and the almost universal custom to use some form of interlock on all station compartments, no plan which has been put forth is conceded to present a complete solution.

Some companies use simply a wooden bar on each compartment group; others use signal lights, and others have automatic lever connections between compartment doors, oil breakers and disconnecting switches. A still later arrangement is based on the use of a lock which operates a switch in the closing circuit of the oil breaker; the key cannot be removed from the lock unless the breaker is opened and the breaker cannot be closed until the key is again placed in the lock.

But there is an objection to all of the schemes, and it is that they are not entirely foolproof. The shift operator and the assistants are human beings and their actions cannot always be predicted with complete confidence. There is a necessary division of labor and of responsibility that leaves the way open for human mistakes. Moreover, in some cases the very elaborateness and complexity of the interlock schemes increases the tendency for operators to take unsafe short cuts under emergency conditions or when the interlocking equipment gives trouble.

Nevertheless, each of the various schemes does give an added element of safety, and this is what is desired. Meanwhile experiences with present equipment and study of other possibilities will help develop a method which may be unanimously accepted as best for general adoption.

Strong Indorsement for Public Information Committees

DURING the recent convention of the American Electric Railway Association W. H. Sawyer, president of the East St. Louis & Suburban Railway, stood forth before his fellows and talked about the work of the public utility information bureaus and what it had been worth to him. It was the kind of a straightforward, manly talk that carries influence. For there is all the difference in the world between blandly accepting such an institution, such a service, as one more "good thing that ought to be supported" and being inspired by listening to an informed and capable executive tell what it is worth and why. "I am not going to criticise those executives who by their actions show that they believe their other work is more important than supporting the committee on public utility information," said Mr. Sawyer, "but I am going to tell them that in my opinion they are missing the best bet."

There are many instances of record where these information bureaus have proved their worth. Utilities need their services—and more of them too. But, even more than that, the individual utility needs to know a little more intimately what this benefit is that has been made available through these state organizations and how to take advantage of it—and how to help in the good work.

Mr. Sawyer put especial emphasis on the profit that comes to the utilities from co-operation with these information bureaus, even in the present stage of their organization and proficiency. A more adequate support from the operating companies, he said, will greatly strengthen and extend the bureaus' influence, and he called upon utility men to get behind this agency of education. The foundation of good public relations is facts—public knowledge of the functions and the record of the service company. These committees are telling this story of the central station for the hundreds of busy executives who cannot or do not tell it adequately themselves. Mr. Sawyer's appeal should not go unheeded by the central-station companies.

Service Transcends Rates

GOOD will for public utilities is made up of many items, but the greatest of these is service. Prices are of secondary importance. No manager can impose fantastic charges and escape popular censure, of course, but no intelligent executive attempts to do so. American standards of living put service before cost so long as the latter is within reason, and it is to the credit of the industry's leaders that they strive to maintain high standards of service in the face of every obstacle. The relatively small number of service complaints which reach the hearing stage in commission regulation of central stations affords a remarkable index of the quality of service rendered the public as a whole.

Once in a while a certain demoralization of service may get a start in a department or in a company. The causes may be obscure to the public, but they should not be hidden to the managerial eye. Personal rivalries sometimes attain headway; lost motion between departments develops; equipment fails unexpectedly, or there may be inefficient forecasting of load requirements. Prompt action by executives is vitally important in such cases, with rigorous analysis of all operating conditions and administrative methods. Larger appropriations for engineering may save the day in some cases; in others sweeping changes in routine may be essential. The causes are always determinable and should be sought out with the impartiality of the laboratory. It is the mark of a good executive to keep tangible and intangible factors bearing upon service under control, and this involves full co-operation by employees and continuously satisfactory public relations as a by-product. Good utility housekeeping, in a word, is what is needed to maintain the requisite standards.

An Executive Viewpoint for Engineers

IN SOME sections of the country the importance of commercial activities has eclipsed that of engineering in the eyes of executives. This is not surprising because the obtaining of new business and the holding of old constitute the most tangible means of securing revenue, and income is what interests the management. However, this is only part of the problem, as increased sales must of necessity result in increased investment and greater magnitude of operations. It is to the problem of production in its broadest sense that the engineer must direct his attention, with a keen appreciation of the relation of his work to successful business development. Too often engineers, possibly because of the nature of their early training and experience, fail to grasp the significance of these facts, with the result that they establish in the minds of business executives an excellent reputation as trained technicians, but give the general impression of being unfamiliar with the broader problems of management. Because of their natural aptitude for analyzing problems and obtaining solutions based on facts, engineers in our large utility companies have a much bigger opportunity than ever before to act as advisers on many of the major problems which face the industry today. However, they cannot afford to wait until called upon to give advice, but must assume the responsibilities of management, for which, by reason of their training, they are peculiarly fitted.

There is still another activity which engineers can undertake that will enhance their value to their companies, and that is active participation in public discussions regarding superpower, interconnection, water-power development, public versus private ownership, and other agitations on problems affecting the economies of production, operation and management. Unfortunately, owing to misinformation generally supplied from unreliable or inconsistent sources, the public has acquired some very fallacious impressions regarding these subjects. They cannot be removed except by utility men re-educating the public through individual conversations and talks before social, civic and commercial and other bodies where tangible facts are presented in a comprehensible manner. Fortunately for engineers, they have the information and unbiased reputation among the public which will enable them to do most effective work if they will only more openly express themselves on the problems which so vitally affect their industry.

Some engineers have recognized these greater responsibilities and are rendering service of inestimable value to the industry. The need for engineers to recognize more clearly their field of responsibility in problems of management outside of the purely technical duties which are a part of the engineering activities of our utilities is most strikingly evidenced in the work of the Technical National Section, N. E. L. A. Engineers who have not acquired a conception of what they can do to help in solving the utility problems can do no better than attend and take an active part in the Technical Section committee meetings of the association to gain the wide perspective and absorb the enthusiasm obtainable there. Primed with this knowledge, it becomes the engineer's obligation to place himself in such a position that he will be able to take a more active part in promoting the things for which he stands.

Plants Should Be Designed for Convenient Operation

OFTEN little things in the estimation of power-plant designers become the big things in the minds of the station operators. Lighting arrangements, the accessibility of storerooms, passageways, window and door locations and arrangements for handling equipment and repair parts are elements of design that have a decided bearing on operating convenience.

In the boiler room the lighting is a vital feature and yet it is very poor in most plants. A building elevator for handling heavy parts from basement to roof is a necessity. Monorails for conveying and electric hoists for lifting greatly facilitate repairs of coal, draft and auxiliary apparatus and yet are infrequently found. Even a little forethought in locating beam-clamp eye bolts will greatly lessen manual labor. In the turbine room the bridge crane is splendid for moving the parts on the main floor, but much of the equipment on the lower floors must be skidded, lifted over obstacles and again skidded before the crane can be brought into operation. Even more chaos exists in the arrangements for handling electrical equipment and for storing supplies and spare parts.

The operating staffs appreciate these minor elements of station design very much, and, in their opinion, designers can make or mar a station by neglecting to study the location of equipment with respect to handling it and its repair parts. Elevators, trucks, monorails, hoists and other material-handling equipment should be used more freely in power stations in order to expedite repairs, to reduce the number of operators and to permit operators to concentrate their attention on those essential elements which make for efficient station operating performance.

"Utilities' Fight to Success a Tip for Railroads"

SOMEHOW, somewhere there is always compensation for the hardships of life. Compensation, in the form of public confidence, good financial position and all that goes with these, is at present the pleasant lot of the public utility companies after the discouraging experiences of the war and pre-war period when it seemed as if a club awaited them at every turn. An indication of the degree to which those outside of the industry feel this to be true comes in an article by a financial writer in the Chicago *Tribune*, under the title quoted above. The author tells the railroad presidents, who, he says, "fear a congressional slaughter, with repeal of the transportation act, public ownership and red ruin," to take heart and bids them "look at their sister public services—the traction, lighting and gas corporations. A few years ago these companies were exactly where the railroads are now. It looked as if everybody was kicking them around. How is it today? Their securities are going right up—they are one of the best things in sight. The companies have been regulated and baited as much as ever the railroads were, but they have come out of the rut, thrived on fights and learned a lot."

Public recognition of the real utility position in the community is becoming very general. It is built on sincere efforts by the utility companies to establish a foundation of clean business methods. The future task will be to foster and maintain this growing good will.

35,000-Hp. Francis Type Units to Operate Under 857-Ft. Head

A NEW world's record will be established for high-head reaction-type hydraulic turbines when the Oak Grove project of the Portland (Ore.) Railway, Light & Power Company is completed. Construction work is now in progress on a hydro-electric development which will have an ultimate capacity of 100,000 hp. The first unit, which will be completed early in 1924, will develop 25,000 kw. and cost about $10,000,000. The hydraulic turbine for this project, which has just been ordered, will be a 35,000-hp., 514-r.p.m. Francis-type, single-discharge unit, operating under a head of 857 ft., made by the Pelton Water Wheel Company. This unit will establish a world's record for a reaction type hydraulic turbine. It will be similar to the Francis type turbines at the Kern River No. 3 plant of the Southern California Edison Company, which are of 25,000 hp. capacity, operating under a head of 810 ft., and which have stood as the world's record up until this time for reaction type turbines. No. 1 shows the character of the country through which a 20-mile wagon road has been built. For the greater part of the distance the road had to be blasted out of solid rock. No. 2 shows the site of the Oak Grove power house at the foot of the large knoll. The top of this knoll will be blasted off and a surge chamber constructed. No. 3 is a glimpse of the city of Portland, a center of industry and commerce in this region, where the power generated will be transmitted for distribution. The water to turn the wheels in the new project will come largely from the glaciers of Mount Hood.

1

2

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Graphic Solution for Wood-Pole Strength

Using Safety Factors and Chart of Diameters Gives Convenient Method for Choosing Poles—Checking Old Poles for Rot Weakness Made Convenient—Solution of Taper Problems Suggested

By EVALD BROKEMYR
Stone & Webster, Inc.

MANY engineers probably are inclined to work by rule of thumb when selecting wooden poles for use in new construction as well as in replacements, particularly if the factors involved are subject to repeated changes, as the length of the poles and the spans in a mountainous country are likely to be. Such practice is, however, apt to shoot far off the mark, for the rule of thumb usually does not take due regard of the circumstance that the moment of resistance of the pole follows the third power of the diameter. One of the consequences is that, in the case of maintenance, the influence of inside rot on the present strength of the pole will invariably be overestimated as compared with the effect of outside rot.

The nomographic chart often offers a convenient means for solving equations that are suitable or can be made suitable for representation by such a chart when the equation in question has to be applied to a large number of individual cases and the exactitude required is not too great. The accompanying chart illustrates the application of a nomograph to the finding of any one factor involved in the strength equation for a wooden transmission pole on tangent construction with regard to transverse wind pressure, when all the other factors involved are known.

The equation underlying the graph is developed in compliance with the method of calculating wooden poles given in the National Electrical Safety Code, Appendix B, for pole lines of certain grades, A, B, C, etc. Heavy loading conditions, as ruled in the code, were assumed, and the safety factor is given for a fiber stress at break of 3,600 lb. as well as 5,000 lb. per square inch—stresses which, according to the code, are to be employed when poles of certain kinds of wood are used.

It will be noted that in the graph, for the sake of convenience, the distinction between the conditions for lines of grades A, B and C with regard to the stress on the material is made by means of different safety factors, while in the examples given in the code different loading in the case of the different grades is assumed. The result is the same in both cases. Thus on the safety-factor line of the graph A_n, B_n and C_n indicate the safety factors required for new poles to be used in lines of grades A, B and C (3, 2, 1.33 respectively), and A_m, B_m and C_m the factors one-third less, which are the lowest permissible factors for the poles of the line in operation.

Needless to say, the graph can be applied not only to poles in lines of grades A, B and C, but also to poles where no grade is specified, a safety factor in this case being chosen.

The graph gives also a convenient means of judging poles that are found to be rotted, outside as well as at heart, as will be explained later. In the case of a power company that stubbed a large number of poles each year the stub-testing reports were transmitted from the field to the office, where the poles to be stubbed were decided upon. A chart, similar to the one presented, proved convenient for that work.

THEORETICAL BASIS FOR CHART

The equation for a pole subjected to bending is

$$B/F = 384M/\pi D_g^3 \qquad (1)$$

where B indicates the breaking fiber stress of the wood. Other symbols are explained in connection with the graph.

The bending moment caused by the wind pressure on the pole itself is:

$$M_p = 8 \times (D_m/12) \times H_t^2/2 = 0.333 \times D_m \times H_t^2 \qquad (2)$$

The wind pressure on the wires plus the ice layer is:

$$P_c = 8 \times (Q/12) \times S = 0.666 \times Q \times S, \qquad (3)$$

and the bending moment caused by the wind pressure on the wires, ice layer included:

$$M_c = P_c \times H_w. \qquad (4)$$

Thus the total bending moment:

$$M = M_c + M_p. \qquad (5)$$

Equations (1) to (5) give:

$$F = \frac{K \times D_g^3}{0.333 \times D_m \times H_t^2 + 0.666 \times Q \times S \times H_w} = \frac{K \times D_g^3}{M} \qquad (6)$$

in which the constant K is 40.9 for a breaking fiber stress of 5,000 lb. per square inch and 29.5 for a breaking fiber stress of 3,600 lb. per square inch.

On a nomographic chart there will of necessity be one axis for each variable in the equation to be represented, provided with numbering within a certain range. If the equation, as in this case, contains more than three variables, there will in addition be a certain number of intermediate or dummy axes, which are used as stepping stones in picking up the different variables, so to say. In the present case P_c is a dummy axis without scale, while the intermediate M_p-M_c-M axis had to be numbered because M_p and M_c have to be read there and added, in order to arrive at M, the scale being used for this latter variable also.

It will thus be noted that certain combinations of scales and intermediate axes represent certain subdivisions of the main equation, and these combinations only will give correct results when the chart* is applied. The combinations are:

D_m, H_t, M_p, representing equation	(2)
Q, S, P_c, representing equation	(3)
P_c, H_w, M_c, representing equation	(4)
M, D_g (or C_g), F, representing equation	(6)

*On the chart one single scale is used to indicate the values of M_p, M_c and M. Similarly one scale only is used for both H_t and H_w values.

The use of the graph can be best explained by an example. Suppose that the diameter of a new pole for grade A line requirements is to be determined under conditions as follows:

Fiber stress at break of the wood: 5,000 lb. per square inch.

Conductors: three wires No. 1 stranded plus static wire $\frac{5}{16}$ in. in diameter.

Span: 250 ft. and 150 ft. on either side of the pole; hence $S = 200$ ft.

Length of the pole: 45 ft.; hence $H_t = 38$ ft. and $H_w = 35$ ft. if it is supposed that the pole is set 7 ft. in the ground and that the center of the wire plan is 3 ft. below the top.

In order to find the bending moment on the pole caused by the wind pressure on the pole itself it will be first assumed that D_m equals 8 in. The chart is then used as follows:

1. Determine P_c at the intersection of the P_c axis with a straight line from the point (3 No. 1 str. + $\frac{5}{16}$) on the Q axis to the point 200 on the S axis.

2. Read M_c at the intersection of the M axis with a straight line from the P_c point just found to 35 on the H_w axis. $M_c = 24,800$.

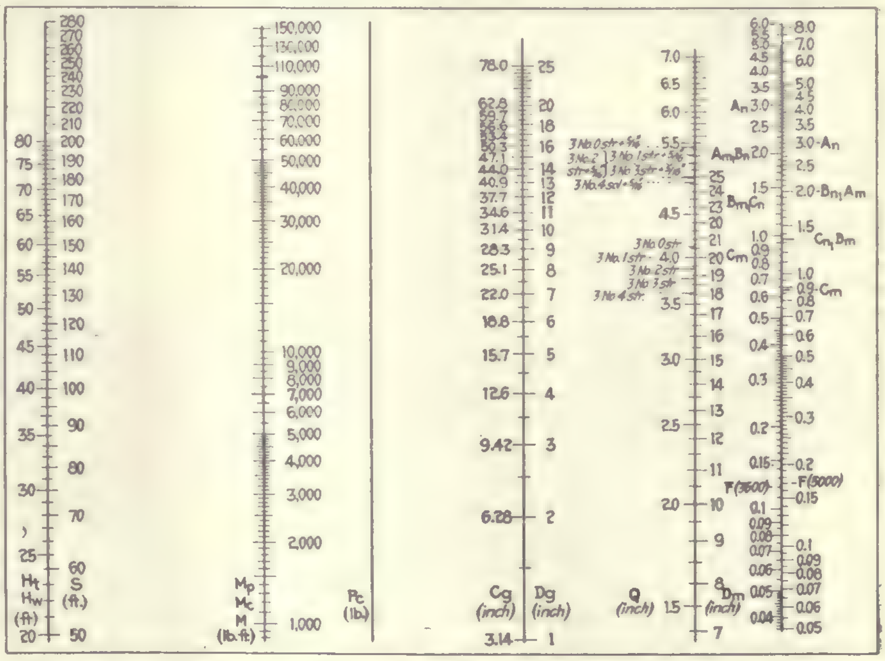
3. Read M_p at the intersection of the M axis with a straight line from 8 on the D_m axis to 38 on the H_t axis; $M_p = 3,800$.

4. M_c plus $M_p = 28,600 = M$.

5. Read the ground diameter (or the ground circumference) at the intersection of the D_g axis with a straight line from 28,600 on the M axis to the point A_n on the F axis; $D_g = 12.8$.

A pole with a diameter of 13 in. at the ground line would thus fulfill the conditions. If the pole has, let us say, 7 in. top diameter, the mean diameter above ground would be 10 in., instead of the assumed 8 in. A repetition of the operation with a regard to this larger diameter would give a ground diameter of exactly 13 in. Generally speaking, a repetition of the operation with a corrected mean diameter will be necessary only in case the assumed mean diameter proves to be very incorrect, while the difference between the ground-line diameter, as found at the first operation from the chart, and the next larger diameter taken, as expressed in non-fractional or half-fractional number of inches, is comparatively small. This is because the bending moment, as caused by the wind pressure on the pole itself, is rather small compared with the moment caused by the wind pressure on the wires at the heavy ice load assumed, and further because the strength of the pole increases with the third power of the diameter.

In a similar manner any one factor can be found from the other factors involved being known. Suppose we had the pole in our example in store and wanted to know for how long a span it could be used, the operation would be as follows: From F and D_g determine M; from M subtract M_p as found from D_m and H_t, this



Chart

representing equation six for the strength of wooden transmission poles on tangent construction with regard to transverse wind pressure of 8 lb. per square foot cylindric surface.

As used the constant K is 40.9 for a breaking fiber stress of the wood of 5,000 lb. per square inch and 29.5 for a breaking fiber stress of 3,600 lb. per square inch, and the other symbols used having the following denotations:

H_t (ft.) = total height of the pole above ground.

H_w (ft.) = height of the pole above ground to the center of the wire plan.

S (ft.) = sum of half the spans on either side of the pole.

M_c (lb.-ft.) = bending moment on the pole caused by the wind pressure on the conductors with the ice layers.

M_p (lb.-ft.) = bending moment on the pole caused by the wind pressure on the pole itself.

M (lb.-ft.) = resulting bending moment: $M = M_p + M_c$.

P_c (lb.) = total wind pressure on the conductors, ice load included.

D_g (in.) = diameter of the pole at the ground line (or diameter of inside rot).

C_g (in.) = circumference of the pole at the ground line, (or circumference of inside rot).

Q (in.) = sum of the diameters of the conductors, ice-loading layer included.

D_m (in.) = mean diameter of the pole above ground.

F (3,600) = safety factor of the pole with regard to the cross-section at the ground line, when the breaking fiber stress is assumed to be 3,600 lb. per square inch.

F (5,000) = safety factor of the pole with regard to the cross-section at the ground line, when the breaking fiber stress is assumed to be 5,000 lb. per square inch.

A_n, B_n, C_n, as marked on the F axis, indicate the points that correspond to the safety factors required for new poles to be used for A, B, C, grade conditions respectively.

A_m, B_m, C_m, as marked on the F axis, indicate the points that correspond to the lowest permissible safety factors during maintenance for poles in lines subject to A, B, C, grade requirements respectively.

3 No. 1 str. + $\frac{5}{16}$ in., etc., as marked on the Q scale, indicate the point that corresponds to the sum of the diameters plus 1 in. ice per wire of the standard combination of three stranded wires, No. 1, plus one $\frac{5}{16}$-in. static wire, etc.

Scale combinations to be used: (1) D_m, H_t, M_p. (2) Q, S, P_c. (3) P_c, H_w, M_c. (4) M, D_g (or C_g), F.

Note: $M = M_p + M_c$.

When the problem is to find D_g, first assume a value for D_m in order to arrive at M_p; if the assumed D_m proves to be very incorrect, repeat the operation with corrected D_m.

For other combinations of conductors than the ones indicated on the Q scale, the sum of the conductor diameters plus ice layer has to be computed and the corresponding point taken.

When the problem is to check poles for rot, subtract the safety factor corresponding to the diameter of the rot at heart from the safety factor corresponding to the outside diameter, in order to arrive at the actual safety factor.

The chart may be applied to any cross-section of the pole above ground, provided H_t and H_w are counted from the cross-section in question, instead of from the ground up.

In the case of a pole carrying a number of wires of different sizes and widely distributed, determine the moments as caused by the wind pressure on the wires individually or in groups, and add the several moments, instead of making all the wires in one group, and refer the wind pressure to the center of the wire plan for all the wires.

is M_c; mark point on the P_c axis corresponding to M_c and H_w; combine this point with Q and read S.

CHECKING FOR ROT

Now suppose some years later the pole is tested for rot and its safety factor at that time is to be determined. Let us suppose the rot is $\frac{3}{4}$ in. outside; D_g will thus be 11.5 in. The bending moment is arrived at as indicated (the mean diameter is in this case known to be 10 in.) and the safety factor is read at the intersection of the F axis with the extension of a straight line from the point on the M axis over 11.5 on the D_g axis: $F = 2.10$. This point being above the point marked A_m, the pole is still strong enough to meet the requirements of the code.

But suppose that the pole test gave evidence of 5 in. inside rot diameter in addition to the outside rot of $\frac{3}{4}$ in. From the same point on the M axis we find the safety factor corresponding to 5-in. diameter; $F = 0.17$. In subtracting this from $F = 2.10$, as found above, the actual safety factor is found to be $F = 1.93$. The pole in this condition would thus not meet the requirements and would have to be reinforced or replaced.

When working with the graph it will usually not be necessary to apply it to each individual pole. In a given line, or at least in a certain part of that line, many factors will be constant, such as number and sizes of wires, length of poles and length of spans. In the case of investigating rotted poles it will be convenient to make up a small table by help of the graph for those conditions, the table showing the largest permissible rot for the various pole diameters to be found in the line.

Graphs for medium and light loading conditions may be built up in a similar way to the chart here given for heavy loading conditions. For the wind pressure at medium and light loading, ruled to be two-thirds and four-ninths respectively of that at leavy loading, the constants in the equations corresponding to the equations (2) and (3) above will be 0.222 and 0.444 respectively for medium loading and 0.148 and 0.296 respectively for light loading. This means, when expressed on the graph, that the numbering on the Q axis and the D_m axis will be offset, as compared with the heavy loading graph, the graph otherwise remaining unchanged, with the same length for the logarithmic unit.

In case the dimensions, the breaking fiber stress of the pole and the loading conditions are such that a tangent drawn to a curve representing the moment of resistance of the pole divided by the safety factor as a function of the height has a less steep slope at the ground line than a tangent to a similar curve representing the total bending moment on the pole, the pole has a lower safety factor for a cross-section somewhere above ground than the one found for the cross-section at the ground line. The cause of this condition is excessive taper of the pole, since the moment of resistance of the pole decreases with the third power of the diameter, while the bending moment caused by the wind pressure on the wires increases directly with the distance from the center of the wire plan, and the bending moment caused by the wind pressure on the pole increases approximately with the second power of the distance of the cross-section from the top of the pole.

In case the first-mentioned curve at the ground line is steeper than the bending-moment curve at the same point, or equally steep, the safety factor found for the ground-line section is the lowest to be found anywhere at the pole. That this may be the case the taper must not be larger than as formulated below. If the bending moments on the pole, the moment of resistance of the pole and height above ground are used as variables, and further if:

M_r = moment of resistance of the pole on the basis of a fiber stress of B/F,
R = taper of the pole in inches per foot length of the pole,
$L = H_t - H_w$,
X = variable height above ground line,
p = wind pressure in pounds per square foot cylindric surface,

the following equations hold good:

$$M_r = (B/F) \times (\pi/384) \times (D_g - XR)^3, \qquad (7)$$

$$M_c = (p/12) \times Q \times S \times (H_t - L - X), \qquad (8)$$

$$M_p = (p/48)\,(H_t - X)^2 \times (2D_g - XR - H_tR) \qquad (9)$$

If the moment-of-resistance curve is parallel to the total bending-moment curve at the ground line, the derived functions of the two curves must be equal when X is made zero. This gives the equation for the maximum allowable taper when the safety factor is lower for the section at the ground line than for any section above ground:

$$R = p \times \frac{(D_g \times H_t + Q \times S)}{0.295 \times (B/F) \times D_g^2 + 0.25 \times p \times H_t^2} \qquad (10)$$

This equation is not likely to be applied to each pole individually, but only to some typical cases which give the smallest taper (i.e., high poles with comparatively low load) and from which the taper or the top diameter of all the poles in the line is then decided upon. In case, however, it should be desired to apply the equation to a large number of poles, a nomographic representation of it may be convenient to use, made up in a similar manner to the one here presented for the pole strength equation.

Gases Liberated by High-Voltage Insulator Testing Apparatus

DURING the testing of porcelain insulators with a 60-cycle flashover apparatus both ozone and oxide of nitrogen are liberated, according to tests made by the Bureau of Mines and described in bulletin Serial No. 2497. It was found that the gases disappear just after the test and that no fatalities have ever resulted from these gases.

Oxides of nitrogen were not found in quantities greater than 0.2 part per million, the limit of accuracy of the method used. The ozone concentration of the gas samples taken directly above the racks during the tests varied from two to ten parts per million. From the information available on the physiological effects of ozone, the amount found in the tests should cause no serious symptoms or after-effects. However, it is advisable to have the test room ventilated at all times so as to reduce the ozone concentration below ten parts per million. This could be obtained by placing fans directly under the test racks so arranged as to blow the gases upward and away from the workmen. If these fans are operated for one or two minutes immediately after each test, this should be ample to remove the gases entirely.

Previous investigators reached the conclusion that six parts per million of ozone causes coughing after moderate exercise. Ten parts per million for a fifteen-minute exposure causes sore throat, and exposure for two hours to twenty parts may prove fatal.

Residence Heating by Electricity

Field Data of Energy Requirements — Temperature and Humidity Affect Results — Costs, Rates and Classified Uses—General Conclusions and Deductions

By E. A. LOEW
Associate Professor of Electrical Engineering, University of Washington

SOMEWHAT more than a year ago an article by the writer appeared in the ELECTRICAL WORLD in which data on the heating of residences by electrical energy were presented. The purpose of the article was not to advocate the use of the electrical method of heating, but to present and analyze the data made available by a rather extensive application of this kind. Electrical engineers will at once recognize the fact that there are certain very definite limitations to this application of electrical energy and that it is economically possible only under special conditions. To compete with coal, the selling price of energy, it was pointed out, must be between 0.5 cent and 0.75 cent per kilowatt-hour. A study of the amount of energy consumed by the average residence was made, and conditions and the types of heating units used, the energy rates in effect and other facts of interest pertaining to the application were pointed out. It was felt at that time that, entirely aside from the fact that the application of electrical energy to this service must perhaps always remain limited in scope as well as confined to isolated instances where a special set of conditions and circumstances make it possible, there is much information of value to be gained from a careful study of the application where it is made on a scale large enough to permit one to draw general conclusions.

In the city of Tacoma, Wash., more than two thousand consumers are now and have for several years been heating their homes entirely or in part by electrical energy furnished by the municipally owned electric plant of about 20,000 kw. rating. At the present time the plant is fully loaded, and the city is building an additional plant, which, when completed, will have an installed machine capacity of about 85,000 kw. The present plan is to continue the sale of electrical energy for heating. Here, then, is an instance where this application has been practiced on a considerable scale for a number of years. The records have been kept in such shape that it is an easy matter to segregate the heating load from the remainder of a subscriber's load and in this way to analyze in detail the requirements for heating. Measurement records of the residences are also on file, as well as the connected heater load and the monthly meter readings. The opportunity is thus afforded for determining with a considerable degree of accuracy the energy consumption, month by month and year by year, of residences of various sizes and kinds, and by relating these to the outdoor temperature and other variables to draw conclusions as to the quantitative relations existing between these variables.

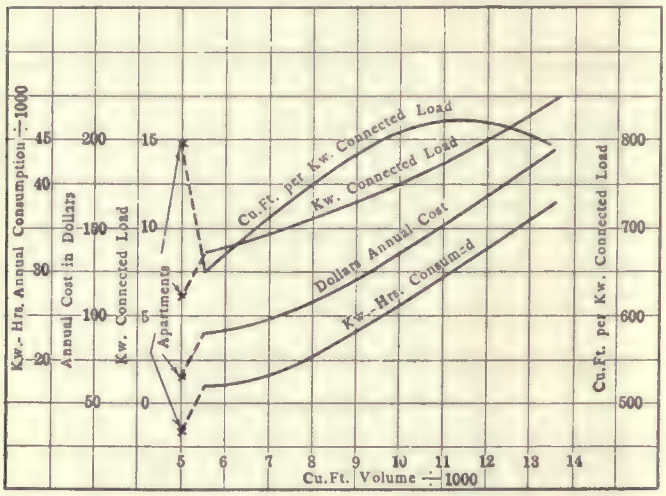


FIG. 1—COST, CONSUMPTION AND CONNECTED LOAD IN TERMS OF VOLUME HEATED

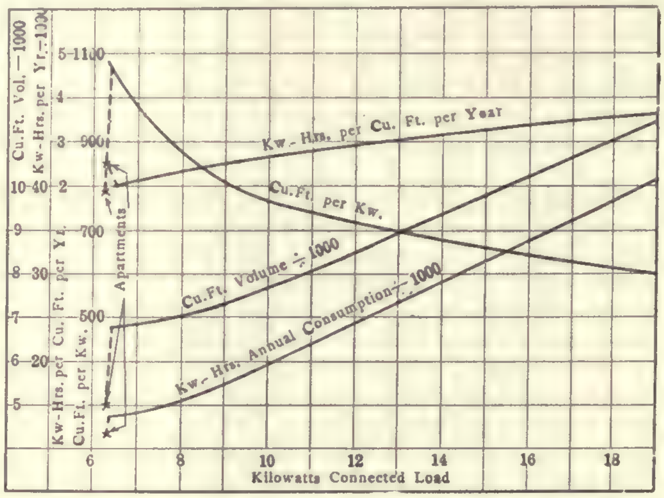


FIG. 2—ENERGY CONSUMPTION AND HEATED VOLUME VERSUS CONNECTED LOAD

DATA OBTAINED

Through the co-operation of the light plant the following data were obtained covering the year 1921 for each one of about two thousand heating customers connected to the city's distribution system:

1. Name and address of consumer.
2. Connected load of consumer's heating plant, in kilowatts.
3. Measurement data pertaining to the consumer's residence. From these the floor space could be computed and the cubical contents estimated.
4. The kilowatt-hour consumption for each month of the year.

In addition to the above, the climatological data pertaining to the year and locality in question were obtained from the office of the United States Weather

TABLE I—SUMMARY OF HEATING LOAD OVER A THREE-YEAR PERIOD

Item	1919	1920	1921
	Year		
Total number of customers	547	925	1,978
Total number of full-year customers	139	423	1,017
Total kw.-hr. consumption	....	8,860,000	18,712,000
Average kw.-hr. consumption per customer	....	8,580	9,470
Total kw. connected load	3,625	6,104	12,760
Average kw. connected load per customer	6.65	6 60	6.45
Total income for the year	$19,490 00	$49,400 00	$97,400 00
Average annual income per customer	$35.60	$53.00	$49.25
Average annual income per kw. connected load	$10 00	......	11.80
Average rate per kw.-hr. sold, cents	0.52	0.557	0.552
Number of customers using 4 kw. or more the full year	103	305	678
Average connected load of full-year customers using 4 kw. or more	8.17	8.48	8.67
Average yearly income per customer using 4 kw. or more full year	....	$85.00	$73 50
Total income from customers using 4 kw. or more full year	....	$26,000	$74,750

Bureau. Of the latter the items which have more or less bearing on the consumption of energy for heating are given in Table VII.*

A few words of explanation with regard to items 2, 3 and 4 seem desirable. Item 2 is subject to change from year to year and must for this reason and because of its bearing on the annual minimum charge for energy be checked up from time to time. This is done by inspectors who go from house to house and with all of the heating load turned on take meter readings. The heating load and the lighting, cooking and appliance load are metered separately. The reading of the heating-circuit meter therefore determines the connected load to be used in computing the minimum charge until the next check is made. This method of checking has worked out very successfully.

Item 4 corresponds to the consumer's monthly statement for heating energy used. The meter readings on which the bills are based as well as the bills themselves are prepared from day to day, and the bills are mailed out when ready. Thus the April bill, for example, of the consumer whose meter is read near the first of the month is in reality the bill for March consumption, while the corresponding bill for a consumer whose meter is read near the end of the month is largely for April consumption. In averaging up these bills and the corresponding consumptions, therefore, it must be borne in mind that the average April values are values of the last half of March and the first half of April, the center of the consumption month being on April first. This observation is made here to explain why

*For more complete data see University of Washington Engineering Experiment Station Bulletins Nos. 15 and 20, "Electrical Heating of Residences," by E. A. Loew.

Each subscriber is required to fill out a measurement card before receiving connection to the city's circuit. This card lists the total occupied floor space of residence as either "working space" or "idle space." Basements, attics, clothes closets, porches and outbuildings, unless used for purposes bringing them within one of these classes, are not considered. The "equivalent floor space" is defined as the total square feet of floor space in the working area plus one-half the square feet of floor space in the idle area. In the tabulations which follow the equivalent floor space is not used, but the volume is estimated on the basis of the total floor space, equal to the sum of the total square feet of working space and the total square feet of idle space. The volume, or cubical contents, of the residence is then estimated on the basis of the total floor space computed as above and an assumed ceiling height of 9 ft. It is apparent that the figure thus determined is perhaps considerably less than the figure one would get by using the outside dimensions of the residence to determine the floor space and the studding height for the ceiling height. However, for purposes of making a comparative study of the energy requirements of residences of different sizes, this method of computing comparative volumes should be quite satisfactory and convenient from all standpoints.

The annual cost of energy is calculated on the basis of 0.5 cent per kilowatt-hour, which is the heating rate in effect unless the total annual charge thus computed is below the minimum of $9 per kilowatt of connected load per annum, in which case the minimum charge is applied. A considerable percentage of certain classes of consumers pay in excess of the 0.5-cent rate on account of the application of the minimum.

RESIDENCES CLASSIFIED

For purposes of this study residences were classified as follows:

1. As to cubical contents.
2. As to number of kilowatts of connected load.
3. As to type, that is, isolated residences and apartments.

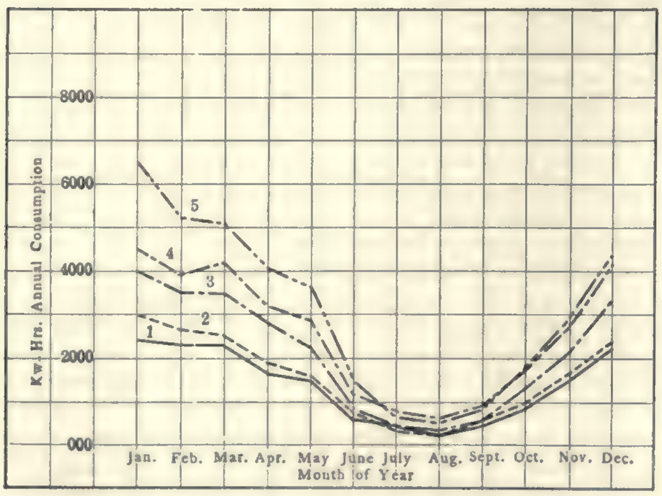


FIG. 3—MONTHLY ENERGY CONSUMPTION BY CLASSIFIED GROUPS OF CONSUMERS

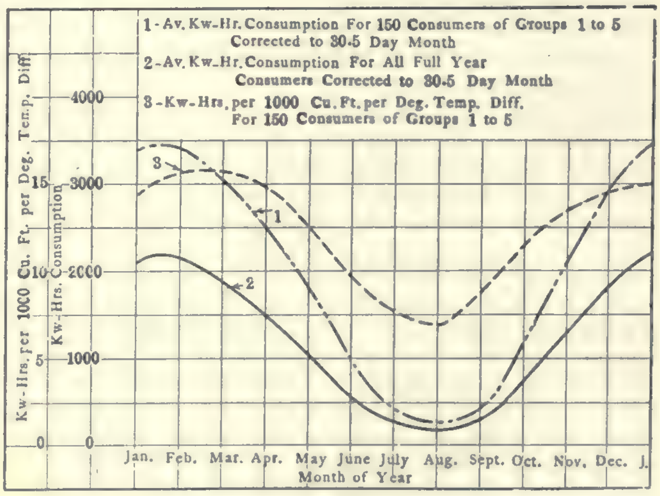


FIG. 4—MONTHLY CONSUMPTION OF ENERGY CORRECTED FOR A 30½ DAY MONTH

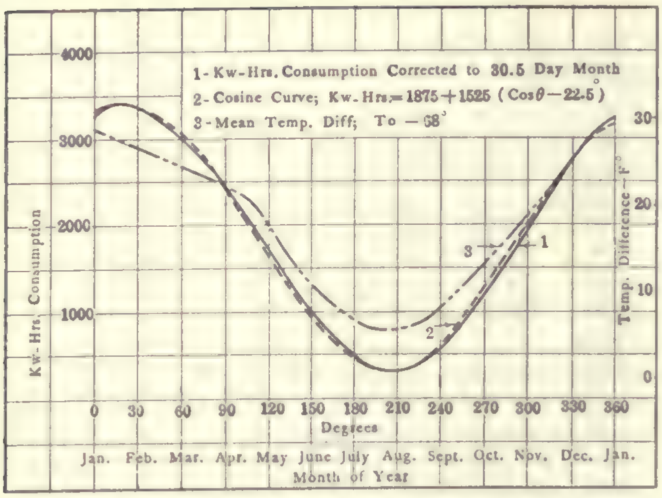


FIG. 5—VARIATION OF CONSUMPTION WITH MONTHLY TEMPERATURE CHANGES

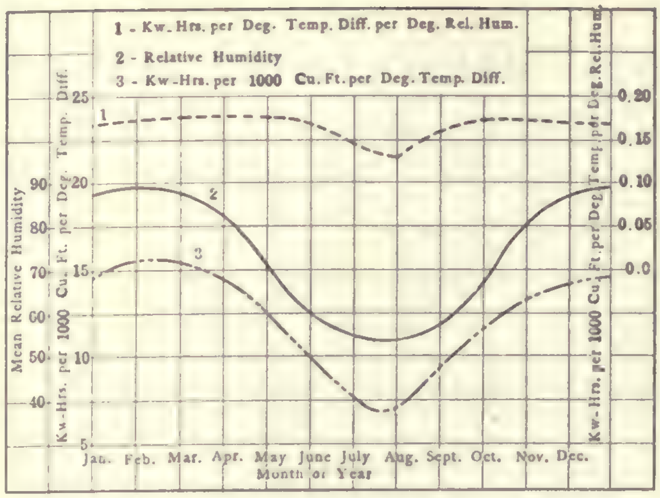


FIG. 6—CONSUMPTION AS AFFECTED BY TEMPERATURE DIFFERENCE AND RELATIVE HUMIDITY

4. As to type of heating plant, into portable heater and furnace plants.

Classification by volume:	Cubic Feet
Group 1—Residences having cubical contents from	4,500 to 6,300
Group 2—Residences having cubical contents from	6,300 to 8,100
Group 3—Residences having cubical contents from	8,100 to 9,900
Group 4—Residences having cubical contents from	9,900 to 11,700
Group 5—Residences having cubical contents from	11,700 to 15,300

Classification as to Type:

Group 6—Apartments
Group 7—Residences having electric furnace plants.

Classification as to Connected Load	Kilowatts
Group 8—Residences with connected load of from	6 to 8
Group 9—Residences with connected load of from	8 to 10
Group 10—Residences with connected load of from	10 to 15
Group 11—Residences with connected load of from	15 or more

The classifications are, of course, not exclusive with respect to one another, and a given residence may be classed in more than one of the various groups. An apartment, for example, may be found in each of the groups 1, 6 and 8, while a certain residence of group 3 may also appear in groups 7 and 9. In listing residences only those were chosen from which the heat energy required was largely or wholly furnished electrically throughout the entire year. A very large percentage of the subscribers who are provided with connections for heating supplement a small amount of electrical heating with heating by wood-burning or coal-burning stoves. It is impossible to determine simply by inspection of the records which consumers use the electrical method only. However, except for the very small residences, it is unlikely that consumers having less than 6 kw. of connected load could heat satisfactorily by electrical energy alone. Consumers with less than 6 kw. were therefore eliminated from consideration and were not listed in the above groups.

Growth of the Heating Load

As a matter of interest Table I is included. Here is given a general summary of the data pertaining to the heating load for the years 1919, 1920 and 1921. The average connected load per consumer remained relatively constant at about 6.5 kw. The average annual income per heating customer during the last two years was about $51. This represents the income from heating only and is the average for all heating customers connected to the system. If all consumers having less than 4 kw. of connected load be excluded, the average figure for the last two years becomes about $80. The average selling price of energy for heating was 55 mills per kilowatt-hour, or 5 mills in excess of the established rate.

In Table V a number of typical consumers belonging to group 1 are listed, together with the pertinent data pertaining to their respective consumption. These are listed in detail in order to afford a better picture of the variations in the several items as between consumers of a given class. The best index to the comparative energy requirements for heating, and one which will serve to compare the requirements of consumers of the different classes, is the "kilowatt-hours per 1,000 cu.ft. per annum." The average value of this figure is fairly constant for all the different groups. It is lowest for the group containing apartment dwellers only and highest for the group having furnace installations. This is to be expected, since these two groups represent the extremes.

Apartments are usually small and compactly built. The exposed superficial area upon which radiation depends is relatively small per unit of volume inclosed. An apartment on any floor except the lowest and the highest in a given building will have its floors and ceilings as well as its inner walls heated by energy liberated in adjacent apartments. Furthermore, the heating plant in nearly every case consists of portable heaters which radiate the energy liberated directly into the space to be heated, and the efficiency of heat utilization is accordingly 100 per cent. Residences provided with furnace plants, on the other hand, are isolated residences with relatively more superficial area per unit of volume inclosed, with a lower efficiency of utilization owing to radiation in the basement where the furnace is installed and with a less flexible heating plant, and therefore one which will probably be operated less economically. It should also be observed that 50 per cent of the apartments listed failed to use the minimum energy requirement of 1,800 kw.-hr. per kilowatt of connected load, whereas among the consumers of group 6 only two were penalized. Thus the apartment dweller seems to have a greater reserve and is better prepared to meet the rigors of a sudden cold snap.

A further point of interest is the wide divergence which exists between the largest and smallest values of specific consumption. Thus among the furnace plants the specific consumption ranges from a maximum of

6.1 kw.-hr. to 1.6 kw.-hr. per 1,000 cu.ft. per annum. Naturally, considerable differences are bound to exist for a number of reasons, among which personal preferences as to temperatures required for individual comfort, the presence or absence of strong incentives to the practicing of economy in the use of energy, the number in a family and the extent to which the residence is continuously occupied are perhaps the principal ones.

Average figures for members of the groups having the lowest and highest load factors are given in Tables II and III. The average consumption for these groups is here tabulated month by month in order to show the effect on consumption of outdoor temperature and other climatic conditions. The mean monthly temperature for the locality is given in column 8, while the ninth column gives the mean monthly temperature difference between out of doors and an assumed indoor temperature of 68 deg. F. The last column in the table gives the consumption per unit volume per degree temperature difference. This figure varies with the season of the year on account of the changing humidity, as will be shown later. However, these figures obtained for a given community under given climatic conditions should be fairly applicable to other communities under different conditions, provided that houses are equally well built in every case, that the average humidity is not greatly different and that varying exposure to winds does not introduce appreciable errors.

Perhaps one of the most interesting relations brought out in the present study is the relation between energy consumption for heating and the

TABLE II—ENERGY CONSUMPTION FOR RESIDENCES FROM 6,300 CU.FT. TO 8,100 CU.FT. VOLUME

Number of consumers considered, 29. Average connected load, 10.1 kw. Average estimated volume, 7,310 cu.ft. Average ratio of working space to idle space, 2.02. Average annual load factor, 20.9 per cent.

Month	Kw.-hr. Consumption, Total	Kw.-hr. Consumption, Average	Per Cent Yearly Total	Average Cost	Kw.-hr. per 1,000 Cu.Ft.	Average Cost per 1,000 Cu.Ft.	Average Outdoor Temp., Deg. F.	Average Temp. Difference to — 68 Deg. F.	Kw.-hr. per 1,000 Cu.Ft. per Deg. Temp. Difference
January....	86,300	2,980	16.1	$16.10	407	$2.20	40.3	27.7	14.7
February...	77,882	2,680	14.5	14.45	353	1.98	42.8	25.2	14.0
March.....	72,466	2,495	13.5	13.50	341	1.85	44.6	23.4	16.3
April......	55,452	1,910	10.3	10.30	261	1.41	47.2	20.8	12.5
May.......	45,373	1,560	8.4	8.35	214	1.14	53.6	14.4	14.9
June......	21,555	742	4.0	4.00	101	.55	60.0	8.0	12.6
July.......	10,194	350	1.9	1.90	48	.26	61.4	6.6	7.3
August.....	7,597	262	1.4	1.40	36	.19	62.2	5.8	6.2
September..	15,475	533	2.9	2.90	73	.40	56.3	11.7	6.2
October....	29,625	1,020	5.5	5.45	140	.75	53.2	15.7	8.8
November..	47,977	1,655	8.9	8.90	226	1.23	45.6	22.4	10.1
December..	67,922	2,340	12.6	12.60	320	1.72	38.4	29.6	10.8
Total....	537,818	18,527	100.0	$99.85	2,520	$13.68	....	....	134.4
Average..	....	......	.....	......	.....	.....	50.4	17.6	11.2

TABLE III—ENERGY CONSUMPTION FOR RESIDENCES FROM 9,900 CU.FT. TO 11,700 CU.FT. VOLUME

Number of consumers considered, 19. Average connected load, 13.3 kw. Average estimated volume, 10,850 cu.ft. Average ratio of working space to idle space, 2.8. Average annual load factor, 26.3 per cent.

Month	Kw.-hr. Consumption, Total	Kw.-hr. Consumption, Average	Per Cent Yearly Total	Average Cost	Kw.-hr. per 1,000 Cu.Ft.	Average Cost per 1,000 Cu.Ft.	Average Outdoor Temp., Deg. F.	Average Temp. Difference to — 68 Deg. F.	Kw.-hr. per 1,000 Cu.Ft. per Deg. Temp. Difference
January....	87,180	4,590	15.0	$23.20	423	$2.14	40.3	27.7	15.3
February...	74,878	3,940	12.9	19.90	363	1.85	42.8	25.2	4.4
March.....	78,234	4,120	13.4	20.70	380	1.91	44.6	23.4	16.2
April......	60,153	3,170	10.3	15.90	292	1.47	47.2	20.8	14.0
May.......	54,948	2,890	9.5	14.65	266	1.35	53.6	14.4	18.5
June......	23,103	1,215	4.0	6.15	112	.57	60.0	8.0	14.0
July.......	13,662	720	2.3	3.55	66	.33	61.4	6.6	10.0
August.....	10,172	536	1.8	2.80	50	.26	62.2	5.8	8.6
September..	16,460	866	2.8	4.30	80	.40	56.3	11.7	6.8
October....	33,704	1,775	5.8	8.95	164	.83	52.3	15.7	10.5
November..	50,269	2,650	8.6	13.20	244	1.22	45.6	22.4	10.9
December..	79,239	4,170	13.6	21.00	384	1.95	38.4	29.6	13.0
Total....	582,000	30,642	100.0	$154.30	2,824	$14.28	....	....	152.2
Average..	....	......	....	......	...	....	50.4	17.6	12.7

TABLE IV—SUMMARY OF ENERGY CONSUMPTION OF ALL KINDS

Group No.	No. of Consumers in Group	Average Kw.-hr. Consumed per Year	Average Cost to Consumer	Average Estimated Volume, Cu.Ft.	Average Ratio of Working Space to Idle Space	Kw.-hr. Consumed per Cu.Ft. per Year	Annual Cost per 1,000 Cu.Ft.	Average Kw.-hr. per Year per 1,000 Cu.Ft. per Deg. Temp. Difference	Average Connected Load in Kw.
1	50	16,680	$89.50	5,520	2.9	3.0	$16.15	13.5	8.4
2	29	18,527	99.85	7,310	2.02	2.5	13.70	11.2	10.1
3	40	25,197	130.65	9,840	2.7	2.6	13.32	11.0	12.2
4	19	30,642	154.30	10,850	2.8	2.8	14.28	12.7	13.3
5	12	37,083	187.80	13,400	1.8	2.8	13.95	12.0	16.9
6	51	11,900	65.70	5,000	2.4	2.4	13.15	10.3	6.3
7	18	33,209	171.15	9,660	2.1	3.4	17.72	14.3	14.6
8*	119	13,718	72.30	6,780	2.4	2.0	10.73	8.6	6.4
9	58	16,858	90.50	7,090	2.7	2.4	12.65	10.3	8.9
10	73	23,841	126.90	8,820	2.2	2.7	14.40	12.0	11.9
11	25	40,460	209.40	11,300	2.0	3.6	18.60	15.6	19.0

* A considerable percentage of the subscribers of group 8 used auxiliary heat.

TABLE V—INDIVIDUAL CONSUMPTION OF ENERGY BY SMALL RESIDENCE CONSUMERS

Customer No.	Kw.-Hr. Consumption Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total Kw.-Hr.	Cost	Cu.Ft. Vol.	U.S.P. / I.S.P.	Kw.-Hr. per Cu.Ft. per Year	Kw. Conn. Load
1	2,641	2,537	2,744	1,937	1,641	777	520	293	768	1,178	1,620	2,111	18,767	$93.85	5,610	2.7	3.3	10.1
2*	2,620	2,313	2,643	1,734	1,583	618	421	...	442	1,008	1,185	2,577	17,144	103.50	6,300	2.6	2.7	11.5
3*	2,651	3,243	3,415	2,911	2,229	1,165	474	422	476	960	1,607	2,965	22,518	115.20	5,460	2.7	4.1	12.8
4	2,125	1,551	3,864	2,128	3,303	1,313	995	811	1,232	1,947	2,899	3,606	25,774	128.90	5,940	2.9	4.3	12.3
5*	2,472	2,514	2,583	1,865	1,914	950	620	462	500	964	1,210	2,041	18,095	103.50	5,760	1.8	3.1	11.5
6*	2,584	2,566	2,318	2,001	1,708	864	684	342	445	810	1,327	2,249	17,898	96.30	5,850	3.3	3.1	10.7
7*	2,500	2,371	2,454	1,869	1,764	670	378	206	348	797	1,374	1,884	16,615	86.40	4,650	2.6	3.6	9.6
8*	2,500	2,132	724	1,199	1,128	379	268	135	268	508	924	1,117	11,282	83.60	5,390	3.8	2.1	9.3
9*	2,407	2,385	2,690	1,894	1,601	510	258	....	100	282	522	819	13,468	86.40	4,510	1.7	3.0	9.6
10	3,500	2,699	3,182	2,133	2,049	965	551	363	590	1,007	1,587	2,637	21,263	106.30	4,510	1.9	4.7	9.2
11*	1,505	1,897	2,266	1,699	1,645	629	345	239	257	750	1,464	1,500	14,196	85.50	5,520	2.6	2.6	9.5
12	2,824	2,000	826	1,476	1,477	600	.....	.....	1,051	869	1,513	2,656	15,294	76.50	5,580	3.1	2.7	8.1
13	2,782	2,502	2,544	1,969	1,790	1,013	908	667	987	1,383	1,593	2,383	20,521	102.60	5,630	4.3	3.9	6.8
14	1,705	1,785	1,770	1,490	1,354	878	650	449	522	1,018	1,283	1,243	14,147	70.74	6,150	3.8	2.4	6.0
15	2,005	1,962	1,818	1,341	1,003	393	.....	.....	163	550	1,320	2,093	12,678	63.90	5,070	2.8	2.7	7.1
16	1,883	1,746	1,466	1,630	1,320	359	189	.....	194	508	1,191	2,003	12,489	62.45	6,070	3.0	2.2	6.3
17	3,200	2,814	2,473	1,805	1,570	404	273	101	554	1,021	1,539	2,379	18,133	90.65	5,850	2.4	3.3	6.0
18*	2,064	2,398	958	543	433	.....	.....	134	.....	480	907	2,027	9,944	54.00	6,150	3.3	1.7	6.0

* Starred consumers paid the minimum of $9 per kw. connected load.

temperature difference between indoors and outdoors. Several sets of curves illustrating this relation are presented. The first is shown in Fig. 3. Here each of the numbered curves shows the month-by-month energy consumption for the corresponding group. The average consumption for all is shown by curve 1 of Fig. 4. The corresponding variation of temperature difference is shown by Fig. 5. A great similarity between the shape of the consumption curves and the temperature difference curves will be noted. As already pointed out, the consumption for a given month is in reality the consumption for one-half the current month plus one-half the previous month on the average. However, the values of temperature difference are in every case the mean values for the current month. For these reasons the values of consumption are plotted on the first of the month while the temperature differences are plotted on the fifteenth of the month. Irregularities (Fig. 3) are due to two principal causes, namely, marked variations from normal in the weather conditions and differences in the number of days included in the billing. Irregularities due to weather conditions have been verified by reference to climatological data, the high point during the month of May being a good example. Inequalities in the time included in the billing are well illustrated by the low points in February. By correcting all months to a thirty-and-one-half-day basis and then drawing a smooth curve through the corrected values, the curves of Figs. 4, 5 and 6 are obtained.

The resulting smooth curves are found to be very nearly simusoidal. This is illustrated by the curves of Fig. 5, showing the average monthly consumption in percentage of yearly total for 375 customers during 1921, the corresponding temperature difference curve and the sinusoidal curve. The agreement between the cosine curve and the energy curve plotted from the data is exceedingly good throughout the year. The error introduced when computing the energy required for the year from the cosine curve is only 0.75 per cent. While it is unfair to draw any general conclusions from these curves, yet it seems likely that a close approximation to the energy requirements for heating for an average season in this locality may be closely predicted from the simple sine curve.

Influence of Humidity

That humidity is an important factor in determining the amount of heat energy required for comfort is clearly illustrated by the curves of Fig. 6. It is there shown that the kilowatt-hour consumption per 1,000 cu.ft. per degree temperature difference is greatest during the months of high humidity and least during the months of low humidity, the average maximum and minimum values for the 150 consumers considered being

TABLE VI—LOAD FACTORS AND VOLUME HEATED PER KILOWATT

The nine-month load factor is computed on the basis of the actual kilowatt-hours used during the nine months in question. (The three months of lowest consumption are omitted.)

Group No.	Average Kw. Connected Load	Average Kw.-hr. Annual Consumption	Annual Kw.-hr. Consumed per Connected Kw.	Per Cent Load Factor, Nine-Month Basis	Per Cent Average Annual Load Factor	Cu.Ft. Heated per Kw. Connected Load
1	8.5	16,680	1,970	27.9	22.5	654
2	10 1	18,527	1,830	26.1	20.9	724
3	12.2	25,197	2,060	29.7	23.6	804
4	13.3	30,642	2,300	32.6	26.3	817
5	16 9	37,083	2,190	31.5	25.0	794
6	6.3	11,900	1,890	27.0	21.6	794
7	14.6	33,209	2,270	34.5	25.9	662
Average	....	......	.....	29.9	23.7	764

16.1 and 6.3 respectively. A smooth curve plotted through the month-by-month values shows the usual winter peak and summer valley. Upon plotting the humidity curve its shape was found to correspond closely to the shape of the specific energy consumption curve. Thus, by dividing the average values of kilowatt-hours per 1,000 cu.ft. per degree temperature difference by the corresponding values of the relative humidity curve 1 of Fig. 6 is obtained. This is approximately a straight line if the values for the summer months be omitted, and these values should properly be omitted since most consumers heat very little or not at all during these months. It may, therefore, be stated that the kilowatt-hours per 1,000 cu.ft. per degree of temperature difference per degree of relative humidity is practically constant for the nine heating months of the year, the average figure for the 150 consumers considered being 0.172 on the nine-month basis. On the basis of twelve months the average value is 0.165. These figures should be of value in determining or predicting energy requirements for heating, not only for the Puget Sound country, but anywhere. As previously pointed out, the type of construction used will, of course, also have to be considered.

Diversity Factor

It is very difficult to get reliable data on the diversity of the heating load alone because the usual lighting and appliance loads are fed from the same transformers. Several attempts have been made to determine what this factor is for a limited number of residences and apartments, as a result of which it seems clear that some diversity does exist and that the diversity factor is somewhere in the neighborhood of 1.6. This diversity is due to the varying habits of consumers, to the fact that a considerable number of residents are away from home during the afternoons and evenings, and to the further fact that a large number of the homes using electrical energy for heating use it as auxiliary to a coal or wood heating plant.

TABLE VII—CLIMATOLOGICAL DATA FOR TACOMA—1921

Item	Month of Year											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Mean temperature	40.3	42.7	35.0	47.2	53.6	60.0	61.4	62.2	56.3	52.3	45.6	38.4
Departure from normal	+2.2	+2.3	+0.4	—1.7	—0.9	+0.6	—2.0	—0.8	—1.3	+1.7	+1.5	—1.9
Precipitation in inches	5.92	5.53	4.36	2.2	2.1	1.64	0.01	1.18	1.59	2 77	6.82	7.36
Departure from normal	+0.14	+0.4	+0.38	—0.56	—0.44	—0.49	—0.65	—0.48	—0.88	—0.63	—1.71	+0.03
Total snow unmelted	2.5	8.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.0	3.5
Greatest precipitation in twenty-four hours	1.67	1.17	2.23	0.5	1.06	0.49	0.01	0.43	0.56	0 48	1 38	3.07
Number of days precipitation was 0.01 in. or more	24	19	16	16	9	15	1	7	13	14	21	15
Clear	0	1	2	1	9	0	7	3	3	6	0	1
Partly cloudy	8	9	13	14	13	15	21	21	16	7	4	7
Cloudy	23	18	16	15	9	15	3	7	11	18	26	23
Prevailing wind	S.W.	S.W.	S.W.	S.W.	N.	N.	N.	N.	S.W.	N.	S.W.	N.E.
Mean relative humidity	88	89	86	78	57	62	54	57	60	74	86	87
Average wind velocity, miles per hour	7.9	6.3	6.5	7.3	6.1	5.5	5.7	6.1	6.1	5.8	6.5	6.9

Inter-Scandinavian Superpower Project

Possibility of Transmitting Power from Norway to Denmark—220-Kv. Direct Current Competes Economically with 132-Kv. Three-Phase—Plans Call for 80-Mile Submarine Cable or 3-Mile Aerial Crossing on 650-Ft. Steel Towers

TWO years ago an inter-Scandinavian commission was appointed by the governments of Denmark, Sweden and Norway to investigate the possibilities of an economical transmission of some of the hydro-electric energy from mountainous Norway to densely populated Denmark, a country which is virtually devoid of every natural source of power. The report of this commission was recently made public. Although the result of its work undoubtedly shows that the project will be difficult of realization economically until construction costs decrease and a bigger power market can be developed in Denmark, the report is of considerable value because a great number of possible alternatives were investigated in detail. With respect to the engineering solutions considered the report offers some remarkably interesting comments.

Of four alternatives finally chosen as the most practicable, two are based upon the use of two-conductor, 220,000-volt direct-current transmission by the Thury constant-current series system, while the two others favor a 132,000-volt, three-phase transmission line.

MARKET FOR ENERGY IN DENMARK STILL TO BE DEVELOPED

Within ten or fifteen years the power demand in Denmark will probably reach 500,000,000 kw.-hr. a year, with a peak load of 157,000 kw. on a load factor of 37 per cent. Obviously it would not be economical to build a transmission plant for such a load, but an analysis of Danish conditions has shown that a base load of 410,000,000 kw.-hr. could be delivered with a maximum demand of 63,000 kw., corresponding to a load factor of 76 per cent. For the estimates two-thirds of the latter amount was chosen as a basis for the first stage of development.

Under these conditions the figures for the four contemplated alternate schemes are surprisingly close together, the cost a kilowatt-year delivered at 50,000 volts at five important load centers in Denmark being estimated at from \$48 to \$53, with a decrease to about \$38 a kilowatt-year when the load increases to 100,000 kw. The prices current in the spring of 1922 were used in the estimates, and the costs will have to be corrected according to prevailing prices. The estimated cost of the entire transmission plant varies from \$10,500,000 for the cheaper direct-current project to \$12,200,000 for the more expensive of the three-phase alternatives. Very nearly one-half of the total yearly cost of the power is determined by the cost of energy in Norway, which was estimated at \$17 a kilowatt-year. The other half of that cost is made up of a 10 per cent annuity on the investment.

According to the more favorable of the two direct-current transmission schemes, power would be transmitted directly from Norway to Denmark through an 80-mile cable in Skagerack as shown on the map (Fig. 1). The plan calls for three single-conductor cables, each insulated for 110,000 volts to sheath. One of these would be a reserve cable, although normally running in parallel with one of the others. The copper area required is 185 sq.mm. (365,000 circ.-mil), and the cost of the cables is about 16 per cent of the total cost.

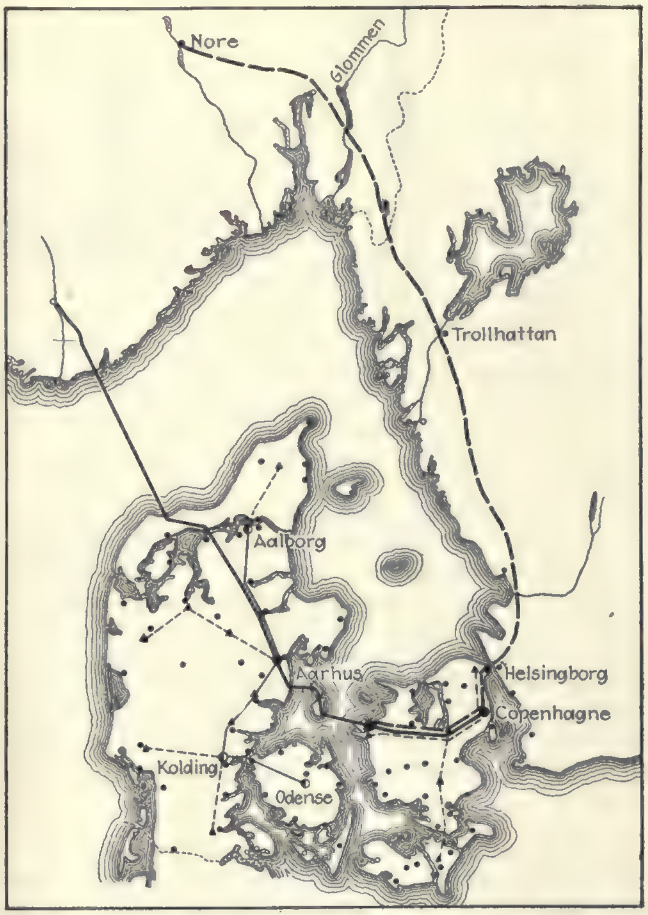


FIG. 1 — PROJECTED TRANSMISSION LINE FOR 132,000-VOLT, THREE-PHASE ENERGY FROM NORWAY TO DENMARK WITH 110,000-VOLT DIRECT-CURRENT CABLES IN THE NORTH SEA

The system is assumed to work at a constant current of 250 amp. at varying voltages up to $2 \times 110,000$, and the current would be delivered from two banks of eight series-generator sets, each set having two 7,000-volt armatures. At the receiving end two similar banks of motors would be used, although these would be installed in different parts of Denmark. The motors would be directly connected to synchronous generators, which would convert the power to three-phase, and this would be stepped up to 50,000 volts for further distribution. The mid-point of the generator and motor systems would be solidly grounded, so that each 110,000-volt side could operate with a ground return in case of trouble on the other side. The current would be kept at 250 amp. by means of high-speed brush-shifting regulators, and by similar devices the speed of the high-tension motors

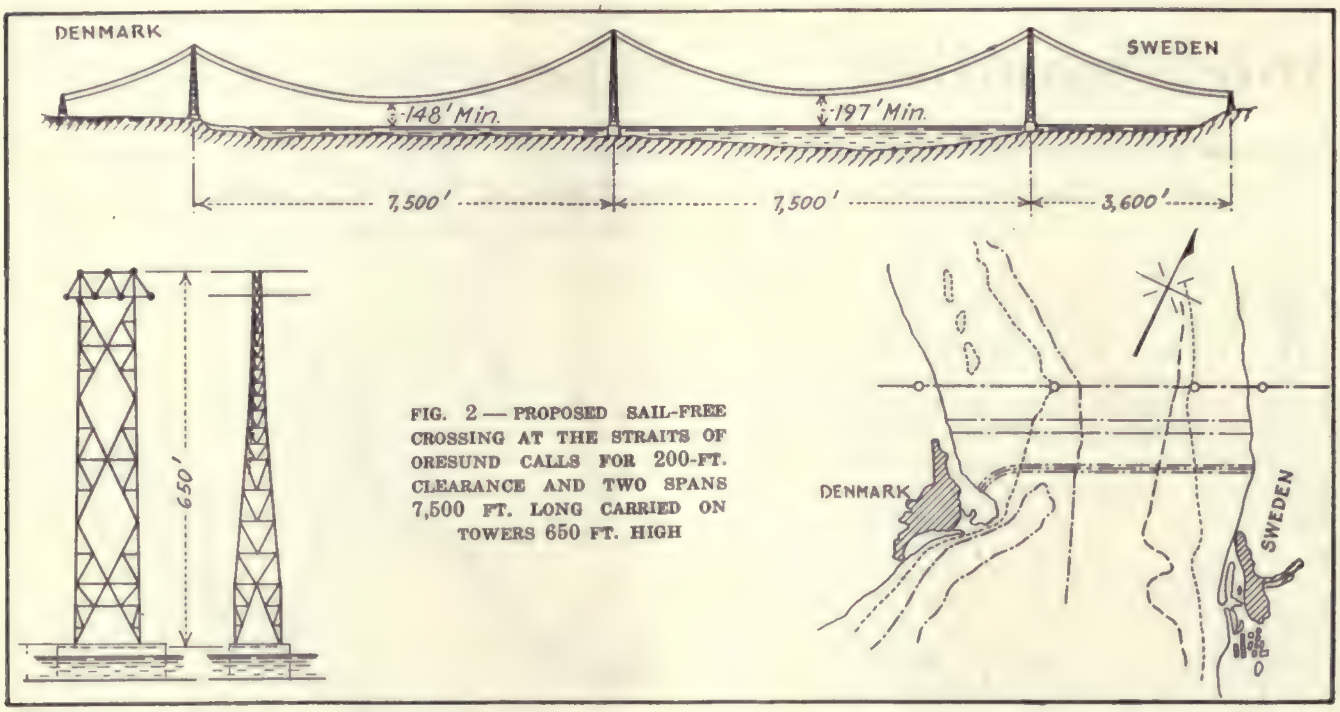


FIG. 2 — PROPOSED SAIL-FREE CROSSING AT THE STRAITS OF ORESUND CALLS FOR 200-FT. CLEARANCE AND TWO SPANS 7,500 FT. LONG CARRIED ON TOWERS 650 FT. HIGH

would be regulated to correspond to a fixed frequency on the three-phase side.

If three-phase transmission were used from Norway to Denmark, a 132,000-volt line would be erected along the Swedish coast down to Helsingborg, on the Straits of Oresund. Since at present cables cannot be operated safely above 50,000 volts, it would be necessary to step down to this voltage before crossing to Denmark. In that case very expensive synchronous-condenser stations would be needed to insure good voltage regulation on the Danish system, and this would limit the economic transmission capacity of the system to about 50,000 kw.

Proposed Overhead Crossing

An alternate scheme therefore has been worked out, calling for an aërial crossing 200 ft. high as a minimum over the Straits. Two spans would be needed, each 7,500 ft. long and carried on 650-ft. high steel towers. The conductors would be 240 sq.mm. (475,000 circ.mil) extra-high-quality steel, surrounded by 110-sq.mm. (217,000-circ.mil) aluminum. The cost of the towers was estimated at $320,000 each, including foundations, consisting of concrete caissons 200 ft. x 100 ft. x 53 ft.

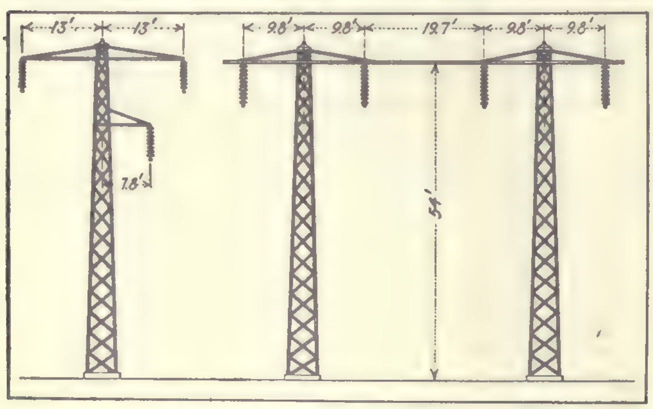


FIG. 3—A SINGLE TOWER WITH THREE 132,000-VOLT CONDUCTORS IS FIRST STAGE OF DEVELOPMENT

With two towers, three live and one reserve conductors for 220,000 volts may be used. The last stage comprises three towers with a 95-ft. crossbeam and two 220,000-volt three-phase circuits.

The total cost of the crossing would be approximately $850,000.

Hydro-electric energy from the Nore falls in Norway, which are now being developed, could be directly transmitted at 132,000 volts over a 400-mile line to Copenhagen, and by increasing the voltage to 220,000 about 105,000 kw. could be economically transmitted per circuit. With such a possibility in mind, the commission recommends the use of the type of transmission towers shown in Fig. 3. At first only one leg would be erected, as shown at the left, and three or four (one reserve) conductors would be used. In the next stage one more tower would be built and the line converted to four-wire, 220,000-volt. Finally a third tower would be added, and six 220,000-volt conductors employed. This type of tower has been chosen for certain other 132,000-volt trunk lines already built in Sweden. The horizontal arrangement of the conductors offers advantages such as facilitating work on the reserve conductor when the line is alive and minimizing contact hazards due to sleet and rain.

400-Mile Transmission Line

Using this type of construction and providing ample mechanical and electrical safety factors, the cost of a 3×120 sq.mm. ($3 \times 236,000$ circ.mil) copper line for 132,000 volts is estimated at $8,800 a mile, and a four-wire 400-sq.mm. aluminum + 90-sq.mm. steel (790,000 circ.mil aluminum + 178,000-circ.mil steel) line insulated for 220,000 volts would cost about $20,000 per mile, based on 1922 market conditions.

Cents, Not Dollars

IN THE article entitled "What It Means to Change from Overhead to Underground," on page 856 of the ELECTRICAL WORLD, issue of Oct. 27, cents, not dollars, should be the unit of cost for the duct foot units given in the first ten items at the top of the page in the right hand column. Also, in the three line summary of costs in the same table, "Per Manhole" applies to the first item only.

Drying Transformers—II

Best Equipment to Use in Drying—Methods for Tanking Transformer After Drying—Limitations of Treatment and Precautions to Be Used in Field Work

By M. E. SKINNER
Assistant to Vice-President Duquesne Light Company, Pittsburgh, Pa.

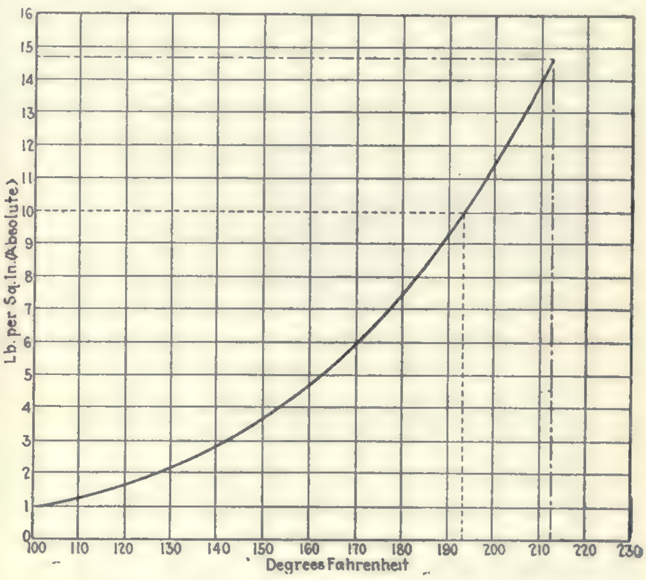
THE fundamental idea of the method of drying advocated in this article is to circulate about 500 cu.ft. of heated air per minute through the ducts of each transformer which is being dried. The proper amount depends upon the size of the unit and, of course, upon whether it is single-phase or three-phase. A 2,000-cu.ft.-per-minute blower should be amply sufficient to take care of drying a bank of three large-capacity units at one time.

With the relatively slow air velocity through the ducts of the transformer the pressure required to force the air through the windings will be low, probably less than ½ oz. per square inch. In fact, the pressure to be supplied by the blower will be determined largely by the drop through the heater, the screens and passages rather than that through the transformer itself. If the piping is of large cross-section and the area of the inlet screen is large, the total pressure may be less than 1 oz. per square inch. However, in many cases this would hardly be sufficient, so it is recommended that the blower be capable of delivering its volume against a pressure of at least 1½ oz. per square inch. Any excess pressure available in the blower can be absorbed by increasing the thickness of cheesecloth over the blower intake or by throttling down the ducts leading to the transformer by means of dampers.

In general, a constant-speed motor will be desirable. Belt drive is more flexible than any other type as it permits the use of various motor speeds without changing anything except the pulley ratio. For a blower, which will deliver 2,000 cu.ft. of air per minute against a pressure of 1½ oz., the power requirements should not exceed 3 hp. In applying the motor it should be kept in mind that either increasing the blower speed or decreasing the back pressure against which it is working will tend to overload the driving motor.

Heaters employing almost any kind of fuel, coal, oil, gas or electricity, may be used, although the latter has many advantages over the first three, any of which will require more or less constant attention and even when carefully watched will result in considerable variations in the temperature of the heated air. Another disadvantage of these heating agents is the fact that the heat must be applied indirectly in order to avoid the injurious effects of the products of combustion on the insulation of the transformer. Of the various types of electrical heating elements, the common cast-grid frame is probably best suited to this work. This construction is extremely rugged, is most readily obtained and can be restacked when necessary to change the value of the resistance. Such a resistance element will also stand, without burning out, the very high temperatures which would result if the air supply should fail for any reason. It is also very well adapted for boxing in so that all the air passes through the active section of the heater.

The control in its simplest elements would consist of switches for the motor and heater circuits. For small motors a safety switch with thermal cut-outs is very convenient. As motors of the size which will be employed may usually be thrown directly on the line, it is not necessary to provide an under-voltage release. A knife switch will do for the heater circuit, but is not adapted for opening the circuit automatically in case of excessive temperatures in the grid chamber due to a failure of the air supply. This can most conveniently be arranged by the use of a circuit-breaker equipment with a low-voltage release and a small bake-oven thermostat. The thermostat is normally open but closes on excessive temperatures, short-circuiting the undervoltage release coil and opening the breaker.



CORRESPONDING TEMPERATURES AND PRESSURES AT WHICH BOILING TAKES PLACE

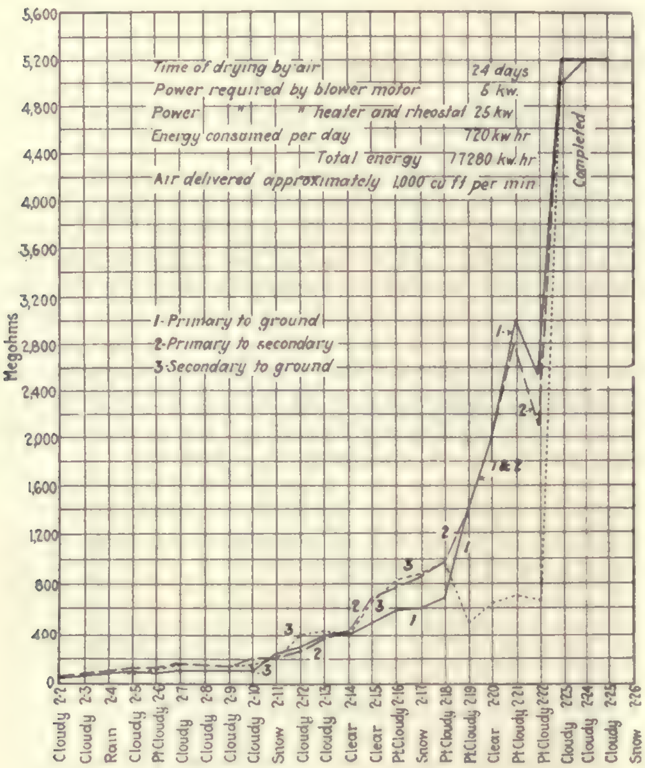
Any source of electrical energy of the proper voltage may be used to circulate current in the windings during the drying period. Alternating current will be found most convenient, for one winding may be short-circuited and the current circulated in both by impressing the necessary voltage across the other winding. If direct current were used, it would generally be necessary to use two sources of supply regulated independently of each other, one for each winding, and the voltage would be inconveniently low on one winding and probably high on the other.

The voltage V to be impressed upon the windings depends upon the impedance of the transformer and the

frequency employed. Z, the impedance of the transformer in ohms, may be obtained from the name-plate data as follows:

Let P = per cent impedance of the transformer (given on the name plate),
I = rated full-load current of either winding,
E = normal voltage of that winding,

then, $P = ZI/E \times 100$, or $Z = P/100 \times E/I$, or



TYPICAL CHART OF INCREASE IN INSULATION RESISTANCE DURING DRYING PROCESS

This was obtained without the use of circulating current. Drying could no doubt have been hastened by supplementing the hot-air heating with a small amount of heat from circulated current.

$I = P/100 \times E/Z$. Since the resistance component of the impedance is very small, the impedance may be considered as directly proportional to the frequency for all practical purposes. From the above it is evident that if a voltage $= P \times E/100$, called the impedance volts, is impressed across one winding, full-load current will flow. To reduce the current the voltage should be reduced in proportion.

As an example take the case of a 10,000-kva., single-phase, 60-cycle transformer for stepping down 110,000 volts to 22,000 volts and having 10 per cent impedance. The full-load current would be 10,000/22 kv. = 454 amp. on the low-voltage side.

$Z = 10/100 \times 22{,}000/454 = 5.0$ ohms at 60 cycles,
$= 2.08$ ohms at 25 cycles.

Twenty-two hundred volts, 60 cycles, impressed on the low-voltage winding would give full-load current, as likewise would 11,000 volts, 60 cycles, impressed on the high-voltage winding. To get one-tenth of full-load current these values should be reduced to 220 volts, 60 cycles, and 1,100 volts respectively. The corresponding figures for one-tenth full-load current at 25 cycles would be 91.6 volts and 457 volts respectively.

The value of current to be circulated depends largely upon local conditions. In general, it will be found to lie between one-fifth and one-tenth of normal full-load current. Its value should be adjusted to maintain a temperature at the inlet to the transformer of not over 90 deg. C. as measured by thermometer.

Opinions will always differ as to the details for handling any piece of work such as the drying of large transformers, but there are a few things in connection with the preparations which will always make for the success and rapidity of the undertaking. First might be mentioned precautions against loss of heat from radiation. These would include, first, shortening up the air ducts between the heater and the transformer as much as possible and, second, lagging the tanks and piping. As mentioned heretofore, a boiler-iron tank 6 ft. in diameter and 12 ft. high will radiate about 7 kw. with a temperature difference of 40 deg. C. between the tank and the outside air. This may be very materially reduced by wrapping tarpaulins loosely about the tank.

It is, of course, absolutely essential to take every precaution against the entrance of dirt into the transformer. Cheesecloth screens should be kept over the blower intake at all times. This cheesecloth should be renewed as frequently as necessary, and it will be found that soaking the cheesecloth with oil will greatly increase its effectiveness in filtering dirt and dust out of the air entering the blower.

With the method of drying suggested it is possible to put all bushings and fittings in place and complete the connections before the drying is begun. Openings in the tank, such as those through which the cooling-oil connections enter, are frequently made oil-tight by the use of a stuffing gland or gasket. Where this material will shrink or crack when dried out it may be necessary to protect such openings from the effects of the heated air. Otherwise they are liable to leak after the tank has been filled with oil.

Sufficient oil to fill the transformers completely should be properly conditioned, ready for use as soon as the drying shall have been completed. Where the oil has been shipped in drums samples from each should be tested to insure that every drum is in good condition. Whenever the oil fails to meet the standard test of 22,000 volts between 1-in. disks, separated 0.1 in., it should be filtered.

Measurements to Be Taken

Insulation resistance measurements to determine the condition of the insulation and temperature measurements to insure that the transformer is not heated dangerously must be taken periodically.

The insulation resistance should be measured from the high-voltage winding to the low-voltage winding, to the core, and from the low-voltage winding to the core. While the insulation resistance of a transformer is the best criterion we have of the dryness of a transformer, it is affected very markedly by a large number of factors besides moisture. It varies with the size and voltage of the transformer, with the form of construction, with the temperature, the fluid in which the transformer is immersed (air or oil), and finally with the moisture content. Being subject to the effect of all of these variables, it is almost impossible to predict what the proper insulation resistance for a given transformer should be. We know that the larger the physical dimensions of the unit and the lower the voltage class the lower the insulation resistance will be; that if the transformer is of the shell form of construction the insulation resistance will be lower than if it is of the core form; that it will be lower after the

transformer is filled with oil than before this is done, and finally that the higher the temperature the lower will be the insulation resistance. However, no one has been able to evaluate all of these factors quantitatively.

It is the practice of transformer manufacturers to measure the insulation resistance on the completion of the vacuum drying and oil impregnation at the factory and prior to the application of disruptive dielectric tests. This figure should be representative of an entirely satisfactory condition of dryness in the insulation and may be used to judge when the insulation resistance has reached its proper value. In making comparisons against this figure it is essential that all other conditions shall be comparable. This is especially true of the temperature, as the insulation resistance is very sensitive to changes in this factor. A transformer in which the insulation is dangerously wet may show a very high insulation resistance when cold.

The most reliable way of judging from insulation-resistance measurements when a transformer is dry enough to tank is to plot daily readings of resistances, all taken at the same temperature. When the insulation rises to a high value and remains steady for two or three days the transformer will be dry enough to tank. The final value of insulation resistance should compare reasonably well with the factory test. In case of a wide discrepancy some other factor other than moisture may be affecting the results.

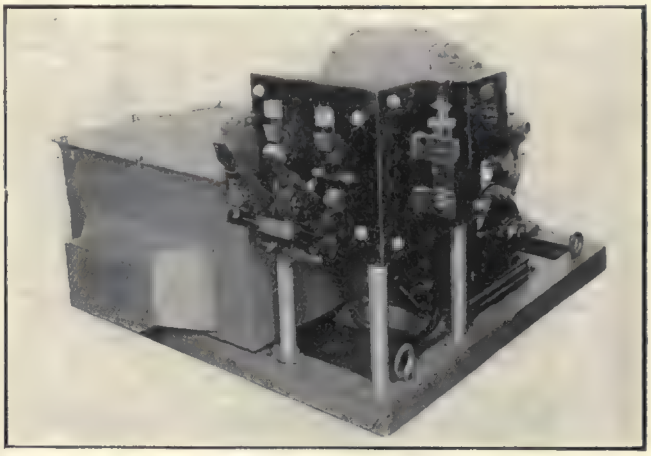
The most satisfactory way of measuring insulation resistance is by means of a megger. In case a megger is not available a high-resistance voltmeter may be used with a source of direct current, as shown in the illustration on page 968.

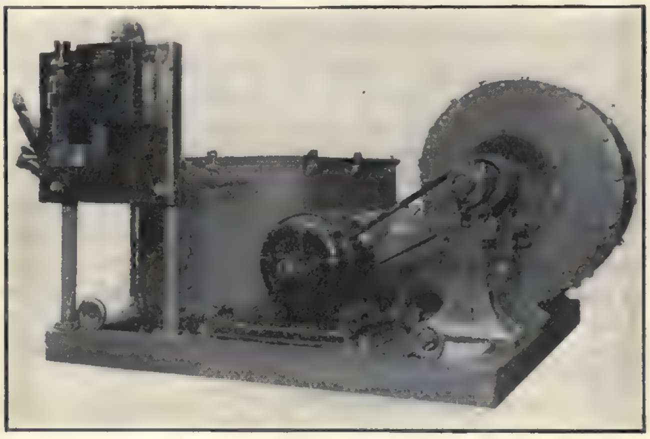
A very careful check on the maximum temperature of the insulation should be maintained throughout the progress of the drying period. If overheated, there is great danger of a fire from spontaneous combustion. It is important to keep in mind always that you are working with a large mass of oil-soaked, inflammable material and to treat it accordingly. A liberal number of thermometers should be placed in the windings. The temperature should also be checked daily from the resistance of the windings. In judging the temperature of the hottest spot from the thermometer and resistance measurements it is important to remember that the hottest air is entering at the bottom at the opposite end of the transformer from where the thermometers are located.

The hottest temperature of the insulation should not be allowed to exceed 105 deg. C. Taking into account the inability to reach the hottest spot with a thermometer, it will probably be advisable to keep the indication of the hottest thermometer below 90 deg. C.

It is important that the transformer be watched constantly during the drying period as the danger of fire is always present and the success of the method depends upon the maintenance of steady temperatures as close to the limit as is consistent with safety. A chart of the periodic readings of insulation resistance and temperatures will be found very useful in following the progress of the drying. Readings of insulation resistance should be taken at least once daily and preferably twice a day. Temperature readings should be taken as frequently as is deemed consistent with safety.

Sometimes transformers exhibit very peculiar performance during the drying period. Such freakish behavior can almost always be traced to some cause which, although it may be obscure at first, will very readily explain the difficulty once it has been located. A simple test which will frequently disclose difficulties of this nature is to take a cooling curve of the insulation resistance. As has been stated previously, the insulation resistance is extremely sensitive to changes in temperature, and as the transformer cools down the insulation resistance should increase materially. Any other behavior should immediately be followed up by a thorough investigation to determine the source of the difficulty. Sometimes moisture will be driven from one part of the insulation into another portion with an accompanying increase in the insulation resistance. Unless this moisture is completely removed from the transformer, however, as soon as the temperature falls the moisture will redistribute and leave the transformer in a dangerous condition. Such cases can be very quickly detected by means of a cooling curve like that referred to above. It is recommended that such a curve be taken in every case toward the conclusion of the drying period.





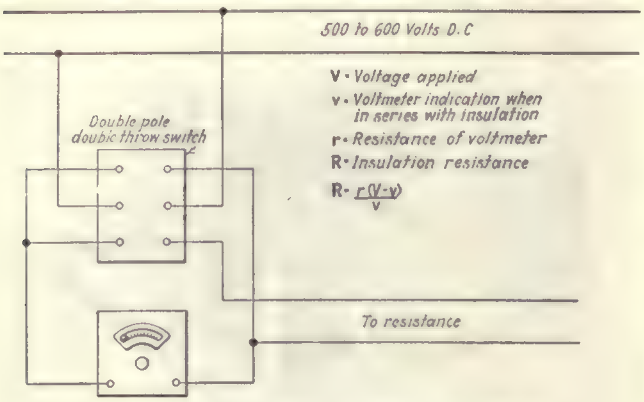
TWO VIEWS OF A DRYING OUTFIT

The apparatus has been mounted on a small angle-iron framework and is entirely self-contained. It has sufficient capacity to handle a bank of three transformers as large as have been constructed up to the present time and will probably be ample to take care of considerable growth in the size of power transformers.

TANKING THE TRANSFORMER

After the insulation-resistance measurements indicate that the transformer has reached a satisfactory condition the transformer should be tanked without delay. Speed is desirable for two main reasons—first, to prevent the insulation again taking up moisture and, second, to set up a circulation of the oil which will dislodge air bubbles which may have got into the transformer as it was being filled with oil. Air

bubbles are a very real source of danger in an oil-immersed transformer as a local discharge starting in such a bubble may spread until it develops into a complete breakdown. The higher the voltage of the unit the more important it is to see that all air bubbles have been removed before voltage is placed upon it.



RESISTANCE MEASURING METHOD TO USE IN ABSENCE OF MEGGER

In order to eliminate danger from this source, it has been the practice of some companies to fill their transformers by exhausting the cases and allowing the oil to flow in through one of the lower pipe connections. This method requires considerable auxiliary apparatus to maintain the partial vacuum, and there is some question whether its expense is justified on apparatus designed for commercial circuits. For testing transformers there is more to be said in favor of this method as the factors of safety are reduced considerably below those used on commercial apparatus and an overstrain caused by an air bubble is much more liable to cause trouble.

Fortunately, air dissolved in dry transformer oil is quite effervescent, and even when agitated violently the bubbles rise with surprising rapidity. If ordinary care is used and the hose through which the transformer is filled is directed against the side of the tank very few bubbles will remain in the oil as it gradually rises over the core and windings. If the tank is filled while the transformer is still hot, a good healthy circulation of oil will be maintained until the heat stored in the core and windings has been absorbed by the oil. This will be found very effective in driving out any air bubbles that have lodged in the windings and insulation.

If it is at all possible, voltage should be applied to the transformer very slowly when it is energized for the first time. This hardly needs further comment, as it is the natural thing to do in the case of any piece of apparatus on first putting it into service.

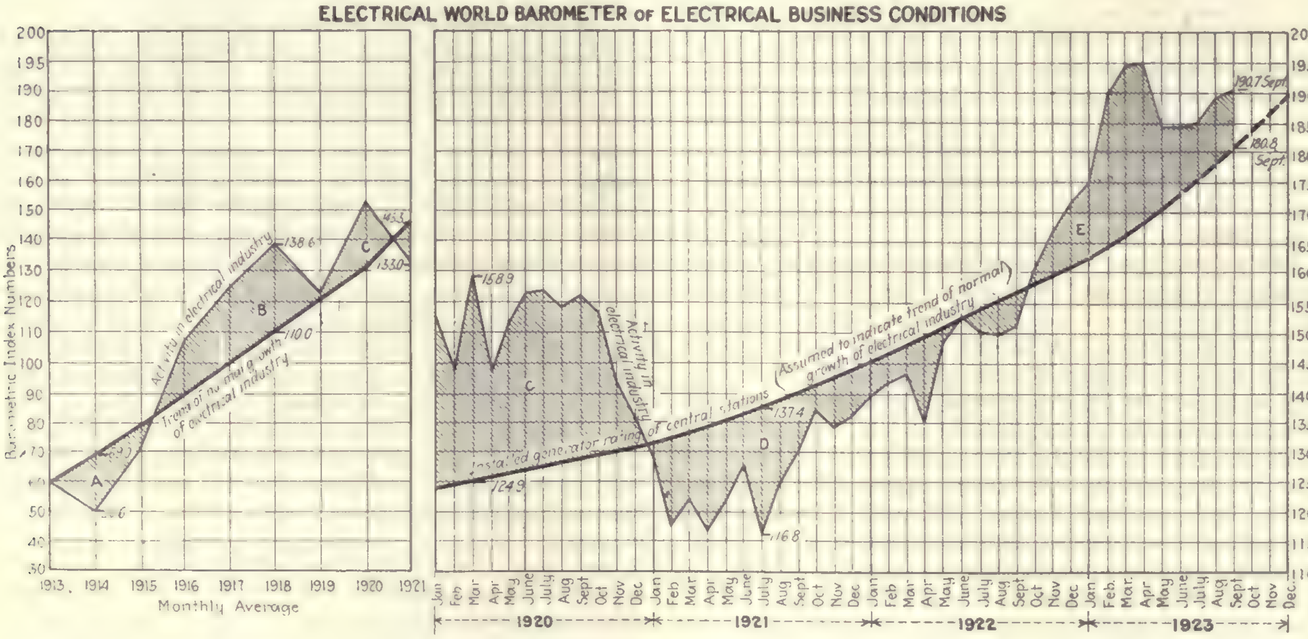
Fall Activities 9.9 per Cent Above Normal

INDEX figures upon which the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" is based indicate that activity in a very large portion of the primary industries of the country was further curtailed during September. Of the primary industries used as a basis for the "ELECTRICAL WORLD Barometer" only three showed increased activity during September over August, that is when referred to their respective normal growths.

Economic authorities agree that general business conditions this fall remain sound. Distribution, as indicated by the record car loadings, has been active, while stocks have not been reported as excessive. These conditions, taken in conjunction with the large purchasing power of consumers throughout the country at the present time, presage fall trade on a high plane.

The data upon which the "ELECTRICAL WORLD Barometer" is based indicate an increase of 1.4 points on the barometer scale as compared with August activities. During this interval the industry has grown 3.0 points, leaving a net increase in activity of 1.6 points on the barometer scale as compared with August. The electrical industry as a whole was operating in September at 9.9 points or per cent above what would have been the point of seasonal demand if growth in the industry had been normal. In August it was operating at 11.3 and in July at 9.3 points or per cent above the point of normal demand.

ELECTRICAL WORLD BAROMETER OF ELECTRICAL BUSINESS CONDITIONS



Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Use of By-Product Power from Steel Plants

To the Editors of the ELECTRICAL WORLD:

I am much interested in the article by L. B. Breedlove on utilization of by-product power from steel plants.

In the production of steel as well as in the production of many other commodities a very considerable element of by-product heat or material which will produce such heat is treated. As far as such heat or material can be used by the manufacturer or by others it should be made use of. Its employment certainly conserves our natural resources in either coal or gas or some other form of fuel and conserves them in a practical way.

The proper position for the central-station company to take, as the writer sees it, is that we should like to furnish these manufacturers with such additional power as they may need over that which they can develop by their by-product heat, which additional power must be developed from raw coal or other fuel.

We believe that the properly organized central power company can furnish such additional power, all things considered, more cheaply and more reliably than the steel mills or other manufacturers can furnish it.

The company with which I am connected will be very glad to enter into negotiations with any of the large steel companies in our territory with the view of furnishing such excess power as they may require over the amount of power which they can produce from waste heat and, at times when the waste heat exceeds their requirements, of absorbing all surplus energy available at any one point. This might be done in two ways:

First, additional energy as required could be supplied to the steel manufacturer on the basis of proper schedules, and in the event of excess surplus by-product power such surplus by-product power could be purchased outright at the point of production. This surplus would have to be bought manifestly at a very low rate—at the best slightly lower than the cost of production in the central power company's power plant. Manifestly this is essential as all of the investment necessary in production machinery, transmitting and distributing lines, etc., would have to be carried whether this surplus power were purchased or not. The power thus purchased and other power would then be sold at remote points of consumption under the company's regular schedule. At first thought one might feel that the steel manufacturer's surplus by-product power should be bought by the central power company at a price substantially equal to the price at which power was sold to the manufacturer by the central power company, but financial considerations make this impossible.

The second method would be to arrange to transmit all surplus by-product power over the company's lines from the point of production to the point of consumption, charging for this service a sufficient amount to carry a just proportion of the cost, maintenance and obsolescence on the line together with a reasonable margin for profit, in which case if the consuming point or points absorbed more power than the producing plant delivered, the excess power would be sold to the consumer under some definite schedule.

Another and the real point of interest in such an interconnection program, however, is the investment saving through interconnection. This investment saving may arise in different ways in different localities. For instance, it may be that the diversity in load between that carried by the central power company and that carried by the manufacturer producing waste-heat by-product may be such that even the central power company may have less apparatus to install to serve its other trade. In other cases, and I think in the majority of cases, the conservation of investment would be for the steel company or such other company as was producing by-product heat. For instance, if the by-product heat plant were to operate independently of any outside sources and 10,000 kw. were its maximum normal requirement, the proper installation would probably be decided on as three 5,000-kw. units, allowing one of the units as a spare. On the other hand, if the plant were to be linked to an outside source of power and were to purchase power in excess of the by-product heat, capacity of one 10,000-kw. unit alone would be necessary as the power reserve could then be taken from the central power company. Such 10,000-kw. unit should not only operate more economically than two 5,000-kw. units but could be installed for about one-half the cost of three 5,000-kw. units.

There are many places today where the steel mills employ high-class engineers in charge of their power plants. In such plants there is no reason why it should not be practicable to operate the power units of the steel mills in parallel with those of the central station, either directly or through frequency changers, as the adopted types of apparatus might require. It is also possible to meter such operation.

C. S. COOK,
Vice-President.

Duquesne Light Company, Pittsburgh, Pa.

Deplores Refusal of Test to "Romex"

To the Editors of the ELECTRICAL WORLD:

It was with regret that I read in the "News of the Industry" in your number of Oct. 20 the article indicating that the National Fire Prevention Association had rejected a field test of the new wiring material, "Romex." The electrical business in this country was not built up in this way, and I think it deplorable that any such committee should have the authority to refuse a reasonable trial of any material unless it is perfectly obvious that such material would constitute a hazard that no one in the business would want to approve. The sooner the manufacturers and fire underwriters realize that wiring costs have passed the reasonable point, the better. Some of the rules have reached the point where they become absurd, and some of the men who are responsible for the formulation of rules in different localities are forming some rules that in my judgment are not defensible.

I do not believe the central-station industry is sufficiently aroused to the seriousness of this situation, and the sooner it does become interested to the extent of insisting on an examination of the rules of self-appointed bodies outside of the most important branch of the electrical industry, the better for all of us. I believe tests of new material can be made by disinterested electrical bodies or engineering institutions equipped with the proper staff and facilities for making unbiased reports on such new material, and that such tests, reports and decisions should not be left in the hands of interested parties as I believe they are today.

Chicago, Ill.

E. W. LLOYD.

Central Station and Industrial Practice

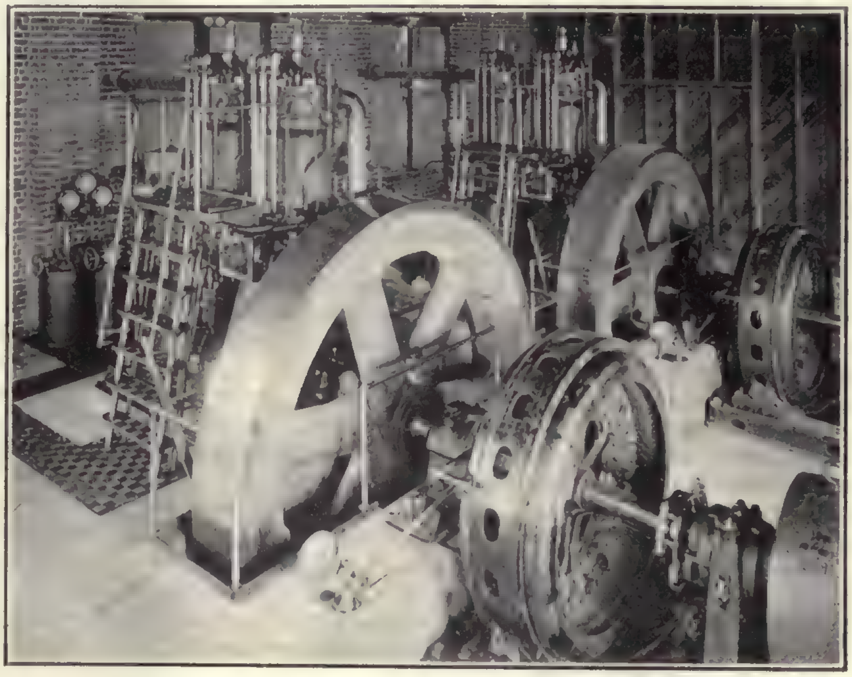
Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

The Economical Operation of Diesel Engines

By C. Mendelsohn

Mechanical Superintendent Old Dominion Company, Globe, Ariz.

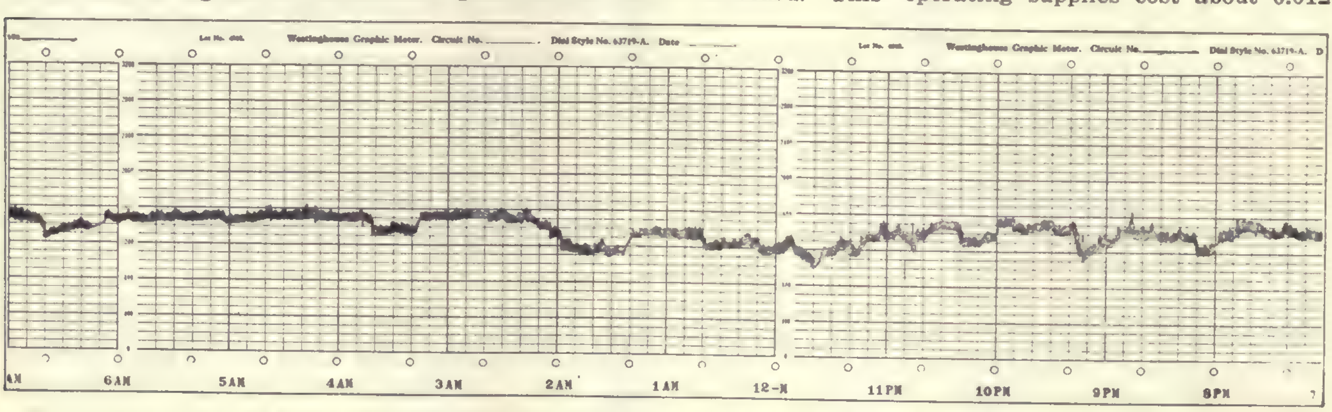
VERY satisfactory results have been obtained from a Diesel-engine generating plant of two units in Arizona belonging to the Old Dominion Company. One unit, shown in the foreground of the accompanying illustration, was installed in February, 1918, while the other was installed May, 1921. The two engines are identical except for the fuel pumps and some minor details. The exciter is directly connected to the older unit and chain-driven by the other. Each unit comprises a vertical five-cylinder, two-stroke-cycle Nordberg-Carels-Diesel engine with a directly connected 850-kva., 2,300-volt, three-phase, 60-cycle alternating-current generator. Each engine is rated at 1,250 brake-hp. at sea level, or approximately 1,000 brake-hp. at the elevation of the plant, which is 3,700 ft. above sea level. The operating crew consists of an engineer and an oiler on each of three eight-hour shifts and a chief engineer directly in charge of the plant. The repair work is done by men sent in from the shops when an engine is down.



AVERAGE FUEL-OIL CONSUMPTION OF ONE BARREL FOR 425 KW.-HR. IS RECORD OF THIS PLANT

Under normal operating conditions there is sufficient load to keep both engines running twenty-four hours per day and every day in the week, and the engines are shut down only for repairs or inspection. For twelve months to June 1, 1923, the total time lost this way amounted to 1,673 engine-hours, or an average of 836.5 hours per engine, which is 9.5 per cent of the total elapsed time. For the last several years the load, figuring power generated at the switchboard against actual running time, has averaged 605 kw. per engine. A typical load curve is shown herewith. Fuel consumption has averaged one barrel for 425 kw.-hr. generated at the switchboard. This compares with a rate of 170 kw.-hr. per barrel for a 750-kw. turbine at the company's steam plant. The engines are running on Mexican fuel oil of about 15 deg. Baumé gravity, except that light oil of about 27 deg. Baumé gravity is used for starting.

The consumption of lubricating oil averages about 3.6 gal. per twenty-four engine-hours. Softened make-up water is used for the circulating system at a cost of about 0.01 cent per kilowatt-hour. Miscellaneous operating supplies cost about 0.012



LOAD CURVE OF 1,500-KW. DIESEL-ENGINE PLANT IS EXTREMELY EVEN OVER THE ENTIRE TWENTY-FOUR HOURS

cent per kilowatt-hour. Of the kilowatt-hours generated at the switchboard, about 1.9 per cent is used for power-plant lights and for circulating the cooling water. The rest of the power that is generated is available for distribution.

The cost of maintenance and repairs has varied over a wide range, decreasing from year to year, owing to the additional experience gained by everyone connected with the operation and upkeep of the engines. It would seem that for this plant, with conditions as at present, 0.21 cent per kilowatt-hour would be a fair average cost for maintenance and repairs over a series of years.

About six months after the new engine was installed it made a continuous run of seventy-eight days, which is a record for these engines. During this run the average load was 610 kw., with fuel consumption at the rate of one barrel of oil for 450 kw.-hr. at the switchboard. The record output for twenty-four hours was made by the older engine about three years after it was installed and soon after the power cylinder liners had been replaced. This output amounted to 20,520 kw.-hr. at the switchboard, or an average load for the twenty-four hours of 855 kw.

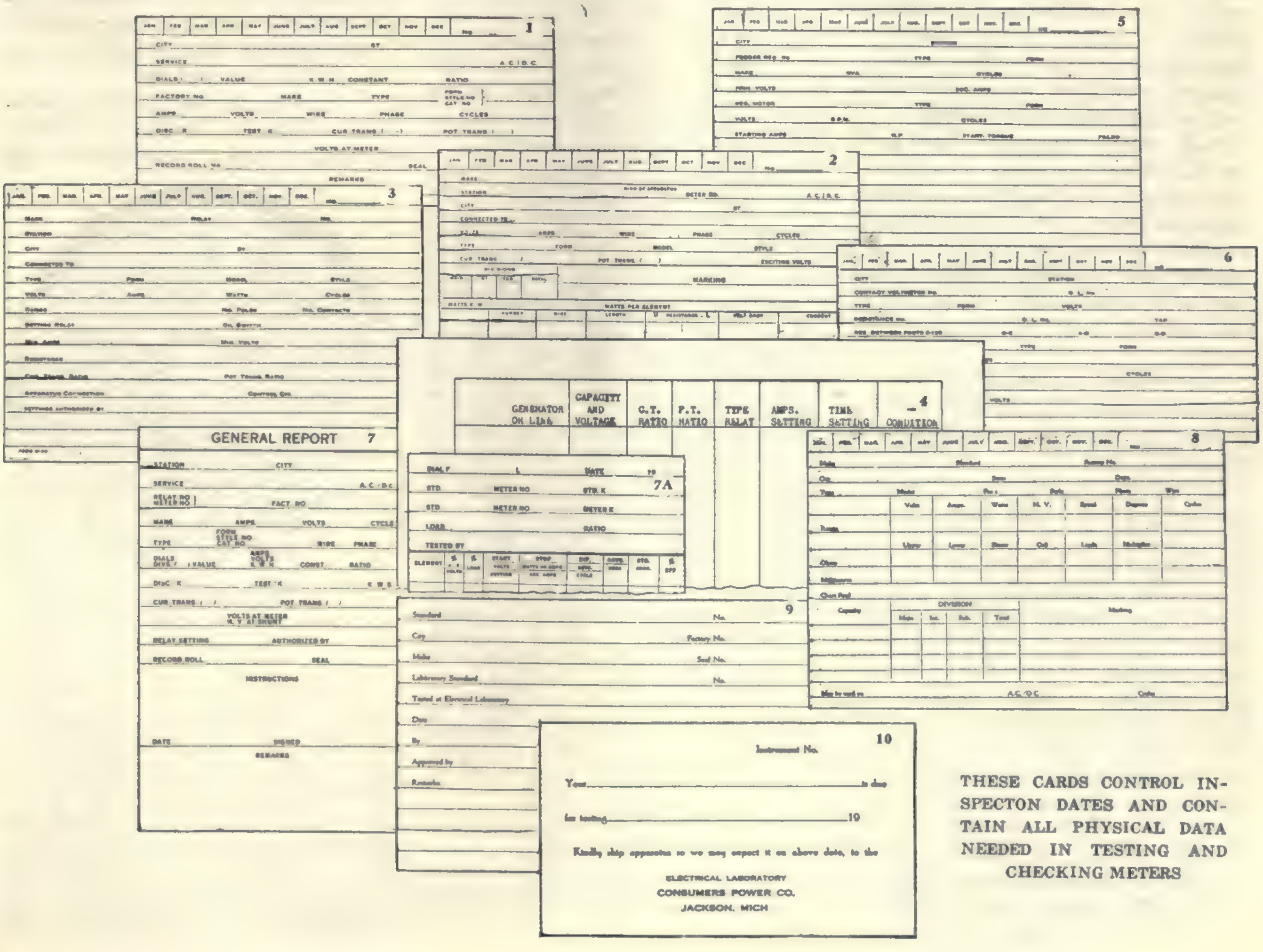
These record runs merely show what it is possible for these engines to do. In ordinary operation it has been found that the best results are obtained when each engine is shut down at least once every fourteen days for inspection and repairs and the maximum peak load does not exceed 800 kw. per engine.

Improving Regularity of Meter Testing

System Used by the Consumers' Power Company, Which Has Proved Very Satisfactory for the Past Five Years, Described in Detail

BY JAMES KELLY
Superintendent Electrical Laboratory, Consumers' Power Company, Jackson, Mich.

THE card-filing system for handling all meter maintenance and testing in the fourteen districts of the Consumers' Power Company, Jackson, Mich., gives at a glance the condition of every meter on the company's lines. This system consists of colored 4-in. x 6-in. cards for various meter types which are housed in a twenty-five-drawer filing cabinet at the electrical laboratory in Jackson. At the top of each card is printed the month of the year. This is done so that colored metal clips may be mounted directly upon these cards to indicate when the meter must again be inspected. These clips are also given different colors to designate the various time intervals between testing. After a meter is tested these clips are then moved ahead a period which varies with the type of the meter; for instance, a billing meter reading receives a check every three months, while for primary meters one check per year has been found sufficient. By these clips a direct check can be made on all work which requires immediate attention.



THESE CARDS CONTROL INSPECTON DATES AND CONTAIN ALL PHYSICAL DATA NEEDED IN TESTING AND CHECKING METERS

Each card also contains space for the meter number, the maker's name, the location of the meter and all other information necessary in making an accurate check of that particular meter. The bottom of the card contains room for any other additional data characteristic of the meter. The range of inspections may be taken from the illustrated number of cards. The card No. 1 covers both the permanent and the graphic watt-hour meters. In filing, this card is placed in the particular division in which the meter or instrument is installed. Card No. 2 is for the permanent station instrument-type meter covering a full description of station instruments. This card is also filed under its particular station in the division wherein it is installed.

RELAY RECORDS IMPORTANT

For relays, card No. 3 is used, which has spacings for all necessary data needed on any one relay. On the back of this card are spaces for the date of last test and for any remarks. It is filed in the same manner as the two cards mentioned above. Card No. 4 is a loose-leaf record covering the most recent settings of a relay. Several copies are made so that the division superintendent may have up-to-date information regarding their relays.

The voltage regulators have card No. 5, which has space allotted for recording all the necessary regulator characteristics. For the regulator auxiliaries, such as contactor voltmeters and line drop compensators, card No. 6 was made. It is filed in the same manner as the first two cards.

The general report, which gives a full description of watt-hour meters, station instruments and relays, is shown on card No. 7. On the reverse side (No. 7-A) the results of the calibrating tests are entered. Each month's data taken from the permanent record cards due for inspection are placed on this general report for the field men to check. They then enter a report of their tests on the reverse side. Should any changes be made in the field, these changes are entered in red ink. This is done so that the laboratory will know that the permanent record card must be changed to conform with the new conditions. This method of using red ink is also used upon meter removals or settings.

Card No. 8 is for the portable instruments and covers a full description of all portable instruments in all territories. Rotating test and portable meters are given card No. 9. On the back of this card are spaces for noting tests "As Found" and "As Left." Cards are made out in duplicate so one record always follows the meter, while a record also remains in the laboratory.

When the time arrives for a new inspection as indicated by the colored clips, a postcard No. 10 is mailed to the meter location notifying the person responsible for the various instruments that they are due in the electrical laboratory for testing by a certain date. After testing, they are expressed back to their original location and then followed up by a letter inclosing a copy of the express receipt and a card covering the tests performed. These data cards are filed in that district, thereby giving a complete performance record of all the instruments on the system.

Steel-Flange Standards for High Pressures Planned

A COMPREHENSIVE program of standardization of steel flanges and flanged fittings was inaugurated Oct. 26 by sub-committee No. 3 of the A. S. M. E. sectional committee on the standardization of pipe flanges and fittings. The following actions were taken by the committee:

Range of Pressures for Steel Flanges.—The maximum steam pressures for which these standard flanges and flange fittings shall be developed are 250, 400, 600, 900, 1,350, 2,000 and 3,200 lb. per square inch. The maximum temperature which they are to be designed to withstand was set at 750 deg. F.

250-Lb. and 400-Lb. Steam Standards.—These two steel standards are to have the same bolt circle and number of bolts as the present American cast-iron standard for 250 lb., except that the 2-in. and 2½-in. sizes for the 400-lb. standard will have eight bolts instead of four. The other dimensions of these flanges are, however, to be modified to meet the conditions set for each.

600-Lb. Steam Standard.—The subcommittee further decided to use as the basis of the dimensions of this standard the bolt circle and the number of bolts of the present 800-lb. hydraulic standard developed by the A. S. M. E. committee. (See *Transactions of A. S. M. E.*, Vol. 40, 1918, page 501.)

900-Lb. Steam Standard.—The basis for this new steam standard flange is to be the bolt circle and the number of bolts of the present 1,200-lb. hydraulic standard developed by the A. S. M. E. committee. (See *Transactions of A. S. M. E.*, Vol. 40, 1918, page 501.)

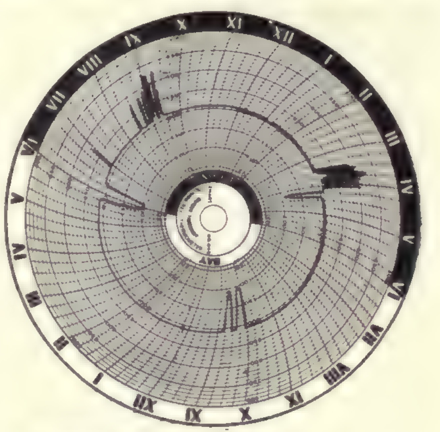
Standards for 1,350, 2,000 and 3,200 Lb. Steam Pressures.—Flanges to withstand these pressures and the corresponding superheats are to be developed after the completion of the first four of the series.

Blow-Off Periods Recorded by Thermometer

BY FREDERICK L. RAY
Superintendent Power Plants, Union Traction Company of Indiana, Anderson, Ind.

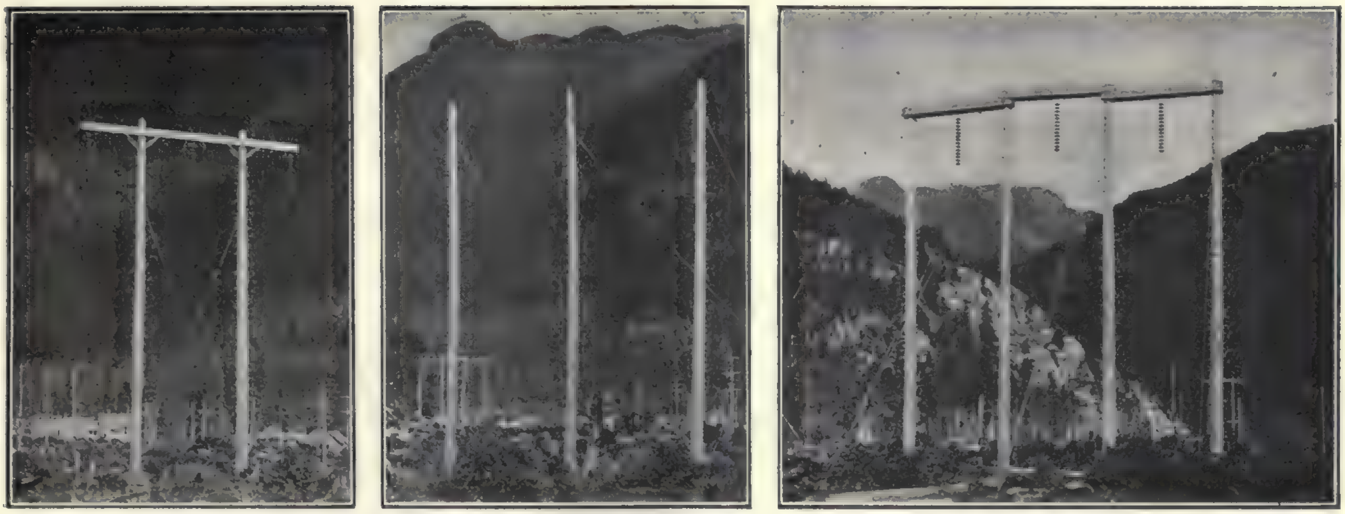
IN BOILER-ROOM operation often the hardest thing for the chief engineer to keep track of is the systematic "blowing down" of boilers. Except by asking the firemen on the various shifts, he has no way of knowing when this operation was performed or how long it took. To obtain an accurate, permanent check on it the Union Traction Company of Indiana, Anderson, Ind., installed a recording thermometer in the blow-off header. The blow-off valves from the sixteen boilers were connected to a main header discharging into the blow-off header. At the extreme end of this header was placed the thermometer element of a remote-reading instrument. The leads were then run up to the main turbine floor, where the indicating unit was placed on a panelboard, directly behind the boilers. As this was a new boiler installation, the panelboard was enlarged so that two flue-gas-recording pyrometers could be mounted adjacent to the recording thermometer. This recording thermometer for the blow-off line cost $64.50.

A temperature chart, shown herewith, taken from the blow-off recording meter, shows a continuous ring



AN INSTANT VISIBLE CHECK OF ALL BOILERS BLOWN DOWN GIVEN BY THIS CHART

at a temperature of 212 deg. F., with the exception of the blow-off periods. The reason for this ring can be explained by stating that with sixteen blow-off valves enough steam is continuously leaking into the header to establish an atmospheric steam condition of 212 deg. F. The periods of blow-off can be easily determined by the increases in tem-



THREE TYPES OF TOWERS USED ON THE 165,000-VOLT SKAGIT RIVER TRANSMISSION LINE

perature at 9 p.m. and 4 a.m.—these being the regular schedules for blowing down. The number of peaks indicates how many boilers were put through that operation.

Wooden-Pole Construction Used on 165-Kv. Line

A HUNDRED-MILE single-circuit transmission line to operate at 165,000 volts is now under construction to bring the power from the Skagit River hydro-electric development of the city of Seattle into the city for distribution. The line will be built entirely of untreated native cedar poles on a 150-ft. right-of-way. The towers are of the H-type, consisting of two poles with timber cross-arms at the top. The three conventional types of towers are shown in the accompanying photographs. The normal length of span is 600 ft. with a minimum ground clearance of 30 ft.

The conductors will be 300,000-circ.mil copper-equivalent, steel-core aluminum, and the line will have a capacity of 90,000 kva. Ten suspension insulator units will be used on the straight suspension towers, twelve units on the angle towers and fourteen units on the dead-end towers. The angle towers consist of three poles and the dead-end towers of four poles, with cross-arms at the top.

The line is being built under contract by an electrical construction firm of Seattle and will be completed by the end of the year. The towers are assembled on the ground with the exception of the insulator strings, and raised in one operation.

Distribution Material Costs in New England

FROM the cost sheets of a New England central-station company come the accompanying material expenses incurred in 1922 from January to December inclusive in connection with the installation of 2,462 services. The total labor expense was $23,072, or slightly under $10 per service. Repetitions in the list are due to the purchase of supplies at different periods during the year.

COST OF SHORT-LINE EXTENSION MATERIAL FOR 2,462 SERVICES INSTALLED

	Number of Units	Price per Unit	Total
30-ft. chestnut poles	220	$10.62	$2,334.62
35-ft. chestnut poles	204	14.88	3,036.03
40-ft. chestnut poles	100	17.25	1,725.47
45-ft. chestnut poles	3	16.30	48.90
No. 6 rubber-covered wire, ft.	2,000	.04	80.60
No. 2-0 wire (weatherproof), ft.	1,097	.082	90.06
No. 4-0 wire (weatherproof), ft.	7,170	.142	1,015.99
No. 2 wire (weatherproof), ft.	24,594	.043	1,079.68
No. 6 wire (weatherproof), ft.	528,258	.017	9,350.17
Outrigger arms	159	1.802	286.61
Ten-pin cross-arms	6	2.706	16.24
Six-pin cross-arms	1,815	1.766	3,206.38
Four-pin cross-arms	143	1.373	196.45
No. 8 two-conductor service cable, ft.	5,535	.04	221.95
No. 8 three-conductor service cable, ft.	78,004	.0815	6,357.33
No. 10 two-conductor service cable, ft.	71,814	.053	3,806.14
No. 6 three-conductor service cable, ft.	2,103	.138	290.95
Insulators, guy wire, strain clamps, etc., for 2,462 services	....	.49	1,265.99
30-amp. 600-volt, three-pole switch	1	....	2.94
200-amp., 250-volt, three-pole switch	1	....	7.95
Three-pole slip couplings	2	.34	.68
Three-pole close nipples	2	.16	.32
Three-pole check nuts	2	.08	.16
Three-pole bushings	2	.495	.99
¾-in. LB fittings and blank cover	1	.45	.45
¾-in. bushings	4	.035	.14
No. 6 rubber-covered wire, ft.	40	.037	1.48
No. 8 wire, ft.	40	.028	1.12
1-in. conduit, ft.	4	.67	2.68
30-amp., 600-volt, three-pole fused switch	1	....	2.94
30-amp., 600-volt fuses	3	.20	.60
No. 8 rubber-covered wire, ft.	21	.02	.42
60-amp., 250-volt switch	1	....	1.50
30-amp., 600-volt, three-pole switch	1	....	4.23
10-in. by 17-in. switch boxes	2	4.34	8.68
Double duct box	1	....	3.82
No. 6 rubber-covered wire, ft.	16	.03	.48
No. 8 rubber-covered wire, ft.	12	.02	.24

	Number of Units	Price per Unit	Total
200-amp., 250-volt, three-pole switch	1	....	7.95
30-amp., 600-volt, three-pole switch	1	....	4.23
3-in. slip couplings	2	.34	.68
One 1½-in. LB fittings and blank cover	1	....	1.16
One ½-in. conduit, ft.	1	....	.23
No. 6 rubber-covered wire, ft.	20	.03	.60
¾-in. conduit, ft.	118	.10	11.80
Ground clamps	12	.12	1.44
LB fittings	....	....	.56
Locknuts and bushings	....	....	1.77
¾-in. shields	8	.147	1.18
¾-in. weather cap	....	....	.59
¾-in. LB condulets and b covers	2	.095	.19
¾-in. conduit, ft.	16	.086	1.37
½-in. LB condulets and b covers	3	.45	1.36
½-in. weather caps	3	.41	1.23
No. 10 rubber-covered wire, ft.	425	.01	4.25
No. 14 rubber-covered wire, ft.	540	.006	3.24
Two-wire No. 14 BX, ft.	200	.058	11.60
¾-in. loom, ft.	250	.02	5.00
¾-in. BX connectors	16	.118	1.87
¾-in. pipe clips, lb.	1	....	.15
½-in. pipe clips, lb.	12	.01	.12
Iron brackets	8	.14	1.12
Glass insulators	8	.12	.96
No. 1935 cut-outs	6	.15	.90
30-amp. three-wire switch	1	....	1.57
12-in. x 16-in. x 4-in. steel box	1	....	2.64
10-amp. fuse plugs	12	....	.36
Ground rod and clamps	....	....	.42
Ceiling plates	10	.10	1.00
"Nail-it" knobs	113	.025	2.83
3-in. tubes	17	....	.27
Window cord, ft.	8	.02	.16
Weatherproof key socket	1	....	.34
Weatherproof pigtail socket	....	....	.39
Miscellaneous small items	....	....	1.05
Dry cells	13	.35	4.55

Note—Other items on this work included: Location orders, $490.67; freight on material, $157.40; teaming material, $91.09; company transportation, $3,756.12; labor, $23,072.89; additional material, $30.98; fee, $30, and one-half cost of poles set by telephone company, $2,186.37.

Extracts from an Operating Code*

High-Tension Testing

BEFORE proceeding with certain high-tension tests it is important to make tests for foreign voltage as in the case of low-tension testing, because the preparation for these tests requires direct handling of the high-voltage conductor by the operator. The following tests were given in last week's issue besides the description and general operation of the testing equipment: Line insulation and ground test, line phase test, transformer insulation and ground test and transformer phase test. Several other tests are outlined below:

Insulation and Ground Test for Generators and Synchronous and Induction Motors, Using Test Set

1. Remove the motor from the stator.
2. Connect the machine leads to a separate bus and line.
3. Apply the line insulation and ground test.
4. Disconnect the machine leads from the separate bus and line.

Insulation and Phase Test on Synchronous and Induction Motors and Rotary Converters, Using Separate Engine

First Method (applied generally to small machines):

1. Throw the starting switch of the machine to the running position.
2. Connect the machine by means of a separate bus and line to an alternator operating at normal speed but with no field.
3. Cut in all resistance in the alternator-field rheostat.
4. Close the field switch.
5. Increase the voltage of the alternator to the normal value at the rate specified by the load dispatcher.
6. Carefully observe the machine being tested to note any insulation defects and also that the rotation is in the proper direction.
7. After a short period of operation in this manner, shut down the machine being tested and allow it to come to rest.
8. With the supply voltage at the normal value, whether fed from the separate engine or from the system, throw the starting switch to the starting position and note that the machine again starts in the proper direction and comes up to the normal starting speed.
9. If the machine starts in the proper direction and comes up to the normal starting speed, proceed with the operations of starting until the starting switch has been thrown to the running position satisfactorily.
10. Shut down the machines.

Second Method (applied generally to large machines):

1. Throw the starting switch of the machine to the running position.
2. Connect the machine by means of a separate bus and line to an alternator operating at normal speed and one-half voltage.
3. Immediately on connecting the machine to the separate alternator, increase the voltage of the alternator to the normal value at the rate specified by the load dispatcher.
4. Carefully observe the machine being tested and note any insulation defects and also that the rotation is in the proper direction.
5. After a short period of operation in this manner, shut down the machine being tested and allow it to come to rest.
6. With the supply voltage at the normal value, whether fed from the separate engine or from the system, throw the starting switch to the starting position and note that the machine again starts in the proper direction and comes up to the normal starting speed.
7. If the machine starts in the proper direction and comes up to the normal starting speed, proceed with the operations of starting until the starting switch has been thrown to the running position satisfactorily.
8. Shut down the machines.

Phase Test on Alternators and Direct-Current-Started Synchronous-Motor Generators

1. Connect the machine to a separate bus and line extending to the synchronizing station.
2. Start the machine and bring it up to the synchronous speed.
3. At the synchronizing station connect the synchroscope and synchronizing lamps between the line and bus and synchronize.
4. Test the synchronizing devices and connections in the station in which the machine that is being synchronized is installed. If the connections are correct, the synchroscope should read zero and the lamps be dark.
5. Remove the cover from the face of the synchroscope, move the pointer off zero and put in the synchronizing plug; the pointer should move back to zero if the connections are correct.
6. Disconnect the machine from the separate bus and, after the line has been energized from the generating station, synchronize the machine against the bus.

Circuit Insulation and Ground Test

1. Energize the circuit from a separate bus and transformer, noting that the ground detectors are connected to this bus.
2. Observe the ground detectors.

Circuit Phase Test

First Method:

1. Have the main station light and power transformer bank connected to the main bus and the auxiliary station light and power transformer bank to the auxiliary bus.
2. Energize the circuit to be tested from a separate bus and transformer and connect it to the auxiliary bus.
3. Using a voltmeter of suitable scale or two 125-volt test lamps in series, check both the main and auxiliary clips of the station light and power secondary double-throw switch for voltage by testing across clips on the same side.
4. If voltage is indicated on both the main and auxiliary clips, test across in turn from each clip on one side to the corresponding clip on the other side.
5. Correct phase relation is indicated by zero voltage between each clip on one side and the corresponding clip on the other side.
6. Transfer a circuit of proper phase to the same bus to which the circuit to be tested is connected.
7. Parallel the circuit to be tested and the circuit of proper phase through the auxiliary bus. Paralleling is the final check on the phase relation of the circuit.
8. Cut apart the circuits.
9. After both the above tests show correct phase relation, check the regulator motor and control apparatus for proper direction of rotation.

Second Method:

1. Connect the circuit to be tested to a separate low-tension bus and through a separate transformer, high-tension bus and line to the synchronizing station.
2. Block in the main oil switch and block the regulator control of the circuit to be tested, and also of a circuit in synchronism with the bus against which the circuit is to be synchonized.
3. Energize the circuit to be tested through the auxiliary bus from the circuit of correct phase.
4. At the synchronizing station connect the synchroscope and synchronizing lamps between the bus and the line. Proper phase relation is indicated by a zero reading on the synchroscope and by the lamps' remaining dark.
5. Disconnect the circuit to be tested and the circuit of proper phase from the auxiliary bus.
6. Remove the blocks from the main oil switches and the regulator controls.
7. Energize the circuit to be tested from a separate low-tension but through a separate transformer.
8. Transfer a circuit of proper phase to the same low-tension bus.
9. Parallel the circuit to be tested and the circuit of proper phase through the auxiliary bus. Paralleling is the final check on the phase relation of the circuit.
10. Cut apart the circuits.
11. After both the above tests show correct phase relation, check the regulator motor and control apparatus for proper direction of rotation.

Circuit Phase Test on Entire Circuit

1. Connect the circuit to be tested, outside the station, to a circuit in synchronism with the bus against which the circuit is to be synchronized. This circuit may or may not originate in the same station as the circuit to be tested. This connection is generally made by the transmission and distribution department at breakdown boxes.
2. Block in the main oil switch of the circuit of correct phase.
3. Connect the circuit to be tested to a separate low-tension bus and through a separate transformer, high-tension bus and line to the synchronizing station.
4. At the synchronizing station connect the synchroscope and synchronizing lamps between the bus and the line. Proper phase relation is indicated by a zero reading on the synchroscope and by the synchronizing lamps remaining dark.
5. If the circuit to be tested is not to be left on after the test, open its main oil switch, disconnecting it from the separate bus.
6. Disconnect the circuit to be tested from the circuit of correct phase.
7. Remove the block from the main oil switch of the circuit of correct phase.

*Abstracted from the operating code of the Philadelphia Electric Company.

Merchandising Policies and Results at Providence*

Growth of Appliance Business Has Necessitated Establishment of Eleven Electric Shops by Central Station —Gross Sales Exceed Half Million Dollars Annually

BY ARTHUR B. LISLE
General Manager Narragansett Electric Lighting Company, Providence, R. I.

EVERY central-station executive whom I know believes it would be entirely unnecessary to do any merchandising, and much better, if there were available contractor-dealers or electrical merchandisers of any sort who were capable, had the capital and were willing to push the business as it should be pushed, thus enabling the utilities to confine their efforts to generating and selling kilowatt-hours. Every executive must decide for himself, however, what his local conditions are; but so far as the Narragansett territory is concerned no one but ourselves would put the effort into merchandising that we have and at the same time give the service and attempt to enhance the good will of the community. The figures given below are significant in this connection.

ORIGINAL ELECTRIC SHOP LOCATION RETAINED

We started in the merchandising business a good many years ago with one electric shop. Soon it grew so that we took the store next door and increased our space. In a few suburban towns like Warren and East Greenwich we had arrangements with local druggists by which they acted as our agents, collecting bills, exchanging lamps and reporting complaints, but experience showed this to be a side issue with them. The public was not taken care of as it should have been, so we decided to establish our own shops, in every case much to the benefit of ourselves and the public.

A few years ago the question arose as to the advisability of moving our electric shop from its office building location to the center of the retail trade district, giving us enlarged space and a great increase in rent. It was decided that it would be better to keep the electric shop where it was and to establish branches in the outlying districts. There are now two shops in Providence proper, and we are planning at least three more. Including our subsidiary companies, we now have eleven electric shops, and in nearly every town we have no trouble or complaints from the electric contractors. We endeavor so far as possible to co-operate with them in every way.

ARTHUR B. LISLE

We maintain prices fixed by the manufacturers, and when we have special sales we give the contractor-dealers an opportunity to join in, even so far as to offer campaign stock to them, agreeing to take it back at the end of the sale if there is any left. We take a prominent part in the Rhode Island Electrical League and do our part in the establishment of electrical homes.

We encourage the department stores to handle electrical goods and, outside of trivial misunderstandings once in a while, work in harmony with them.

We spend about $20,000 a year in newspaper advertising and use illuminated billboards, as well as mail circularization with bills and without them. We make a very strong effort to dress our windows attractively. Practically all the time of one man is spent in going from store to store designing and changing window displays.

Whenever it is possible, the plan is followed of having something moving, such as a pump in operation, fans, motors, trick devices, a woman using a flatiron, ironing machine, washer or demonstrating some cooking device. An expert advertising agency is employed to handle the company's activities in the display field, this concern making a special study of such problems as a part of its business. As much of our merchandise appeals to women, this advertising house has a woman on its staff who studies sales and application problems from a woman's viewpoint. This is felt to be of great advantage to the company.

SALES ARE $18 A YEAR PER CUSTOMER

In the seven electric shops of the Narragansett company proper there was merchandised during the first half of 1922 $81,000 worth of incandescent lamps and $138,000 worth of appliances, a total of $219,000, and in the corresponding six months of 1923 the company sold $89,000 worth of incandescent lamps and $238,000 worth of appliances, a total of $327,000, or an increase of 49 per cent. This is at an average rate of $18 per customer per year.

The electric shops are run as a department by themselves under the management of A. H. Allcott, who is responsible for them and is entitled to the credit for their success. Against this department are charged

*From an address delivered before the New England Division, N. E. L. A., at Swampscott, Mass., Sept. 5-8.

the rent for the shops, the salaries of all employees, all incidental expense, all delivery expense, bookkeeping, storehouse, uncollectible accounts, merchandise adjustments, insurance, taxes and interest on the investment. If any reduction in the price of incandescent lamps or apparatus of any kind occurs, the loss is charged to the account of this merchandise. The gross sales in 1922 totaled $569,000 and included 4,284 flat-irons, 4,768 portable lamps, 2,214 vacuum cleaners, 464 washing machines and fifty-two electric ranges, besides many other appliances.

In November, 1922, the company started a campaign on vacuum cleaners, advertising in the newspapers and by a broadside which offered $3 for an old broom or carpet sweeper in part payment for the cleaner, for cash or on time payments, $1 down and 75 cents per week. In one month the company sold 1,152 cleaners for $66,572, or one every thirteen minutes of a ten-hour day.

A broadside was sent to residential customers on the mailing list advertising the value of electrical appliances as Christmas gifts, and this was followed by newspaper advertising. The result was a gross business during the twenty-one-day Christmas season of $122,000, which exceeded that of the previous year by 37 per cent. Last April we had a washing-machine campaign, selling the machines at $115 each and with each offering as a premium a clothes drier, step ladder and box of soap chips. The resulting sales totaled 188 machines for $22,300. Despite the sale of 1,152 cleaners in November last 1,125 more were sold this year, the feature of this campaign being a table lamp as a premium. Eight hundred of these cleaners were sold over the counter without the aid of outside salesmen. In a single flatiron campaign now drawing to a close we expect to sell two thousand irons. In this campaign small broadsides were sent to forty thousand customers.

Favorable Outlook for Profit in Electric Shops

We cannot say after the charges of a zealous auditor are all in that we have made money in this merchandising department, but when some of the local conditions improve we shall make money in this business. The estimated income from the apparatus sold in 1922 was $109,000 per year.

The best policy for a central-station company is to hire an expert merchandiser, back him up with moral support, capital and inspiration, and let him furnish the perspiration. This leads to results beyond one's fondest hopes.

To Help the Farmer Move His Wheat

CENTRAL-STATION companies have often been of material assistance in promoting the commercial and civic welfare of the communities they serve. The above window shows how the Nebraska Power Company in Omaha did its part in the national movement launched to aid the farmers by encouraging the purchase and use of more wheat and flour.

What a Public Utility Should Advertise

An Advertising Man's Criticism of Some of the "Copy" Used in Good-Will Publicity

By Robert S. Merrill

"THEY ought to have their rates cut," declared an advertising man recently when he was looking over a series of advertisements which the local central-station company had been running in an attempt to explain its problems to the lay public. "Some electric light companies can do the most asinine publicity work I ever saw," he went on.

"They use space and talk about the 'magic of electricity' and that sort of bunk until they get lots of people to believe that their sole investment is in a wizard's wand and a push-button on the wall. Surely there is something that can give people a picture of substantial buildings and interesting equipment.

"You know people like to read about interesting machinery—look at the magazines of the popular mechanical and scientific type and the circulations they have. Of course, they are written so almost anybody can understand them. So why not somethink like that about electric light plants?"

He was right; the public can be interested in the workings of the plant itself. For instance, the Grand Junction (Col.) Electric, Gas & Manufacturing Company used paid advertising headed "The Rainmaker" to explain some of its equipment. It read:

So many have asked us the function of the "rainmaker" at our electric plant at Fifth and South Avenue that we believe it of general interest.

This equipment constitutes what is known as a spray pond. Its sole function is to cool the water coming down from the steam condensers on our steam turbines. After being cooled, the water is pumped back through the condensers and is used over and over again. The steam condensers are box-like affairs filled with small copper tubes. The steam strikes one end of the tubes, the cool water the other, condensing the steam and forming the vacuum under which the turbines work, thereby greatly increasing their efficiency.

Every one seems to think that this spray pond is in some way used for making ice. It has no connection with the ice plant.

The spray pond takes the place of the old high cooling towers which have recently been wrecked and removed. The pond is much more efficient and dependable, requires less power for pumping and far less attention.

The "rainmaker" is one more step toward modernizing the plants which furnish the citizens of Grand Junction with electrical energy and artificial ice.

There are many things of interest in the plants that furnish Grand Junction with utility service. Have you ever been through these plants? We shall be glad to furnish you with a guide who will explain the modern equipment operating in these plants. Let us know when it is convenient to inspect them.

Now, here is a company that realizes that its plant contains many things of interest. It extends an invitation to the public to visit it and offers to furnish guides. There are always, in any city or town, persons who will accept such invitations. But more will not because a startling number have just enough timidity to dread first experiences. Some of them really do not see what right they have to impose upon anybody's time.

For such persons—and they are the far greater number—why not take the plant to them through the newspapers?

GET THE LAYMAN'S VIEWPOINT

In short, get somebody to tell in type and illustrate with pictures the interesting things about your plant. Be sure that it is written so that a child can understand it. Be sure that it is pictured as the public would want to see it—not what interests an electric light man. That's why it would be a good idea to get an outsider to do it; electric light men are generally too close to their work to see things as others see them.

A series of articles that would picture the light plant as an interesting place also would make it apparent that there was a big investment in equipment and distributing systems. Any person intelligent enough to be interested in the equipment will be aware that it cost considerable money to install it.

Therefore don't insult them by making it appear that the series was run for the purpose of putting over an increase in rates or something. Don't give them any cause to wonder why the electric light company is spending all that money.

If they read an interesting description of some part of an electrical system, that alone will absorb them. They will begin to feel acquainted with the company; the company will represent something more tangible than a magician's wand. Then when it has any pleading to do, if ever, more persons will be ready to lend a sympathetic hearing.

Should there be pictures in such a series? Judge for yourself, but did you ever hear anybody remark, "Gee! that's a little machine to cost that much." Why not impress people by telling what a thing does rather than by its size? Many more persons are able to understand action described in words than the number who can understand a picture of a machine. To grasp the idea from the picture one must be mechanically minded. One of the leading popular science magazines insists upon having a human being in each picture, because a picture of a machine standing alone seldom means anything to the average reader.

The advertisement, "Bulbs and the Plant You Don't See," which the Western Electric Company ran some time ago in the interest of the electrical industry is a good example of drawing a picture so the public will understand it. It began: "Here's a curious reversal of nature. Bulbs in plain view, but the plant out of sight—and too often out of mind." It spoke of the "miles of distributing mains which connect the house with the generating station where there is the equipment of stokers, boilers and generators and where there are men on the job night and day to keep that equipment in order." The advertisement closed with: "But don't ignore the plant altogether. Neglect has stunted many a one, and if it stunts this, your service and the whole community will suffer. The electric light plant, like every other, needs nourishment—and what it thrives on best is your good will."

FORGET ELECTRICITY'S MAGIC

If the plant thrives on good will then the best thing is for the public and the plant to get better acquainted. Tell the public about "the rainmaker" (use names that will stick in their minds) or anything else rather than harp on the idea of the "magic." The "magic" idea is a pleasing day dream, but buildings and machines make rates understandable.

What Other Companies Are Doing

Texas.—Six salesmen of the Texas Power & Light Company sold more than a thousand kitchen lighting units during eighteen days' work in Temple and Taylor, two of the district towns served by the company. The campaign was launched in Taylor, and at the end of the first day's work all doubt as to the success of the campaign was dispelled. Each of the six salesmen reported back in the evening with more orders than had been expected for the first week.

Boston, Mass.—Twenty thousand new customers have been added to the Edison Electric Illuminating Company's books during the past year, and a total of 166,000 customers is now served in the 650 square miles of territory reached by the system. Peak loads this fall are passing all previous records. About half the houses in company territory are still unwired. Since Jan. 1, 1923, about 80,000 kw. in new business has been added to the company's lines, the bogey for the year being 100,000.

Oklahoma City, Okla. — On the theory that any institution that increases the wealth of the state is a public benefactor and that to discourage the sending of money out of the state is to add to the state's wealth, the Oklahoma Gas & Electric Company has developed a campaign for keeping public utility dividends at home. Two teams of sixty-five each have been organized among the company's Oklahoma City employees to compete for thirty days ending Nov. 30 in the placing of the company's preferred stock. The winning team is to be entertained by the company at a dinner-dance at the close of the contest.

Springfield, Ill. — **The Illinois** Power Company has taken a group life and disability policy covering its employees. The company pays the entire cost. The life insurance varies from $500 for employees in service one year to $1,500 for those in service eleven years or longer.

Ladysmith, Wis.—The Lake Superior District Power Company is in the midst of an extensive washing-machine campaign to place an electric washing machine in every home in this city and the nearby town of Brucé. So far the campaign has been highly successful. Orders have been taken for a carload of electric washers. At the county fairs held in Ladysmith and Ashland this company established booths labeled "wife-saving stations" designed to stimulate the sales of electric appliances and the installation of electricity in homes. Besides appliances, charts were displayed to the public at these fairs, showing the growth of the company and the location and extent of its properties in Wisconsin. Merchandise sales of the company for one week in September amounted to $4,262.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Hydro-Electric Development and Steam Equipment

The Paradox of Hydro-Steam.—G. H. Moore.—A very complete analysis is given, showing that energy generated by combined steam and hydro-electric prime movers costs less than when generated by either one separately. The author presents the essential elements which dictate the economic proportionment of hydro-electric and steam electric generating-plant capacity. Data on a 32,000-kw. hydro plant, a 32,000-kw. steam plant and on 32,000-kw. plus 18,000-kw. hydro-steam plants show that in one particular instance the annual cost per kilowatt-hour with a 50 per cent load factor would be \$0.0055, \$0.0096 and \$0.0051 respectively.—*Engineering News-Record*, Aug. 30, 1923.

Insulation in Power Plants.—L. B. McMillan.—The author gives the simplest and cheapest method of recovering and preventing avoidable heat losses in the power plant. In tabular form are given the heat losses from uninsulated hot surfaces, total radiation areas of standard flanges, data on commercial pipe coverings and losses that occur through flange unions by radiation.—*Blast Furnace and Steel Plant*, August, 1923.

Surface Condensers.—J. M. Drabelle.—Turbines are now being so designed as to make use of lower absolute pressure than ever before, thereby placing on the condensing apparatus requirements that a comparatively few years ago were not even heard of. In this article the author discusses surface condensers and the factors that govern obtaining and maintaining low absolute pressures. The requirements of a well-laid-out condenser installation are also outlined.—*Sibley Journal of Engineering*, October, 1923.

Generation, Control, Switching and Protection

Pellet Type of Oxide-Film Lightning Arrester.—N. A. Lougee.—An abstract of this paper may be found in the Electrical World report of the A. I. E. E. summer convention, July 7, 1923, page 20.—*Journal of A. I. E. E.*, October, 1923.

Deformation of Traveling Electric Waves.—S. A. Stigant.—In order to minimize the effects of the transients resulting from switching operations, arcing ground and atmospheric lightning discharges various forms of lightning-arrester gear are in use, most of which embody the characteristics of inductance and capacity. The manner in which inductance and capacity act in deforming the initial shapes of transient waves is dealt with. For this purpose two circuits of the same surge impedance are considered, a series choke coil being inserted at the junction between the two circuits in one case and a condenser being shunted from the junction of the two circuits to earth in the other.—*Electrical Review (England)*, Sept. 21, 1923.

Transmission, Substations and Distribution

Overhead Transmission Lines.—Four reports of the British Electrical and Allied Industries Research Association on different types of conductors for overhead lines are given. These reports cover (1) hard-drawn copper wires and cables, (2) hard-drawn aluminum wires and cables, (3) galvanized-steel wires and cables, (4) steel-cored aluminum cables. Scope of the investigations, a description of the materials under test, the range of the samples tested, mechanical and electrical tests, etc., are considered for each type of wire.—*Institution of Electrical Engineers (England)*, September, 1923.

Insulation Design of Anchors and Tower Supports for 110,000-Volt, 4,427-Ft. Span Over Carquinez Straits.—L. J. Corbett.—The methods by which some of the problems were solved, the hinged anchor structure, the sturdy insulated support for the towers, the movable top for the middle tower support to allow for relative motion, and the supplementary cable system to obviate crystallization at the supports, are described. This paper was presented at the Pacific Coast convention.—*Journal of A. I. E. E.*, September, 1923.

Overhead-Line Alignment Charts.—K. Riedlinger.—A set of alignment charts is shown from which can be obtained readily all required characteristics for a line stretched between two towers. The advantage of these charts over previously published ones is the need of only one curved scale for all kinds of single or bi-metallic conductors. The use of these charts for transmission lines or for catenary railway lines is explained by two examples.—*Elektrotechnik und Maschinenbau*, Sept. 23, 1923.

Units, Measurements and Instruments

X-Ray Examination of Materials.—A. G. Warren.—The author describes the aspects of radiography, showing how the technique of the subject has been developed and indicating the lines along which progress may be expected in the future. He describes how the ordinary inspection of metals resolves itself into the detection of faults—that is, lack of homogeneity, flaws, cavities, presence of foreign materials, bad welds, etc.—and considers the detection of hidden bad workmanship, the examination of sealed bodies which it is undesirable or unsafe to dismantle, the examination of alloys, etc.—*Journal of Institution of Electrical Engineers (England)*, September, 1923.

Electrical Strain Gages.—The Bureau of Standards has recently completed the work of assembling, testing and calibrating thirty-six electrical strain gages for the Bureau of Aeronautics of the Navy. These gages, together with twenty-four others previously supplied to the bureau, were recently installed on the navy dirigible ZR-1 at Lakehurst, N. J. The gages are being used for the continuous measurement of stresses in various parts of the dirigible during flight.—*Technical News Bulletin No. 78 of the Bureau of Standards.*

Selection and Care of Pyrometers.—J. W. Conzelman.—After explaining the fundamental principles underlying the operation of the four main types of electrical pyrometer—namely, thermocouple, resistance, radiation and optical—this article gives many practical hints on the selection and care of thermocouple instruments. These include detailed instructions for making, calibrating and installing.—*Power*, Oct. 23, 1923.

Two Photographic Methods of Studying High-Voltage Discharges.—K. B. McEachron.—An abstract of this paper may be found in the Electrical World report of the A. I. E. E. summer convention, July 7, 1923, page 17.—*Journal of A. I. E. E.*, October, 1923.

Illumination

Projection of Light.—W. J. Jones and E. A. Marx, Jr.—Experiences with the use of gas-filled electric lamps in optical lanterns are summarized. It is shown that under the best conditions the percentage of the original light reaching the screen does not exceed 5 to 10, although it is evident that there is much difference between various forms of lanterns in this respect. In the motion-picture projector the proportion of light reaching the screen is even less.—*Illuminating Engineer (England)*, Vol. XVI, No. 3.

Development of the Electric Incandescent Lamp.—B. P. Dudding and C. J. Smithells.—The first of a series of articles dealing with the development of incandescent lamps. The first article outlines the history of this type of lamp from the early platinum filaments of Grove and other experimenters to the modern gas-filled tungsten-filament lamp. Early metal filaments proved unsuitable, and the carbon filament took their place about 1880. The metallized carbon-filament lamps of 1907 had an efficiency of 3.5 watts to 4 watts per spherical candle. Experiments upon increased selective radiation led to the manufacture of carbon-silicon lamps and the Nernst lamp, the latter employing rare-earth filaments, with a degree of success which was

overshadowed by the introduction of metallic-filament lamps. The latest development of gas-filled lamps has improved the efficiency of electric incandescent lamps from 9 watts per candle of the ordinary carbon lamp to about 0.7 watt per mean spherical candle.—*Beama*, October, 1923.

Motors and Control

Electricity as Applied to Steel Mills.—Ten articles in this issue are devoted to the electrification of steel mills, particularly to motors and control for steel-mill drive. H. L. Barnholdt considers the direct-connected induction motors versus geared motors for rolling iron and steel. J. H. Ashbaugh gives a treatise on the speed regulator for individual motor-reel drive. Among the other subjects discussed are the foot control for main reversing-mill motors and strip mills and the electric drive for cold-rolled steel strip reels.—*Electric Journal*, September, 1923.

Ratings of Industrial Electric Motors and Generators.—C. RODGERS.—A short review is given of the changes and developments during the past few years of the standard specifications for the rating for motors and generators. The temperature that insulation will stand, the electric limits, commutation and pull-out torque imposed by the design and the mechanical limits such as strength of shaft for which the machine is built are discussed.—*Beama*, October, 1923.

Automatic Starters for Synchronous Motors.—Two types of starters are described, one for starting on full voltage and the other for part voltage. A frequency relay is used to close the field switch at the proper time for each method.—*Power*, Oct. 16, 1923.

Heat Applications and Material Handling

The Lifting Magnet.—Labor shortages and rising production costs demand practical solutions for material-handling problems. It is shown in this article how by an investment of $1,600 one lifting magnet can do the work of sixteen men and do it at a cost of $1.60 per day, all charges included. The several practical applications of lifting magnets are discussed.—*Blast Furnace and Steel Plant*, August, 1923.

Electric Arc Welding with Alternating Current.—O. WUNDRAM.—This paper explains the very low efficiency of direct-current welding, partly due to the required motor-generator set and partly to the many necessary interruptions of the welding to renew electrodes or to clean the piece on which work is being done. During these interruptions the set is left running, and a total efficiency of 50 per cent or less may be the best obtainable. The poor results obtained with alternating-current welding are ascribed to the use of improperly designed transformers. High-ignition voltage, independence of voltage from length of arc within wide limits during welding and zero voltage at short circuit are the desirable characteristics of a welding transformer. These characteristics can be had with a very elastic coupling between primary and secondary windings, giving high leakage. A machine of this type is described with which successful welding at an efficiency of between 75 per cent and 80 per cent has been actually accomplished. The rectifying action of an arc between iron electrodes is a welcome addition and advantage of alternating-current welding. The high efficiency and simplicity of alternating-current welding are promising features of this method.—*Elektrische Betrieb*, Sept. 24, 1923.

Electrophysics, Electrochemistry and Batteries

Multiple Electrode Systems.—A. H. HEATLEY.—A study is made of current distribution in electroplating baths. From Ohm's law a general theory is developed for current distribution in an electrolyte with n electrodes and is tested experimentally for $n = 3$, 4 and 5. Equations are developed, and their possible application in electroplating is discussed. Experiments in a simple case yield confirmatory evidence. Formulas developed in a previous paper are shown to have a limited application, and a new definition of throwing power is suggested.—*Paper presented before American Electrochemical Society at Dayton, Ohio*, Sept. 27-29, 1923.

Manufacture of Chemicals by Electrolysis.—ALBERT CLARKE.—In this article, the third of a series, organic compounds as prepared by electrolysis are considered. In the preparation of organic chemicals by electrolysis the two main objects which have been pursued by the electrochemists have been to make use of the hydrogen evolved at the cathode in an acid or alkaline bath for reducing purposes and the oxygen which is given off at the anode for oxidizing purposes. It has been found possible to substitute organic groups by halogens and to bring about the reaction known as condensation. The author treats the subject according to the reaction involved for reduction, oxidation, substitution and condensation, in preference to describing isolated instances of the manufacture of specific bodies.—*Beama*, October, 1923.

Traction

Automatic Train Control.—The Chicago & Alton Railroad is making a test of an automatic train-control device of the intermittent induction type, which, with no change in the engine equipment, but with the addition of a slow-acting relay, may also have the speed-control feature as well as the automatic stop. The six-page article discusses the device in detail, its installation and operating results.—*Railway Review*, Sept. 15, 1923.

Development of Street-Railway Cars.—As the convention number, preceding the meeting of the American Electric Railway Association at Atlantic City, Oct. 8-12, this entire issue is given over to car development. The purpose is to bring before the industry a broad perspective of the direction and nature of recent development in electric railway car design. The articles point out the trend of development, the good and the fallacious, and indicate what seem likely to be, or what may well be, the future lines of development. Eight articles cover the subject.—*Electric Railway Journal*, Sept. 29, 1923.

Railroad Electrification in the Dutch East Indies.—G. DE GELDER.—A detailed technical and economical discussion is given of railroad electrification in general and as applied to this territory. Water power will be used exclusively. Power from the same system will also be available for industrial and for home consumption. Some features of the first line, now under construction (Batavia-Meester Cornelis-Buitenzorg), are the 70,000-volt transmission line and 1,500-volt direct current for railroad use. Motor-car trains will be used extensively, equipped with automatic starting devices, with locomotives for rush hours and freight only.—*Ingenieur (Holland)*, Sept. 8, 1923.

Electric Mine Haulage.—J. F. MACWILLIAMS.—A discussion of the maximum grade for locomotives, when and how to repair wheels, safety features of locomotive design, burn-outs due to defects in series fields and advantages of good feeders and return circuits.—*Coal Age*, Oct. 25, 1923.

Telegraphy, Telephony, Radio and Signals

Telephone Transmission Over Long Distances.—H. S. OSBORNE.—Similarities and contrasts of power transmission and telephone transmission over long distances are pointed out. The problems of telephone transmission on open-wire lines are illustrated by a discussion of the methods by which the over-all efficiency of the transcontinental telephone circuit has been greatly improved. A brief discussion is given of recent important developments in telephone transmission through cables over long distances. A demonstration talk between Havana, Cuba, and Avalon, on the Catalina Islands off the Pacific Coast, is described as an illustration of what can be done with the commercial telephone system in its present stage of development. This paper was presented at the Pacific Coast Convention of the A. I. E. E.—*Journal of A. I. E. E.*, October, 1923.

Single-Layer Inductance Coils for Radio-Frequency Standards.—Detailed instructions for the construction of a series of single-layer inductance coils suitable for radio-frequency standards are described. There are seventeen coils in the series, designed to cover the approximate range of 8 microhenries to 5,000 microhenries. Beginning with the smaller coil, each successive coil has approximately one and a half times the inductance of the previous coil.—*Letter Circular No. 103 of Bureau of Standards.*

New Books

Reviews of the Latest Contributions to Technical, Industrial and Commercial Literature of Particular Interest to Members of the Electrical Industry

Kent's Mechanical Engineers' Handbook

Tenth edition, 1923. Rewritten by R. T. Kent and staff. New York: John Wiley & Sons, Inc. 2,247 pages, illustrated.

"Kent's Handbook" has long been a useful and valuable source of practical engineering information, and the new edition in every way sustains the standards set in the past and indeed improves upon them. The book has been almost completely rewritten and much new material has been added. The balance is excellent and the contents represent the latest opinion and knowledge of practicing engineers and specialists.

The power section is particularly good, with its new and extended steam tables and information about the different practices which are changing the art so rapidly. Many new and rearranged tables and charts offer useful material on all phases of mechanical engineering, with particular emphasis placed on the properties of materials and the standards adopted by engineering and manufacturing organizations.

New chapters on reinforced concrete, automotive engineering, aëronautics and heat insulation are included, and many of the others have been greatly extended, including that on electricity. The indexing and printing are of a high standard, and the practical viewpoint has been kept in producing a complete and valuable volume. The authors have included also many thousands of references for the convenience of readers who wish to obtain more detailed information directly from source authorities.

Absolute Measurements in Electricity and Magnetism

By Andrew Gray. Second edition, rewritten and extended. New York: Macmillan Company. 819 pages, illustrated.

An advanced text for colleges and those interested in the fundamental aspects of electrical science. The book represents an immense amount of work and contains much new material on electromagnetic and electrostatic measurements and units. The treatment of inductance is particularly good and covers the application of the theory to the quantitative calculation of coils.

The fundamental experiments in electromagnetic phenomena are reviewed and discussed, units are treated thoroughly and measurement methods are treated in detail. The scope of the work is very large, covering, among others, chapters on units and dimensions of physical quantities, magnets and magnetism, magnetic induction, induced magnetization, unit currents and currents in networks, electromagnetism, calculation of coil constants, mutual influence of currents, measurement of activity in electric circuit, measurement of inductances, electrostatic measurements, medium inductivity effect and measurement of specific inductive capacity. Appendices cover details of the subject matter in greater detail and contain valuable tables of constants and units. The book is carefully indexed and edited and should be in the library of all those seeking fundamental knowledge of electromagnetic phenomena and measurements.

Der Drehstrommotor

By Julius Heubach. Berlin: Julius Springer. 599 pages, 222 illustrations.

This is the second edition of a text first published some twenty years ago. In comparison with American texts it is unusual. In fact, so far as the writer is aware, there is no book in the English language in which the principles of the polyphase induction motor *alone* are spread over almost 600 pages. Rare indeed is the American textbook on the whole field of alternating-current machinery that approaches this size, and into most of them is crowded, in addition, something of an exposition of the principles of alternating-current circuits. With this situation in mind, the writer was prepared to find considerable padding. But such is not the case. On the contrary, the whole treatment is characterized by a thoroughness that is quite typical of German and English texts.

As in the earlier edition, the theory is based on the method of fluxes and the circle diagrams of Heyland, Ossanna and Sumec. The leakage reactance and equivalent circuit method of Arnold and Steinmetz are not mentioned. About one-half of the book is devoted to a most detailed derivation and explanation of these circle diagrams and to the calculation of the distribution of the magnetic field, including the leakage fields. The remainder of the book contains chapters on testing of motors, the induction generator, single-phase motor, design and the effect of variation of voltage, frequency and the various motor constants on the behavior of the machine. This last is very thoroughly done, and the effects are illustrated by numerical calculations for a given motor.

The mathematics in the book is extremely simple, resort being had to the calculus only rarely. This was to be expected from the fact that the author leans so heavily on the circle diagrams. The book should appeal to those who wish a strong treatment of the induction motor from the standpoint of fluxes rather than leakage reactances. As the author intimates in the preface, however, the discussion is rather too elementary and extended for specialists in this field.

P. H. DAGGETT.

Patents Throughout the World

By William Wallace White and Wallace White. New York: Trademark Law Publishing Company. 244 pages.

The authors of this work have done an important job in digesting and arranging in a systematic way the patent laws of the nations of the world. A series of tables has been prepared to show at a glance the conditions under which patents may be obtained in the various countries, and these answer at once questions raised in connection with the filing of forms and applications. The digests of the patent laws are arranged in convenient form for perusal by the non-technical patent man or the patent attorney. A good index aids greatly in making the book usable, and an introductory chapter of general information regarding patents makes clear the terminology used in the succeeding chapters. Details concerning licensing, assignment of patents, patent rights and what things are patentable are covered in the digest of the laws of the several countries. The book should be well received by those interested in patents.

Aide-Mémoire et Schémas de l'Entrepreneur-Electricien

By P. Maurer. 620 pages, 262 illustrations. Paris: Dunod.

A handbook for the practical wireman, containing in eighteen chapters all information needed by the man installing or repairing electrical apparatus and machinery in the field. Connection diagrams for machines and plants form the bulk of the volume. Most of the illustrations are poor, and the total absence of halftone cuts, together with inferior paper, detracts from the appearance of the book.

A. PALME.

Books Received

Automatic Telephone Systems—Vol. II. By William Aitken. New York: D. Van Nostrand Company. 227 pages, illustrated.

Les Transformateurs. By P. Bunet. Paris: Librairie J.-B. Baillière et Fils. 632 pages, illustrated.

Valence and the Structure of Atoms and Molecules. By Gilbert Newton Lewis. New York: The Chemical Catalog Company. 172 pages, illustrated.

The Prevention of Vibration and Noise. By Alec. B. Eason. London: Henry Frowde and Hodder & Stoughton. 163 pages, illustrated.

Practical Control of Electrical Energy. By A. G. Collis. London: Henry Frowde and Hodder & Stoughton. 157 pages, illustrated.

Hydro-Electric Power Stations. By David B. Rushmore and Eric A. Lof. New York: John Wiley & Sons, Inc. 830 pages, illustrated.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Ferris Amendment Beaten

New York State Gives Large Majority Against Power Houses and Lines in Forest Preserve

A MAJORITY of great size was registered at the general election in New York State on Tuesday of this week against the so-called Ferris amendment to the state constitution, which, as readers of the "News of the Industry" are aware, would have permitted the building of electric transmission lines and power houses in territory not to exceed 3 per cent of the State Forest Preserve in the Adirondack Mountain region.

The complete vote on this amendment in Greater New York City was 501,650 against the amendment and 257,947 in its favor, or approximately two to one against it. Up the state less crushing but still decisive majorities appear at this writing to have been cast against the proposition in almost every county. Five other proposals submitted to the voters of the state were carried, in the main by large majorities, the effect of the determined attack on the water-power amendment being thus clearly shown.

The Ferris amendment, as the ELECTRICAL WORLD's news columns have made clear, had the support of many prominent engineers and others interested in electrical development, but it was unable to make headway against the determined opposition of those apposed to any encroachment whatsoever on the state lands, supported as they were in this instance by the Governor, by many influential newspapers and by virtually all advocates of public as opposed to private hydro-electric development.

The amendment as worded would have permitted either state development or development by private companies under fifty-year leases. No new amendment can be submitted to the voters for at least two years, as a constitutional amendment must before submission be passed by two successive legislatures.

Experimental Rural Line to Go Ahead in Minnesota

The proposal for an experimental rural line in Minnesota which, as told in the ELECTRICAL WORLD for Oct. 20, page 825, was drawn up at a recent conference between farmers, representing the Minnesota Farm Bureau Association, and officials of the Northern States Power Company is to be carried out in the near future. The location of the line has been changed from West Concord to Red Wing, about 40 miles away. The line at the latter point will be from 5 to 8 miles in length and will serve not more than three farms per mile, or a minimum total of fifteen farms. Among these are a poultry farm, a beef-cattle ranch and a "silver-fox farm," though most of the farms are diversified in character. There is an agricultural school in the district and several of the farmers along the projected line are graduates of the Minnesota Agricultural College. It is expected that the experiment will be in full swing before winter sets in.

Muscle Shoals Still Topic

Ford's Friend's Active—Weeks Favors Initial Installation of Eight Units at Wilson Dam

MUSCLE SHOALS will not down. Apparently it is slated for very active consideration at the forthcoming session of the new Congress. Friends of the Ford offer are very active. Their latest proposal is that the government shall construct a steam plant equal to that at Gorgas so as to meet the conditions of Mr. Ford's proposition. Representative Madden of Illinois, the chairman of the appropriations committee of the House of Representatives, on Nov. 5 acquainted the President with a proposal that the government duplicate the Gorgas plant at a point 10 miles southwest of the Alabama Power Company's plant. It is understood that the President favors an early determination of the disposition which is to be made of Muscle Shoals.

Two new offers for the government's Muscle Shoals properties are about to be made, it is reported. Sight should not be lost of the fact that the Alabama Power Company never has withdrawn its offer.

Interest in the project was stimulated by the request of the Secretary of War for an extra budgetary appropriation of $2,000,000 so that four more 30,000-kw. units can be installed at Wilson Dam in addition to the four covered by the first plan. This action is said to have followed a request to that effect made by Senator Underwood. It is known, however, that the Chief of Engineers long has been of the opinion that the installation of four additional units is justified. Since provision is being made for the ultimate installation of eighteen units, the proposed additions in no way affect the construction program of the government, which is now 60 per cent complete.

Power Board Activities

Portland Company Wants to Retain Construction Railroad—License for Priest Rapids Asked

THE chief engineer of the Federal Power Commission, Col. William Kelly, will report in person on the controversy which has arisen as to the disposition of the 26-mile railroad line built by the Portland (Ore.) Railway, Light & Power Company in connection with its water-power development on the Klackamas River, 50 miles south of Portland. The company desires to retain the railroad as a permanent adjunct of its water-power development, to insure the ready transfer of heavy machinery to the plant in case of accident. Officials of the Forest Service object to this plan unless the road is made a common carrier and hold that its presence, if available for limited use only, in effect bottles up the upper watershed of the Klackamas.

The Washington Development & Irrigation Company has made formal application to the commission for a license covering its 350,000-hp. project at Priest Rapids. The company has complied with the conditions of the preliminary permit, which was granted March 3, 1921. It is assumed that the commission will authorize the issuance of the license at an early date, since all of the questions involved were threshed out at the time the preliminary permit was granted.

The proposed development of water power at Kelly's Ford above Fredericksburg, Va., on the Rappahannock, does not come within the jurisdiction of the Federal Power Commission, the chief of engineers has reported.

Another Big Plant for Indianapolis Light & Heat

Construction of another large electric plant to serve the Indianapolis and central Indiana territory will be completed late in 1925 by the Indianapolis Light & Heat Company, according to a recent announcement by C. C. Perry, president of the company. He said preliminary work on the project has been begun on a 145-acre tract about 8 miles southwest of the city on White River. The plant will cost about $5,000,000 and will involve an expansion program in addition to improvements now being made in the equipment of the company's physical property. These improvements, constituting the 1923 development program, are costing about $1,700,000.

For a Study of Technical Education

Carnegie Corporation Gives $108,000 for Investigation by S. P. E. E. of Engineering Training—W. E. Wickenden Chosen to Conduct the Work

AN APPROPRIATION of $108,000 for the study of engineering education was made on Oct. 31 by the Carnegie Corporation of New York, the study to be conducted by a director responsible to a committee of the Society for the Promotion of Engineering Education. As the ELECTRICAL WORLD goes to press news comes from the committee that W. E. Wickenden, assistant vice-president of the American Telephone & Telegraph Company, has accepted appointment as director.

The resolution adopted by the Carnegie Corporation sets aside for the purpose $24,000 during the present fiscal year and $12,000 during the fiscal year 1924, with the understanding that if, in the judgment of the executive committee, substantial progress shall have been made in this study by Jan. 1, 1925, the balance of the $108,000 will be made available to the society as follows: $24,000 additional during the fiscal year 1924, $48,000 during the fiscal year 1925.

This appropriation is the direct result of effort by a development committee appointed in the summer of 1922 to study for three years the development of the Society for the Promotion of Engineering Education and to formulate an answer to the question "What can the society do in a comprehensive way to develop, broaden and enrich engineering education?" This committee, appointed by President C. F. Scott, professor of electrical engineering at Yale, comprises, besides himself, Dean M. E. Cooley of Michigan, John H. Dunlap, secretary of the A. S. C. E.; Prof. D. C. Jackson of the Massachusetts Institute of Technology and President F. W. McNair of the Michigan College of Mines.

OBJECT OF COMMITTEE

Conferences were held by Professors Scott and Jackson with Dr. Henry S. Pritchett of the Carnegie Corporation with the view of obtaining a suitable appropriation. The object of the committee was stated in a memorandum to Dr. Pritchett to be a "discriminating study of the present state of engineering education" and "the fitness of the present-day curriculum for preparing the student for his profession." To this end it is purposed to relate the investigation, which is primarily to follow the educational point of view, to other studies on the same subject, particularly the one under way by the National Industrial Conference board, which is being conducted from the standpoint of the employers of engineers and of practicing engineers themselves. The S. P. E. E.'s committee will "study the process by which the curriculum of fifty years ago has come to its present form; it will seek to set forth the nature and the weakness of the curriculum as at present administered, and it will indicate such modifications or developments as would seem to make for a sound, well-balanced and fruitful course of study for engineering students."

ORGANIZATION AND PROGRAM

The following organization and program is suggested as one fitted to this investigation:

1. The inquiry shall be carried on under the general direction of a committee appointed by the Society for the Promotion of Engineering Education, with the understanding that this committee shall include at least two men chosen from outside the society and the engineering profession, whose point of view will be primarily that of the trained teacher.
2. The active conduct of the study will be under the supervision of a director appointed by the committee, whose office shall be in New York, and, if possible, in the Engineering Building. The publication of the results of the study will be also in the hands of the director.
3. The director shall organize committees in the faculties of as large a number of engineering schools as may be practicable, who shall co-operate with the committee and with the Society for the Promotion of Engineering Education in the prosecution of this study.
4. Inasmuch as a study of the engineering curriculum of American schools should include a knowledge of and comparison with the best schools in Europe, it is considered necessary that the director of the committee shall, as soon his work is organized, visit such engineering schools of European countries as may throw light upon the best methods in engineering education.

Replying to the committee's overtures, Dr. Pritchett said that the study proposed seemed to him essential and that he could think of no better means of carrying it out than through the organization and program described.

Dr. F. P. Keppel, who has succeeded Dr. Pritchett as head of the Carnegie Corporation, has indorsed the movement and is taking an active interest in it.

Rates of Coast Valleys Company Are Slashed

Electric rates charged by Coast Valleys Gas & Electric Company have been reduced 8 per cent for lighting and 14 per cent for agricultural power use by the California Railroad Commission. The Coast Valleys Gas & Electric Company purchases power wholesale from Pacific Gas & Electric Company and supplies Monterey, Pacific Grove, Carmel, Salinas, King City and surrounding territory on the Monterey peninsula and in the Salinas Valley.

Two uniform lighting rates are provided by the new schedules, one for towns and the other for rural territory, eliminating existing distinctions. Industrial power rates are generally reduced to all consumers except those whose operations are unusually continuous through the month. The average reduction is approximately 8 per cent. An unsatisfactory schedule of agricultural rates has been replaced by a simplified schedule designed to eliminate complaints. The company will be obliged to furnish transformers, which have heretofore been furnished by consumers. On account of the present disjointed rate a few bills may be raised and others reduced below the average.

Lighting service applicable to cities and towns throughout the territory served will be, for the first 10 kw.-hr. or less per month, $1; for the next 40 kw.-hr., 7 cents; for the next 150 kw.-hr., 6 cents; for the next 800 kw.-hr., 5 cents, and all over 1,000 kw.-hr., 4 cents. The rates applicable outside cities and towns begin with a charge of $1.25 for 10 kw.-hr. or less, otherwise they are the same as the urban rates.

The electric rates of the Coast Counties Gas & Electric Company, which also purchases electricity wholesale from the Pacific Gas & Electric Company, distributing it in Santa Cruz, Watsonville, Hollister, Gilroy and surrounding territories, were also reduced, all towns being placed upon one rate and all rural territory upon another. The total reduction in lighting rates is about 15 per cent, but because of the different schedules on different parts of the system some consumers will be reduced much less than 15 per cent and others much more. Industrial power rates are reduced an average of 18 per cent over the entire system. Agricultural rates are reduced by the entire elimination of the surcharge and by slight further reduction, making a total reduction of approximately 12 per cent. The general lighting rate schedules within cities and towns and outside incorporated territory are the same as for the Coast Valleys Gas & Electric Company.

Clearing House Established for State Associations

To co-ordinate the activities of state, sectional and national sections of electric utility organizations, as well as to serve as a clearing house for practices which can be used to advantage by all of them, an organization was formed at a recent meeting of secretaries of such associations at Atlantic City. E. N. Willis of Dallas, Tex., was elected president and J. N. Cadby of Madison, Wis., secretary. In forming this organization it was recognized that varying methods have been successfully employed to increase interest and attendance at meetings in different parts of the country and to enhance the usefulness of the organizations. The new body hopes to make all these methods equally available to all sections, and all are invited to contribute ideas. It was the general opinion that the relation between state and sectional associations with respect to legislation could be improved if each association were advised of legislation pending in other states, since it often occurs that the same bills are pending in several states simultaneously. The secretaries of the state associations of Ohio, Indiana, New York, Massachusetts, Texas, Wisconsin and Illinois and of the American Electric Railway Association attended the Atlantic City meeting.

Work Begins on Dix River Plant

This Hydro-Electric Project Will Be Interconnected with Other Middle West Utilities Properties—Rock-Filled Dam 270 Ft. High and 760 Ft. Wide

ELECTRICAL interests in Kentucky and neighboring states are watching with interest the construction of the Kentucky Hydro-Electric Company's new plant, which will be 3½ miles from the mouth of the Dix River at a point where it flows into the Kentucky River at High Bridge, 20 miles from Lexington, Ky., and about 100 miles from Cincinnati on the north and 75 miles from Louisville on the west. The rock-filled dam, now begun, will be of the type of the Strawberry Dam in California. It will be 270 ft. high and 760 ft. across the gorge, thus ranking as one of the biggest east of the Rocky Mountains, and will form a lake 36 miles long and in places more than a mile wide.

This plant will be completed about Jan. 1, 1925, at a cost of about $7,000,000, including 95 miles of double-circuit steel-tower transmission lines to Lexington and to the Ohio River near Louisville. The plant will have a capacity of 36,000 hp., it being intended to connect three 12,000-hp. Morris waterwheels to three 8,000-kw. Allis-Chalmers generators. The power house will be built in the old river channel, just below the dam.

The Kentucky Hydro-Electric Company is a subsidiary of the Middle West Utilities Company. Its transmission lines will tie in with the present transmission system of the Kentucky Utilities Company at Lexington and with that of the Interstate Public Service Company at Louisville, these companies being also controlled by the Middle West Utilities Company, which, as already told in the ELECTRICAL WORLD, is planning a big steam plant at Jeffersonville, Ind., on the other side of the Ohio River. A transmission line will also run southeast from the Dix River power plant 80 miles to the plant of the Kentucky Utilities Company now being built at Pineville, Ky., and still further to Varilla, Ky., and Pocket, Va. This line is being constructed by the Kentucky Utilities Company. Eventually a line will be carried to western Kentucky to augment service to coal mines and other industries in that region.

The Dix River project will be the first large hydro-electric development in central Kentucky, though the hydraulic power possibilities of the river were foreseen in the days of Boone. The plans include construction of a highway bridge across the gage, 800 ft. long, and the building of new waterworks for Danville, Ky., whose present plant will be flooded out.

Savings Banks to Make Survey of Public Utility Securities

The public utility committee of the National Association of Mutual Savings Banks of the United States has begun an intensive study of public utility securities with a view to broadening and strengthening state regulation as applied to them, according to the *Savings Bank Journal*, the official organ of the association.

In the preliminary survey of the committee it is planned to assemble data only for a limited number of companies, possibly not more than fifty, one or more of their issues to be of the highest possible grade and therefore a potential savings bank investment. Electric light and power, gas and telephone companies alone will be considered.

"This discussion reflects the great interest which savings banks have displayed in recent years in public utility securities," says the *Journal*. "They have been in the foreground upon every occasion when search has been made for additional classes of legal investments which would meet the three recognized savings bank canons—safety, liquidity and yield. But they still are not legal in some states, notably New York, and in general those states which permit their savings banks to purchase public utility issues limit the companies to those within the state."

Middle West Executives in Conference

More than one hundred executives of the Middle West Utilities Company attended a three-day session in Chicago from Oct. 24 to 26. This conference discussed problems ranging from safety and insurance, transmission systems, rural lines and farm service to stock-selling conferences. Delegates of the women's committee on public relations from the various Middle West properties were present. The conference terminated on Friday night with a banquet at the Blackstone Hotel, where M. H. Aylesworth, executive manager N. E. L. A., discussed "The Normal Pulse of the Public." F. K. Schrader of the Halsey-Stuart Company spoke on "Public Utility Financing from an Investment Banker's Viewpoint," and W. J. Hodgkins of the Lake Superior District Power Company dealt with the "Value of a Conference to an Executive."

Radio Bill to Come Up Again in Next Congress

The radio-control bill which failed of passage in the last Congress because of congestion of the Senate calendar in the closing hours of the session will be introduced again early in the next session, according to information received by Secretary of Commerce Hoover. The Secretary said that his information was to the effect that the general lines of the White bill in the last session would be followed by the new measure, with modifications which will mean simplification, worked out as the result of experience gained in the intervening months.

The principal features of the measure are to vest control over radio in

SITE OF DAM TO BE ERECTED ON DIX RIVER BY KENTUCKY HYDRO-ELECTRIC COMPANY

the Department of Commerce, requiring transmitting stations to obtain licenses so that confusion in the air may be eliminated by regulations stipulating wave lengths to be used and hours of sending.

St. Joseph, Mo., Will Purchase Central-Station Energy

The Missouri Public Service Commission has approved a contract entered into by the city of St. Joseph, Mo., and the St. Joseph Railway, Heat, Light & Power Company under which the city temporarily discontinues the operation of its municipal lighting plant and purchases electrical energy for street lighting and other city purposes from the company. The contract provides the city shall pay a rate of 1.8 cents per kilowatt-hour for the first 500,000 kw.-hr. per year and 1 cent per kilowatt-hour for all in excess.

At a public hearing held in St. Joseph before members of the state commission evidence was introduced tending to show that it would cost the city $38,000 for energy bought from the company to supply 1,500 street lamps, while it was costing the city between $40,000 and $50,000 annually to operate its own plant, which supplied light for only 500 street lamps.

Topics at Forthcoming Convention of A. S. M. E.

Among subjects of central-station interest to be discussed at the coming meeting of the American Society of Mechanical Engineers at the Engineering Societies Building, New York, Dec. 3-8, are these: "Factors in the Spontaneous Combustion of Coal," by O. P. Hood; "Economic Phases of Coal Storage," by F. G. Tryon; "Coal Handling and Coal Storage," by H. E. Birch and H. V. Coes; "Economy Characteristics of Stage Feed-Water Heating by Extraction," by E. H. Brown and M. H. Drewry; "High Pressure, Reheating and Regenerating for Steam Power Plants," by C. F. Hirschfeld and F. O. Ellenwood; "Reheating in Central Stations," by W. J. Wohlenberg; "Margins of Improvement in Central-Station Steam Plants," by E. L. Robinson; "Boiler-Test Results with Preheated Air at Colfax Station," C. W. E. Clarke; "Boiler-Plant Economics," N. E. Funk and F. C. Ralston, and "The Gibson Method and Apparatus for Measuring the Flow of Water in Closed Conduits as Applied in Testing the Efficiencies of Waterwheels in Hydro-Electric Power Plants," by N. R. Gibson. The power test codes committee of the society will hold a public hearing on the code for stationary steam generating units.

On Wednesday evening, Dec. 5, there will be a joint session with the American Institute of Electrical Engineers and the American Society of Civil Engineers, when John R. Freeman, Providence, will speak on "Fundamentals of Hydro-Electric Equipment."

"Electric Fleet" of United States Navy Complete

The U.S.S. *West Virginia*, last of the battleships to be built by the United States government under the Washington Arms Conference limitation and sixth to be equipped with the electric drive, thereby completing the "electric fleet," will be commissioned at the Newport News shipbuilding yards about Dec. 1. She will be a sister ship to the *Maryland* and the *Colorado*.

The *West Virginia* is electrical throughout. Her main propulsion machinery consists of two Curtis steam turbo-generators, designed to develop 12,600 kw. at a speed of 2,150 r.p.m. to drive the ship 21 knots. These supply power to four 8,000-hp. General Electric induction motors, directly connected with the four propellers and turning at 177 r.p.m. The motors, among the largest ever built, are 12 ft. in diameter, weigh 62 tons, and the 32,000 hp. thus available for propulsion purposes is enough to supply power to a city of 100,000 population. The two turbo-generators, supplied with steam generated by eight oil-burning boilers, can be run independently. Either is capable of driving the ship up to a speed of about 17 knots. The power generated by them is used for no other purpose than propelling, electrical current for other needs being generated by six 300-kw. generators and two 400-kw. Diesel generators.

Virtually every electrical appliance used afloat and ashore has been installed in this new battleship. The electrical equipment includes radio telegraph, loud-speaking telephones, ordinary telephones, gyroscope compass, steering gear, anchor windlass, capstan, boat cranes, winches, air compressors, air heaters, turret training, turret-gun elevating, ammunition hoists, gun firing, range signaling, powder-testing oven, ice machines and much besides.

W. L. R. Emmet, consulting engineer of the General Electric Company, who advocated the principles of the electric drive as long ago as 1909, was instrumental in its adoption by the government and designed the first electric drive installed by the navy.

Commissioners Will Discuss Superpower at Miami

The official call for the thirty-fifth annual convention of the National Association of Railway and Utilities Commissioners has just been issued by Commissioner Dwight N. Lewis of Iowa, the president. The convention will be held in Miami, Fla., beginning Dec. 4 next, and will last four days. Headquarters will be at the Hotel Urmey. The local arrangements are in the hands of R. Hudson Burr, chairman of the Railroad Commission of Florida, whose main office is at Tallahassee.

The sessions of the convention will be devoted mainly to the presentation and consideration of reports from twenty standing and special committees, which will, as usual, include such topics as public ownership and operation, safety of operation, service, rates, capitalization, motor vehicle transportation, statistics and accounts. A discussion on the superpower movement will be led by W. D. B. Ainey, chairman of the Public Service Commission of Pennsylvania.

Weymouth Outlines Boulder Canyon Project

Plans are now being perfected in the Denver offices of the Reclamation Service for the projected Boulder Canyon dam on the Colorado River near Las Vegas, Nev., which will cost between $40,000,000 and $50,000,000, and for a power project in connection with the dam, which will cost a similar sum. Construction of this huge dam and power project will, it is understood, be recommended to Congress when it meets in December by the Reclamation Service.

According to F. E. Weymouth, chief engineer for the Reclamation Service, the proposed Boulder Canyon development would make possible the protection of life and property in the Imperial Valley through the control of floods on the Colorado River, the reclamation of 2,000,000 acres of land below the dam, the reclamation of 4,000,000 acres above the dam, and the development of a continuous flow of 800,000 kw. to 1,000,000 kw. of electricity, providing power for the industries of California, Nevada, Arizona and southwestern Utah.

The project as now outlined involves the storage for irrigation and power purposes of 34,000,000 acre-feet of water. It is estimated that the cost of the development would be repaid to the government in a reasonably short period by the sale of electrical energy.

Taxpayer's Suit Against Los Angeles Bureau

A taxpayer's suit has been brought by W. W. Mines, a real-estate dealer of Los Angeles, against the municipal Bureau of Power and Light to prevent expenditures by the bureau designed to promote the Boulder Canyon power project, from which the city authorities hope to procure a great additional source of power supply. The rapidly growing population of the southern California City makes it very difficult for the municipal plant to keep pace with the demands upon it. Contract has been awarded for nineteen transformers to be installed in new substations, and the program calls for the installation of thousands of miles of transmission-line extensions. The City Council by a majority of six to three has passed an ordinance appropriating $25,000 to enable the Bureau of Power and Light to begin efforts to condemn the seventeen-million-dollar electric properties of the Los Angeles Gas & Electric Corporation.

British View of World Power Conference

It Is Not to Be Carried on for the Commercial Benefit of British Manufacturers Alone, but to Extend Educational Stimulus to Engineers of All Nations

[This article is based on the personal investigations of Paul Wooton, Washington correspondent of the Electrical World, who has recently returned from England and France, where he covered several assignments for the Electrical World and other McGraw-Hill engineering publications.—Editors.]

BRITISH electrical manufacturers have a deep conviction that anything which betters the status of the engineer helps them. They feel that they must depend on the engineer for much of the progress made by the industries which use electrical equipment and that they are dependent on him for most of the conceptions which require new applications of electricity.

It was that thought which induced the British manufacturers to propose the World Power Conference. The conference is to be held in July, 1924, during the British Empire Exhibition, but is no part of it. The principal nations of the world are participating in the power conference, while the exhibition is a family reunion of the commonwealths making up the empire.

There is every reason to believe that the World Power Conference was not proposed with the idea that it would be of greater commercial advantage to British manufacturers than to those of other countries. The real object unquestionably is to give the electrical engineers of the world, as well as other engineers interested in power in any form, an opportunity to add to their education and to broaden their views. By exchanges of views all will benefit from such a conference, it is believed. In that connection it is pointed out that electrical engineers are interested in more than the technical problems which confront them. They are interested in the management of properties and in the financing of development. It is in recognition of the broader functions which the engineer is coming more and more to exercise that the power conference expects to devote a considerable portion of its time to the discussion of the relationships between electrical undertakings and their financing.

The decision to call a power conference was reached by the British Electrical and Allied Manufacturers' Association before there was any thought of convening it during the British Empire Exhibition. In fact, there was objection on the part of many manufacturers to calling it at that time because of the belief that more time should be allowed for the preparation necessary for such a comprehensive conference. It was decided finally, however, that advantage should be taken of the presence in London at the time of the exhibition of a large number of engineers and business men and of the facilities for cheaper transportation then to be in effect.

The British manufacturers see in the conference, in addition to its service to engineers, an opportunity to acquire more exact knowledge as to the world's power resources. Every effort will be made to build up a comprehensive record, setting forth the exact situation existing in each country. This information, of course, will be available to all concerned. Much of the information on world power resources which does exist is of doubtful value because of the changed conditions which have come about since the war.

British Conservatism Disappearing

British interests are throwing off much of the ultra-conservatism that once characterized many of them. They are coming to the opinion, long held in America, that there should be liberal interchange of ideas and a minimum of secrecy. It is hard to keep secrets from any one who really wants to find out, they have learned, whereas the more open policy prevents duplication and eliminates waste. They realize that no one nation can supply all of the needs of the world for electrical equipment and now declare that they are convinced that it is better to co-operate in improving practice, undertaking standardization and reducing costs, thereby stimulating demand for products and increasing the capacity of the world to absorb them. It is in such channels that the thoughts of the British manufacturers are flowing. The idea will be worked out in detail and presented in papers and in discussion at the conference. Incidentally it has been decided that no time will be consumed in reading long papers. All papers will be printed in advance and distributed among those in attendance. The entire time at the sessions can then be devoted to discussion, with the idea of bringing out the condensed viewpoint of delegates on any particular paper.

The tentative program (see Electrical World, Aug. 25, page 399), which embodies ideas presented by O. C. Merrill of the American committee and by J. B. Challies, the director of the water-power branch of Canada's Interior Department, has met with favor in France, Switzerland and Italy, which were the only countries heard from up to the time that Mr. Wooton left England. It is expected, however, that suggestions from these and other nations will be forthcoming which will meet with favor and be included.

While the British expect Americans to be their chief competitors, for all time to come, in the electrical field, they are outspoken in their desire to have Americans rather than others in this rôle. Some of them complain of alleged dishonest methods used by manufacturers in certain European countries. The fact that American costs of production are much higher than those of their Continental competitors doubtless is an important further factor in influencing them to take that view.

Electrical Development in Eastern Tennessee

The accompanying map, showing the power lines in Tennessee east of the Tennessee River, has been made by the Public Service Information Bureau of the state from data compiled by the Public Utilities Commission's engineers. It shows where the present high-tension lines of the power companies traverse middle and eastern Tennessee territory and indicates the new developments contemplated. There are more than 900 miles of high-tension power lines supplying the industries, mines, cities and towns of east Tennessee, and two-thirds of the power transmitted over these lines is hydro-electric. The ultimate capacity of the plants covered by applications now on file is estimated at 700,000 hp.

Existing and Projected High-Tension Lines in Eastern Tennessee

In the region of the Clinch and Powell Rivers are the great coal fields, which are rapidly being electrified, while the aluminum industry at Maryville is supplied with power for its electrical furnaces from the power plant at Cheoah, in North Carolina, and from a supplementary line of the Tennessee Electric Power Company, fed with power from the Ocoee River plants in Tennessee. Electric power serves another of the state's industries in the copper basin at Ducktown, while the zinc mine at Mascot consumes almost half as much power as the entire city of Knoxville. While these are the larger power-consuming industries in the state, thousands of essential indus-

tries, particularly the cotton mills along the Southern Railroad from Knoxville to Chattanooga, are dependent almost altogether on electric power. Power lines that reach to Mount Pleasant as a terminus for the phosphate fields there and to Nashville are fed from the same hydro-electric sources.

Delay on Clinch and Powell River Schemes Necessary

The survey of resources of the Tennessee River which is being conducted by army engineers will not have reached a point where reports will be available on the Clinch and Powell Rivers for at least a year. This means that the Federal Power Commission will not be able before that time to pass upon the applications of the Knoxville Power & Light Company, the Tennessee Electric Power Company and the Tennessee Hydro-Electric Company.

Development of Hiawassee

Southern Appalachian Power Company Sees Capacity of 200,000 Hp.—Andrews, N. C., Defiant

THE Federal Power Commission has received an application from the newly organized Southern Appalachian Power Company of Asheville, N. C., for a preliminary permit covering a 170-ft. dam and power structure at a point on the Hiawassee River one mile above Murphy, N. C. The development will be in the extreme western tip of North Carolina.

The Hiawassee is a tributary of the Tennessee and has its source just over the ridge from the Tugaloo and other streams which have been thoroughly developed on the eastern slope of the range. The dam proposed in the application would control the annual runoff of the river and provide a low-water flow of 1,300 cu.ft. per second. It is estimated that 50,000 hp. could be developed at this site. The most attractive feature of the project, however, arises from the fact that 400 ft. of head can be developed in the river below Murphy, which would, according to the promoters, make possible the development of 150,000 hp. in that stretch. The development would, it is claimed, increase the low-water flow at Muscle Shoals by 10 per cent, and it would benefit materially the Hales Bar project of the Tennessee Electric Power Company.

This project emphasizes the fact that power development can do more for the control of floods than many times the expenditure on the type of works usually employed in flood control. The Hiawassee development would control the waters falling on 400 square miles of drainage area. It would increase materially the navigable capacity of the Tennessee and in addition would create navigable pools above each of the four or five dams which eventually would be built.

Another feature of this application is the fact that the power developed is to be sold to a number of companies already operating distribution systems. Incidentally the development would drown out the dam proposed by the town of Andrews, N. C. It is this small municipality which is defying the Federal Power Commission. It has sold its bonds and has let contracts for its project, which is 7 miles above the site of the Southern Appalachian Power Company. Materials are being transported to the dam site, it is understood. The district representative of the Corps of Engineers has instructions to request an injunction from the federal court when ground is broken.

Brief News Notes

Pine Flat (Cal.) Conservation Project to Include 50,000-Kva. Power Plant.—It has been determined by the committee in charge of the Pine Flat conservation project in southern California, which involves the building of a dam in the Kings River, that a power plant to be rated at 50,000 kva. and cost about $3,000,000 shall be included in the scheme.

Georgia Commission Adopts Standard Utility Accounting.—The uniform system of utility accounts advocated by the National Association of Railway and Utilities Commissioners, with special forms for electric light and power companies, gas and street-railway companies, has been adopted by the Georgia Public Service Commission for use throughout the state.

Durham, N. C., to Develop Flat River.—The City Council of Durham, N. C., has approved plans calling for an expenditure of approximately two million dollars on a water supply and water-power plant on Flat River. Two plans were presented to the city by the engineers, one calling for a 58-ft. dam which would have supplied the city with its water needs, the other calling for a dam 85 ft. high to supply the city with water and generate electric power. This latter project was approved.

New Project for the Choctawhatchee.—Despite the injunction against the municipal project of Dotham, Ala., reported last week, the erection of a hydro-electric power dam on the Choctawhatchee River seems assured through the action of the Alabama Public Service Commission in granting a certificate of convenience and necessity for this purpose to the Houston Power Company. The dam will be 50 ft. in height instead of 30 ft. as was first planned. Bonds to the amount of $1,000,000 were authorized.

West Penn Buys Vandergrift Electric Company.—The West Penn Power Company has purchased the property of the Vandergrift (Pa.) Electric Light & Power Company, and eventually Vandergrift will be connected to the main transmission lines of the West Penn system, although for the present the new owners will continue to operate the local plant. The adjacent territory has been supplied with electric power by the West Penn organization for a number of years.

New Plant for Rock Island, Ill.—Ground will be broken this fall for a plant at Rock Island, Ill., for the People's Power Company, to cost $1,500,000, Manager E. B. McDonald announces. The equipment will include a 30,000-kw. steam turbo-generator. When the plant is complete it will have a capacity of 60,000 kw. The People's Power Company is controlled by the Tri-City Railway & Light Company, whose subsidiaries serve Moline and Rock Island, Ill., Davenport, Iowa, and other places.

Big Reservoir on Yadkin River Is Projected.—The Tallassee Power Company of Badin, N. C., is said to be planning the erection of a huge dam at High Rock on the Yadkin River, several miles above Badin. A basin covering about 30 square miles of territory is proposed, which will serve as a reservoir for water supply during periods of drought. The plant at Badin is able to operate only part time now because of low water, and it is to take care of this situation that the big reservoir is proposed.

Fire Menaces Seattle's Power System.—Flames which swept through timber in the Cedar River watershed and adjacent areas reached within 300 yards of the large hydro-electric station of Seattle's light department on Oct. 30, and vigorous action was necessary to save the light system from serious damage. The penstocks carrying water from Cedar Lake to the power station were saved by boring holes in the wooden-stave pipes, permitting water to flow over the outside of the pipes when the fire threatened the lines.

Educators Urge World Metric Units.—Worldwide adoption of the metric units of weights and measures was strongly urged at the World Conference on Education, recently held in San Francisco. The metric resolution was discussed in the group session on "greater unification in science," the committee in charge being Y. Ishimura (for Asia), Dr. Maria de Maetzu (for Europe) and Percy E. Rowell, chairman (for America). Passage of the metric standards bill which will be again introduced in the new session of Congress to convene in December was advocated.

Electric Vehicle School Lectures to Be Published.—Because of the widespread interest in the Electric Vehicle School lectures which were presented at the sessions of the school held in New York, Chicago and more recently in San Francisco it has been decided to publish them in book form. Already

more than a thousand copies of this book have been ordered. The cost of the complete set of twelve lectures will vary from $1.50 to $2, depending on the number ordered. Charles R. Skinner, Jr., chairman Electric Transportation Bureau, N. E. L. A., is in charge of the publication.

International Character of Pigeon River Development.—The proposed plan of the Pigeon River Lumber Company of Wisconsin Rapids, Wis., to erect five power houses at points within a distance of 15 miles on the Pigeon River to develop 25,000 hp. has been temporarily halted pending approval of the project from the Canadian government. In a decision handed down by the Federal Power Commission at Washington it was ruled that owing to the fact that the Pigeon River flows into Lake Superior from the Province of Ontario, making it an international stream, the project cannot be started until the sanction of the Canadian authorities is obtained.

Transmission Line Crosses Sierra Nevada Mountains—The 60-kva. transmission line 50 miles in length tying in the system of the Truckee River Power Company with that of the Pacific Gas & Electric Company has recently been completed. The line, which was described in the ELECTRICAL WORLD for May 19, page 1165, crosses the Sierra Nevada Mountains at an elevation of 7,300 ft. and, owing to the severe winter storms, heavy construction was necessary. The new line has a capacity of 7,500 kva. and will give the Truckee River Power Company additional power for supplying its mining and other load in Nevada.

Peninsular Power Company Increases Capital.—To meet the financial requirements of its proposed plan to make extensive additions and extensions to its plant and outside properties, the Peninsular Power Company, which operates several hydro-electric properties in northern Wisconsin and the upper peninsula of Michigan, furnishing light and power service to iron-mining companies and cities, has taken steps to increase its capital stock from $3,000,000 to $4,500,000, for which state consent has been received. The preferred stock will thus be increased from $1,500,000 to $3,000,000.

Growth of Service in Los Angeles.—During the past twelve months, according to Chief Electrical Engineer Scattergood of Los Angeles, the city's power bureau has constructed 195 miles of electric lines, each line carrying a large number of high-voltage wires. The construction of new lines and improvements of existing lines has necessitated the setting of 9,500 poles in the city. To meet new demands for commercial, industrial and domestic power and lighting service, the bureau is installing on an average 100 new meters and services each day. Within the past twelve months more than 28,000 electric services, or enough to serve a city of 100,000 people, have been installed by the bureau.

Transformer Runs for Eighteen Years Without Overhauling.—Eighteen years of continuous service and still going strong is the record credited to the 20-kva., 10,000-volt General Electric transformer shown in the accompanying illustration. It was recently sent to a local warehouse from the Fullerton district of the Southern California Edison Company, which originally purchased it, marked "no longer needed in district." In spite of its condition, which was then unknown, the apparatus successfully withstood potential tests before being sent to the shop with instructions to "clean and paint." When the transformer case was removed the sludge at the top resembled coke and was knocked

off with a hammer. At the bottom it looked like axle grease. Records of the Pittsfield factory of the General Electric Company show this machine was tested in January, 1905.

Electric Smelter for Denver Advocated.—Frank E. Shepard, president of the Denver Engineering Works, is endeavoring to vitalize the project of establishing an electric smelter in that city. The possibilities, he says, are incalculable. "Norway and Sweden for years have been treating ores electrically for $3 a ton," Mr. Shepard asserts. "Here in Denver the cost would probably be $10 a ton, because of the higher cost of power, but this would permit the treatment of fifteen-dollar ore at a profit of $5 a ton, after all freight and smelting cost had been paid."

Northern Illinois Company Purchases Interurban Public Service.—The Public Service Company of Northern Illinois has announced purchase of the Interurban Public Service Company, an electric utility serving the towns of Roselle, Bloomingdale, Cloverdale, Itasca, Wooddale, Meachan, Shaumberg, Bartlett and Ontarioville. These communities, which will add about 1,800 customers to the lines of the Northern Illinois company, are about 25 miles west of Chicago and are now being served from a central generating station at Roselle. It is the purpose of the purchasing company to build 66,000-volt lines to serve them. The acquisition of this property closes the gap of the outer belt line of Chicago between the northern and southern extremities of the territory now served by the Public Service Company of Northern Illinois.

Associations and Societies

Lehigh Valley Section, A. I. E. E.—This section will meet at the Schuylkill Valley Country Club, Pottsville, Pa., on Nov. 16 and 17. C. A. Hall, general manager of the East Penn Electric Company, and engineers of the J. G. White Corporation will describe the new plant at Pine Grove.

American Electrochemical Society.—This society has already made plans for its next meeting, to be held on April 24, 25 and 26, 1924, in Philadelphia, with headquarters at the Bellevue-Stratford. There will be two symposiums, one on "Recent Progress in Electrodeposition," S. Skowronski, Perth Amboy, N. J., chairman, and the other on "Organic Electrochemistry," C. J. Thatcher, New York City, chairman.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

Electrical Supply Jobbers' Association—Hotel Statler, Buffalo, Nov. 12-15. Franklin Overbagh, 411 South Clinton Street, Chicago.

Electrical Manufacturers' Club — Hot Springs, Va., Nov. 14-18. F. L. Bishop, Hartford Faience Company, Hartford, Conn.

Arkansas Utilities Association—Pine Bluff, Nov. 15-16. R. I. Brown, Little Rock Railway & Electric Company, Little Rock.

Electric Power Club—French Lick Springs Hotel, French Lick, Ind., Nov. 19-22. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Southeastern Division, N. E. L. A.—Hillsboro Hotel, Tampa, Fla., Nov. 19-22. Charles A. Collier, Georgia Railway & Power Company, Atlanta, Ga.

Electrical Credit Association, Central Division—Hotel LaSalle, Chicago, Nov. 20-21. F. P. Vose, 1341 Marquette Bldg., Chicago.

Commercial National Section, N. E. L. A.—Group meetings, Salt Lake City, Nov. 21-22.

Empire State Gas and Electric Association—Electric Section, Edison Club, Schenectady, Nov. 21-22.

American Physical Society—Ryerson Physical Laboratory, Chicago, Nov. 30-Dec. 1. H. W. Webb, Columbia University, New York.

American Society of Mechanical Engineers—New York City, Dec. 3-6. C. W. Rice, 29 West 39th St., New York.

National Association of Railway and Utilities Commissioners—Miami, Fla., Dec. 4-7. J. B. Walker, New York Transit Commission, New York City.

American Engineering Council (F. A. E. S.)—Washington, Jan. 10-11. L. W. Wallace, 26 Jackson Place, Washington.

American Institute of Electrical Engineers—Midwinter convention, Philadelphia, Feb. 4-8. F. L. Hutchinson, 33 West 39th St., New York.

Commission Rulings

Rules of a Commission Are Not to Be Adopted in Part Only.—The Illinois Commerce Commission has forbidden the United Utilities Company of Lena, Ill., to pick out certain sections of an order of the commission relating to the establishment of credit for its customers and has ordered the company to adopt the rules in their entirety inasmuch as they cover a comprehensive policy in regard to credits.

Monopoly and Failure to Serve.—Petition was made to the Connecticut Public Utilities Commission that the United Illuminating Company of New Haven be compelled to make an extension of its lines for two miles to serve a would-be customer residing in the town of Fairfield, or that, failing this, it relinquish its charter right in the town and another utility be allowed to come in. The commission denied the plea, holding, first, that an extension of utility service should not be ordered when there is not a reasonable demand for the extension and the probability of a reasonable return, and, second, that it has no power arbitrarily to authorize a utility to enter a territory for which another utility holds the charter because the latter cannot or will not make an extension.

Original and Reproduction Cost.—The Public Service Commission of Louisiana, holding that it is not its province or right to disregard or refuse a consideration of any fundamental basis for establishing valuation, took issue with the Shreveport Railways Company's contention that the commission was restricted, in its determination of the value of property devoted to public service, to the testimony appertaining to a physical appraisal of the company's property on the basis of the reproduction cost new under present prices less depreciation. Although it held that reproduction cost is to be considered as one of and along with the other elements to determine a fair value, the commission concluded that the original cost of the property was material and necessary to a determination of the case.

Standby Equipment Frequently Used Should Be Included in Rate Base.—In a valuation of the property of the Martinsville Gas & Electric Company, the Indiana Public Service Commission ruled that any part of a generating plant actually used during interruptions of service over a transmission line should be included in the rate base of an electric utility where such interruptions are frequent and for prolonged periods. In the case under consideration the company procured its energy from another utility over the latter's high-tension line but had retained its own old generating plant as a reserve. If, the commission said, the service from the other company was perfect there would be no reason to include the old plant in the appraisement; but investigation had shown that the purchased service was not dependable and that it was necessary for the greater part of the Martinsville company's standby equipment to be maintained if the company was to furnish adequate and continuous service.

Amortization of Unused Property—Discrimination. — In fixing electric rates for the Martinsville Gas & Electric Company, the Indiana Public Service Commission ruled that that portion of a standby plant which is not used and useful should be eliminated from the rate base, that a sufficient amount should be allowed as an operating expense to permit the long-time amortization of property rendered useless when an electric utility stops generating energy and purchases it from another company, and that the proper amount to be amortized in the case of abandoned property is the cost of reproduction less depreciation less the salvage value. Special contracts according certain consumers reduced rates are illegal, the commission ruled further in this proceeding, and render both utility and consumers liable to a penalty under the Indiana law. Discrimination, it asserted, exists when demand charges are made for power loads and no energy charges are made, when parties having both lighting and power loads are billed only at the power rate, and when parties having lighting loads are billed on the power schedule.

Relation of Rates and Service. — In denying the application of the city of Los Angeles for a reduction of rates by the Southern California Telephone Company, on the ground of poor service, the California Railroad Commission said: "Rates cannot be determined on a consideration of relative service conditions only, although the quality of service rendered must have a bearing upon the compensation to be paid therefor. Other factors, such as operating revenue from present rates, operating expenses, resulting return on a reasonable investment or rate base and the practical conditions under which the utility is operating, must be considered. . . . On the other hand, the company has assumed an obligation to render adequate and efficient service in the Los Angeles territory. If for any reason it has failed to keep pace with the phenomenal growth and development of that territory and now finds itself in a position where it must practically rebuild its entire facilities under conditions which necessarily interrupt and reduce the efficiency of the service, it must not expect the ratepayers to assume all the burdens and save the company from the result of its own lack of foresight or enterprise."

Recent Court Decisions

Provision of Illinois Utility Law Declared Void.—In a street-railway grade case (Illinois Commerce Commission ex rel. City of Bloomington vs. Cleveland, Cincinnati, Chicago & St. Louis Railway Company), the Supreme Court of Illinois declared that the provision in the public utilities act that "the decision of the commission shall not be set aside unless it clearly appears that the finding of the commission was against the manifest weight of the evidence" is void as an attempt to prescribe a rule governing judicial action and determination, in violation of the state constitution. The court held, however, that all doubts as to the propriety of means or methods used in the exercise of the powers clearly conferred on the Commerce Commission should be resolved in favor of its action, and there should be ascribed to its decisions the strength due to the judgment of a tribunal appointed by law and informed by experience. (140 N. E. 868.)*

Revaluation of Potomac Electric Power Company Ordered. — Under a decision rendered by the District of Columbia Supreme Court, that body will revalue the properties of the Potomac Electric Power Company, using as a basis the valuation data gathered in 1916-17 by the Public Utilities Commission, unless the company appeals from the decision and causes further litigation. The litigation has been before the courts several years, and meanwhile a fund which now exceeds $4,000,000 has accumulated through impounding of the difference between the rate collected for electrical energy—10 cents —and the rate fixed by the commission, which has been changed several times during the litigation, varying from 8 cents to nearly 9 cents. The commission fixed a valuation on the company's properties for rate-making purposes and announced its decision in 1918, reducing the rates, whereupon the company appealed to the courts, alleging that replacement values had not been allowed by the commission on existing prices and also that some items had been excluded erroneously. The District Supreme Court denied the injunction; the District Court of Appeals reversed this action, and the United States Supreme Court refused to take jurisdiction last spring, thus allowing the reversal of the Court of Appeals to stand. The company then contended that the entire valuation work must be done over, while the commission contended that the District Supreme Court had the authority to make a revaluation from the old records. This contention is upheld.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

W. H. Patchell, British consulting engineer, who has been spending some time in this country, departed for England on Tuesday, Nov. 6.

H. R. Whiting has resigned as superintendent of steam plant and substations of the Porto Rico Railway, Light & Power Company, San Juan, to become superintendent engineer with the Compañia Electrica de Santo Domingo, Santo Domingo.

D. C. Smith, for seven years manager of the Fort Smith (Ark.) Light & Traction Company, has resigned to become affiliated with the Byllesby Engineering & Management Corporation of Chicago, operating manager of the Fort Smith properties.

Frank H. Golding, district manager of the Federal Electric Company, Buffalo, and for some years associated with various Insull properties in the Middle West in an executive capacity, has been appointed general manager of the Cambridge (Mass.) Electric Light Company, succeeding the late Welles E. Holmes.

Prof. Vladimir Karapetoff of the school of electrical engineering, Cornell University, has been awarded a prize of four thousand francs by the Montefiore Foundation of the University of Liège, Belgium, for his kinematic computing devices of electrical machinery. Descriptions of these devices have appeared in the technical press during the last three years.

M. R. Frederickson, who has been in charge of the Wisconsin Valley Electric Company's properties at Tomahawk as division manager for the last few years, has been promoted and transferred from that city to take over the duties of commercial manager at Wausau.

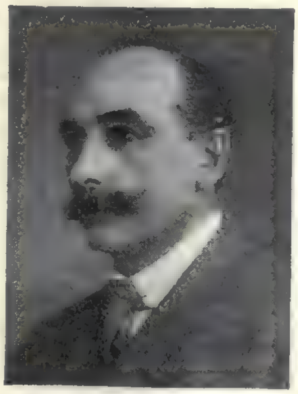
E. V. Pryor, who has been manager of the commercial department of the Wisconsin Valley Electric Company for more than six years, has severed his connection with that company to take charge of the merchandising department in Oakland, Cal., of the Altofer Brothers Company, manufacturer of the A B C electric washing machine.

Frank W. Smith, vice-president of the United Electric Light & Power Company, New York, has been made chairman of a committee of representative leaders in the gas and electric interests in New York formed to co-operate with the Red Cross in its annual roll call, opening Armistice Day, Nov. 11, and continuing until Thanksgiving.

Gerard Swope, president of the General Electric Company, was the first Aldred lecturer at the Massachusetts Institute of Technology, Cambridge, on Nov. 9, the opening day of the course. These lectures have been established by J. E. Aldred of Baltimore and New York, who has been responsible for similar lectures bringing leaders in science and industry into other educational curricula, thus tying the interests of engineering students more closely in with those of the business world.

Roger T. Smith, Electrical Engineer of Great Western Railway

Roger T. Smith, electrical engineer of the Great Western Railway, London, since 1905, received his scientific training at University College, London. Soon after his graduation he went to India and supervised the installation of waterworks pumping machinery for five large Indian cities. Returning to London, he spent the year 1894 with the Westminster Electric Supply Corporation as resident engineer at the Davies Street generating station, and for the next three years he was technical manager for the Imperial Continental Gas Association of La Compagnie Electrique Anversoise (Antwerp, Belgium). He joined the staff of Sir Alexander Kennedy, consulting engineer, in 1898 and in 1902 was sent to Buenos Ayres as Sir Alexander's representative on a large electric railway scheme. When he returned to England he was placed in charge of the electrification of the Great Western Railway, London District, and on the completion of that work he became identified with the railway company as its electrical engineer.



R. T. SMITH

Mr. Smith is a past-president of the Institution of Electrical Engineers, a member of the Institution of Civil Engineers, the Institution of Mechanical Engineers and the American Institute of Electrical Engineers.

M. L. Kachel, who has been with the sales department of the Northern States Power Company for the last five years, has been appointed manager of the Minot (N. D.) division of the company.

R. M. Rankin of the lighting engineering department of the General Electric Company at Schenectady, will spend six months with the Portland (Ore.) Railway, Light & Power Company as exchange engineer.

W. P. Hendricks, for a number of years associated with the William A. Baehr Organization, consulting engineers, Chicago, is the new purchasing agent for the Illinois Power & Light Corporation, with headquarters at Chicago.

R. R. Robley, operating engineer of the Portland, (Ore.) Railway, Light & Power Company, recently left Portland for the Schenectady works of the General Electric Company, where he will spend six months studying engineering problems. Mr. Robley was chosen by the Portland company to represent it on a personal exchange plan by which the two firms exchange two engineers for six months.

Harry J. Vance, purchasing agent for the Illinois Power & Light Corporation with headquarters at Peoria, Ill., has been made purchasing agent for the Illinois Traction, Inc., with headquarters at Chicago. Mr. Vance is well known throughout Illinois, having been for many years purchasing agent for the Illinois Traction System, which became a subsidiary of the Illinois Power & Light Corporation last June.

Edward Woodbury has recently been appointed electrical engineer of the Merced Irrigation District on powerhouse design and construction for the consulting engineers on the project. He was formerly connected with the installation of the hydraulic and electrical features of the Pit River power house.

Obituary

Ralph E. Rugh, for many years vice-president of the Western Coil & Electrical Company, electrical equipment manufacturer of Racine, Wis., died recently at his home in that city.

Michael B. Ryan, inventor, died at his home at Milford, Conn., on Wednesday, Oct. 31, following a week's illness. Mr. Ryan, who was sixty years old, was known as the inventor of the automatic electric chain-welding machine.

Jeremiah W. Clapp, treasurer of the Memphis (Tenn.) Power & Light Company, died at his home in Memphis on Nov. 1 after an illness of several months. Mr. Clapp was seventy-one years of age.

William F. Wendt, founder and former president of the Buffalo (N. Y.) Forge Company, died at his home in that city on Tuesday. Oct. 30. Mr. Wendt, who was a brother of the present president, retired from the company in 1916. He was sixty-five years of age.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

A Super-Standard Electrical Code—the Underwriter's Viewpoint*

The Proportion of Electrical Fires—Would Super-Standard Soon Become New Minimum Standard? — Improvement Should Be Sought Through Strengthening the Present Code

BY F. J. T. STEWART,
Superintendent Bureau of Surveys, New York Board of Fire Underwriters

IT HAS been pointed out that fire insurance companies regard electricity as an important fire hazard, and that under the operation of the present National Electrical Code an important percentage of the total annual fire loss is due to electricity. It is contended, therefore, that super-standard installations should appreciably reduce this loss and justify special recognition by underwriters. If this conclusion is correct, it must be predicated on the assumption that the electrical fires have occurred largely in equipments installed and maintained in full compliance with the present code.

RATIO OF ELECTRICAL FIRE LOSSES TO ALL LOSSES

An analysis of electrical fires shows that most of them do not originate in standard installations, but in such as are defective, usually as the result of improper installation, deterioration and neglect, or from misuse, as in the case of electric pressing irons, improper fusing, etc. In fact, a nine-year summary of the results of detailed investigations of fires in New York by the electrical department of the New York Board of Fire Underwriters shows that out of a loss of $1,614,338 the cause of which was definitely established as electrical, only 21 per cent was caused by fires in equipments which, according to the records, were in compliance with the requirements of the National Electrical Code. Some part of this small percentage must also be charged to the misuse of such standard equipments and to possible deterioration. The balance, amounting to 79 per cent of the losses due to electricity, occurred in equipments known to have been defective.

The fire loss due to electricity has been characterized as an inportant percentage of the total annual fire losses. We should first of all determine whether or not the electrical loss is sufficiently large to justify a super-standard electrical code and special recognition of the reduced fire hazard to be expected from compliance therewith. The records of the National Board of Fire Underwriters, which have been comprehensively compiled with care for the last five years, show that the annual fire loss from electrical causes during that time was 5.3 per cent of the total. These figures have been criticised by electrical statisticians of the Society for Electrical Development, who after an extensive investigation estimate that the electrical losses are less than one-half of this amount, or, to be exact, 2.57 per cent. I have already shown you records indicating that less than 21 per cent of the electrical losses have occurred in standard equipments intelligently used. Therefore, 21 per cent of 5.3 per cent gives 1.1 per cent of the total annual fire losses as the amount due to fires in standard electrical equipments based on the insurance records, or less than 0.55 per cent based on the estimate of the electrical statisticians.

COST WOULD EXCEED SAVINGS

If the exact amount of the electrical losses due to standard installations lies somewhere between these two estimates, it must be evident that the cost of preparing and applying a super-standard electrical code to save at the best some portion of this loss, amounting to only a fraction of 1 per cent, is hardly worth while. Certainly no degree of recognition would be justified that could be a determining factor of a super-standard equipment. The cost to the electrical industry and the underwriters of preparing such a standard, applying it and giving credit for such a small degree of difference in the fire hazard would greatly exceed the saving, even if the electrical loss could be reduced to zero thereby, which of course would be impossible, as misuse and deterioration will always cause some fires.

Detailed specifications for a super-standard equipment would only constitute another set of minimum requirements to secure a different classification, and it could never be made so high as to include all the abnormal precautions which a limited number of persons are sometimes willing to take. Anxiety to avoid interruption and disorganization of a highly profitable business and to go the limit in safeguarding life are the most likely motives for providing extreme safeguards rather than a relatively small insurance reduction.

WOULD BECOME NEW "MINIMUM STANDARD"

After the establishment of a super-standard there would be at once a tendency to make its provisions a part of the ordinary standard. It would weaken respect for the present code. Municipal authorities, eager to do their duty in safeguarding lives and property against this mysterious hazard, would "play safe" by enacting the super-standard into law, either in whole or in part. In fact, the laws in some cities now include certain requirements which would probably be suggested as part of a super-standard, such as conduit work to the entire exclusion of knob and tube work.

Even on this point there is chance for considerable argument as there are certain situations where the open work is concededly preferable to conduit work, notably in cold storage rooms and places containing corrosive vapors. There are also some who prefer and encourage open work in all locations where there is no great danger of mechanical injury to the wires.

If a super-standard were adopted

*A paper presented before the Association of Electragists International, Washington, D. C., Oct. 12, 1923.

and a considerable number of installations were made in compliance therewith, merely for the insurance recognition, much confusion and friction would result, provided extensions or alterations were made without ascertaining in advance that an installation is in the super-standard class when such is the case. It would complicate the electrical business to the extent of making investigation necessary in each case to know what standard should govern any extensions or alterations. Experience already gained in a few cases where especially stringent requirements have been enforced shows that friction has occurred, because it was assumed that the usual requirements were to apply and extensions were made accordingly.

General Basis of Rates

The increased safeguards to electrical installations which are being added from time to time and intended primarily for the protection of life all tend in the aggregate to strengthen the protection against fire. They also teach caution and a more intelligent and careful use of electrical equipments. These considerations may be counted upon further to reduce losses by fire below the present relatively small amount in buildings having installations that are in compliance with the present code.

Most insurance schedules start with a base rate which is intended to include the collective losses resulting from commonly found fire hazards which have been protected by reasonable safeguards. Thus, it is frequently found that no specific penalty is provided for fire hazards due to lighting, heating, hot ashes, electricity, matches, smoking, etc. Accordingly, it often happens that no cognizance is taken of a standard electrical lighting installation in a building, as compared with the absence of electricity altogether. This attitude is based on the conclusion that the losses on fully standard electrical installations are so small that they do not justify the cost of applying a small charge in every building. Theoretically, of course, there should be some charge for an electric lighting installation, as in the long run the presence of any electrical installation, however well safeguarded, is going to add something to the fire hazard as compared with no artificial light whatever. It may therefore seem that, because of the practical considerations involved, the electrical industry is already being favored in the cases where no attention is called by any penalty in the insurance schedule to the fire hazard incident to a standard electrical installation.

Better Off Without a Super-Standard

From the strictly rating point of view, the most important objection is that the establishment of such a practice as is sought in this connection would constitute a precedent that would have to be followed in many other and quite different connections, so that, for instance, we would have a super-standard for acetylene, city gas, fuel oil burning equipments, internal-combustion engines, fire alarms, sprinklers, fire windows, etc. Any thorough-going practice of that kind is physically impossible because of the multiplicity of cases that would arise and the minute differentials that would have to be figured in literally thousands and thousands of risks.

In so far as the fire hazard is concerned, I am convinced there is no occasion for a super-standard code. From the standpoint of the electragist anxious to do only the highest grade of work, I believe he is better off without the super-standard—another minimum requirement. It would encourage the cheap and irresponsible type of contractor to undertake high-grade work to put a super-standard in his hands. At present the field is wide open to give good salesmanship, lighting efficiency, artistic effects and high-grade work a chance to win out by appealing to higher instincts of human nature rather than to a relatively immaterial difference in the degree of fire hazard, even if this difference justified the expense of analyzing it. Most manufacturers, including even makers of fire-extinguishing equipments, aim to avoid a situation where the chief consideration influencing a sale is whether or not the insurance recognition yields an attractive return on the cost of the article to be sold—they endeavor to make their appeal rather a gain in safety.

Present Code High Standard

The present electrical code is already a high standard. This opinion, I think, has been confirmed by the record of fire losses with standard equipments already quoted. If the code is occasionally strengthened when experience develops weaknesses, we can feel reasonably certain that there will be no necessity for a super-standard, with all the expense, complications and annoyances resulting from two standards, the enforcement of which must of necessity be arbitrary and 100 per cent complete in order to place the equipment in one class or the other.

Comprehensive reinspections at more frequent intervals would, in my opinion, do more to reduce the electrical fire loss than a set of super-standard requirements. The fire records already quoted confirm this conclusion, showing as they do that about 80 per cent of the electrical fire loss results from defective equipments and is therefore preventable under the present code by proper care and maintenance.

Strengthens the Present Electrical Code

Even should electrical fire losses in standard equipments ever show the need of better safeguards, it seems as if you must agree that a strengthening of the standard will be essential rather than the creation of another or super-standard. You cannot afford to go ahead electrifying America under a minimum standard that may be weak enough to leave a chance that electricity will figure as the worst of all fire hazards. Gentlemen, you are steering the electric industry toward dangerous ground if you work for a so-called super-standard of safety instead of bending your energies to strengthening the National Electrical Code so that it will always represent a full measure of reasonable safety that will shield your wonderful product from the possibility of becoming a notorious firebrand.

There is no parallel in the safeguarding of fire hazards in any other line of business to compare with the dual standard of safety as proposed for electricity. You would at once be confronted with the question, "Why the minimum standard if the super-standard affords a measurably better degree of safety against fire?" Inevitably, any admission that the difference in fire hazard is measurable amounts to a confession that the minimum standard is too weak; in other words that it is sub-standard. You are proposing to risk the good name of electricity as a safe product to bring about a condition whereby the fire insurance companies will finance the purchase of really safe installations. It seems that this would inevitably lead to a most unwholesome situation for all concerned.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

APPLIANCE selling holds the center of the field in the electrical trade this week. In all parts of the country demand is strengthening, and manufacturers are reporting a heavy call for the full line of electrical comfort and labor-saving appliances that are suitable for Christmas gifts. Jobbers are devoting a large share of their attention to this holiday trade. The prevalent feeling seems to be that sales this year are going to set a new record for the electrical industry.

The general tone of business in the East is better this week. Boston, Philadelphia and Atlanta experienced a stronger general demand, though in the New York district porcelain, conduit, wire and wiring devices generally were slack and the market was characterized as spotty.

In the Middle West general business was steadier, although sales in either the Chicago or the St. Louis area were not large. There was a slight reduction in the price of wire and pole-line hardware reported in St. Louis. Conduit and wire were selling better in Chicago than the week before. Business on the Pacific Coast continues in good volume with prices steady. Orders from Japan to the lumber and other industries continue to influence considerable buying of electrical material. Throughout the country sales of radio material are steadily increasing.

Many Electrical Machinery Makers Reported Deficits in 1921

OF THE 572 corporations in the United States engaged in the general manufacture of electrical machinery, including stationary and marine equipment and refrigerating apparatus, during 1921, the Bureau of the Census reported late last week that 383 reported no net income and the total showed deficits aggregating $20,348,361. Of the total corporations, 189 had net incomes aggregating $34,289,413, on which they paid a total tax of $4,089,018.

New York State Electrical Factory Earnings Now $31.88

WEEKLY earnings of workers in the electrical manufacturing factories of New York State during August were at the average rate of $31.88, according to a bulletin just issued by the Industrial Commissioner at Albany. The average weekly earnings of these workers in the factories of New York City amounted to $22.29, according to the report, with those of the territory outside of New York City receiving an average of $32.90.

The course of employment in representative electrical manufacturing establishments in New York State showed a decrease in the number of employees from July to August of 0.1 per cent, compared with an increase from June to July of 1.9 per cent, and compared with an increase from August, 1922, to August, 1923, of 18.6 per cent. Amount of payrolls from July, 1923, to August, 1923, increased 0.3 per cent, compared with an increase of 2.1 per cent for July over June, 1923, and with 41.4 per cent for August, 1923, over August, 1922.

Signal Apparatus Shows Improved Design and Better Market

SIGNAL equipment business may be said to have been placed on a considerably higher plane during the last three months. A better supply of raw material and skilled labor has become available and has naturally improved the ability of manufacturers to make deliveries and effected economies that have been reflected in more satisfactory profits. This, of course, has relieved the stress all along the line. At the same time the market has strengthened materially and jobbers' stocks are moving well, so that the tendency toward price cutting that crept into the situation a month or two ago has been relieved. There has been distinct progress made also in the improvement of types of signal apparatus that go into apartment houses and school installations.

New designs for apartment houses and school call telephones include no receivers that can be removed by that class of radio enthusiasts who have taken so many of them for use on radio sets. The trend is toward the hidden loud-receiver attachment which is within the telephone box itself. Moreover, there is an absence of shiny brass and copper parts in the newer equipment, designers supplying the dull black and colored enameled styles, which are easily cleaned.

Although the largest field for signal equipment remains in the apartment-house installations, the schools are taking surprisingly large amounts of all sizes of signal lamps, bells, buzzers, telephones, heat-recording apparatus, etc. The schools of New England, whose organization is recognized as the highest in the country, lead in the consumption of this material; New York schools are second, and Middle Western schools are taking the third greatest amount.

A surprising volume of signal apparatus is being used today in the average grade school of forty rooms, where only five years ago its use was generally limited to a few classroom bells in the halls and there were practically no telephone or call systems in the teachers' or principals' rooms. Today the modern school of forty rooms is equipped with between thirty and forty telephones, as well as call systems, forty classroom bells, fire alarms, signal lights for teachers and great areas of switchboards for operation of this equipment from almost any floor in the building.

October Electrical Imports Showed Gain of $35,245

IMPORTS of electrical apparatus, machinery and supplies through the port of New York during October show a surprising increase in value. The total of last month's imports was $83,052, an increase of $35,245 over September, when the figure was $47,807. Germany again led in the value of most of the commodities that are also sent in by her only important competitors, England and France. The totals for these countries during October are as follows: Germany, $41,842, in September $18,732; England, $21,080, in September $13,510, and France, $15,836, in September $11,653. The highest value in the table of information just issued by the Department of Commerce was for cable instruments imported into this country by England and amounting to $13,513. France and Germany sent no cable instruments during October. The second highest value in the import list is that for radio apparatus sent by Germany and amounting to $13,025.

Included under classifications in the list are many other items of interest to American electrical manufacturers. Germany sent $2,234 worth of hair driers, and there is no indication that any other country tried to secure any of that business. Germany also sent $3,186 worth of plugs, $7,797 of carbons, $855 of dry batteries, $10 of vacuum cleaners, $1,469 of reflectors, $4,323 of fixtures, $94 of perfume burners, $1,240 of electric stoves, $3,319 of table lamps and $1,242 of sockets. England sent $2,750 worth of radio apparatus, $2,814 of carbons, $620 of lighting fixtures, $535 of electric stoves, $838 of floor lamps and $10 of storage batteries. France sent $6,151 worth of carbons, $4,679 of fixtures, $1,727 of table lamps, $19 of electric signs, $10 of insulators, $3,190 of electric fountains, $40 of projectors, $10 of X-Ray apparatus and approximately $10 worth of hat pressers.

Details of Census on Lighting Fixtures in 1922 Announced

ANNOUNCEMENT is made by the Department of Commerce that returns received from 521 establishments engaged in the manufacture of lighting fixtures show products to the value of $76,402,000 during the year 1922. This special report is the first of an annual series and was made by the Bureau of the Census at the request of the manufacturers and associations representing the industry. Schedules were mailed to all establishments which reported the

manufacture of electric and gas fixtures, lamps and reflectors, and shades for the 1921 census of manufactures, and to others presumed to have manufactured lighting fixtures in 1922, whose names were obtained from trade directories.

Lighting fixtures reported in the following table are arranged in five main groups, according to the purpose for which the fixtures are to be used, namely, commercial, residence, industrial, street and marine lighting, followed by the auxiliary group "shades," as representing component parts of the complete fixtures. It will be seen by reference to the following table that the value of residence lighting fixtures constitutes 54.5 per cent of the total value of products reported. Of the 521 establishments reporting lighting fixtures, 254 manufactured home lighting fixtures, 178 manufactured table and floor lamps, and 109 manufactured reading lamps. The next group in importance

MANUFACTURE OF LIGHTING FIXTURES DURING 1922

Class of Product	Number of Establishments Reporting	Value
Total	...	$76,402,193
Commercial lighting fixtures	...	7,267,941
Auditorium	67	1,825,390
Operating and hospital	41	492,013
Orchestra	14	125,525
Store	105	3,058,213
Window and showcase	40	1,246,321
Stage	25	520,479
Residence lighting fixtures	...	41,621,505
Home lighting	254	24,234,471
Table and floor lamps	178	12,222,814
Reading lamps	109	5,164,220
Industrial lighting fixtures	...	7,718,846
Adjustable	13	311,005
Car	16	2,087,358
Office and drafting room	36	1,658,494
Desk lamps	23	291,811
Factory or industrial	46	3,370,178
Street lighting fixtures	22	3,948,308
Marine lighting fixtures	22	525,678
Shades	...	15,319,915
Glass	69	8,105,068
Parchment, paper and celluloid	28	310,299
Silk, cretonne, linen or other fabric	82	6,379,553
Tin, aluminum, brass or other metal	14	517,995
Reed, rattan or other wooden form	2	7,000

is shades, with a product of $15,319,915, or 20 per cent of the total value reported for lighting fixtures. In this group the leading class is glass shades, with a product of $8,105,068 in sixty-nine establishments.

Reports were received from twenty-five establishments, with a total product of $10,509,645, divided as follows: Automobile lamps, $9,258,984; incandescent electric lamps, $573,999; miners' lamps, $342,103; bicycle lamps, $154,371; lanterns, $94,476; electric locomotive headlights, $75,000, and wagon lamps, $10,712.

These establishments were excluded from the accompanying table for the reason that the products reported were not considered to be lighting fixtures within the meaning of this investigation.

Spotty Conditions Prevail in New York; Wire Falls Off

ALTHOUGH several new developments indicating a heavy demand for important commodities are features of this week's New York electrical market, a few lines are selling in less volume and with slightly lower prices. Jobbers call the situation spotty and hope for increases before the end of November. Those wholesalers specializing in washing machines, heating appliances and novelties report the best holiday season in their histories and state that shipments from the factory are far below normal deliveries. On the other hand, conduit, porcelain, wires and wiring devices are not moving as actively, and there is a tendency toward soft prices in all these lines, with a 2 per cent falling off in No. 14 rubber-covered. Lamp cords are firm. Stocks of these lines are in excellent condition.

In general, jobbers and manufacturers are marking time and are waiting for a settlement of the market for the heavier materials which is expected to come after inventory taking is finished. There is a feeling in the trade that the greatest buying of electrical materials and supplies was made during the heavy rushes of October and that the dealers and contractors are sufficiently supplied for present needs.

Wire and Conduit Markets of Philadelphia Still Weak

ACCORDING to reports received from the Philadelphia territory, a good demand for electrical goods is reported by the dealers. Sales of radio material, in particular, have increased, and labor-saving devices are in better request than they were a month ago. Almost all orders booked are for delivery within sixty days, although a few are up to and beyond ninety days. Stocks of finished goods are moderate, in some cases even light, and they have changed but little from those on hand at this time last month. Prices in general are unchanged, with the exception of those on copper wire and rigid conduit, which are lower and are still weak.

The demand for electrical contracting work has become brisker with the advent of colder weather, and labor in the Philadelphia territory is considered adequate, although one firm reports a scarcity of skilled workers. According to reports received from thirty-five manufacturers of electrical machinery and apparatus in Pennsylvania, New Jersey and Delaware, the number of wage earners during September showed a noticeable increase over that of August. The following table gives employment data for each of the two months, the number of firms reporting being thirty-five:

	Week Ending Sept. 15	Week Ending Aug. 15	Per Cent Change
Number of wage earners	12,881	12,477	+3.2
Total wages	$313,390	$299,709	+4.6
Average weekly wage	$24.33	$24.02	+1.3

New England Optimistic on Farm-Lighting-Set Sales

CONTRARY to the general feeling in the South and West, reported here a few weeks ago, representative opinion in farm-lighting-set manufacturing and distributing circles throughout New England is to the effect that 1923 will roll up an excellent total of business in this line. One large house, which set a bogey of 30,000 units at the beginning of the year, expects to market these by Dec. 31. All through the year deliveries have been satisfactory with the exception of the late winter period, and in some localities where sales representatives were greatly handicapped last winter by heavy snowfalls plans are now being made for the use of gasoline-driven snow sleds, these having been developed to a high degree of efficiency of late. A vigorous drive will be made this winter in this section for farm-lighting business, with the idea of taking full advantage of the "indoor" season in the country districts, when the salesman who penetrates to remote localities is often warmly welcomed by the prospective customer. Prices have been steady of late on representative units; a large amount of preliminary sales work has been accomplished in regions hitherto none too thoroughly canvassed, and the outlook is favorable for another good year.

Conduit Boxes Show Softer Prices by Boston Jobbers

A BETTER tone is manifest in electrical purchases, and nothing serious has been experienced in the way of reduced demand for staple products. Appliance sales are very active, and ordering against the forthcoming holiday trade is a feature of the jobbing field. Some anxiety as to

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.0354	$0.0354	$0.0304
Cold finished shafting, per lb.	0.0465	0.0465	0.039
Brass rods, per lb.	0.1525	0.1575	0.17
Solder (half and half), per lb.	0.295	0.295	0.265
Cotton waste, per lb.	10 to .13	.10 to .13	.09 to .11½
Washers, cast iron (½-in.), per 100 lb.	6.50	6.50	6.00
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.38	3.38	3.02
Machine oil, per gal.	0.297	0.297	0.33
Belting, leather, medium, off list	30–10%	30–10%	40–5%
Machine bolts, up to 1-in. x 30-in., off list	40–10%	40–10%	40%

December deliveries is being expressed in these lines. Prices are fairly firm this week, although softening in conduit boxes was anticipated Monday.

Stocks are meeting current needs in most lines, but poles are scarce and there is little prospect of an increased supply from local fields this fall. The kitchen lighting-unit campaign is sweeping New England in record-breaking style. General business is responsive to a better feeling throughout the country, barring slow recovery in cotton textiles. Central-station companies are very busy on line extensions owing to favorable weather, and interior wiring supplies are moving in fair volume without spectacular features.

Chicago Electrical Trade Steady but Uneventful

CHICAGO electrical jobbers and manufacturers report steadiness in demand for all general lines, with no advances or declines in prices and stocks in fair shape for the heavy holiday buying which will take place in the next few weeks.

Conduit sales have increased slightly, and rubber-covered wire sales have improved considerably. Pole-line hardware sales are much better than a month ago, owing to the heavy buying for replacements by the utilities. Appliance manufacturers report gratifying success from these advertising campaigns and believe that their present sales will total the largest in their experience.

Public Utilities Heavy Buyers in St. Louis Territory

BUSINESS in St. Louis during the past thirty days indicates an unsettled condition. In a number of electrical lines slight gains over the corresponding period last year are reported, but a recession in volume of trade in goods based on iron and steel is reported. Manufacturers and jobbers report that sales are numerous but not large. There is steady buying on the part of public utilities. Active demand for radio equipment and for household appliances continues. Initial buying of holiday goods is responsible for an increase in sales over the corresponding period last year. Stocks are fair and prices in general are firm, but there has been a slight reduction in the prices of copper, wire and pole-line hardware.

Atlanta Jobbers Report Satisfactory Business in Most Lines

JOBBERS report most satisfactory business in practically all lines, particularly heating devices. One of the largest jobbers states that his fall stocks of this line were 50 per cent in excess of those of last year, and, owing to the unusually active demand, these stocks are almost exhausted and it has been necessary to place large additional orders to handle the anticipated holiday trade. Heavy sales of pole-line hardware and a satisfactory movement of poles are reported, with considerable pick-up in the sales of lighting fixtures. One jobber reports a five-point price reduction on all types of transformers, effective Nov. 1.

After being somewhat slow for six weeks, the retail electrical business has improved considerably, and retailers have begun to place orders on the jobbers for holiday stocks. All the electrical interests in Atlanta are planning a very intensive co-operative pre-holiday advertising campaign, and the prospects are that the business this season will set a record in this section.

Excellent Volume and Improved Collections Along Pacific Coast

AN EXCELLENT volume of business is reported from the Pacific Coast with improved collections. Prices on most wiring staples have now become fairly steady and changes on individual articles in the wiring-device lines are nearly all minor adjustments. There is a general feeling that, after its long slump, copper is going to rise and several large wire orders are reported that have been placed with the idea of anticipating an increase in prices.

Porcelain used in house wiring is moving well with evidences of a keen price competition of business manufacturers. The appliance business continues to build up toward the Christmas market. An activity in Christmas-tree lighting outfits is already showing, although the demand will naturally not reach its peak until December.

The Pacific Coast continues to receive substantial orders from the Japanese for lumber and other materials. Out of this has come a considerable demand from industries affected for electrical materials.

The Metal Market

DURING the week copper has improved in price to 12.62½ cents, lead has declined slightly, and zinc has not shown much activity in either direction. On the whole, a better feeling is noticeable among the producers, but the situation in the copper and zinc markets remains unsatisfactory.

The official contract price of lead by the American Smelting & Refining Company has been reduced to 6.75 cents a pound, New York. Sales had been light at the former level, and the reduction was made to stimulate buying. Sales of lead have been a little heavier in volume than last week, but the market has been quiet.

The market for slab zinc has been inactive. Prices have ranged between 6.30 cents and 6.35 cents a pound, East St. Louis, during the week. A small number of export sales have been made.

NEW YORK METAL MARKET PRICES

	Oct. 31, 1923 Cents per Pound	Nov. 7, 1923 Cents per Pound
Copper, electrolytic	12 50	12.62½
Lead, Am. S. & R. price	6.75	6 75
Antimony	8 27½	8 50
Nickel, ingot	27.00 to 32 00	27.00 to 32 00
Zinc, spot	6 67½	6 35
Tin, Straits	42 12	42.02
Aluminum, 98 to 99 per cent	25.00	25.00 to 26 00

Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Century to Manufacture Larger Sizes of Induction Motors

The Century Electric Company, St. Louis, announces that it is now manufacturing three-phase squirrel-cage induction motors up to and including 15 hp. This will add three more sizes to its list of this type of motor, viz., 7½, 10 and 15 hp. The company has been manufacturing three-phase squirrel-cage induction motors in small sizes for a number of years, and the demand for larger sizes has become so insistent that officials have decided to expand their squirrel-cage-motor line in this manner.

Alberger Condenser Contract

The contract for the new condenser to be added to the Logansport (Ind.) electric light plant has been awarded to the Alberger Condenser Company, Chicago, by the Board of Public Works of Logansport. The contract price, $26,326, calls for the purchase of the new condenser, connecting up and packing the new piece and also the repair of the present condenser in the plant. The new machine will cover a floor space of 5,100 sq.ft.

Radio Not Making Any Progress Against Cable, Says Carlton

Newcomb Carlton, president of the Western Union Telegraph Company, sailing on the *Mauretania* last week for a six weeks' trip abroad, said: "Western Union earnings for the nine months of the year have been very satisfactory. Our business has been running neck and neck with last year, but it is really 10 per cent less than it should be. Dividend prospects have not been discussed and will not be until later in the year. Radio is not making any progress against the cable, but, of course, it must be granted that the radio is now entering the best season of the year.

"We have not begun the manufacture of the Italian cable to the Azores, owing to British interference. I have been working on this matter for over a year, and eventually we will

win out through the aid of the State Department at Washington. The Western Cable Company of Great Britain, which holds the concessions in the Azores, wants a tribute or royalty from all American cable companies landing on the islands."

American Brass Cuts Prices

The American Brass Company has reduced quotations for its products, bringing them down to the basis of 12.50 cents to 12.62½ cents a pound for copper metal. Seamless tubes of all sizes have been cut 1 cent a pound, copper and brass products ½ cent, and copper-wire products ¼ cent per pound. Similar reductions were made on Oct. 8 last.

Two Dallas Jobbers Combine as Electric Appliance Company

Among the important recent mergers is that of the Electric Appliance Company and the Electric Specialty Company, both jobbers of Dallas, Tex., which will be conducted under the name of the Electric Appliance Company with the following officers: M. E. Martin, president; Charles L. Martin, secretary and general manager; M. F. Sterret, assistant to the president, and Harry Greer, sales manager.

All of these men have been identified with the electrical jobbing business in Dallas, and with the combining of forces and added financial strength a greatly increased volume of business is expected. It is reported that W. W. Low and Thomas I. Stacey of Chicago still hold a substantial interest in the company.

Stetson & Sloane Correction

The recent announcement published on this page concerning the organization of the firm of Stetson & Sloane as engineers and contractors, with offices at 60 State Street, Boston, to engage in the development of group and community electric light, water and sewage disposal systems, and particularly to engage in rural electrification, was incorrect as the name "Stetson" was spelled "Stepson" and the address "60 State Street" was given as "3061 State Street."

Henry D. Sears Appoints J. W. Fay New England Representative

Henry D. Sears, 80 Boylston Street, Boston, general sales agent for "Weber" wiring devices, announces the appointment of John W. Fay as district representative in all the New England states except Connecticut and the metropolitan district. Mr. Fay has been a specialty salesman with the Malden (Mass.) Electric Company and succeeds Carl C. Smith, who recently resigned.

The Parry Battery & Electric Company, Provo, Utah, recently incorporated, is successor to the Parry Battery Company and was organized for the purpose of carrying on the business of manufacturing electrically propelled vehicles. Ernest B. Parry is president of the company.

The Western Electric Company has leased the former plant of the Continental Candy Company, Westside and Claremont Avenues, Jersey City, N. J., approximating 240,000 sq.ft. of floor area, and will remodel and equip the structure for a new branch plant for the manufacture of telephone switchboards and apparatus. It is expected to commence production in January, giving employment to about 750 operatives. The company will begin operations at once at its new works at 780 Frelinghuysen Avenue, Newark, N. J., recently leased, which has been improved and equipped to give employment to more than 700 persons. Bids are being asked for structural steel for the initial units of the new plant to be erected at Kearny, N. J., and erection will soon begin. The latter works will cost more than $15,000,000.

The American Electrical Switch Company, Minerva, Ohio, has been organized to take over the plant of the former Lewis Electrical Company and has purchased the equipment. Charles P. Wolfe is general manager of the new company.

The Dixie Club Jobbers, an association composed of the electrical jobbers in the Southeast, held a two-day meeting at the Tutwiler Hotel in Birmingham on Oct. 26 and 27. The president, Percy Stearns of the Interstate Electric Company, New Orleans, was in charge of the convention.

Landers, Frary & Clark, Inc., New Britain, Conn., manufacturers of electric heating and cooking equipment, has taken bids for the erection of a new six-story addition on Ellis Street, 65 ft. x 160 ft., and expects to lay foundations at an early date. The firm will be equipped for increased manufacture.

The Electric Storage Battery Company, Philadelphia, will commence the construction of a new one-and-two-story plant at Rising Sun Avenue and Adams Road, Crescentville district, to cost about $100,000, including equipment. A contract for the work has recently been awarded.

Sweeping Changes in General Electric Sales Organization

Lighting and Power and Mining Departments Are Renamed Central-Station and Industrial Departments—Transfers Affecting Prominent Figures in the Personnel

IMPORTANT rearrangements of the present field of work within the sales branch of the General Electric Company, involving a change of name of two departments, have just been announced. As reported in the ELECTRICAL WORLD last week, Dana R. Bullen, for a number of years manager of the supply department, has been advanced to the position of assistant vice-president on the staff of the vice-presidents in charge of sales of general apparatus and supplies. In addition, what has hitherto been known as the lighting department becomes the central-station department and the name of the power and mining department is changed to the industrial department.

P. W. Stone, manager of the former lighting department, will continue as manager of the central-station department. M. O. Troy, formerly manager of the transformer sales department, is appointed executive assistant manager of the central-station department, with headquarters at Schenectady, and W. M. Stearns, formerly one of the assistant managers of the supply department, becomes assistant manager of the central-station department in charge of the street lighting, miscellaneous switchboard devices, holding company contracts and miscellaneous supply and order sections.

R. D. Mure, assistant manager of the former lighting department, becomes assistant manager of the central-station department in charge of apparatus sales. F. G. Vaughen, with the present staff, is transferred to the central-station department and continues in charge of the meter business of the company, retaining the title of sales manager meter department. Similarly, W. S. Clark and present staff, in charge of the company's wire and cable business, are transferred to the central-station department.

The railway supply section and present staff, conducting the company's business on railway motor and control parts, railway line material and rail bonds, are transferred from the supply department to the railway department, of which E. P. Waller is manager.

The industrial heating device, industrial control, mine locomotives and stationary motor repair parts, and "fabroil," "testoil" and "textolite" gears sections of the supply department are transferred to the industrial department, of which A. R. Bush, manager of the department under its former name of power and mining department, continues in charge.

N. R. Birge, one of the two former assistant managers of the supply department, is assigned to the staff of the president of the company. Mr. Birge will assist in supervision of associated manufacturing companies, being associated with D. C. Durland in this work.

All these changes became effective November 1.

Foreign Trade Notes

HYDRO-ELECTRIC PLANT IN CONNECTION WITH CANAL IN ALSACE-LORRAINE, FRANCE.—A hydro-electric plant, which will develop about 100,000 hp., according to *Commerce Reports*, will be built between the towns of Rosenau and Kembs, in connection with a canal which is to parallel the Rhine.

CONCESSION GRANTED FOR HYDRO-ELECTRIC DEVELOPMENT IN MOROCCO.—Approval has been given, *Commerce Reports* states, for a concession to a group of financial interests to generate and distribute electricity in Morocco. The project includes the construction of a group of plants, aggregating 15,000 kw. to 20,000 kw. capacity, situated in the upper basin of the Oumer-Rebia and its tributaries. The names of this group may be obtained from the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., or any of the bureau's district or co-operative offices, by referring to file No. 106,360.

PROPOSED TRANSMISSION OF ELECTRICITY FROM NORWAY TO DENMARK.—Three plans have been prepared by the committee appointed by the Danish, Norwegian and Swedish Power Transmission Commission for the transmission of electricity from Norway to Denmark. The first plan provides for the transmission of electricity by means of cables from southern Norway through Skagerrak to Jutland, thence by overhead conductors to Aarhus, and through the Little and Great Belts to Zealand and Copenhagen, where the energy will be transformed to alternating current. The water falls of Kviken and Otra, near the Norwegian south coast, will be utilized for generating electricity. Under the second plan it is proposed to transmit electricity through Sweden as far as Helsingborg through the sound, and then through Denmark. A large power station is being erected near the Nore Cataract, from which energy will be obtained. The third plan calls for another overhead transmission line through Sweden.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Shanghai, China (No. 8,050), for an arc-welding machine, alternating current.

An agency is desired in The Hague, Netherlands (No. 8,059), for electrical equipment.

An agency is desired in Algiers, Algeria (No. 8,060), for electrical goods and supplies.

CONCESSIONS GRANTED FOR ELECTRIC PLANTS IN ARGENTINA. — Four concessions have been granted by the Province of Cordoba, Argentina, since July 1, according to *Commerce Reports*, for the establishment of electric lighting plants. The names of the concessionaires and the towns to be supplied with electricity can be obtained from the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., or from any of the bureau's district offices, by referring to file No. 109,537.

PROPOSED ELECTRIC PLANT AT SAO PAULO, BRAZIL.—Permission has been granted by the State of São Paulo, Brazil, to the Sociedad Anonyma Brasital, *Commerce Reports* states, to install a hydro-electric plant at Santo do Itú, São Paulo. The power will be used in its textile plant.

New Apparatus and Publications

VACUUM PUMPS.—A new line of small vertical belt-driven vacuum pumps, known as type 15, has been developed by the Ingersoll-Rand Drill Company, 11 Broadway, New York City.

FARM ELECTRIC PLANT.—The Independent Light & Power Company, Oelwein, Iowa, has placed on the market a new farm electric plant, known as model "T."

INDUCTION MOTORS AND STARTERS.—The Metropolitan-Vickers Electrical Company, Ltd., Trafford Park, Manchester, England, is distributing leaflets Nos. 39/1-1, 59/4-1, 59/5-1 and circular No. 1059/1. The first describes its standard squirrel-cage induction motors, the second and third two types of auto-transformer and star-delta starters, and the circular its automatic oil-break ironclad switchgear.

ELECTRIC REFRIGERATOR. — The National Electric Products Corporation, 500 North Dearborn Street, Chicago, has brought out the "Serv-El" refrigerator, which is available in two styles, one with the machine unit in the lower section, and the other consisting of the machine only, which can be installed in any good refrigerator.

ELECTRIC GRINDER.—A new electric grinder, known as No. 102, has been placed on the market by Forbes & Myers, 172 Union Street, Worcester, Mass.

ELECTRIC WATER HEATER. — The National Water Heater Corporation, represented by Marshall & Company, 509 Fifth Avenue, New York City, has developed a water heater which is to be installed in place of an ordinary faucet. It is not a lamp-socket device, but is to be permanently installed by special wiring direct from the meter to the heater.

WALL BRACKET. — A wall bracket which may be regulated to give five different degrees of light has been placed on the market by W. A. Harvey, 53 Burr Building, Scranton, Pa.

COMMERCIAL LIGHTING UNIT.—The Peerless Light Company, 663 West Washington Boulevard, Chicago, has added a commercial lighting unit to its "Peerlites" line of lighting fixtures. The company has also brought out a complete line of Chippendale fixture parts.

ELECTRIC MOTORS. — The Wagner Electric Corporation, St. Louis, is distributing bulletin No. 134, describing its new type of constant-speed, alternating-current motor, which is known as the "Fynn-Weichsel" motor.

INSULATING MATERIAL.—The Thermal Syndicate, Ltd., 350 Madison Avenue, New York City, is distributing a booklet entitled "Vitreosil Data," giving the characteristics of its product, which is manufactured and marketed under the trade name of "Vitreosil," and also its use in connection with the electrical industry.

UNDERFEED STOKER.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing a booklet which describes and illustrates the Westinghouse new-model underfeed stoker.

CLEANING TOOL.—A tool, "Goodnite" for cleaning commutator slots on undercut commutators has been placed on the market by the Martindale Electric Company, 11,737 Detroit Avenue, Cleveland.

CHARGING UNIT FOR STORAGE BATTERY.—A resistor unit for charging automobile storage batteries has been developed by the Ward Leonard Electric Company, Mount Vernon, N. Y.

SAFETY SWITCH.—The Domestic Electric Company, 7222 St. Clair Avenue, Cleveland, has placed on the market an automatic safety switch for use with electric washers.

ELECTRIC LOG HEATER.—The Hersh Electric Specialty Company, 850 Twenty-second Street, Milwaukee, has brought out an electric fireplace log heater.

New Incorporations

THE RIPLEY (MISS.) LIGHT COMPANY has been incorporated with a capital stock of $10,000 by A. C. Anderson, C. T. Nelms and others.

THE NEW HAMPSHIRE POWER COMPANY, Newport, N. H., has been chartered by Roger F. Hooper, Franklin King and William Hill, all of Boston. The capital stock of the company consists of $55,000 in preferred shares of $100 each (par value) and 6,000 shares of common stock without par value.

THE TUSTEN LIGHT & POWER COMPANY, INC., Narrowsburg, N. Y., has been incorporated with a capital stock of $35,000, to supply electricity for light, heat and power. The directors are: R. H. Huebner, M. Huebner, both of Narrowsburg, and W. J. Steinberger, Sussex, N. J.

THE CORNING (MO.) ELECTRIC LIGHT COMPANY has been incorporated to install and operate a commercial system in Corning. P. A. Christian and R. E. Schultz, both of Corning, are among the incorporators.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

AUBURN, ME.—Plans for the proposed brick manufacturing plant to be established in the Danville Junction section, to cost about $200,000, include a power house. H. B. Richie, Aroostook, is interested.

AUGUSTA, ME.—The stockholders of the Central Maine Power Company have voted to increase the capital stock of the company by $9,500,000, subject to the approval of the Public Service Commission.

EAST DORSET, VT.—The Manchester Marble Company plans to install electric power equipment in connection with the rebuilding of its Friedley plant, recently destroyed by fire with loss of about $100,000.

MORRISVILLE, VT.—The Village Council is considering a hydro-electric development, to cost about $150,000. C. A. Slayton is superintendent of the municipal electric plant.

ALLSTON, MASS.—Plans for the proposed local plant for assembling motors to be erected by the International Harvester Company, 606 South Michigan Avenue, Chicago, include a power house. The cost is estimated at $1,000,000.

BETHEL, CONN.—Electric power equipment will be installed in the proposed local plant to be established by the Specification Brush Company, 121 West Seventeenth Street, New York.

Middle Atlantic States

BUFFALO, N. Y.—Electric power equipment will be installed in the new local plant of the Bemis Brothers Bag Company, St. Louis, Mo., comprising the former works of the Kelly-Springfield Tire Company, 711 Northland Avenue.

DEFERIET, N. Y.—The St. Regis Paper Company, Watertown, plans to build a power house at its proposed local pulp and paper mill, to cost about $500,000.

DUNKIRK, N. Y.—Electric power equipment will be installed at the plant of the Atlas Steel Corporation, in connection with extensions and improvements to cost about $400,000.

HIGH FALLS, N. Y.—The International Paper Company, 100 East Forty-second Street, New York, plans to build a hydro-electric power plant on the Saranac River, to cost about $500,000.

POTSDAM, N. Y.—The installation of electric pumping machinery at the proposed new waterworks, to cost about $175,000, is under consideration. Bogart & Pohl, 60 Church Street, New York, are consulting engineers.

CANTON, PA.—The North Penn Power Company has acquired the properties of the Canton (Pa.) Illuminating Company and the Troy (Pa.) Electric Light & Power Company. The systems will be merged and extensions and improvements made.

CHEAT HAVEN, PA.—The West Penn Power Company, Pittsburgh, is planning to build a large hydro-electric plant at Cheat Haven.

HARRISBURG, PA. — The Harrisburg Light & Power Company will issue bonds for $275,000, part of the proceeds to be used for extensions and improvements.

MEADVILLE, PA.—The Venango Public Service Company has acquired the property of the Northwestern Electric Service Company and plans extensions and improvements to the system.

PHILADELPHIA, PA.—Electric traveling cranes and other electrical equipment will be installed by the Philadelphia & Reading Railroad Company at its new piers in the Port Richmond section, to cost about $1,500,000.

PHILADELPHIA, PA. — The American Ice Company, City Central Building, will install electric power equipment at its proposed ice-manufacturing plant, to cost about $350,000.

YORK, PA.—The American Chain Company, Bridgeport, Conn., will install electric power equipment at the proposed addition to its local plant, to cost about $500,000.

BALTIMORE, MD.—Electric power equipment will be installed in the new plant of the Industrial Chemical Company, 110 East Forty-second Street, New York, in the Fairfield section, now under construction, to cost about $1,000,000.

BALTIMORE, MD. — Electric power equipment will be installed in the printing plant to be erected by the Baltimore *American*, at Commerce and Pratt Streets, to cost about $500,000. George R. Callis, Jr., American Building, is architect.

DUNBAR, W. VA.—Plans are being considered for the installation of electric pumping machinery at the proposed new waterworks plant.

HINTON, W. VA.—The West Virginia Power Company has been granted permission by the Federal Power Commission for preliminary work, to cost about $150,000 in connection with a hydro-electric project on the New River, near the mouth of the Bluestone River.

FARMVILLE, VA.—Bonds to the amount of $50,000 have been voted for improvements to the municipal electric plant.

NORFOLK, VA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 30 for conduit and wiring changes, lighting fixtures, etc., in the United States post office and court house, Norfolk. For details see Searchlight Section.

YORKTOWN, VA.—Bids will be received by the Bureau of Accounts and Supplies, Navy Department, Washington, D. C., until Nov. 27, for 2,500 battery holders, for the local navy mine depot. (Schedule 1541).

WASHINGTON, D. C.—A power house will be erected at the Garfield Memorial Hospital in connection with a new building at Tenth Street and Florida Avenue, to cost about $250,000. Col. P. M. Anderson, Southern Building, is engineer.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Nov. 27 for electrical supplies for Eastern and Western yards (Schedules 1530 and 1540); for dry cells and batteries (Schedule 1528); fuses and fuse elements (Schedule 1529) for Eastern and Western yards, and for flashlights (Schedule 1532).

WASHINGTON, D. C.—Bids will be received by the chief of air service, United States Army, until Nov. 12 for two ammeters and two voltmeters (Circular Q.R. 24-51); 200 connector-panel assemblies, and 200 switch-panel assemblies (Circular CAS 24-47).

WASHINGTON, D. C.—Bids will be received by the general purchasing officer, Panama Canal, until Nov. 19 for four motors, 25,000 ft. telephone wire, 10,000 ft. rubber insulated wire, 434 lb. magnet wire, 500 lb. cotton-covered wire and 10,000 ft. single-conductor wire (Circular 1569); also, until Nov. 22 for 100 switchboard cords and miscellaneous electrical and mechanical appliances (Schedule 1570).

North Central States

DETROIT, MICH.—Electric power equipment will be installed in the new plant to be erected by the Detroit Concrete Receptacle Company, 4225-27 Michigan Avenue, in the Woodward Heights section, to cost $250,000.

LANSING, MICH.—Extensions and improvements, involving an expenditure of about $1,200,000, are contemplated by the Michigan State Telephone Company in connection with its merger with the Citizens' Telephone Company.

PALMER, MICH.—The Michigan Gas & Electric Company has contracted to furnish service for the local Isabella Mine of the Youngstown Sheet & Tube Company, the initial load to approximate 400 hp.

PETOSKEY, MICH.—The Petoskey Portland Cement Company is planning to construct a new power plant at its mill.

CLEVELAND, OHIO.—The City Council is considering an issue of $400,000 in bonds for the installation of additional street lamps and distribution service for same.

MARION, OHIO.—Steps have been taken by property owners for the installation of ornamental lamps on First Street between Main and Jefferson Streets.

TIFFIN, OHIO.—Electric power equipment will be installed in the proposed plant addition to be erected by the Standard Sanitary Manufacturing Company, Bessemer Building, Pittsburgh, to cost about $350,000. G. W. Netcher, Tiffin, is architect.

TOLEDO, OHIO.—The City Council has authorized the installation of fifty-seven electric lamps to be installed in the Wildwood, recently annexed to the city.

INDIANAPOLIS, IND.—The Indianapolis Light & Heat Company has acquired a tract of land near the city on which it proposes to erect a superpower generating station within the next two years.

INDIANAPOLIS, IND.—The Indianapolis Lighting & Heating Company will erect a new building, 30 ft. x 200 ft., at Fortieth and Northwestern Streets, for general operating service.

JEFFERSONVILLE, IND.—The Interstate Public Service Corporation has been granted permission to issue $126,000 in bonds and $75,000 in capital stock, the proceeds to be used for the purchase of the property of the Jeffersonville Water, Light & Power Company, and for extensions.

GRANVILLE, WIS. — Preliminary arrangements are being made by the Milwaukee (Wis.) Electric Railway & Light Company to erect an electric plant in Granville.

GREENBAY, WIS.—The Wisconsin Public Service Corporation has completed the installation of the 60-cycle generators (replacing the 25-cycle generators) in its High Falls hydro-electric plant. Plans are now under way by the company to install 60-cycle equipment in its two hydro-electric plants on the Peshtigo River and also its steam auxiliary steam generating plant at Manitowoc, to replace the 25-cycle equipment.

PULASKI, WIS.—Plans have been completed by the Badger Utility Company for extending its transmission lines into new territory. The company purchases energy from the Wisconsin Traction, Light, Heat & Power Company, Appleton.

WAUKESHA, WIS. — Plans have been prepared by the Waukesha Gas & Electric Company and the Wisconsin Telephone Company for placing their wires underground in the downtown section of the city.

WEST BEND, WIS. — The Atlantic & Pacific Milk Products Company contemplate building a power house in connection with proposed additions to its plant.

WISCONSIN RAPIDS, WIS.—The Pigeon River Lumber Company has received a three-year permit from the Federal Power Commission for its hydro-electric project on the Pigeon River, consisting of five dams and five power houses.

LESUEUR, MINN.—The Minnesota Valley Canning Company contemplates erecting a power house at its factory, to cost about $50,000. R. W. Richardson, Zenith Building, St. Paul, is engineer.

CLARINDA, IOWA.—The Lee Electric Company will soon purchase two new boilers for its local plant.

HAMBURG, IOWA.—The Iowa Service Company will soon rebuild its transmission line from Hamburg to Riverton, a distance of 10 miles.

SIOUX CITY, IOWA. — Extensions are contemplated to the ornamental lighting system, consisting of 200 electroliers, to cost about $20,000.

SPRINGFIELD, MO. — Electric power equipment will be installed in the proposed new plant of the Inland Printing & Binding Company, to replace its factory recently destroyed by fire, with loss of about $200,000.

WEST POINT, NEB.—The City Council contemplates purchasing electricity from the Nebraska Gas & Electric Company, Norfolk, to operate the municipal electric system. The company plans to erect a line at once.

KANSAS CITY, KAN. — Bonds to the amount of $4,100,000 have been authorized by the voters, of which $2,000,000 will be used for extensions to the Municipal Electric Light Department, $2,000,000 for the Water Department and $100,000 for the Fire Department.

MARQUETTE, KAN. — Plans are being prepared for rebuilding the municipal electric distributing system.

Southern States

NORTH WILKESBORO, N. C. — The municipal electric plant was recently damaged by fire.

ROANOKE RAPIDS, N. C.—The Roanoke Rapids Power Company has awarded a contract to Stone & Webster, Inc., 147 Milk Street, Boston, engineer, for the construction of an addition to its hydro-electric power plant, including alterations and improvements in present station and waterway.

ROCKY MOUNT, N. C.—Extensions to the municipal electric light plant are under consideration.

GREENVILLE, S. C.—Arrangements are being made to erect a new power house at the Teachers' Training College at Greenville, to cost about $125,000.

SPARTANBURG, S. C.—The Manufacturers' Power Company plans to install a local light and power system for commercial service.

ATLANTA, GA.—Electric power equipment will be installed in the proposed plant of the Nelstone Company of Georgia, Inc., 509 Candler Building, to cost about $100,000. R. L. Langston is manager and engineer.

SAVANNAH, GA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 28, for furnishing and installing lighting fixtures in the United States marine hospital at Savannah. For details see Searchlight Section.

JEFFERSON CITY, TENN.—The Tennessee Electric Power Company, Chattanooga, has purchased the local electric plant. The company has also been granted a franchise in White Plain.

MEMPHIS, TENN.—The Blair Construction Company plans to install a lighting system on a tract of property to be developed in the Parkway Place section, including street lamps, and commercial system.

NASHVILLE, TENN.—Plans are under consideration for extensions to the municipal waterworks, to include a power house. The J. N. Chester Engineers, Pittsburgh, Pa., is engineer.

SHELBYVILLE, TENN.—Plans are under way by the Public Light & Power Company to build a dam and power house to develop 750 hp., at a cost of about $75,000. L. W. Hope is engineer in charge.

BIRMINGHAM, ALA. — Electric power equipment will be installed in the proposed local ice-manufacturing plant, to cost about $100,000, to be constructed by Henry L. Sherrod, Gadsden, and associates.

RUSSELLVILLE, ALA. — The Alabama Power Company has acquired the local municipal power plant.

JACKSON, MISS.—The Enochs Lumber Manufacturing Company contemplates rebuilding its power house and plant, recently damaged by fire, with loss of about $450,000.

BLYTHEVILLE, ARK.—The Arkansas-Missouri Power Company contemplates extensions and improvements, to cost about $274,000.

EUREKA SPRINGS, ARK.—The Carroll County Utilities Company has applied for a franchise in Berryville and plans to erect a high-tension transmission line through that city and other places to Harrison with power plants at both ends of the line.

ERATH, LA.—The installation of a municipal electric ssytem, to cost about $12,000, is under consideration.

LAWTON, OKLA. — The Southwestern Light & Power Company plans to erect a 66,000-volt transmission line to Quanah, about 105 miles. A branch line will be erected to Snyder.

DALLAS, TEX.—The North Texas Trust Company, Mercantile Bank Building, is planning to install an electric lighting system on property to be developed in the northwestern section of Oak Cliff.

GRAND SALINE, TEX.—The installation of electrically operated pumps in connection with a new waterworks system, to cost about $80,000, is under consideration. H. N. Roberts, 422 Irving Place, Dallas, is engineer.

GRAND SALINE, TEX.—The American Public Service Company has acquired the properties of the Grand Saline Light & Power Company, and also the systems at Quitman, Gilmer, Big Sandy, Alba and vicinity, and will make extensions and improvements.

HOUSTON, TEX.—Plans are being arranged for the installation of electrically operated pumping machinery in connection with extensions to waterworks plant, to cost about $500,000.

HOUSTON, TEX.—The City Council is considering the question of requiring the electric light and street-railway companies to place their wires underground on Washington Avenue between Tenth and Fifth Streets.

JACKSONVILLE, TEX.—The Jacksonville Electric & Ice Company has acquired the properties of the Rusk (Tex.) Light & Power Company and the Troupe (Tex.)

Light & Power Company and will make extensions. A transmission line will be erected to Rush, Troupe and vicinity.

Pacific and Mountain States

PORT TOWNSEND, WASH.—The Washington Coast Utilities Company plans extensions and improvements to its local system, to cost about $22,000.

TACOMA, WASH.—Bids are being received, to be opened about Dec. 1, for construction of the dam in connection with the Lake Cushman hydro-electric plant, to cost about $1,250,000. Bids for equipment will be asked for early in the year and for power house early next spring. J. L. Stannard, City Hall Annex, is engineer in charge. Ira S. Davisson is commissioner of the municipal electric plant.

CLAREMONT, CAL.—Electric power equipment will be installed in the proposed local plant of the American Crushed Rock Company, to cost about $150,000.

LOS ANGELES, CAL.—The Art Commission has approved plans for an ornamental lighting system on Sunset Boulevard, consisting of 750 lamps standards, to cost about $300,000.

MARYSVILLE, CAL.—Funds to the amount of $1,150,000 are available for development project at Bullard's Bar dam for the Yuba River Power Company. The work will include raising the dam to 175 ft., the construction of a hydro-electric plant to develop 6,500 hp. and erection of transmission lines to the Colgate power house of the Pacific Gas & Electric Company.

NATIONAL CITY, CAL.—Electric power equipment will be installed in the proposed local group of industrial buildings to be erected by the Spreckles Brothers Commercial Company, San Diego, to cost about $100,000.

REDLANDS, CAL.—Extensions and improvements to cost about $250,000 in the Redlands district are contemplated by the Southern California Edison Company. The work will include several large substations which are to be made intercommunicative with the Laguna Bell 220,000-volt station, where energy is received from the generating station in the Sierra Nevada Mountains.

SAN JOSE, CAL.—Plans are being prepared by the Pacific Gas & Electric Company, San Francisco, for a local warehouse and garage, to cost about $90,000.

SANTA MARIA, CAL.—Plans are being prepared by the City Trustees for the installation of an ornamental lighting system on Broadway and Main Street.

TAFT, CAL.—A special election will be held on Nov. 27 to vote on the proposition to issue $148,000 in bonds for the installation of an ornamental lighting system.

THREE RIVERS, CAL.—The San Joaquin Portland Cement Company plans to build a power plant in connection with its proposed local mill, to cost about $600,000.

TURLOCK, CAL.—The Turlock Irrigation District has approved an appropriation of $500,000 for the construction of a steel-tower electric transmission system, about 90 miles.

MISSOULA, MONT.—The City Council plans to install electrically operated pumping machinery in connection with extensions and improvements in the waterworks, to cost about $600,000.

DENVER, COL.—Plans will be prepared by A. E. and C. A. Millington, engineers, Denver, for a hydro-electric power plant to be constructed in the vicinity of Lake Orchard, Ketchikan, Alaska, with initial capacity of about 10,000 hp., to be used for service at a local paper and pulp mill, for which plans also are in progress.

Canada

JARVIS, ONT.—Plans are under consideration for the erection of a transmission line from here to Hagarsville (7 miles), to cost about $35,000. The work will be done under the direction of the Hydro-Electric Power Commission of Toronto.

TORONTO, ONT.—Extensions and improvements are contemplated to the Toronto Hydro-Electric System, involving an expenditure of about $1,940,000. E. M. Ashforth is manager.

THREE RIVERS, QUE.—The North Shore Power Company, Ltd., it is reported, will call for bids about Nov. 15 for the construction of a dam at Chute de la Cheminée, on the Bastican River, St. Geneviève Parish, to develop about 4,000 hp. The cost is estimated at about $500,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued Oct. 16, 1923)

1,471,096. Electrical Apparatus; F. F. Brand, Pittsfield, Mass. App. filed May 8, 1919. Low-voltage transformer winding of tubular coils through which cooling liquid flows.

1,471,129. Recording Mechanism; D. S. Holt, Mittineague, Mass. App. filed Oct. 31, 1921. Pen-and-holder construction for graphic instruments.

1,471,132. Trolley-Wire Support; A. E. Anderson, Milton, Mass. App. filed June 29, 1923. Wire splicer.

1,471,135. Trolley; W. A. Bartlett, Baltimore, Md. App. filed March 1, 1923. Trolley contact wheel with several grooved rollers.

1,471,165. Radio Reception; L. L. Jones, New York, N. Y. App. filed July 19, 1920. Utilizes two antennas.

1,471,173. Terminal for Electric Conductor Wires; J. A. Kuller, Brooklyn, N. Y. App. filed March 24, 1920. Plug connection.

1,471,183. Shield for Electrical Apparatus; A. G. Miller, Philadelphia. App. filed May 22, 1920. X-ray apparatus.

1,471,196. Field Frame; A. B. Owen and T. Hall, of Ridgway, Pa. App. filed Jan. 24, 1917. Method of forming machine frames.

1,471,208. Multiple Lamp Socket; B. I. Rockoff and E. Rockoff, Chicago, Ill. App. filed June 26, 1919. Combined plug and lamp socket.

1,471,263. Electrical Apparatus; H. M. Hobart, Schenectady, N. Y. App. filed Aug. 28, 1919. Cooling transformers by water system where water evaporates.

1,471,319. Radio-Telegraph Signaling System; H. Pratt, San Francisco, H. F. Elliott, Palo Alto, and U. B. Murphy, Burlingame, Cal. App. filed Jan. 3, 1921. Audio-frequency waves radiated from antenna system to which an undamped wave arc generator is connected.

(Issued Oct. 23, 1923)

1,471,326. Welding Electrode; J. P. Copland, Hudson, Ohio. App. filed Nov. 12, 1921. Contains chromium and tungsten.

1,471,329. Surgical Baker; W. S. Edmands, Boston, Mass. App. filed Jan. 28, 1922. For heat treatment of human body.

1,471,335. Signaling System and Method of Operating the Same; E. D. Johnson, East Orange, N. J. App. filed Jan. 24, 1918. Uses one-way telephone repeater for either direction.

1,471,340. Outlet or Junction Box; J. G. Knight, Brooklyn, N. Y. App. filed Sept. 15, 1921. Eight-sided box.

1,471,342. Means for Controlling Processes of Production; L. Logan, Arlington, Mass. App. filed April 30, 1920. Automatically controlling process by variations in radiant energy.

1,471,345. Electric Ignition System for Internal-Combustion Engines; J. L. Milton, Cleveland, Ohio. App. filed June 14, 1912.

1,471,357. Electrical Impulse Indicator; S. Ruben, New York, N. Y. App. filed March 15, 1922. Vacuum tube indicates impulses sharply at high speed.

1,471,383. Method of and Means for Measuring Unbalance; A. B. Clark, Brooklyn, N. Y. App. filed Oct. 15, 1919. For telephone line and its network.

1,471,388. Signaling Circuit; E. Dietze, Brooklyn, N. Y. App. filed Jan. 26, 1921. Telephone circuit having characteristics of Campbell type.

1,471,391. Rheostat; R. R. Dunlop, Columbus, Ohio. App. filed May 27, 1921. Grid resistances for railway motors.

1,471,404. Signaling Circuit; W. H. Martin, New York, N. Y. App. filed Jan. 26, 1921. Telephone circuit having characteristics of Campbell type.

1,471,406. Radiotelegraphy; F. S. McCullough, Cleveland, Ohio. App. filed July 25, 1919. Determining direction of distant transmitting stations.

1,471,418. Tuning Transformer; J. F. Rodgers, Brooklyn, N. Y. App. filed May 26, 1922. Variable inductance for wireless circuits.

1,471,423. Art of Treating Grain in Bulk by Electricity; F. S. Smith, Philadelphia, Pa. App. filed Feb. 12, 1919. For destroying any insect life.

1,471,432. Device for Testing Electric Circuits; G. W. Welford, Jr., Philadelhia, Pa. App. filed Nov. 12, 1921. For determining whether line is alive or dead.

1,471,455. Electric Door Opener; F. C. Ernst, New York, N. Y. App. filed Aug. 15, 1922. No spring used to return latch to locking position.

1,471,469. Method of Detinning Tin Scrap and the Like; E. Kardos, Newark, N. J. App. filed April 14, 1920. By immersing tin scrap in alkaline electrolyte.

1,471,486. Dry Cell; A. C. Jewett, New Haven, Conn. App. filed July 1, 1920. Method of holding depolarizing material together.

1,471,494. Electric Fixture Canopy; M. J. Lubow, New York, N. Y. App. filed Jan. 6, 1922. Lamp socket fastens directly to canopy.

1,471,545. Conductor Support; H. P. Chandler, Mansfield, Ohio. App. filed May 1, 1923. For securing trolley wire to overhead hanger.

1,471,546. Conductor Support; H. P. Chandler, Mansfield, Ohio. App. filed June 18, 1923. Trolley-wire clamp.

1,471,547. Production of Submarine Signals and the Location of Submarine Objects; C. Chiloswky and P. Langevin, Paris, France. App. filed May 19, 1917. By synchronous vibrating apparatus.

1,471,617. Telephone-Exchange System; A. E. Lundell, New York, N. Y. App. filed Sept. 8, 1917. Setting up of connection controlled by the calling subscriber.

1,471,632. Self-Induction Coils for Loading Telephone Cables; E. Schürer, Cologne-Mulheim, Germany. App. filed April 28, 1921.

1,471,636. Artificial Line; H. J. Vennes, New York, N. Y. App. filed Aug. 24, 1920. Carrier-current telephone system.

1,471,638. Telephone System; D. F. Whiting, New York, N. Y. App. filed Dec. 28, 1918. Amplifying means.

1,471,639. Telephone System; D. F. Whiting, New York, N. Y. App. filed July 22, 1919. Attenuation-equalizing means for voice-frequency range.

1,471,641. Electrolytic Gas Cell; C. F. Adams, Dayton, Ohio. App. filed March 9, 1922.

1,471,682—Portable Electric Lantern; C. B. Burnet, South Norfolk, Va. App filed June 25, 1920. Self-contained generator driven by spring motor.

1,471,696. Telephone; J. Kay, Stockport, and J. Jennings, London, England. App. filed March 22, 1921. Small inter-office telephone sets.

1,471,698. Reciprocating Electric Motor; G. Mazza, Turin, Italy. App. filed April 12, 1921. For percussive tools.

1,471,708. Electrical Apparatus for Indicating and Repeating Movements at a Distance; J. L. Routin, Paris, France. App. filed Feb. 25, 1920. Based on principle of Wheatstone bridge.

1,471,733. Theft Alarm; C. A. Isbell, Pasadena, Cal. App. filed Feb. 5, 1920. For automobiles.

1,471,739. Battery Holder; M. Kammerhoff, Orange, N. J. App. filed April 26, 1920. For flashlights.

1,471,756. Wave Signaling System; W. B. Schulte, Madison, Wis. App. filed Oct. 17, 1918. Relates to the plate-filament circuit of a wave-receiving system.

1,471,823. Electric Sadiron; W. C. Boswell, Baltimore, Md. App. filed June 14, 1922. Heating elements readily removed.

1,471,834. Electric Motor Terminal Connection; M. A. Defibaugh, Battle Creek, Mich. App. filed Aug. 24, 1921. For split-phase induction type motors.

1,471,849. Ammeter; F. W. Kaisling, Jr., Chicago, Ill. App. filed Oct. 25, 1919. For ignition and lighting circuits of automobiles.

1,471,851. Armature Winding; R. T. Kingsford, Philadelphia, Pa. App. filed May 15, 1920. For automobile storage-battery charging generator.

1,471,863. Electrical Change-Over Apparatus; H. Riegger, Berlin, Germany. App. filed Aug. 24, 1922. For submarine signaling purposes.

1,471,878. Electric Gong; G. H. Bickell, Brookline, Mass. App. filed Oct. 13, 1919. Operated by alternating current.

1,471,893. System and Apparatus for Power Transmission and Regenerative Braking; W. S. H. Hamilton and R. D. Knape, Schenectady, N. Y. App. filed Oct. 15, 1921.

1,471,897. Battery-Charging System; H. M. Jacobs, Schenectady, N. Y. App. filed April 6, 1921. Suitable for several voltages.

1,471,901. Synchronizing of Shafts; H. Lemp, Erie, Pa. App. filed Oct. 6, 1921. Method of driving several shafts at same speed.

1,471,907. Machine for Heading Porcelain Tubes and the Like; A. G. Mason and L. C. Buckley, Lisbon, Ohio. App. filed March 4, 1922. Automatic operation.

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"Reducing the Labor Content"

THIS striking phrase was used by Gerard Swope the other day to show the potentialities of electricity as an agency for cutting unit costs of production. The first Aldred lecturer thus went straight to the heart of his theme. Indeed, some day the historian of these times will write the record of electricity as the greatest accelerator of production and the most helpful burden bearer introduced by engineers to modern civilization. Even in this early stage of world electrification the results that have been realized from the application of so flexible and economical a form of energy to everyday human toil have caused the industrial conceptions of the most sanguine of electrical engineers to be welcomed not as imaginative visions of what may be generations hence, but as matter-of-fact programs for the near future.

TO REDUCE the amount of human effort required to perform the tasks of the day is one of the highest accomplishments of the engineer, and it is an evidence of advancing intelligence that manual laborers themselves no longer oppose progress in this direction as a menace to them but welcome it as a blessing; for all save the dull have come to see that with the march of invention and the harnessing of Nature's forces come less arduous toil, shorter work hours, greater earnings, and in the long run a reduction in the numbers of those whose employment is intermittent or precarious.

An economic analysis of costs shows labor to be the most striking item in the tabulation. The electrification of industry increases production, lowers the labor content, surrounds the worker with the comfort of improved illumination and places at his hand a better control of processes together with a surer application of power at the proper time and place.

WHETHER labor content is defined as the effort of mankind to achieve a productive result in the home, in the factory, office or store, in the field, forest or on the sea, makes little difference. The all-inclusiveness of electric service as the economic solvent of a costly era challenges the imagination. So long as electricity does the work of the world better, more rapidly, at less unit cost than other agencies, its "place in the sun" is impregnable. To cheapen production without sacrifice of quality is economic victory, and in its ability to cut unit costs without impairing—nay, while improving—the welfare of the worker electricity leads the march of progress upward and onward to ever-widening horizons of service to mankind.

Joseph Sachs

An engineer and inventor of rare versatility who has contributed greatly to the development and exploitation of a wide range of electrical wiring accessories, notably in the field of fuse protective devices.

IT IS natural that the most extended fame in the electrical industry should come to men whose achievements and creations have been spectacular for size and importance. The fact that for one great invention of major class there must be perhaps a hundred smaller inventions providing the foundation details from which the structure must be fabricated is forgotten. Yet men like Joseph Sachs, chief engineer of the Johns-Pratt Company, Hartford, Conn., who have contributed to the development of the materials, fittings and equipment that are vital elements in the electric circuit as perfected today, have displayed a genius of as high an order as the fathers of more conspicuous apparatus. Mr. Sachs has to his credit more than two hundred diversified patents.

Born in New York City in 1870 and educated in the public schools and the College of the City of New York, he began his electrical work with the Sprague Electric Motor Company in New York in 1890, soon afterward joining the Edison Machine Works, now the General Electric Company at Schenectady. He had a distinct inclination for inventions and for the next six years engaged in extensive development work embracing electric railway equipment, fire alarms, signals for railways, electric type-setting machinery, electric metal heating and melting, ore separation, protective devices and switches. He made a study of electric canalboat propulsion, lectured and wrote many articles for technical and popular magazines.

In 1908 Mr. Sachs became associated with the Johns-Pratt Company as consulting and chief engineer, and from that time to this he has devoted himself to the development, manufacture, exploitation and sale of inclosed-fuse protective devices and other electrical accessories based on his own inventions. His work has been extremely versatile. In addition to the fields already mentioned, he has interested himself in electric drive and control for motor vehicles and a wide variety of fittings used in wiring construction, covering almost all the electrical accessory field.

About ten years ago Mr. Sachs began the development of standardized protective electric service equipment. His efforts have borne conspicuous fruit in the recently announced combination of four large manufacturers in the production of a standard service entrance unit.

In 1903 the John Scott medal was awarded to him by the Franklin Institute for pioneer work in fuse protection devices. He is a fellow of the A. I. E. E. and an active worker with the A. M. E. S.

Editorial Comment

Electrical World, November 17, 1923

Volume 82 Number 20

The Brightest Star in the Industrial Firmament

THROUGHOUT the world records show that the industry which is most alive today is the electrical. A greater percentage of workers and equipment is engaged in the production of electrical energy and electrical apparatus and supplies than is employed in other industries. Why? Edison says that it takes ten years to get the public to accept an idea. We have been trying to electrify the world during the last forty years and were making great headway when the war intervened. The seed sown then, however, did not die and is now blossoming forth. In many sections of the country the growth is so intense that the old record of doubling the crop every five years has by intensive cultivation been beaten. Now the crop is doubled in four years, and there are no indications of a dearth. Truly, ours is a productive industry, and if half the ideas promulgated ten years ago bear fruit, there will be great difficulty in harvesting the yield.

Why the Ferris Amendment Was Smashed

WHEN the voters in the most populous commonwealth in the Union carry four amendments to the state constitution by majorities ranging from small to large and simultaneously sink a fifth amendment deeper than ever politician's plummet sounded, it must mean something. Last week such a tidal wave swept over the proposed amendment to New York's organic law designed to permit the use of a very small part of the Forest Preserve for the generation and transmission of electricity. This amendment had the outspoken support of many eminent engineers; it was pretty generally indorsed as a matter of course by electrical men and all professionally interested in power development, and its putative father and other political sponsors did what they could to save it. But all was in vain. The waters wild went o'er their child, and they were left lamenting.

Yet nowhere to a greater degree than in New York are the people alive to the advantages of electrical energy. Nowhere have they a keener sense of the loss inherent in unused water power. Nowhere have they been more assiduously "fed up" on the benefits of superpower. Why, then, the apparently astonishing result? It is unreasonable to attribute it all to the arguments of a few rich estate owners. Since when were American voters so responsive to esthetic appeals obviously tinctured with the suspicious flavor of exclusiveness? Was it not, rather, because the opponents of the amendment at once christened it the "water-power grab" and because, however unjust this name may have been, it stuck like a burr? One might have thought that the charge thus thrown at the supporters of the amendment would have spurred them to a convincing refutation; but no one came forward to demonstrate to reasonable men and women that no "grab" could follow the passage of the amendment. There were only "say so's" in denial and engineering arguments, when the objectors wanted assurances of conservation and proper remuneration to the state.

Why Not an Open Power Policy Openly Arrived At?

IT WILL be two years at least before another amendment can be submitted. Before that shall be done there is ample time to clean up the whole water-power situation in New York. But it must be cleaned up in the open. Cannot power men co-operate with political leaders of standing and integrity to formulate, after full hearings, a state policy, fair to all, which will become as impregnable in New York as the federal policy bids fair to become in the nation at large? If necessary to convince the voters that no sinister motive lurks behind it, the legalistic objection to encumbering the constitution with non-basic law must be disregarded and that instrument must itself provide the answer to the cry of exploitation.

The electrical industry in the state has a great part to play in bringing this clarification about. More important even than the promotion of good public relations between central-station companies and their customers by means of fair and courteous treatment of individuals is the promotion of good public relations between the industry at large and the American electorate by a policy at once so public-spirited and so frank that not even the most prejudiced can believe there is aught concealed.

A Responsibility of Schedule Committees

THIS week again there is more evidence that associated class groups of electrical men still continue to forget that they are elements in a great industry, not independent, isolated organizations with no responsibility to anybody but themselves. The Electrical Supply Jobbers' Association has just held its annual winter convention in Buffalo at the same time that the Electrical Manufacturers' Club met at Hot Springs, Va. Inasmuch as the Electrical Manufacturers' Club is a semi-social organization composed of executives of the electrical manufacturing industry and its meetings are rarely attended by other than members, there are undoubtedly few among the jobbers who would have gone to Hot Springs. It is of very great importance to the electrical industry, however, that the executives among the manufacturers shall attend the conventions of the jobbers, and, normally, there are a fair number of them present; but this year, because of mere lack of care in the arrangement of dates, it was impossible. No one doubts that most misunderstand-

ings are due to lack of contact. Differences of opinion between jobbers and manufacturers and a lack of harmonious policies that goes no little way to introduce costs and troubles into the distribution of electrical products could be materially relieved if the jobber and the manufacturer knew each other better and had a clearer vision of each other's problems. Conventions of these national associations offer opportunities for such contact that are invaluable, and it is a distinct hurt to the electrical industry that committees will continue arranging convention schedules without regard to possible conflicts with other meetings through a lack of appreciation of the industry interests that are involved.

Cheerful Illumination Needed in Autumn

LATE autumn is anything but cheerful. Others besides the poets sometimes find the days both short and melancholy and the atmosphere dank and cold. People remain indoors more, and whether at home, at work, shopping or at play, they rely on artificial illumination to dispel the gloom. That the illumination should be adequate goes without saying. It should in addition impart a warm glow and an atmosphere of cheerfulness. Electric light and power companies can perform an excellent service in educating the public mind to appreciate the inherent domestic and civic advantages of electric lighting. The place to begin is where it is most needed—in the home. A survey there is not only conducive to good will but profitable as well. Besides, every seller should see that the buyer gets a maximum benefit from the product bought. What people need most now is illumination, and electric light companies should make it their business to see that what they sell is very good and as cozy and cheerful as illuminating skill and artistic treatment can make it.

Regional Studies on Interconnection Advance the Day of Accomplishment

AS ANOTHER evidence of the fact that the electric utilities themselves are actively at work to bring to the public the benefits of interconnection, the 1923 report of the transmission lines committee of the Empire State Gas and Electric Association is commendable. But, beyond being a definite indication that some one is at work, it also presents information and ideas which will be found valuable not only in the particular region under study but also wherever the problem is being approached. For this reason the ELECTRICAL WORLD is publishing parts of this report in this and succeeding issues.

This week the general survey of the present interconnection and the practicabilities, problems and advantages of further connection are presented. The map, printed as a supplement, together with the statistical and numerical analyses, represents two years of endeavor on the part of the committee to present a concrete picture of the situation.

That ten million dollars will provide the more important interconnections necessary to a realization of the greater benefits in economy and dependability of service in this region may seem an overstatement to some and an understatement to others. It is surely not an immoderate amount, however, when it is considered that the capital released by such further interconnection is figured at $7,875,000 and the capitalized operating savings at $17,500,000. The definiteness with which these facts are presented should assist materially in encouraging those whose responsibility it is to carry on further interconnection in the state to proceed to a definite conclusion.

The discussion and proposals along other lines than the specific cost and savings in New York State will doubtless draw comment from other sections where further interconnection is a pressing problem. The voltage and frequency recommended, the basis of power interchange agreements, the question of power control are all subjects of vital interest to other sections with which ultimately the region under discussion will be connected. A national policy—at least, a policy of correlating the efforts and results of the various sectional studies—is vital and will not be overlooked by the industry.

Another factor of value in such definite reports as this one made in New York is that there is definite answer provided to politician and public as to exactly what benefits are derivable from "superpower" development. Comprehensive, informative reports like this are the best-known antidote to misinformation.

The Handicap of Insufficient Condensing Water

WATER is vitally essential to any power project. The layman does not always appreciate how valuable it is. Coal to him is the all-important element, whereas a modern power station requires from 600 tons to 1,000 tons of condensing water for every ton of coal burned. This is what determines the choice of site for a superpower station and this is what handicaps many an existing plant. The Barton station at Manchester, England, is a typical example. Excellent in design and equipment, a kilowatt-hour ought to be manufactured in it as cheaply as anywhere, but for want of water it is like a cripple on crutches. The same is true of the new station at Birmingham, England, where water is so scarce that sewage must be utilized. What these interior cities need is adequate outlets to the sea. That has been the salvation of many a nation and will also be the salvation of steam superpower stations. Cooling towers are excellent in their way, but they are stones around the necks of large and efficient power systems.

Making the Weaker Part Interchangeable

IT SEEMS to be rather a trite assertion that a combinational device should be so designed that the parts most subjected to wear or damage will be the ones readily removable and interchangeable. Yet every automobilist who has had trouble with his carburetor or gears has the impression that the whole car has been solidly built around just these parts and that getting at an Egyptian king's inner burial chamber is a child's task as compared with reaching the portion of the car's mechanism for which he is seeking.

In the case of electrical indicating instruments it is usually the pivots and not the jewels that are damaged, and yet ever since our industry has begun it has been the universal practice to mount the pivots permanently in the ends of the shaft and to put the jewels in

removable screws in the frame. This practice necessitates the removal of the complete moving element in case of damage to the bearings. It is welcome information that at least one of the prominent instrument makers has recently reversed the usual construction, so that the armature shaft now carries the jewels and the frame the removable pivots. By keeping a few spare pivots in stock it now becomes a matter of only a few minutes to unscrew an old pivot and to put in a new one, without disturbing the moving element.

Besides being an ingenious solution of an old trouble, this change is a splendid example of at least two instructive general principles, namely (a) that many types of construction accepted as gospel truths are simply unnecessary survivals of old engineering traditions, and (b) that a solution of a trouble is sometimes found in simply interchanging two old parts or functions.

Low-Voltage Releases Protect Against Burn-Outs

MANY electrical distribution systems have occasional heavy peak loads which result in low voltage on heavily loaded industrial feeders. Under these conditions of low voltage, motors equipped with low-voltage releases are better protected than those equipped with no-voltage releases only. The tendency is for the user of the motors to keep them operating as long as possible, and under low-voltage conditions burn-outs may be frequent unless the low-voltage release is provided. Other advantages accompanying the use of low-voltage protection are that the station is benefited by having the load on the system automatically reduced and, on geared applications, breakages are reduced because sudden jars resulting from voltage fluctuations are eliminated.

Use of Electric Light for Stimulating Growth in Plants

THE papers by Professors Harvey and Findlay presented at the last convention of the Illuminating Engineering Society offer an encouraging outlook as to the possible use of electric light in hothouses, plant-breeding establishments, agricultural experiment stations and the like. The assimilation of carbon by plants is increased proportionally to light intensity, so that with the use of intense electric light the growth of plants is much accelerated. The data and photographs given in the two papers leave no doubt about this point.

This new use of electric light deserves careful consideration on the part of power companies and lamp and fixture manufacturers. While by no means a ready business at the present time, it deserves going after in a systematic way. The lights can be used from late at night until early in the morning, thus constituting a steady and desirable off-peak load. Considerable prospective business lies near large cities where there is a steady demand for fancy flowers and vegetables. If these could be raised a few weeks ahead of the regular season, or for special occasions like Easter and Thanksgiving Day, the price that they would command may pay for the cost of the required electrical energy.

It has also been pointed out that the production of new and desirable hybrid varieties of plants can be much helped by the use of electric light, because two existing varieties can be forced to bloom at the same time, and also because the production of male and female flowers in some plants is dependent upon light intensity.

Kindle the Spark —Don't Stamp on It

IN A CERTAIN city, not so long ago, a man of genius in the real estate business developed several squares in a residence neighborhood into a little "Maxfield Parish community" of delightfully artistic homes. Homes, garages and planting all combined to create a most unusual and appealing atmosphere. Naturally there was a stir of public interest. People flocked to see the new homes. The idea came to an electrical man of this community that here was an ideal setting for a "home electrical." Thousands of people were coming to look at this development and would be delighted to inspect one of the homes completely furnished. It might be used as a background for a demonstration of electricity in the home.

He took the idea to the local central-station company and to the local electrical league. But they were cold. He was not a leader in the electrical family. It was not his place, they felt, to initiate electrical co-operative activities. He was a small manufacturer of a rather unimportant product. Who was he to be organizing an electrical home? The men of the lighting company frowned upon him and were too busy to furnish any appliance for such an affair or to assist him. The electrical league at last voted him money, but its members would not help in this irregular proceeding.

But he was an enthusiastic chap, and when nobody else would take hold and make good this unique opportunity to promote the local electrical industry he went ahead himself. By the most persistent and courageous effort he personally secured the co-operation of individual manufacturers, who furnished and equipped one of these homes as a "home electrical." From the point of view of the charm of the home itself and the ingenuity and skill with which it had been advertised and operated it has been one of the most interesting and successful of these demonstrations ever held. Tens of thousands of people have visited it and been instructed. The house itself was sold for $5,000 more than the similar ones about it. It brought tremendous benefit to the electrical community of the city.

All the industry agrees today that the executive of the central-station company should and must be the father of the local electrical family. He must be the leader if the electrical idea is to be carried enthusiastically forward in that town with the harmonious support of all electrical interests. It is so clear and so obvious a necessity that it seems impossible that little jealousies and red-tape considerations, as in this case, can be allowed to block the path and discourage zeal.

The homes of American cities must be equipped electrically. It is a task that confronts the entire industry. It is committed to it. This is recognized as one of the greatest opportunities and obligations before electrical men today. It is realized, too, that comparatively little progress is being made toward getting this job done, so great is the expansion of the market. Surely, then, the central station should welcome aid from any side and give its hand to any man who comes with a contributing idea and a will to work for the advancement of electrical development.

Mammoth Roof Bushing for 165,000-Volt Circuit

ONE of the largest roof bushings ever manufactured is shown here. It weighs 2,600 lb., has an over-all length of 17 ft. and is designed for a normal voltage of 187,000. It is one of four built by the Westinghouse Electric & Manufacturing Company for the Skagit River development of the city of Seattle. Three will be used for connecting a 165.000-volt bus with a bank of three 10,000-kva., single-phase transformers. The fourth bushing will be held in reserve on the property for use as a spare.


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Windsor
Franklin
Tilton
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Cavendish
Danby
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New London
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Newport
Warner
Rochester
Somersworth
Dover
Chester
Charleston
Contoocook
Concord
Suncook
Hooksett
Manchester
Bellows Falls
Portsmouth
N. Hampton
Manchester
Putney
Somerset
Searsburg
Keene
Marlboro
Harrisville
W. Peter-
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Milford
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Amesbury
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Fitz William
Vernon
Readsboro
Winchester
Winchendon
Townsend
Lawrence
Ipswitch
Gloucester
LOWELL
Middleton
Salem
Adams
Shelburne
Greenfield
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Gardner
Leominster
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Shirley
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Leverette
Clinton
Hudson
Marlboro
BOSTON
Amherst
Barre
Framingham
Wollaston
Lee
WORCESTER
Millbury
Fisherville
Braintree
Weymouth
Milford
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Westfield
Chicopee
SPRINGFIELD
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Wrentham
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Rockville
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Properties of Electric Sheet Steel

Effect of Chemical Composition, Heat Treatment and Aging on Permeability, Hysteresis, Specific Resistance and Mechanical Properties—Recent Research

By C. H. WILLIS
Johns Hopkins University, Baltimore

A HUNDRED THOUSAND tons of sheet steel was used in the United States in the manufacture of electrical machinery in 1916. This steel cost approximately $7,000,000, and the energy loss due to hysteresis and eddy currents in the product will probably cost an additional $2,900,000 yearly. This statement is based on the assumption that yearly the average loss is 1 watt per pound, that the average daily service is eight hours and that power costs 0.5 cents per kilowatt-hour. This gives some idea of the volume of this business as well as the importance of the magnetic quality of the product.[1]

The magnetic properties of iron are distinctly superior to any other known element. For this reason it was thought for a long while that the best magnetic material obtainable would be the purest iron. However, experiments in recent years have shown that the magnetic qualities of iron alloyed with certain substances may be distinctly superior to those of the purest iron obtainable.

There are a few substances which seem to affect directly the magnetic properties of the iron, such as cobalt and nickel. There are still other substances which are themselves magnetically inert and yet affect the magnetic quality of the iron, such as silicon and aluminum.

The action of the silicon is generally considered to be indirect, and it is probable that the effect of the silicon can be explained by its action on the other more harmful impurities, such as carbon and oxygen, which tend to harden the steel and thereby increase the losses and lower the permeability.

However, there is considerable evidence that certain compounds are formed between the iron and silicon such as FeSi and Fe_2Si, and Yensen finds some suggestion of the compounds $Fe_{18}Si$ and $Fe_{10}Si_2$. It is quite possible that the silicon may affect directly the magnetic properties of these alloys. For instance, some of the alloys of aluminum, manganese and copper are distinctly magnetic, though the elements themselves are apparently non-magnetic. The exact manner in which the silicon acts has not been definitely determined, but it is definitely known that the silicon will prevent the formation of cementite, Fe_3C, and will reduce the iron oxide present. Both the cementite and the iron oxide are very objectionable magnetically as they have a large hysteresis loss and low permeability. Therefore, the magnetic effect of the silicon would seem to be sufficiently explained by these facts [2,3].

SOME IMPROVEMENTS IN THE MAGNETIC QUALITY OF IRON SINCE 1900

Year	Investigator	Substance	Maximum Permeability	Hysteresis Loss per Cubic Centimeter, per Cycle (B = 15,000 Gaussee). Ergs.
1900	Hadfield	Swedish iron	4,000	5,500
1900	Hadfield	2.5 per cent silicon steel	5,100	4,700
1910	Terry	Electrolytic iron	11,000	......
1914	Yensen	Pure vacuum iron	19,000	1,640
1915	Yensen	0.15 per cent Silicon vacuum iron	66,500	916

One of the most serious defects of early magnetic iron was its aging. Iron which was kept around 100 deg. C. for a few days was found to have an increased hysteresis loss. Sometimes this increase was as much as 100 per cent. This effect caused a serious lowering of the efficiency and thereby lowered the rating and useful life of the apparatus. About 1900 Hadfield discovered that by adding a small amount of silicon this effect was practically eliminated and the addition of 3 per cent silicon would sometimes cause the loss to decrease with time.[1,4]

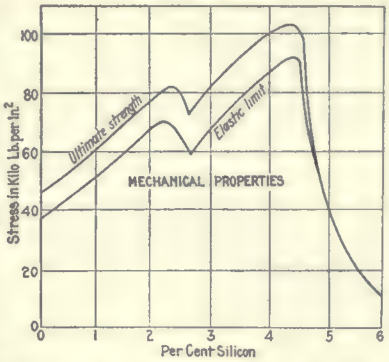


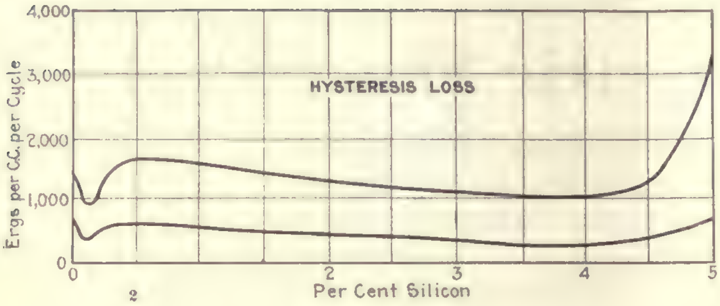
FIG. 1—SILICON CONTENT HAS PECULIAR EFFECT ON ULTIMATE STRENGTH AND ELASTIC LIMIT

However, the silicon not only prevents aging, but it actually reduces the hysteresis loss to about two-thirds that for the pure iron. The curve (Fig. 2) shows the relation between the silicon content and the hysteresis loss as determined by Yensen in his vacuum-furnace tests. This curve shows the optimum result. However, as stated above, the hysteresis loss of high-silicon steel (about 3.5 per cent silicon) is only about two-thirds that for good open-hearth iron.

The permeability at flux densities below 11,000 gausses is increased by the addition of silicon. Above this value the permeability decreases with increasing silicon. For the usual working flux densities around 12,000 gausses the permeability is somewhat reduced. This is a disadvantage as the permeability at working density is the limit in design, but the effect is not serious, because the change in permeability is small for this density. The results obtained by Ruder of the General Electric Company are shown in Fig. 4.

The saturation value also falls off with increased silicon content. This indicates that the silicon acts largely as a foreign substance and diminishes the active cross-section of the iron. This is not usually important in design, for the iron is not frequently worked near saturation. However, for armature teeth

[1]T. Spooner, *Electric Journal*, Vol. 14, page 91, March, 1917.
[2]T. S. Fuller, *General Electric Review*, Vol. 20, page 566, 1917.
[3]N. B. Pilling, *Electric Journal*, Vol. 19, page 469, 1916.
[4]W. E. Ruder, *General Electric Review*, Vol. 18, page 197, 1915.



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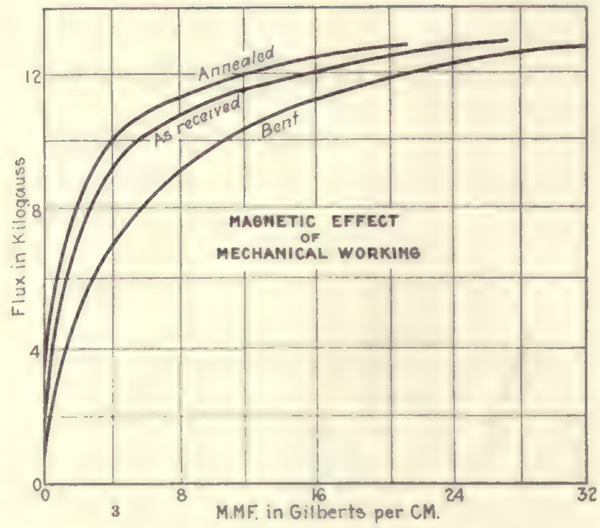

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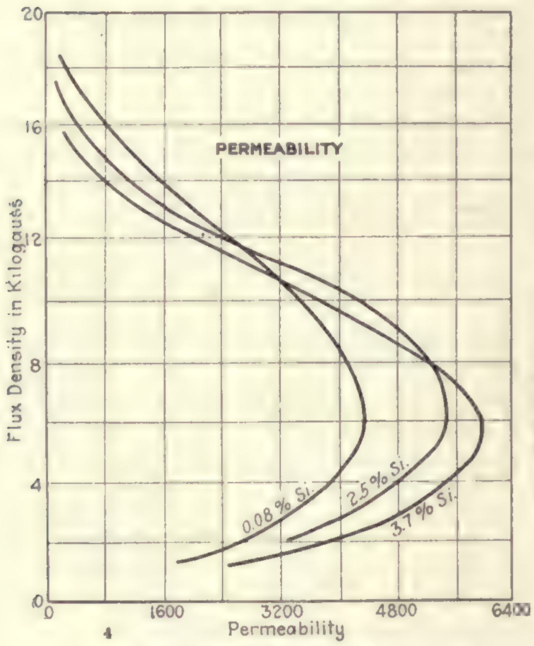

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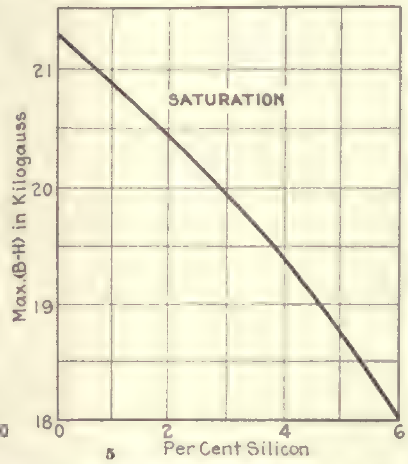

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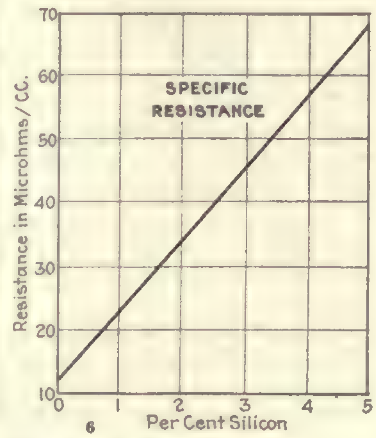

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FIG. 2—RELATION BETWEEN SILICON CONTENT AND HYSTERESIS LOSS. FIG. 3—BENDING AND ANNEALING HAVE OPPOSITE EFFECTS ON MAGNETIC PROPERTIES. FIG. 4—SILICON CONTENT INCREASES PERMEABILITY. FIG. 5—SATURATION IN TERMS OF PER CENT SILICON. FIG. 6—SPECIFIC RESISTANCE INCREASES WITH SILICON CONTENT

and similar places it is sometimes a matter of consequence. The results shown in Fig. 5 were obtained by Gumlich[4].

The effect on the electrical resistance is shown in Fig. 6. These results were obtained by Burgess. The eddy-current loss of course decreases with increasing specific resistance, and for this reason the high-silicon steel is used where lowest iron loss is desired [3,5].

The addition of silicon has also a marked effect on the ultimate strength and elastic limit of steel. The results in Fig. 2 were obtained by Yensen in his vacuum-furnace tests. The results on commercial samples give approximately the same results [6]. There is an interesting critical point at 2.56 per cent silicon. Alloys of this approximate composition were not forgeable and sometimes crumbled into crystals from ⅛ in. to ¼ in. across. Yensen suggests that this may be due to the compound $Fe_{19}Si$. Another critical point is found about 5 per cent silicon, which would correspond to $Fe_{19}Si_2$. However, there is not as yet sufficient proof to warrant this conclusion [2].

Along with the increase in strength, however, the steel becomes more brittle. With more than 4 per cent silicon the sheets cannot be sheared satisfactorily as they will crack along the edges of the cut [3,4].

It must be remembered that the curves shown above represent only a fair average of the results on many samples. In commercial steel it is not unusual to find two samples from the same manufacturer and with the same approximate composition one of which will be 100 per cent higher than the other in permeability, and the other qualities may vary accordingly [1].

From the above curves it is seen that the only disadvantage of adding fairly large amounts of silicon, about 3.5 per cent, is the increase in brittleness and lowering of the permeability at working flux density. For these two reasons high-silicon steel is not usually employed for moving machinery, a steel containing less than 1 per cent silicon being preferred. In the manufacture of transformers high-silicon steel is generally used as the losses are more important here. High-silicon steel is also used for induction motors sometimes.

Mr. Spooner of the Westinghouse company gives the following figures as a fair average for these two steels as manufactured commercially [1]:

Silicon Content, Per Cent	Hysteresis Loss per Kilogram (60 Cycles, 10,000 Gausses), Watts	Maximum Permeability	Permeability 16,000 Gausses
Low, 0.0–1.0	2.2	5,000–6,000	500
High, 3.5–4.5	1.3	6,000–7,000	250

All mechanical working, such as rolling, shearing,

[5] C. F. Burgess, *Metallurgical and Chemical Engineering*, Vol. 8, page 131, 1910.

[6] T. D. Yensen, *Bulletin 83*, *University of Illinois*.

punching, hammering and bending, tends to harden the steel. This is attended by an increase in hysteresis loss and a lowering of permeability. In taking magnetic measurements it is also important to remove all stresses such as may be produced by clamping in the permeameter, etc., for these will materially change the magnetic quality of the steel. An idea of the magnitude of this effect may be obtained from Fig. 3.

By annealing the harmful effects of working may be removed. It is for this reason that laminations for transformers, where it is important to have low losses, are always carefully annealed after punching. The first annealing after rolling may decrease the hysteresis loss by 80 per cent and increase the permeability by several hundred per cent.

Since Hadfield's discovery of the superior qualities of silicon steel many other substances have been tried as alloys, but none has been found which will give a product superior to silicon steel for general use. One very interesting alloy of cobalt has been found which has a saturation value about 13 per cent higher than pure iron and a permeability at high flux densities also greater than that for pure iron. Unfortunately, this compound has a low specific resistance; otherwise it would be well suited for use in armature teeth and similar places.

The most interesting work recently undertaken is that by Yensen upon the effect of melting in a vacuum. He has prepared alloys using very pure iron melted and alloyed in a vacuum furnace. By this means he has produced steel with a maximum permeability around 66,500 as compared with 11,000 for the best produced before this. He also finds a hysteresis loss of about one-third that of commercial steel. But there seems little hope of applying the vacuum method to the general manufacture of silicon steel, because of the cost of the vacuum-furnace treatment. However, the vacuum product promises to find application in many special uses, such as current-transformer cores, etc.[6]

For some time there was great interest in electrolytic iron, but the properties of this were not found to be superior to silicon steel for general use. However, by powdering and compressing electrolytic iron it is possible to make a substance having very low iron loss and a fairly constant permeability over a wide range of flux density. These are the properties necessary in the cores of loading coils for telephone lines, and this method of manufacture is now employed. Electrolytic iron is used because it is very brittle before the hydrogen has been driven off and can therefore be easily powdered. After powdering, the hydrogen is removed by heating[7].

[7]B. Speed and G. W. Elmen, *A. I. E. E. Journal*, Vol. 40, page 598.

Measurement of High Values of Insulation Resistance

Increasing Importance of Knowledge of Behavior of Insulation in Cables Leads to Refinements in Methods of Measurements

By J. B. WHITEHEAD

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IT IS well known that the resistance in ohms or megohms of nearly all classes of insulation used in electrical machinery varies so widely with the conditions of the material and of the test as to make this quantity practically valueless as an indication of the probable performance of the insulation. Measurements of insulation resistance by means of a series-connected voltmeter of known resistance, by the megger and by other types of ohmmeter give results which are of value only in equipment of relatively low voltage rating. In the case of high-voltage machinery such measurements serve merely as indications as to whether the insulation will stand up to the first applications of voltage, but throw little light on its subsequent behavior and life. In fact, it is a difficult matter to prescribe a set of conditions, even for a single type of insulation, in which a definite value of ohmic resistance may be measured with satisfactory uniformity on repetition. The Standardization Rules of the A. I. E. E. carefully avoid both the exact definition of insulation resistance

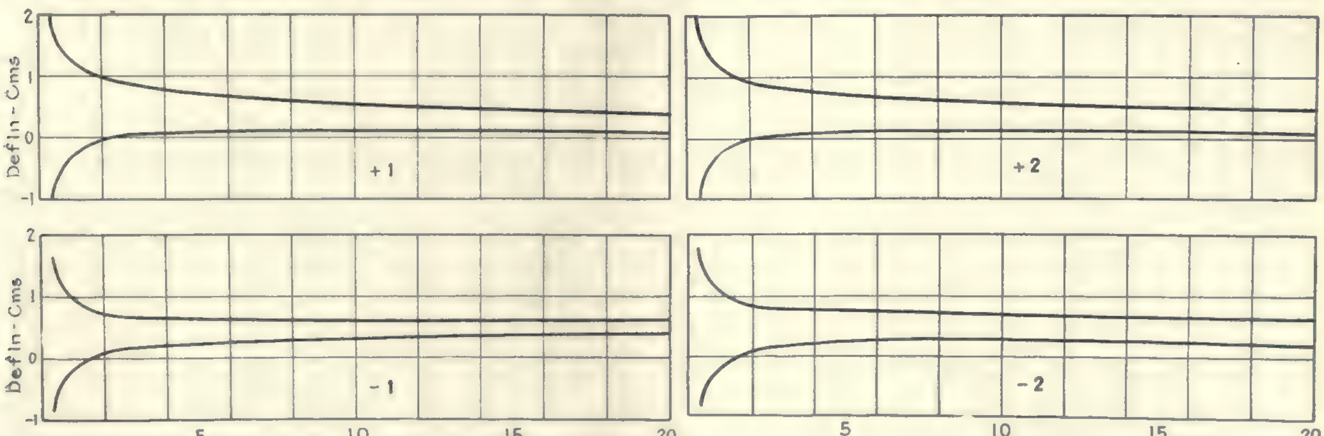


FIG. 1—CHARGE AND DISCHARGE DURING DIELECTRIC ABSORPTION TESTS

and the fixing of conditions for its measurement. In the section on wires and cables the leakage current after a one-minute application of voltage is given as the method for determining the *apparent* resistance of the insulation of a cable, per unit of length, but for the reasons mentioned no more accurate definition or specification is possible.

It is also well known that the explanation of these conditions lies in that property of all types of insulation known as dielectric absorption. When continuous voltage is applied to insulation, the flow of current is at first due to the charging of the electrostatic capacity, but it continues thereafter with decreasing intensity over periods of time relatively short in some cases, but in others extending to an hour or more. The insulation "absorbs" electric charge, and time is required for saturation. On short circuit, time is also required for the complete discharge. This phenomenon suggests a kind of electric viscosity.

Now, theories of dielectric properties, of which there are many, and none of them completely satisfactory, nearly all include the specific resistance of the dielectric as a definite property—subject to variations due to temperature and perhaps other influences, but nevertheless as definite as the specific resistance of conductors. And the total current at any instant after applying continuous voltage is the sum of the decreasing current due to dielectric absorption and the steady current due to the conductivity. Thus since the absorption current continually decreases and approaches zero after a time, the true conductivity or insulation resistance may be measured by reading the steady current at known voltage after the current has reached a constant value; that is, after the absorption current has died out. Unfortunately, however, the time required for the current to reach a steady state varies widely with different materials and in some cases is several hours. Figs. 1 and 2 show typical curves of the variation of current with time following the application of voltage. Both sets were taken on built-up flexible insulations, such as are used on machine windings and are composed of fibrous materials and mica. The curves of Fig. 2 pertain to a sample having a relatively small amount of mica and just manufactured; those of Fig. 1 pertain to a sample having a large amount of mica and after operation for some time under voltage and temperature. Comparing the curves for 1,200 volts and 1,160 volts, it will be seen that in Fig. 2 the current is still decreasing steadily after fifteen minutes, while in Fig. 1 the rate of decrease is extremely small after two minutes. Comparing further the current after one minute with the final steady reading, we find in Fig. 2 a probable ratio of from 5 to 6, while in Fig. 1 the value is about 1.7. Thus the common method of comparing insulation resistance on the basis of one-minute current readings is valueless, except perhaps as among samples of the same material. Even in that case the results would give a comparison only.

Measurements of both the absorption and resistivity of dielectrics and insulation of all types are very important for extending our knowledge both of the nature of dielectric phenomena and of the processes active in commercial insulation. In the latter case especially increasing evidence is being brought forward to show that the breakdown of insulation is closely related to resistance and absorption properties. Such measurements require instruments of great precision, in the case of alternating voltage for dielectric loss and power factor, and in the case of continuous voltage for current. This article is written principally to describe a difficulty encountered in measuring some of the higher values of resistance of commercial insulation, values from 100,000 megohms to 500,000 megohms. Samples of such insulation are often in the form of lengths of cable, assembled armature coils, and so possess considerable electrostatic capacity. If their resistance is relatively low and the absorption high, by spending sufficient time both absorption and resistance may be studied without trouble by the arrangement shown in Fig. 3. In the experiments referred to the galvanometer was of D'Arsonval type and had a sensitivity of 2×10^{-10} amp. per millimeter of scale. In the case of high resistance, measured after the dying out of the absorption current, the readings of the galvanometer

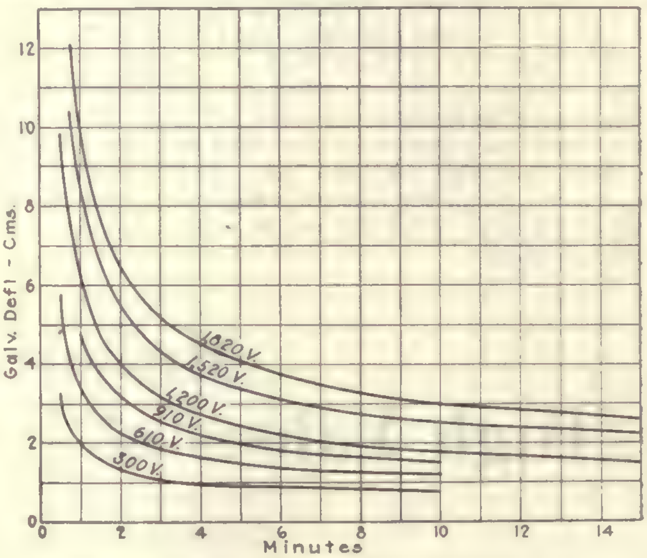


FIG. 2—INFLUENCE OF FOREGOING CONDITION ON DIELECTRIC ABSORPTION

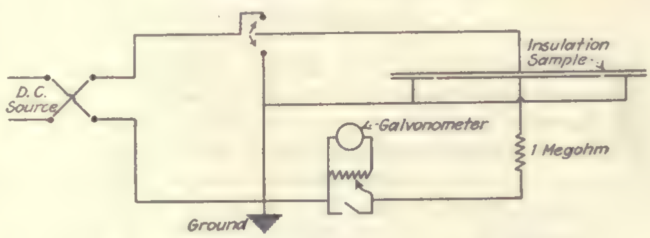


FIG. 3—ARRANGEMENTS FOR MAKING DIELECTRIC ABSORPTION TESTS

at full sensitivity were often of the order of 1 cm. or 2 cm. or less, at from 1,000 volts to 2,000 volts direct current. In this region it was found that the galvanometer readings were very unstable, the oscillations being erratic and at times violent.

The trouble was traced to small fluctuations in the applied voltage, fluctuations far too small to be detected by the usual direct-reading instrument, in conjunction with the capacity and absorbed charge of the sample. The first source of continuous potential consisted of two 1,800-volt direct-current generators in series, directly connected and directly driven from a storage battery. Although the utmost attention was given to all mechanical and electrical conditions, including various connections of shunted capacity and series reactance, and although apparently perfectly smooth and steady operation resulted, the conditions in the galvanometer circuit were little if any improved. The

generators were then abandoned, and rectified alternating voltage was tried. A directly driven 250-volt, 3,000-cycle generator was used, its voltage stepped up and rectified by a "kenotron," or hot cathode vacuum tube, and the output circuit provided with shunted capacity in the well-known manner. This arrangement under careful attention gave some improvement, but far from satisfactory conditions for observation. The operation of each of these sources of continuous potential was apparently perfect, as judged by ordinary tests, and, in fact, the galvanometer reading was the only indication of unstable conditions. There was, therefore, some doubt as to whether the trouble was in the source of potential or in the insulation itself. The samples were found to have values of electrostatic capacity in the neighborhood of 5×10^{-4} microfarads. The effect of a fluctuation of direct-current voltage may be estimated in terms of the change of charge of the capacity, the time involved in the change, the resulting equivalent current, and hence its effect on the instrument. Thus a fluctuation of 1 per cent in an impressed voltage of 1,000 volts, occurring in one-half second, would hardly be perceptible on a direct-reading instrument. Yet such a fluctuation would cause an oscillation of charge due to capacity alone equivalent to a current of 10^{-8} amp., or fifty divisions of galvanometer scale. It was fairly evident, then, that for the high values of resistance to be studied some other source of continuous potential would have to be used.

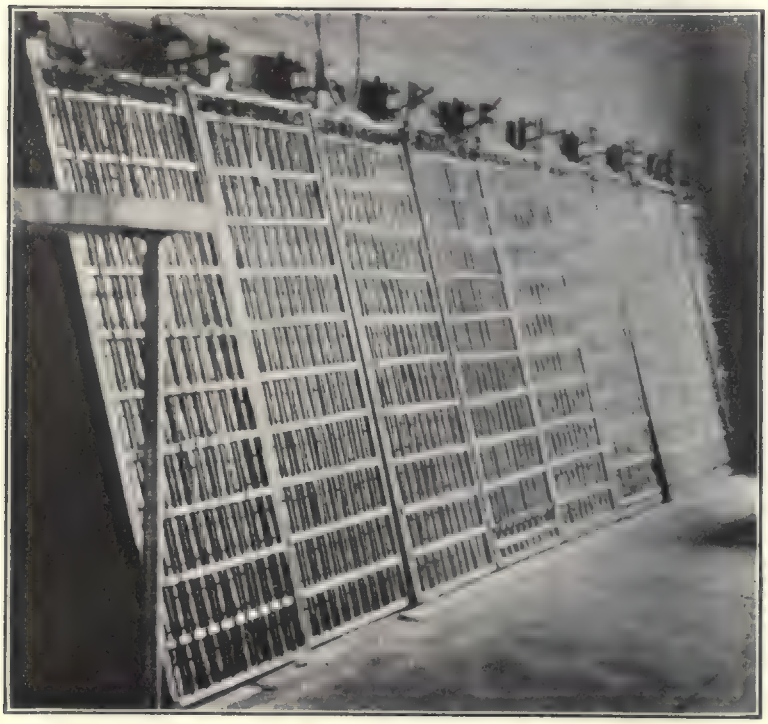


FIG. 4—HIGH CONTINUOUS CURRENT POTENTIAL OBTAINED FROM 2,000 RADIO PLATE BATTERIES

Both primary and secondary (i.e., storage) batteries have often been used for obtaining a constant and steady value of continuous voltage. By reason of their short life the use of primary batteries is usually restricted to relatively low values, say up to 250 or perhaps 500 volts. As to storage batteries, every well-equipped experimental laboratory has probably been through the experience of constructing a storage battery for high voltage. In fact, small-capacity cells assembled in groups for this purpose can be had on the market. The writer's own experience with a 9,000-volt battery of this character has been that unless the battery receives almost daily attention it deteriorates rapidly by sulphation and is expensive and troublesome unless constantly in service. In the present instance the battery referred to was not available for this particular research work.

RADIO PLATE BATTERIES GIVE MOST SUITABLE POTENTIAL SOURCE

Experiments on insulation at high values of continuous voltage have been rare, and there is some evidence that there are important changes in the normal properties as the voltage is raised. For a series of preliminary experiments it was determined to work up to at least 3,000 volts. Both the storage battery and the ordinary 8-in. dry battery were found to mount considerably in price, and so attention was turned to the small dry cells used for the plate batteries in radio work. Even these at the lowest marked rate cost about $5 per 100 volts. However, the interest of a well-known manufacturer was engaged, and 2,000 individual cells slightly defective in manufacture were obtained at a cost of about $50. These cells had a guaranteed life of one year. They were assembled in vertical columns of twenty cells each, and ten of these columns were mounted side by side, separated by wooden strips, in a shallow wooden rack set up on one end. The bottom of the tray and the sides of the vertical columns were lined with sheet fiber impregnated with paraffin. Ten such racks were required for the 2,000 cells. They rested on the floor, tilted slightly backward from the vertical, leaning against a side wall and being insulated from each by porcelain wiring cleats. In this position the weight of each column was used to assist the contact between the positive and negative terminals of adjacent cells. Sucessive columns were connected in series by soldered connecting wires, and a simple arrangement of switches, two bus lines and two flexible cables with spring-clip contacts permitted rapid adjustment for any voltage and also reversal of polarity. A photograph of a part of the complete set-up of the 2,000 radio plate batteries is shown in Fig. 4.

The battery gave excellent results from the beginning. The only difficulty encountered was with poor contact between some of the topmost cells. This was remedied by compressing each column with spiral springs or wedges between the topmost cell and the upper end of the wooden frame. This in turn necessitated crosswise wooden retaining strips to prevent the whole column of cells from buckling outward. With this done, however, no further trouble was encountered. Galvanometer deflections down to 1 mm. or 2 mm., at the highest voltages, were perfectly steady. Naturally, after a few months individual cells begin to fail, and the life of the whole is not much longer. But the cost of replacement is not high for important research, and for measurements of the character mentioned such a battery appears to possess electrical advantages equaled only by the storage battery, and in many cases to be preferred to the latter on the basis of maintenance and upkeep.

England's Latest Generating Station

Features of the Barton Station of the Manchester Corporation Electricity Department—It Is of the Superpower Type Sanctioned by Great Britain's Electricity Commission and Is Typical of Modern English Steam-Station Practice

(This is another article secured as a result of W. H. Onken's trip to and through Europe this summer.)

FIG. 1—COAL FROM BARGES IS REMOVED BY TWO OVERHEAD TRAVELING CRANES CARRIED ON A GANTRY 63 FT. ABOVE WATER LEVEL AND DISCHARGED INTO TWO WEIGHING HOPPERS OR TO STORAGE HOPPERS

THE new electric generating station of the Manchester (England) Corporation Electricity Department, which was formally dedicated a few weeks ago, represents the last word in English large modern power-station design and hence has attracted considerable attention. While the site at Barton, Trafford Park, is capable of accommodating 150,000 kw. of plant, there is no certainty that more than 75,000 kw. of equipment will ever be installed owing to limitations of condensing-water supply.

The present plant of 75,000 kw. obtains condensing water from the Manchester Ship Canal, and permission to utilize the water was obtained with difficulty. Should further abstraction of water not be allowed, sewage and subsoil water will have to be utilized, or a different site chosen for another power station. The new station and the work complementary thereto were designed by and the erection carried out under the supervision of S. L. Pearce, the chief engineer of the Manchester Corporation Electricity Department.

The station abuts Bridgewater Canal, over which coal may be brought from the West Lancashire coal fields, and a siding from the Trafford Park railways also permits direct rail communication for coal supply with the principal railway systems of the country. Storage is provided for 26,000 tons of coal, of which 3,500 tons are deposited in the boiler-house bunkers. Water-borne coal is removed from boat by two overhead traveling cranes carried on a gantry 63 ft. above the water level and discharged into two hoppers which feed automatic weighing machines situated outside the eastern end of the boiler house before it passes to the boiler-house bunker conveyors. If desirable, water-borne fuel can also be discharged into reinforced-concrete hoppers cantilevered out on the face of the dock wall and then fed onto the main conveyors for distribution on the storage ground.

Rail-borne coal is delivered to the station over a three-track coal viaduct, one track passing over the weighing machine and connecting with the full siding, and the remaining two passing over the unloading hoppers and also connecting with the railroad siding. The cars are unloaded by tippers of the cradle type, placed between the rails over the hoppers, the latter discharging at the bottom through a filler into the main distributing conveyors, which are of the gravity bucket

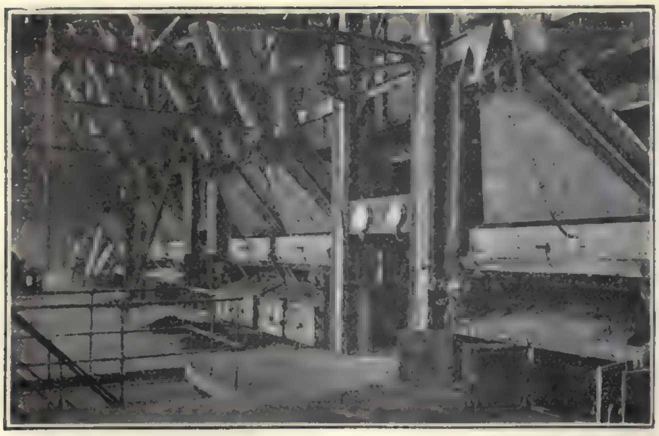


FIG. 2—NINE B. & W. DOUBLED-FIRED MARINE-TYPE BOILERS, OPERATING AT 375 LB. AND 738 DEG., ARE EQUIPPED WITH ECONOMIZERS AND AIR HEATERS

Normal rating is 100,000 lb. of water evaporated per hour per boiler. Chain-grate stokers are used.

FIG. 3—THREE RATEAU IMPULSE TURBINES ARE EACH RATED AT 27,500 KW., AT 0.8 POWER FACTOR, 1,500 R.P.M., AT A POTENTIAL OF 6,600 VOLTS

Multiple exhausts and bleeder heating are used. Each turbine has fourteen stages and fifteen wheels.

type. Ashes and clinkers are directly removed from the hoppers at the back of the boilers, either by railroad or industrial railway cars running on tracks in the basement of the boiler room at ground level.

Boiler Plant

The boiler plant of the Barton station is of considerable interest, containing as it does nine of the largest boilers in use in Great Britain. The units are of the double-fired B. & W. marine type and are fitted with both economizers and air-heating arrangements. There are nine boilers installed, and each of them is capable of evaporating 100,000 lb. of water per hour, actual, at its most efficient rating when supplied with fuel having a calorific value of not less than 10,500 B.t.u. During overload periods the boilers may be driven to evaporate 120,000 lb. of water per hour, actual, so that the total evaporative capacity for the station is slightly more than 1,000,000 lb. of water per hour.

Each steam-raising unit is complete in itself and consists of the boiler proper, superposed steam-tube economizer, integral superheater, air heater, chain-grate stokers, mechanically forced and induced draft plant, and a steel chimney—the latter being 9 ft. in diameter with a height of 100 ft. to the top from the firing-floor level. A grit arrester has been installed in connection with each chimney.

The plant is designed to operate at a working steam pressure of 375 lb. per square inch, and the superheaters are capable of imparting a temperature to the steam of 296 deg. F., making a final steam temperature of 738 deg. F. at the boiler stop valve. The boilers, which are fired from each end, are designed so that either coal or coke or other fuel may be burned separately or together in the furnaces. To assist the operating staff to obtain the best efficiency from the plant, a liberal provision of steam instruments is provided.

Turbine Installation

The present installation in the turbine room consists of three steam turbines of the Rateau impulse type, coupled to three-phase alternators, capable of delivering a maximum continuous output of 27,500 kw. at a power factor of 0.8. The turbines run at a speed of 1,500 r.p.m., and each is designed to develop at its most economical rating, the power corresponding to an output of 25,000 kw. and to carry for short periods a maximum load of 31,250 kw.

The normal conditions for which the turbines are designed are as follows: Steam pressure at turbine stop valve, 350 lb. per square inch gage; total temperature of steam and turbine stop valve, 700 deg. F.; vacuum at turbine exhaust at normal full load, 29.1 in.

One of the chief points of interest is the construction of the exhaust end of the machine, which is arranged on the now well-known multi-exhaust principle. The turbine has fourteen stages and fifteen wheels, the fourteenth stage having two exhaust outlets from which the steam is directed in a stream-line path to the condenser. The size of the exhaust opening is 8 ft. x 16 ft.

FIG. 4—SWITCHING IS DONE AT 33,000 VOLTS

The 6,600-volt generators are connected directly to their respective transformers through link switches only.

FIG. 5—VIEW OF SWITCHBOARD AND CONTROL ROOM

Six feeders are now supplying energy to the Manchester area, with two feeders soon to be added.

A bleeder feed-water heater forms a part of the turbine equipment, being inclosed in a compartment which extends across the turbine casing. The heater is exposed to steam drawn from one of the latter stages of the turbine.

The main alternators are designed on standard lines operating at 6,600 volts. Each machine is ventilated on the closed-air-circuit principle, cooling water being obtained from the main condenser circulating-water system, at the rate of 70,000 gal. per hour.

The main condensing plants are each designed for maintaining a vacuum of 29.1 in. when dealing with 240,000 lb. of steam per hour and supplied with 40,000 gal. of circulating water per minute at an inlet temperature of 55 deg. F.

They each have a cooling surface of 40,000 sq.ft. with tube lengths of 19 ft. 6 in., the tubes being 1 in. in diameter of Admiralty mixture and 18 standard wire

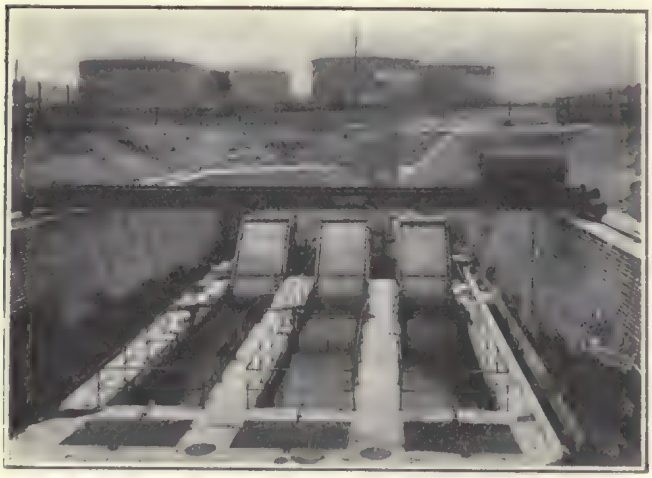


FIG. 6—CIRCULATING WATER IS TAKEN FROM THE MANCHESTER SHIP CANAL IN AN INTAKE AND SCREENING CHAMBER 26 FT. BELOW THE NORMAL CANAL WATER LEVEL

Inclined grid screens and traveling-band screens are placed at the entrance of the three water canals.

gage thick, and two water passes. The condenser shell is built of riveted and welded mild-steel plates with cast-iron waterheads and mild-steel doors.

The air-extracting plant is in duplicate, one unit being a kinetic rotary plant fitted with two steam jets in series, in addition to the water jet. The second unit is a steam ejector air pump of the three-stage type. Both plants are cross-connected so that they can be run singly or operated together. Each plant has a considerable margin above the normal air withdrawing capacity required.

The whole of the feed system is arranged on the closed-circuit principle. The condensate after withdrawal from the main condenser passes successively through the jet heaters, the main turbine bleeder heaters, the house-service turbine heaters and the Venturi meters to the boiler-feed pump suction.

The circulating water is taken from an inlet in the Manchester Ship Canal and is discharged at a point about 600 yd. below. The intake and screening chamber was excavated to a depth of 26 ft. below the normal water level of the canal and about 50 ft. below ground level.

The water thus obtained will have a minimum depth of 11 ft. in the chamber in the event of any accident to the gates at Barton locks, which have a lift of 15 feet. The water is drawn through three canals, fitted with inclined grid screens and traveling-band screens.

Six electrically driven pumps have been installed in the pump chamber below the turbine house, and each pump is capable of delivering 20,000 gal. of water per minute against a total head of 37.5 ft.

After passing through the condensers, the water is discharged into vertical wells in the floor of the turbine-room basement, which communicate with the outlet culvert. A midrib or weir wall extends the whole length of the chamber over which the water passes previous to returning to the canal, the discharge being made by ten openings at the bottom of the outer wall. The wall serves to distribute the flow along the whole length of the chamber and also serves as a measuring weir.

In the switch house are the main step-up transformers, wherein the voltage of generation is raised to 33,000. The middle section of the ground floor is occupied by the pressure-testing outfit, the main transformer oil-circulating pumps and water coolers and the neutral earthing resistances. The first floor of the switch house contains the main and auxiliary busbars, isolating switches, current and potential transformers, etc., while on the second or top floor are all the oil switches and reactors.

The whole of the switching is done at the full busbar pressure of 33,000 volts. No switchgear is interposed between the 6,600-volt and 33,000-volt circuits, as the generators are connected directly to their respective transformers through link switches only.

At the present time four feeders have been laid for transmitting the Barton 33,000-volt supply into the Manchester area. In addition, the Lancashire Electric Power Compny, which has entered into an agreement with the Manchester Corporation for a bulk supply delivered at the Barton bus-bars, has provided two feeders for its requirements. Two additional feeders will be provided by the Stretford Urban District Council for a similar bulk supply arrangement.

For receiving and transforming the Barton supply, the following distributing stations have been erected in the Manchester area: Stuart Street, Oldham Road, High Street (Chorlton-on-Medlock), Moss Side and Dickinson Street. The High Street station is the first complete outdoor substation operating at 33,000 volts in England.

Arizona Reports Large Central-Station Growth

The United States Census Bureau has just issued the following data on the central stations in Arizona:

	1922	1917	Per Cent* of Increase, 1917–1922
Number of establishments	31	29	.....
Commercial	27	25	.....
Municipal	4	4	.....
Income	$3,974,000	$2,141,000	85.5
Electric service	$3,917,000	$2,103,000	87.6
All other	$57,000	$38,000	50.0
Total expenses, including salaries and wages	$3,170,000	$1,752,000	80.9
Number of persons employed	608	436	39.4
Salaries and wages	$861,000	$451,000	90.9
Total horsepower of prime movers	71,922	38,662	86.0
Steam engines and turbines:			
Number	29	28	.....
Horsepower	22,029	23,870	—7.7
Internal-combustion engines:			
Number	28	15	.....
Horsepower	11,862	3,592	230.2
Waterwheels and turbines:			
Number	23	4	.....
Horsepower	38,031	11,200	239.6
Kilowatt capacity of generators	48,765	26,972	80.8
Output of stations, kw.-hr.	147,370,000	65,732,000	124.2
Number of consumers' meters in service	48,231	24,303	98.5
Number of customers	38,134	24,320	56.8

* A minus sign (—) denotes decrease; percentages not shown where base is less than 100.

Interconnection in New York State*

Study of Proposed Intercompany Network Designed to Give Largest Power Pool in America—Itemization of Savings, Operating Procedure and Control — Recommendation for Immediate Development

INTERCONNECTION of electric light and power systems is by no means a merely technical problem. It is an economic and a public policy problem of immediate importance. It has an important bearing on the question of state policy regarding water-power development and the regulation of electric utilities. The transmission lines committee believes, therefore, that the comprehensive study of the New York State situation which it has just completed has been most timely, and that its findings are worthy of careful consideration by the association and by its individual member companies.

The growth of the electrical industry has been from small individual plants into large systems made up of a number of plants feeding into transmission lines and supplying loads widely diversified in territory and character. The same fundamental reasons which have made it necessary to connect several plants in one system together and to replace small, inefficient plants with large plants operating at high economy apply to interconnections between the present systems, whether they be large or small. Interconnections between large systems have been working in some sections to a large extent for a number of years, and the advantages obtained have proved to be very large. The further advantages to be gained by still greater interconnection are apparently greater than those which have been obtained up to the present.

Outline of Advantages

Interconnections between the major companies throughout New York State will permit the following:

1. The loading of hydro-electric plants without pondage to full capacity at all times, thus conserving waste water in the normal light load period.

2. The hydro-electric plants with storage to store up water when the stream-flow plants are able to carry the load, so that the storage plants can carry greater loads during the heavy load hours.

3. The saving of waste power and relief to other companies by taking advantage of the diversity of water flow on different watersheds, particularly at the time of the early spring floods.

4. Relieving the load on steam plants to a large extent during the high-water period, thus making a direct saving in coal consumption. A further large economy can be effected by balancing the load and hours of load between hydro plants and steam plants, so that the steam plants will be run at economical loads when they are in operation.

5. The large and efficient steam plants to operate on base loads, thus requiring the use of the inefficient steam plants for short time peaks only or for short periods in the year. This in itself will make a large reduction in the coal consumption.

6. The present equipment to carry greater loads owing to diversity in loads on different systems.

7. Duplicate service in many instances, permitting restoration of service after trouble in plants or on other lines.

8. The amount of equipment necessary to carry in reserve against emergencies to be materially reduced.

9. The building up of a new plant to full capacity with large and efficient units at the time of initial installation, with a material reduction in the investment cost per kilowatt, and in carrying charges per kilowatt, owing to the fact that the interconnected system will supply sufficient load for the entire plant.

10. The postponement by some companies (by taking advantage of the situation mentioned in paragraph 9) of the development of a new plant, thus conserving capital charges.

The committee finds that interconnection in New York State, to an extent which is entirely practical, would, if lines and equipment were installed, permit the following:

In 1923, the release of 60,000 kw. of the present reserve capacity for carrying load. This represents the release of $7,875,000 in capital invested.

In 1933, a saving in installed capacity of 237,000 kw., representing a plant investment of $37,125,000.

The largest part of the generating capacity in the state is in the metropolitan district and in the Niagara district. A study of the relation of these two groups to the state as a whole, together with interconnections between other companies throughout the state, shows that approximately 40 per cent of the total generating capacity in the state would be affected by general interconnection.

If a portion of the money which normally is spent for generating plants be put into lines and equipment for interconnection, a much greater return may be made on the investment, as is explained below.

It is estimated that the energy generated by hydro-electric plants in the State of New York, with the exception of Niagara and St. Lawrence plants, will amount to 1,250,000,000 kw.-hr. in 1923; also that 250,000,000 kw.-hr. could be developed and disposed of as surplus hydro-electric energy.

It is estimated that 500,000,000 kw.-hr. will be generated by steam outside of the metropolitan district in 1923, and that 100,000,000 kw.-hr. of this steam energy will be developed from low-efficiency plants or from good plants operating at low load factor.

It is assumed that the 250,000,000 kw.-hr. of hydro-electricity is salable at 0.5 cent per kilowatt-hour and that the 100,000,000 kw.-hr. of steam energy would cost 0.5 cent less if generated in high-efficiency steam plants operating at high load factor. We have, therefore, 350,000,000 kw.-hr. at 0.5 cent, making $1,750,000 which could be saved or earned in 1923 by interconnection and efficient use of plants, leaving out the Niagara,

*Abstract of transmission lines committee report, convention of Empire State Gas and Electric Association, Lake Placid, N. Y., Oct. 8-9, 1923.

St. Lawrence and metropolitan groups. This amount, capitalized at 10 per cent, would justify an investment of $17,500,000.

The saving in coal would amount to 137,500 tons, which, at $6 per ton delivered, will be $825,000 saved in coal bills. This is based on the estimate that an average of 2¾ lb. of coal is consumed per kilowatt-hour under present conditions.

On a basis of the capital released, $7,875,000, and the capitalized operating savings, $17,500,000, an investment of $25,375,000 would be justified. If less than one-half of this one-year saving, or $10,000,000, be spent, it will provide all the more important interconnections.

The latest study shows a diversity in peaks in the up-state section of New York of approximately 29 per cent and the combined generating capacity to be greater than the simultaneous peak by 63 per cent. This figure of 63 per cent, however, includes a large amount of steam equipment installed to carry load during low-water periods, and it does not represent correctly the capacity which would be available for interconnected loads during the low-water periods.

The steam stations in the metropolitan district have a large reserve capacity, except during their lighting peaks. This excess capacity could be made available to other companies in the state for the greater part of the time that the up-state companies require steam capacity. The low-water period in the hydro-electric plants does not normally come at the time of the year when the metropolitan lighting peak is on, and even at the season of the metropolitan peak the actual duration of the peak load is not a large proportion of the total time. Therefore the metropolitan steam stations could supply a very appreciable part of the steam-power requirements of the up-state companies. By means of load displacement in the interconnected system very appreciable amounts of power may be transmitted over long distances without excessive loss. This plan of operation would permit the metropolitan companies to dispose of off-peak energy and would give an improved load factor. Owing to the high economy of these large steam stations, a large saving in total cost would be made.

Non-Profit Interchange Basis

In order to obtain all of the advantages of interconnection with other companies, as previously outlined, it is necessary that the flow of power over these lines be determined almost entirely by the physical requirements and the available sources of power. Operating agreements between different companies should be such that these agreements will not prevent the operating departments from obtaining power freely from other companies when required for load or to obtain economies. One way of accomplishing this, as has been done in some instances, is by making agreements covering interconnections and exchange of power in which the charges for energy are such that the delivering company neither makes nor loses any money by the transaction. In all phases of power exchange the same principle should apply.

One outstanding point is that one of the major savings obtainable by interconnection and unrestricted exchange of power is the release in capital investment and the reduction in operating costs. If the attempt is made by any company to obtain further advantages by adding a profit to the sale of interchange power to other companies, the major advantages of the entire plan are largely nullified.

These remarks do not, of course, apply to a straight purchase or sale contract in which firm power and energy is sold by one company to another.

The committee recommends that the towers and substations be erected to accommodate lines operating at 132,000 volts, the initial installation to be insulated for and operated at a lower voltage which will take care of the requirements in the near future. It is recommended that this lower voltage be either 66,000 or 110,000.

The frequency of 60 cycles is recommended as a standard for future construction, and it is recommended that systems operating at other frequencies change to 60 cycles if or when it is practical to do so.

Committee Organization and Personnel

The transmission lines committee was formed of system managers, superintendents and engineers from companies representing practically all classes of steam plants, hydro-electric plants, transmission systems and combinations of these, consulting engineers of several companies and representatives of the two largest electrical manufacturing companies.

The committee was divided into four sub-committees, which worked as follows:

1. The committee on load, distance and voltage made a study of the loads on the various major systems in the districts under consideration, the distance between the load centers of various systems and the voltages which appear best suited for the interconnecting lines.

2. The frequency committee made a study of the frequencies at which systems are operating at present in New York State, the load carried at the different frequencies and the policies of the various interests with reference to retaining the present frequency or adopting a frequency of 60 cycles; also of the relative growth of 60-cycle and 25-cycle systems throughout the United States as shown by reports from the two largest manufacturers of electrical equipment.

3. The line and substation costs committee made studies of the construction costs of transmission lines and substations for 66,000, 110,000 and 132,000 volts. Its report includes detailed estimates of these costs, together with such supporting data that these estimates may be used as a guide at any time by the substitution of revised cost figures. The report includes also one-line diagrams of the substations on which the committee's estimates were made.

4. The liaison committee gathered information from companies and organizations in Vermont, Massachusetts, Connecticut, New Jersey and Pennsylvania, and the results of its work outside New York State are shown on the maps prepared by the load, distance and voltage committee.

Discussion of Interconnection

This report is based on a survey of the electrical systems in New York State and to a limited extent in adjacent states, and is intended to show the possibilities and advantages obtainable through interconnection of the various systems for the interchange of power. The plan contemplates the exchange of power in amounts up to 25,000 kw. when operating at 66,000 volts, as is recommended for the immediate future. This interchange of power would be between adjacent systems or load centers or from generating stations of

one system to loads of another. In cases of long-distance transmission of power the operation would be very largely by means of load displacement. The report is not intended to cover transmission of very large blocks of power from generating sources to distant load centers, as was outlined in the superpower report. Interconnection, in order to be of maximum benefit, should be interstate as well as throughout individual states or sections.

Some provision will be necessary in operating organizations of interconnected companies in the direction of forming a clearing house for gathering and distributing the exchange power. It will be very advisable for some central operating organization to be set up to which reports of excess power, on the one hand, and demands for power, on the other, will be sent in regularly, so that a co-ordinating operator can arrange for the collection, transmission and distribution of the exchange power as required. Particular attention should be directed to the necessity of high-grade and adequate construction in all parts of the systems which become interconnected. The circuit breakers used in connection with the lines and substations should have sufficient capacity to take care of the full requirements. Connections between the main substations on the interconnecting systems and the local systems should be well protected by means of reactors, to prevent severe disturbances in case of short circuits in the local systems.

EFFECT OF INTERCONNECTION ON CAPITAL INVESTMENT AND PLANT CAPACITY

		Kw.
Generating capacity in New York State central stations:		
Steam		1,500,000
Hydro-electric		1,000,000
Total		2,500,000
Portion of above affected by interconnection		1,000,000
1923		
	Without Interconnection, Kw.	With Interconnection, Kw.
Plant capacity affected	1,000,000	1,000,000
Steam	400,000	400,000
Hydro-electric	600,000	600,000
Cost of above:		
Steam, at $125 per kilowatt	$50,000,000	$50,000,000
Hydro-electric, at $150 per kilowatt (present estimated cost)	90,000,000	90,000,000
	Kw.	Kw.
Reserve capacity over peak requirements (12 per cent)	120,000	180,000
Steam	*90,000	†135,000
Hydro-electric	*30,000	†45,000
Capital released for future load (difference between cost without interconnection and with interconnection)	....	7,875,000
1933 (9 Per Cent Annual Increase)		
	Kw.	Kw.
Plant capacity affected	2,370,000	2,133,000
Steam	870,000	783,000
Hydro-electric	1,500,000	1,350,000
Cost of above:		
Steam, at $125 per kilowatt	$108,750,000	$97,875,000
Hydro-electric at $175 per kilowatt (future estimated cost)	262,500,000	236,250,000
Saved by interconnection:		
Steam	....	$10,875,000
Hydro-electric	....	26,250,000
Capital released by interconnection		$37,125,000
Cost of interconnecting lines to make above possible		10,000,000
Line capacity (two No. 4/0 circuits), in kw.		25,000

* Reserve of each company available to that company or connected companies only.

† Available, up to capacity of interconnecting system, to any company.

Many times plans have been made for new stations, extension of existing stations or existing systems which have been proved in a very few years to have been entirely inadequate for the purpose. The caution is here thrown out that it is well to make plans for all new stations and extensions on a very broad scale, making provision in the plans, in the grounds purchased, and in some cases, in the buildings erected, for a very large expansion.

The supply of power from one transmission system to another necessarily reverses the direction of the normal power flow in the receiving system for a certain distance, and there is a consequent reversal of the voltage gradient over this distance. The distance over which the power flow is reversed depends upon the amount of power interchanged and the load distribution along the line. For a supply of power of reasonable continuity and for an appreciable period of time this reversal of voltage gradient can be met to some extent by changing taps of the transformers at distribution points, especially if such transformers are equipped with ratio adjusters which can be operated without removing manhole covers. This method, however, will be in most cases impracticable for intermittent supplies on account of the load interruptions required for operating the ratio adjusters. At an appreciably increased cost external reactances can be provided which will permit changing transformation ratios without load interruption.

More adequate correction of the voltage regulation can be effected by the application at proper points of synchronous condensers. These can be connected to the secondaries of boosting auto-transformers or three winding transformers with necessary taps in the high-tension windings. This synchronous-condenser equipment can probably be usefully employed at all times for voltage and power-factor regulation at the end of the transmission system, even when no power exchange takes place between the interconnected systems, and its installation will in some cases be justified without establishing the interconnection.

For the interconnection between the western and central New York systems the voltage regulation question is less serious on account of the necessary regeneration from 25 cycles to 60 cycles between these systems, which will permit of independent voltage control at the point of interconnection.

POWER CONTROL

The control within predetermined limits of the power supply between interconnected transmission systems, each having miscellaneous power sources, is a problem which has to be worked out by the respective operating organizations. Division of load between both systems, although somewhat influenced by voltage regulation and load distribution, is primarily determined by governor adjustment and characteristics of prime movers at each power source. At the present time there is no device available which will control the load division at points of interconnection. However, the problem of load division has been worked out satisfactorily for systems under control of one operating organization and also for systems under different operating control. It does not seem possible to work out in advance a method which will insure predetermined load division between interconnected systems, but through the co-operation of the respective operating departments this problem is capable of satisfactory solution.

The direct interconnection of two transmission systems without the introduction of a two-winding transformer may require for satisfactory operation that the transformer neutrals be connected to or insulated from ground in the same manner for both systems, in order that the relay and lightning-arrester operation in one system shall not be interfered with when interconnected with another transmission system. Moreover, the interconnecting of two systems necessarily exposes one

system to disturbances originating in the other system. In case of ungrounded or high-resistance neutral operation the accidental grounding of one conductor in one transmission system necessarily raises the voltage to ground of the two other conductors in the entire interconnected system to the full delta voltage. Some of the lesser insulated lines of one system may therefore cause considerable communicating trouble in the systems interconnected therewith, unless proper engineering and construction is followed.

If adjacent systems are supplied by power sources too far apart, and there is too much resistance drop in the lines between such sources, the generators of the respective systems may operate unsatisfactorily on account of hunting. While this is unlikely to occur on the systems in question, yet it is a possibility.

Existing Transmission Lines

Several transmission-line sections have been built with structures which will permit operation at 110 kv., or, if necessary, 132 kv. No circuits are operated at the present time at a higher voltage than 66 kv., but plans are being executed for increasing the operating voltage to 110 kw. on certain lines before 1924.

The lines through New York State from Westchester County in the south to Massena in the north and Niagara Falls in the west will be continuous by 1924 with the exception of three gaps:

1. From the northern terminal of the 45-kv. line of the Westchester Lighting Company at Peekskill to the United Hudson Company's at East Walden, approximately 30 miles.
2. From the Northern New York Utilities 110-kv. line at Brown's Falls to the southern terminal of the 80-kv. line of the St. Lawrence Transmission Company at Pyrites, approximately 23 miles.
3. From the western terminal of the 66-kv. line of the Adirondack Power & Lighting Corporation at Oneida to the eastern terminal of the 110-kv. lines of the Niagara, Lockport & Ontario Power Company at Woodward, a distance of approximately 30 miles. In addition to the connecting transmission lines, frequency-changing equipment is necessary for interconnection at this point.

As explained previously, however, some of the lines are of relatively small capacity.

[The present situation with reference to interconnection in New York and neighboring states is shown in a comprehensive map, prepared by the committee and published as a supplement to this issue of ELECTRICAL WORLD.]

The interconnected system, as covered in this study and as indicated in the table, will have a line capacity of 25,000 kw. at 66,000 volts. It should be kept in mind, however, that all companies in the interconnected system except those on the ends of transmission lines may obtain power from more than one direction, some of them possibly from three or four directions. The system as proposed would, therefore, make it possible for the intermediate companies to obtain two or more times the amount of power indicated if they have need of it.

Rural Electrification Experiment in Minnesota

Joint Investigation to Determine Maximum Economical Use of Energy on Farms—Other States Likely to Start Similar Studies

ELECTRIC utilities in Minnesota which have been active during the past in serving rural communities where it was economical to do so have taken the lead in actually starting a co-operative investigation to determine the economic possibilities in farm electrification. In other words, a study will be made jointly with farmers and others interested in agriculture in which it will be determined how far the electrical comforts and conveniences of city life can be extended to the farm and still be made to pay for themselves in value of home and farm work performed and saving in labor. This activity is in line with a movement initiated by the National Committee on Relation of Electricity to Agriculture (Dr. E. A. White, director, Chicago), which is composed of representatives of the United States Department of Agriculture, American Farm Bureau Federation, American Society of Agricultural Engineers, National Electric Light Association and manufacturers of isolated farm electrical equipment. Similar co-operative studies are expected to start very soon in other states, considerable interest having been manifested already in Iowa, Kansas, Wisconsin, Ohio, Alabama, California, Oregon, and New England.

EVERY ELECTRICAL CONVENIENCE FOR HOUSEHOLD AND FARM USE BEING TRIED OUT ON EXPERIMENTAL FARMS

To accomplish the results for which the national committee is working a conference of state farmers and others interested in agriculture was called in Minnesota by J. F. Read, president of the Minnesota Farm Bureau Federation, in co-operation with the Northern States Power Company, which is operated under the direction of the Byllesby Engineering & Management Corporation. It was acknowledged that the farmer wants elec-

tric service and should have it, but it was pointed out that it is an economic problem whether, under present conditions, electric service companies can furnish power in every rural community at rates which will be attractive to farmers and at the same time sufficiently remunerative to the supply company. It was also pointed out that the national committee has decided, after a general analysis of the situation, that the solution of the problem, if there be a solution, lies in a careful consideration of the information which can be obtained only after a study shall have been made of the following subjects:

1. Effect of power applications on agricultural prosperity.
2. Extent to which labor is used throughout the year on farms, with a view toward ascertaining how it can be maintained at a more uniform figure by greater application of power.
3. Total cost of farm operations and relation of farm power and labor expense thereto.
4. Extent of uses of power on different types of farms in different localities.
5. Use of power in foreign agriculture and practicability of adopting some foreign methods in this country.
6. Peculiarities and magnitudes of agricultural power requirements as well as hand operations that might be electrified.
7. How farm processes requiring mechanical or hand power can be modified to increase economy of operation.
8. New applications of power on farm.
9. Maximum economic use of power on farms with present practices.
10. Possibility of conducting some industrial operations in rural districts to utilize labor during off-peak farm activity period.
11. Effect of electricity or some of its converted forms on plant growth, bacteria, preserving milk, curing hay, drying fruit, etc.

INVESTIGATIONS THAT ARE IN PROGRESS

Some of these investigations will have to be conducted nationally, it was explained. For example, considerable information regarding items 1 to 6 inclusive has already been collected by the Department of Agriculture but must be culled out of records and reclassified. This is a big job on which the Department of Agriculture is already at work. Farm management associations and agricultural schools will undoubtedly be interested in studying item 2. Item 4 is a subject which Secretary Hoover of the Department of Commerce promised to investigate at a recent conference between the national committee and some Washington officials. Items 6 to 10 inclusive are subjects which it is believed can best be investigated in state co-operative committees. Item 11 is chiefly a subject for agricultural colleges or private and commercial laboratories. The chief thing is to have these activities co-ordinated and directed. This will be done in a national way by the national committee, while state committees which may gradually be formed will function as the co-ordinating force on local matters under the supervision of the national committee.

In the Minnesota conference at which these plans were discussed it was pointed out that items 6 to 10 inclusive are subjects which are within the province of investigation by state co-operative committees. To enable these investigations to be conducted, the electric company proposed (1) to build a short experimental line from one of its primary transformers through a rural community composed of a dozen or so farms; (2) to furnish power at a reasonable charge to be determined later; (3) to assist in securing farm equipment free of charge from manufacturers; (4) if the farmers would co-operate, to keep records of costs, economies and benefits derived from different electrified devices and processes. Several farmers manifested their interest by accepting the terms and Red Wing has been selected as the point just outside of which the trial line will start. It will be at least 5 miles in length and serve at least fifteen farms from a primary transformer. (See ELECTRICAL WORLD, Nov. 10, page 981). Each customer will be permitted a demand of 3 kw. on which he will pay a fixed amount per month to cover overhead charges on generation and transmission. The 5-mile rural line in this case will cost about $4,875, or about $325 per farm, excluding connecting lines to the farmhouses and buildings. In any case the farmers will pay for the low-voltage services from the distribution line to the farm house or buildings, and the supply company will furnish and install the meter.

COST OF RURAL LINES TO FARMER

If the farmers pay for the erection of the line and turn it over to the supply company for maintenance, the total fixed charges for each farmer will be $4.76 per month. If the supply company builds it, the charge will be $6.90 per month. To these fixed charged are added 75 cents a month per customer for reading the meter, bookkeeping and "shooting" line trouble and 25 cents a month per customer for transformer losses. Energy will be charged for at the rate of 5 cents per kilowatt-hour for the first 30 kw.-hr. and 3 cents per kilowatt-hour for excess. On this basis and with the company building the line, the total cost to a farmer using 100 kw.-hr. per month will be $10.50 per month, or 10.5 cents per kilowatt-hour if all fifteen farmers participate. If he uses only 30 kw.-hr., the total monthly cost will be $8.40, or 28 cents per kilowatt-hour.

The farmers were apprised of the fact that if they used energy only for lighting their expense would be high, but if they found other uses that would raise the consumption above the average of about 27 kw.-hr., the cost would be reduced in proportion to the extent of use. The aim is to show how farmers can use 100 kw.-hr. a month to advantage without exceeding a 3-kw. demand. It was pointed out that any benefits resulting from electrification which in the aggregate would be equivalent to $125 per year in reduced operating expense, convenience or the like would pay for 100 kw.-hr. per month. Any greater advantages would make the use of electricity an economical investment.

On these experimental farms it is purposed to install every electrical convenience for household and farm use. The women's work will be lightened by washing machines, ironers, vacuum cleaners, dishwashers, toasters, etc. To aid the men in their work equipment will be provided for milking, separating, pumping, grinding, threshing, etc. The extent of electrification will be limited only by the character of the farming conducted and by the variety of equipment that can be obtained or newly invented. Energy required for operating equipment which does not show favorable results will be deducted from the farmer's bills.

With the data which are to be collected from these

experiments and the results of first-hand studies to determine how farm operations can be modified to adapt them to more economical use of power, it is expected that farmers can be informed definitely of ways in which they can use electricity to more extensive advantage; manufacturers of equipment will become better acquainted with the farm-power problem; agricultural engineers and farm management associations and similar bodies will be better equipped to advise desirable changes in farm operation, and electric service companies will be able to develop rural loads which can be served at attractive rates and still earn a reasonable profit.

Standardization of Electrical Units in Terms of Length, Mass and Time

A MICROMETER of extraordinary accuracy, capable of determining measurements of one one-hundred-thousandth of an inch, has been perfected by the Bureau of Standards for measuring the diameter of some 12-in. porcelain cylinders to be used in electrical measurements. The new instrument makes measurements independent of the observer. In order to obtain this degree of accuracy it is necessary to operate the micrometer from a distance and to take readings from it through a telescope, lest the heat of the observer's body warp the thick steel ring sufficiently to cause an error. Both the instrument and the cylinder must be kept in a constant-temperature box during the measurement.

The micrometer consists of a cast-iron ring large enough to pass easily over the 12-in. cylinders. On opposite sides are the micrometer screw and the contact pin, while at right angles are adjustable lugs for centering the device on the cylinders. The micrometer screw is driven by a tiny electric motor, and when it has pushed the cylinder against the contact pin the latter breaks the motor circuit and stops the screw. The whole device when in use is suspended by three light rods and can move freely the short distance required. The cylinders which are to be measured will be wound with wire on a precision lathe and will form inductance coils of very accurate construction whose inductance can be calculated from the dimensions.

This research is a part of a program for standardization of all of the electrical units in terms of the fundamental standards of length, mass and time.

Six Hundred and Sixty City-Owned Plants Abandoned

MORE than 660 municipally owned electric plants and other public utility properties have either been abandoned or have reverted to private ownership, according to a survey just completed by the National Electric Light Association, which was based largely on United States Census Bureau compilations. The report shows that the average rate of municipally owned plants is more than twice as high as the average rate of all companies reported. Other facts disclosed by the report are:

In 1912 power was purchased by 8.7 per cent of the municipal plants. In 1917 power was purchased by 23.3 per cent.

Of the population of the United States served with electricity the companies serve 93.8 per cent and the municipal plants 6.2 per cent.

The average city tax rate in 1921 as shown by the United States Census in cities of over 30,000 having municipal plants doing commercial business was $19.31. The average city tax rate for the non-municipal plant cities nearest in population to the above was $15.50. Exempting municipal plants from taxation necessarily means that the tax rate on other property must be increased.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

No Interference from Supervisory Control

To the Editors of the ELECTRICAL WORLD:

Some engineers have raised the question of whether there is not a probability of inductive interference being caused by the use of supervisory control systems, especially if the distributor system with polarized relays is used. These engineers and other skeptics must remember that interference can occur only between open wires. If either the power or control circuits are inclosed in cable, this condition is eliminated. Furthermore, even if open wires are used, the relays which are used in the supervisory system will not respond to the commercial frequencies which can be transferred from a power line to the supervisory control circuit. Consequently the argument that the polarized relays make the distributor system susceptible to inductive interference does not hold. CHESTER LICHTENBERG.

General Electric Company,
Schenectady, N. Y.

High-Class Overhead-Line Construction

To the Editors of the ELECTRICAL WORLD:

It is a very great pleasure to inspect overhead-line construction of the high class shown and described by D. J. White in the ELECTRICAL WORLD for Sept. 29, page 662. It is easy to understand, with secondaries and primaries laid out as Mr. White has done, why troubles were reduced by two-thirds. The proper use of secondary racks is in sharp contrast with the slovenly construction that is all too prevalent, and Mr. White is to be congratulated on the showing he has made.

The proper location of the neutral on the top spool of the rack is so infrequent as to excite comment when it is tied in correctly. One of the chief advantages of the secondary rack is the means of interposing the grounded neutral between falling primaries and the "outside" legs of the secondary main, yet the writer knows of several cities where a general rebuilding is in progress using secondary racks, where the neutral is tied into the middle insulator, leaving the upper wire exposed to falling primaries and foreign wires. It is extremely doubtful if such construction justifies the expenditure necessary to change from the cross-arm type of construction, especially if extremely light-weight racks with their attendant short life be used.

The writer has always advocated, as a means of avoiding future troubles from secondary racks, that the wires be tied on the outside of the insulators, i.e., on the side away from the pole. It is a more or less natural procedure for a lineman to pull in the wires between insulator and the steel of the rack, as a means of support is thus afforded during stringing, and it is also argued that if the wires should ride down off the insulator at a

later date, they will not fall to the ground. It should be appreciated, however, that, if they should ride down, they will in this position ground on the steel of the rack, and inasmuch as the displacement from normal position will be only about two inches, it will be difficult for a trouble shooter to locate the fault. If the wires are tied on the outside of the insulators, a loose wire would fall free of the rack and be supported by adjacent poles at a level several feet below the rack in a position very easy to detect. If racks are used for crossings over busy streets, tracks or where clearance is small, the inside tie would probably be desirable, but in residential sections and outlying districts, where secondaries sometimes stretch out to a pretty good length, the outside tie is felt to be far superior.

L. C. PETERMAN,
Engineer Electrical Division.
Dwight P. Robinson & Company,
New York City.

Why All Test Data on Oil Circuit Breakers Cannot Be Divulged

To the Editors of the ELECTRICAL WORLD:

Regarding the questions which have been asked concerning my letter of Sept. 15 in reference to plain-break versus explosion-chamber types of oil circuit breakers, it should be realized that a great deal of the information which might be requested concerning these breakers is considered as confidential technical data by the General Electric Company and not to be divulged to any one at this time. The reason for this stand is twofold.

Improvements are being made in the oil-circuit-breaker art as a result of the thousands of tests which have been made and which are being continued daily, and it is not desirable to divulge all the test data until the improvements have been completed. Moreover, the engineer or operator who might request the information might easily draw wrong conclusions from the data submitted, because he has had no opportunity of learning facts and will draw what to him are logical deductions and make serious mistakes in so doing.

From his experience with mechanics, electricity and magnetism and the accurate constants pertaining thereto, he would draw logical conclusions, but with the plain-break oil circuit breaker there are no such general accurate constants in the present type of apparatus. To draw safe conclusions an accurate knowledge of the maximum or minimum value of widely varying values must be had, and these can be had only as the result of exhaustive tests made upon full-size apparatus equipped with the necessary measuring instruments.

For instance, a series of one hundred short circuits by an oil circuit breaker on a given generator and circuit upon which no changes are made during the tests may give an arc length of 2 in. or less as a minimum and 9 in. or 10 in. as maximum. The gas generated may be, as an illustration, perhaps 1 cu.ft. or 3 cu.ft or more. The engineer without experience would reason that interrupting a given current at a given voltage under given conditions would give a definite arc length and a definite quantity of gas generated, but in so doing he would make a serious mistake.

Data obtained from tests made with small apparatus are useless when applied to the design of large ones. The results of foreign tests are being used today by engineers to check up the probable modern oil-circuit-breaker performance. No greater mistake could be made than to use the results of these tests for such work. The above remarks, which apply particularly to plain-break breakers, have been made that engineers may have a better conception of the functioning of the oil circuit breaker and of its extreme fluctuations. In the case of the explosion chamber the variations are much less than in the case of the plain break, and the breaker performs much more consistently.

My letter of Sept. 15 was not written with the idea of giving specific data on any particular oil circuit breaker, but to confirm the South African conclusions and to compare more specifically the two types of breakers, and to that end all conditions affecting a series of tests of the two breakers were made as nearly identical as it was possible to make them. Neither type of breaker was favored in any way, and the results obtained indicate the efficiency of the two types tested as nearly as we are able to make comparisons.

Whether the tests were made single-phase or three-phase, delta or Y, grounded or ungrounded, at unity or zero power factor or intermediate value, whether the breaker was connected to an isolated bus with no other load or in multiple with loads of static transformers, induction or synchronous motors and loads of various magnitudes, whether the test was made at the end of a long line or at the generating station, what the full speed of the breaker (at no load) may have been, are all of no moment and would act only to confuse the results in the mind of the reader. The vital fact is that during the comparing tests all conditions were the same for the breakers being compared so far as we were able to make them the same. If one breaker has, for instance, a different speed characteristic than the other under load, it will show up in the behavior of the breaker and be charged against or credited to it in the final conclusions.

A pertinent question might be asked in reference to the curve Fig. 6, showing the variation of arc lengths with the current. Strictly speaking, this plot does not show the arc length unless this length is represented by a straight line between contacts. The ordinates do represent the *separation* of contacts at interruption, and it was assumed that the arc did hold in a straight line between stationary and movable contacts.

With very heavy currents the arc is undoubtedly deflected from the straight line by the inherent magnetic blow-out effect and the mean arc length would undoubtedly be greater than the direct line between contacts at interruption. It should be remembered, however, that with high-tension circuits the current is not sufficiently large to give any pronounced blow-out effect, particularly as this blow-out effect is not entirely (or largely) due to the normal field between studs of the breaker, but is due to a local loop of fairly small diameter which is made possible by the small separation of contacts required for interruption at comparatively low voltages. With high-voltage circuits this condition does not exist, and the inherent magnetic blow-out effect is comparatively small and of little value in determining the interrupting capacity of such breakers.

The switchboard department of the General Electric Company would be glad to answer directly to the inquirer such specific questions as may be asked on its oil circuit breakers of any type, if the question can be answered without the divulging of confidential data. There are many questions that can be freely answered and explanations that can be made which will greatly limit the liability of drawing wrong conclusions.

JOHN D. HILLIARD,
Switchboard Engineering Department.
General Electric Company,
Schenectady, N. Y.

Central Station and Industrial Practice

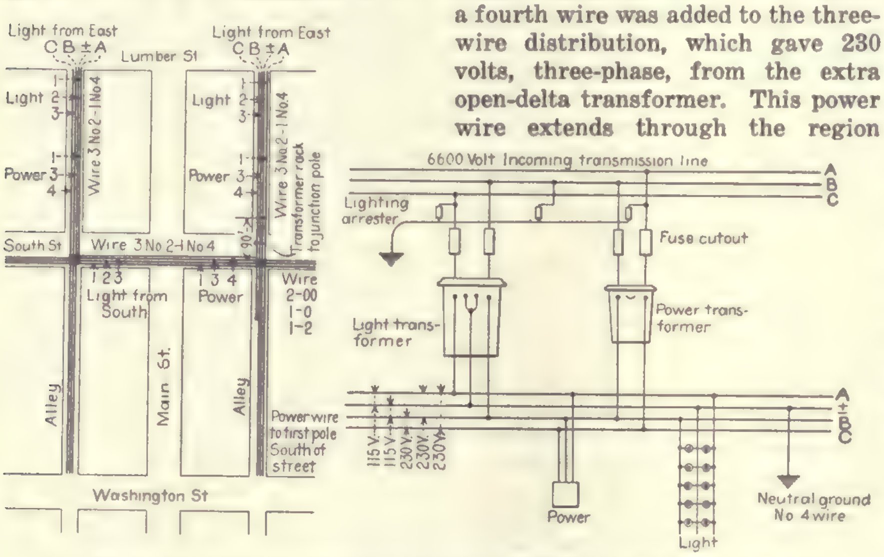
Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Supplying Power Lines from Lighting Circuits

BY D. G. WALLACE
Operating Engineer Illinois Power & Light Corporation, Bloomington, Ill.

IN LAYING out distribution circuits in localities where power loads are not large enough to warrant the additional heavy distribution investment, some scheme must be worked out which will not seriously jeopardize the line regulation of the lighting consumers. This situation is not so troublesome in virgin territory as in places where the distribution circuits have grown up rather hurriedly owing to a rapidly growing demand for power during the past few years.

Such a problem confronted the Illinois Power & Light Corporation when it was required in 1921 to give service to the town of Flanagan, about 40 miles north of Bloomington, Ill. But since there had theretofore been no electric power in the town, the utility company had a chance to develop a complete new distribution system without being hampered by questions of old investment and precedent. The manner in which the company handled the circuits to include power consumers without entailing very much additional expense is shown in the accompanying illustration.



SUPPLYING POWER IN CONJUNCTION WITH LIGHTING CIRCUITS IN SMALL COMMUNITIES

The transmission voltage entering Flanagan was 6,600. This was stepped down for the lighting distribution circuits to 115 volts and for power to 230 volts. The general lighting distribution was handled through three transformers, while for power a fourth transformer was connected open-delta as shown in the accompanying illustration. All main secondary circuits were run three-wire with the center wire two sizes smaller than the others. For power a fourth wire was added to the three-wire distribution, which gave 230 volts, three-phase, from the extra open-delta transformer. This power wire extends through the region where large motors are employed. Such an arrangement avoided the added expense of a separate power circuit of three wires, and as the power load is nearly all in the daytime, this system makes a flexible distribution, keeping the costs at a minimum.

For balancing loads a distribution map was drawn up as shown. It indicates the transformer location and the wire sizes and differentiates between the power and lighting circuits. For street lighting a constant-current, 220-volt transformer operating at 6.6 amp. is connected directly to the power transformer, thus eliminating the expense of a 6,600-volt street lighting transformer.

Check Tests on "Glassteel" Lighting Unit

TESTS have been made by the National Lamp Works and the Commonwealth Edison Company to determine the characteristics of the "Glassteel" lighting unit made by the Benjamin Electric Company, which were reported by Wyllis E. Quivey, illuminating engineer of the Benjamin company, at the Chicago Section meeting of the Illuminating Engineering Society, Oct. 31. This unit is similar in some respects to the RLM reflector, but has a diffusing-glass inclosure for the lamp and permits some light to radiate toward the ceiling.

According to tests, the light in the 0-60-deg. zone ranges from 42 to 46 per cent of the bare lamp flux; that in the 0-90-deg. zone ranges from 54 to 60 per cent; that in the 90-180-deg. zone is about 7 or 8 per cent, while the flux in the 0-180-deg. zone is 62 to 67 per cent. The published efficiency of the RLM dome, it was reported, is 66 per cent, or slightly more than the average for the new unit.

Using a 300-watt clear lamp in the "glassteel" unit, the brightness per square inch of exposed surface ranges from 3 cp. to 8 cp., as compared with 15 cp. for the RLM dome. When sighted at an angle of 45 deg. the brightness contrast between the new unit and the ceiling is about 250 to 1. This condition existed with a unit mounted 36 in. below a whitewashed tile ceiling in fair condition. Compared with this the brightness contrast of an RLM dome is 1,000 to 1 and upward, it was contended.

Demonstrations showed that the shadows from the "glassteel" unit are more vague and more luminous than for an RLM reflector because of the greater uniformity of brightness across the open mouth of the new unit. However, the new unit requires more attention for proper maintenance, since the depreciation in efficiency under the same conditions was in the ratio of 22.9 to 16.3 for the "glassteel" and RLM respectively.

Testing and Repairing Poles on Transmission Line

BY J. H. SIEGFRIED
Superintendent of Power Pacific Power & Light Company, Kennewick, Wash.

TO PREVENT failures and prolong the life of a 45-mile, 66,000-volt transmission line from Walla Walla to Pasco, Wash., the Pacific Power & Light Company is carrying on a thorough inspection and repair of defective poles. The line was built in 1911, and during the early part of this year heavy wind storms broke a number of poles in a section of the line which had not been inspected, showing the necessity of a systematic inspection and repair of the whole line.

The work consists of straightening, resetting, stubbing and reguying the poles where necessary. Five men with a Dodge truck compose the crew. Every pole is first tested by digging 18 in. below the ground line on one side and boring a ¾-in. hole diagonally from that point about two-thirds of the way through the pole. The borings are watched and examined carefully and indicate the condition of the heart of the pole. If the pole is found solid, the hole is filled with creosote and a cedar plug is driven in to prevent any decay starting at the test hole. If the pole is unsound, a hitch is taken around it and a double set of triple sheave blocks attached to an 8-ft. A frame (shown in Fig. 1) is used to raise the pole from the ground. Temporary side guys keep the pole upright as the work must be done with the line "hot." The pole is sawed off just above the ground line and the butt swung to one side. The remaining stub is pulled out with a pole jack as shown in Fig. 2. After creosoting the butt of the pole and cleaning out the hole, the pole is lowered into the hole and retamped. Before the hitch is taken on the pole it is creosoted to a point which will be above the ground line when the pole is reset.

The creosoting is done in a novel and effective manner. A piece of 6-in. pipe, fitted with caps at both ends, is used as a storage tank. In the cap at the top was placed a valve stem from an automobile tire. Eight feet of hose fitted with a nozzle, such as that used in spraying fruit trees, was attached to a valve in the cap at the lower end. The tank is partly filled with creosote and air pumped in with a hand tire pump. The creosote is effectively sprayed into all cracks and checks, the operation requiring less than one minute per pole.

At points where trees prevent the resetting of poles they are stubbed. Grass and weeds are removed from a 6-ft. circle around the poles and the line is left in first-class condition. The total cost of the work done on 709 poles was $1,150.85, an average of $1.62 per pole. Seven poles were reset in one day at a cost of $32.08, or $4.58 per pole. In another day ninety-one poles were tested and weeds removed at a cost of $27.65, or $0.304 per pole. The average cost of testing and cleaning 709 poles was $0.397 per pole. Only fourteen poles had to be stubbed. This work cost $149.77, or $10.55 per pole.

A card record is kept of the inspection and work done on each pole.

FORM 1080
PACIFIC POWER & LIGHT COMPANY
POLE RECORD

Walla Walla-Attalia SECTION POLE NO. 742 HEIGHT 60 FT.

CONSTRUCTION		ARM		INSULATORS				GUYS	CIRCUITS		TELEPHONE	
ST. LINE	✓	SINGLE	✓	TOP		BOTTOM		NO.	DOUBLE		BRACKET	
CORNER		DOUBLE		PIN	SUSP.	PIN	SUSP.		SINGLE	✓	PIN	✓
STRAIN		BUCK		NO.	NO.	NO.	NO.	TYPE			TRANSPOSITION	
SEMI-STRAIN				1		2						
TRANSPOSITION		OTHER WIRES ON THIS POLE		6600 Volt Distribution Line from TOUCHET SUBSTION								

INSPECTION

DATE	BY WHOM	CONDITION AS FOUND	WORK DONE TO CORRECT DEFECTS	DATE
4/14/23	Smith	Rotten Butt	Cut off and Reset	4/16/23

FIG. 3—TYPE OF CARD USED FOR PERMANENT POLE RECORD

The back of this card is ruled for noting all insulator changes. One column gives the date of change and another the position of insulator and the reason for the change.

FIG. 1 (LEFT)—METHOD USED IN RAISING POLES TO BE RESET. FIG. 2 (RIGHT)—PULLING OUT A BUTT WITH A POLE JACK

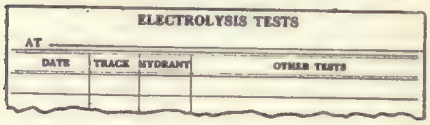
A sample of the card used is shown in Fig. 3. The upper part of the card is used for a record of the type of line construction used on the pole. The result of the inspection is shown on the lower part of the card, while on the back a record of insulator changes is kept.

Systematizing Electrolysis Tests on Cable Sheaths

Electrolysis tests on cable sheaths of the Worcester (Mass.) Electric Light Company have lately been organized on a routine basis. All electrolysis matters are under the supervision of the company's distribution engineer and instructions for testing have been prepared as follows:

All matters connected with electrolysis are under the supervision of the distribution engineer. Electrolysis tests shall be made by the meter department on his request.

About July 1 of each year the distribution engineer shall furnish the meter engineer with a list of locations of manholes where electrolysis tests are to be made, and the tests shall be made as soon as possible thereafter by men from the meter department. The test consists of voltage readings between the sheaths of the Worcester Electric Light Company cables and the rails of the Worcester Consolidated Street Railway Company, and also, where possible, between the cable sheaths and a hydrant or other part of the city water system. Twenty readings must be taken, spaced ten seconds apart. The readings are not to be taken if a street car is within 200 ft. on either track.



TYPICAL FORM FOR RECORDING ELECTROLYSIS TESTS

For each location a report must be made out by the tester on the form shown in the accompanying illustration. The voltage recorded should be the average of the twenty readings taken, and it should be plainly indicated whether the voltage is positive or negative. If some of the readings are positive and some are negative, the voltage recorded should be obtained as follows: The positive and negative readings should be added separately, the smaller sum subtracted from the greater, and the sum remainder divided by twenty, the polarity being that of the greater sum. If the manhole has water in it or is otherwise in poor condition, this should be reported on forms suitable for this purpose. At the same time the electrolysis tests are made the maximum demand meters at the Madison Square substation of the Worcester Consolidated Street Railway Company and in various manholes should be read and reset and the readings recorded on the proper meter reading cards. These meters should also be read about Jan. 1. The reports of the testers and the results of the maximum-demand-meter readings shall be turned in by the meter engineer to the distribution engineer.

A map showing the results of the tests at the different locations shall be prepared under the direction of the distribution engineer, who will then see that the reports are properly filed for the service office. This map shall be kept on file in the service office for each location where electrolysis tests have been made. These cards shall be filed alphabetically by streets. The result of each test shall be transferred to the corresponding cards from the report of the tester under the direction of the chief clerk of the service department.

Estimated Cost of Making Substation Changes

A Massachusetts central-station company serving a manufacturing city of about 20,000 population has found that increasing business requires the installation of voltage regulators for a new bank of 1,250-kva. transformers, building a new 13,000-volt bus structure with outdoor switches, installing a set of 2,500-volt oil switches and recoppering a principal power circuit.

A new transformer bank of 3,750-kva. total rating requires a set of regulators to enable the company to furnish a more acceptable commercial service voltage. The estimated cost of this work is given in Table I. At present there are two 13,000-volt feeders running from the company's substation, the switching equipment for which consists of but one 13,000-volt outdoor oil switch and one indoor oil switch of the same voltage rating. The addition of the new 3,750-kva. transformer bank necessitates providing a 13,000-volt wooden-pole bus structure and the installation of three more outdoor oil switches with arresters, etc. These costs are given in Table II.

The present oil switches at the company station were installed about 1908 and are considered obsolete in design and inadequate in capacity. With only the present transformers in service the switches would be called upon to rupture 50,000 kva. during trouble. They are not capable of rupturing 40,000 kva. safely, and with the addition of a new 3,750-kva. transformer bank these switches might be called upon to rupture 91,000 kva. on short circuit. In this case a serious fire might result. The situation is to be remedied by the installation of seven switches, the estimated cost of which is given in Table III.

Considerable overload is being carried on the company's No. 1 circuit. The resulting line loss is serious, running close to 20 per cent, and the voltage regulation is troublesome. The use of larger copper will obviate the greater part of present troubles and allow increase of load

TABLE I—INSTALLATION OF VOLTAGE REGULATORS

Two 500-amp., 2,300-volt 10 per cent I. R. S. regulators	$5,940
Foundations and erection	810
Conduit and cable	380
Wiring screens, etc.	820
Engineering, administrative and general expense	795
Total	$8,745

TABLE II—ESTIMATED INSTALLATION COST OF 13,200-VOLT BUS STRUCTURE

Field superintendence and tools	$648
Three 15,000-volt, KO-36 coil switches	7,128
One 15,000-volt metering outfit	756
One 15,000-volt arrester	756
Disconnecting switches	648
Foundations	540
Pole structures	810
13,000-volt wiring and installation	2,160
Temporary work	540
Conduit and control cable	540
Switchboard	540
Lighting	214
Engineering, administrative and general expense	1,528
Total	$16,808

TABLE III—ESTIMATED INSTALLATION COST OF 2,300-VOLT OIL SWITCHES

Field superintendence, labor and expenses		$5,940
Seven type K-32-C 600-amp. oil switches		4,612
Seven switchboard sections, 90 in. x 24 in. x 2 in.		648
Pipe framework and fittings		648
Conduit and fittings		540
No. 4/0 three-conductor cable		648
Addition to double bus		865
Fourteen type PQ relays		325
Fourteen type W-12 current transformers		430
Fourteen type E-18 potential transformers		540
Miscellaneous material		1,624
Engineering, administrative and general expense		1,682
Total		$18,502
Salvage—estimated cost of oil switches removed from service:		
Seven switches, at $62.60	$438.20	
Estimated labor of installation	350.00	
		788
Estimated total net cost		$17,714

TABLE IV—COST OF CHANGING 2¼ MILES OF LINE TO LARGER-SIZE WIRE

No. 1 copper for 4,000 ft. of circuit; i. e., 12,000 ft., or 3,600 lb.		$817
Labor and fittings		324
Trucking		54
Total		$1,195
Salvage:		
Estimated original cost No. 6 wire removed from service—4,000 ft. of circuit, or 12,000 ft. No. 6 wire—1,345 lb., at 16 cents	$215	
Estimated cost of stringing above wire, at $40 per mile (2¼ miles)	90	
		305
Net estimated total cost		$890

on the circuit. The cost of increasing this line to No. 1 wire is in Table IV.

Transformer Used as Ground Detector

By S. F. Jones
Repair Shop, City Lighting Department, Seattle, Wash.

The necessity for an inexpensive ground detector to be used on outlying feeders which do not emanate from a substation where an attendant is on duty has led Seattle's

FIG. 1—GROUND DETECTOR USED FOR ISOLATED FEEDERS

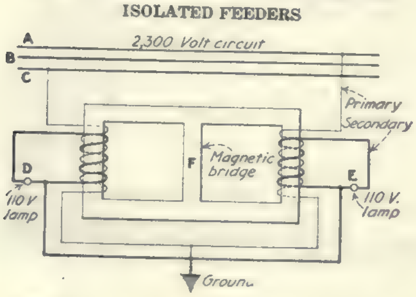


FIG. 2—MAGNETIC LEAKAGE PATH IS ESSENTIAL FEATURE OF GROUND DETECTOR TRANSFORMER

With no ground on the 2,300-volt circuit lights *D* and *E* burn at half brilliancy. With a ground on leg *C* light *E* burns at full brilliancy, and with a ground on leg *A* light *D* burns at full brilliancy. If leg *B* is grounded both lights burn at full brilliancy.

lighting department to develop the special ground-detector transformer shown in Fig. 1. The essential feature of the transformer is the magnetic leakage path *F* (Fig. 2). The two windings are connected in series so that the normal flux produced by these windings passes around the core in the same direction. When one primary winding is short-circuited by a ground on the line, the flux of both windings passes through the magnetic bridge *F*. The essential features of the transformer and the connection are shown in Fig. 2.

These ground detectors weigh about 50 lb. and cost about $40 each.

Field Testing Equipment and Its Maintenance

By H. F. Leeper
Meter Department, Ohio Power Company, Canton, Ohio

The field testing equipment used by this company is divided into three parts, namely, three-phase meter-testing outfits, single-phase meter-testing outfits and direct-current meter-testing outfits. Of the first group there are two complete outfits, one of which is used in testing self-contained meters and the other in testing transformer meters. The self-contained meter-testing equipment consists of a fiber tool kit, 16 in. x 9 in., in which are carried tools and auxiliary apparatus which are essential to all three outfits. This kit also contains current leads of 100-amp. carrying capacity and two sets of potential leads made from No. 14 flexible lamp cord, one set of the latter being for the rotating standard and the other for the load box. The load box used with this outfit is the 75-amp. type F States phantom load.

The rotating standard for this equipment is equipped with 1, 5, 10, 15 and 100-amp. coils. The outfit suitable for transformer meter testing is identical with the self-contained meter-testing equipment except that the current leads are made from flexible No. 10 cord and a 15-amp. States phantom load is used. The rotating standard has only 1-amp. and 5-amp. coils.

The single-phase outfits differ from the three-phase in that the fiber kit is replaced by a rheostat and tool kit built into a single unit. The resistance coils of the rheostat range from 0.25 amp. to 15 amp. A single set of current and potential leads is used, the potential lead being No. 14 flexible lamp cord and the current lead No. 10. A 1-amp. and 5-amp. coil standard completes the outfit.

For direct-current meter testing two complete outfits are used. The first is for calibrating large direct-current meters and consists of a fiber tool kit as previously described. An Edison storage battery is used for obtaining the load. The second testing unit is practically the same as the single-phase outfit.

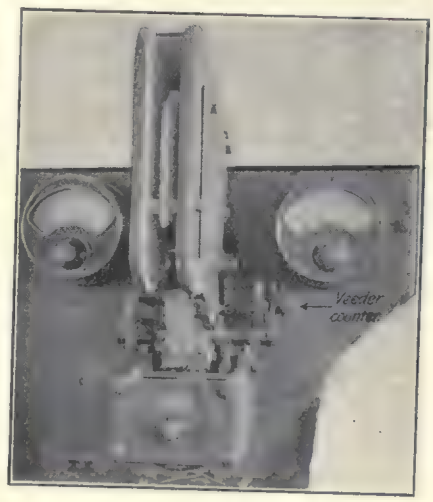
The maintenance of the testing equipment is taken care of by the shop foreman, who keeps a duplicate of each piece of apparatus and issues new when the old proves defective or is in need of repair. The old equipment is turned in, then repaired and kept in stock. New repair parts, such as jewels, etc., are issued only in exchange for the old.

AUXILIARY APPARATUS USED WITH METER TESTING OUTFITS

One 60-watt, 110-volt test lamp, with 3-ft. leads, having test clips on ends.
One two-cell flashlamp.
One fish and tackle box.
One magnet and balancing wrench.
One bronze magnet scraper.
One brush wrench (T.R.W. meters).
One lag-adjusting wrench.
One upper jewel wrench.
One pivot wrench.
One offset screwdriver.
Four small hexagon connections.
Two small switch connectors.
One T.R.W. brush needle.
One watch oiler.
Two small cut-out connectors.
One tooth brush.
Linen tape.
Crocus cloth.
Peg wood.
One rag.
One rubber syringe used to blow dust out of meter.
One small bottle of gasoline.
Sufficient supply of jewels, pivots and few small repair parts for day's work.
Pliers, ordinary screwdrivers and similar small tools supplied by tester.

Counter to Record Opening of Reclosing Switches

By installing counters in connection with automatic reclosing equipment, relay contactors, etc., a complete check of operation may be obtained which will facilitate the location of any faults and will give an accurate record of the number of times the equipment opens or closes. This is particularly advantageous when equipment is installed at remote points as the record of opera-



MOUNTING VEEDER COUNTER ON RECLOSING EQUIPMENT GIVES CHECK ON OPERATION

tion gives a good basis to determine the period of examination of the apparatus. Veeder counters placed on equipment, as shown in the accompanying illustration, are being used by several companies, and now manufacturers are providing the counters on equipment where requested.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Electric Ranges Build Valuable Load

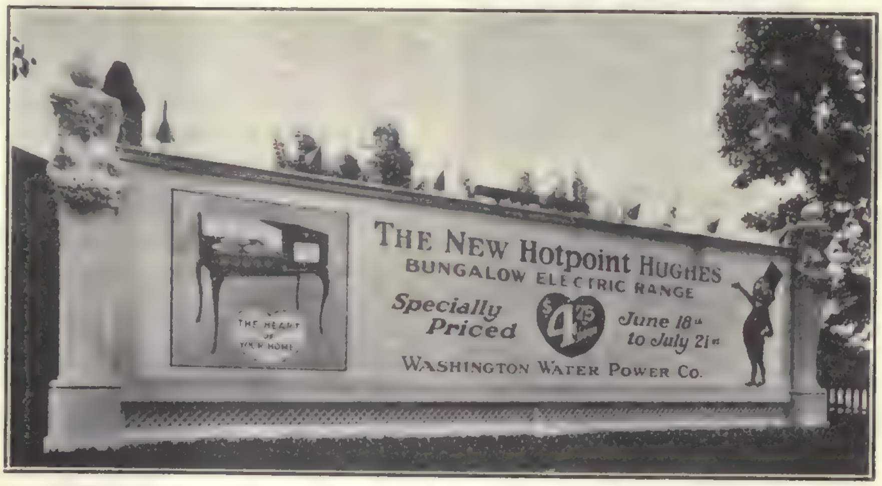
Central Station Concludes Second Successful Campaign, Which Will Add $28,500 in Yearly Revenue—14.9 per Cent of Residential Customers Now Use Ranges

By J. T. Ryan
Washington Water Power Company, Spokane, Wash.

ADDING 316 electric ranges, each with an electric water heater, to a company's lines in five weeks is a considerable accomplishment in itself. That the Washington Water Power Company did this in face of the fact that only two months before it had terminated a six weeks' campaign during which 431 ranges and water heaters were sold makes the later sale even more remarkable. The value of this new business in gross annual revenue from energy consumed is put at $39,000 for the first campaign and $28,500 for the second. Thus the use of the total 747 electric ranges and water heaters will bring into the company some $67,500 per year. In view of the value of this load the methods used in staging the second campaign are interesting.

Primarily, a thorough understanding of the psychology of the community served by his company led Lewis A. Lewis, sales manager, to put on the second campaign so soon after the first. Enthusiasm in the sales department was first aroused at a banquet presided over by Ray W. Turnbull, representative of the Hotpoint-Hughes range, which was to be featured in the sale. The campaign opened on June 18, and on June 11 preliminary advertising was begun in the local papers. This consisted of four 12-in. blind advertisements consisting of a heart-shaped design inclosing the legend "$4.75 down" and the words "Watch for announcement." During the campaign illustrated advertisements were run, amounting to 1,461 in. in twenty-two insertions. Up to July 11 the range but could not be induced to consider buying. In the belief that many of these people would buy at the lower price, on July 11 the advertisements were changed by announcing the total price for a range and water heater installed. This radical departure from the previous methods produced a marked acceleration in the selling. In the smaller towns the price was advertised from the beginning.

As a special inducement a five-piece combination aluminum cooker set was given with each range. With



ILLUMINATED BILLBOARD USED IN SECOND SPOKANE RANGE CAMPAIGN

no reference was made to the price, which was $164.75, covering the complete installation of a bungalow type R-101 range, together with a water heater. This was payable $4.75 down and $7 per month. This price was $85 lower than that of the range sold in the previous campaign, during which it was observed that many people telephoned to ask the price of

RESULTS OF RANGE AND WATER-HEATER* SALES CAMPAIGN

	Spokane	Towns Directly Served by Company	Total
Population	115,000	55,000	170,000
Residential customers	24,700	7,500	32,200
Ranges in use at beginning of campaign	2,598	1,887	4,485
Sales of campaign type ranges	153	101	254
Sales of other larger new ranges	31	31	62
Total new sales	184	132	316
Grand total in service	2,782	2,019	4,801
Percentage of residential customers using ranges	11.25	26.9	14.9
Gross sales value	......	......	$57,000.00
Gross annual revenue added by new ranges sold in campaign	......	......	$28,500.00

* The size of water heaters varied, but most of them were of 750 watts capacity.

every bill sent to residential customers during the campaign an attractive insert was attached. Illuminated signboards were displayed on principal car lines. One of these is shown in the accompanying illustration.

Salesmen's Commissions

To stimulate the greatest possible effort among the salesmen, they received a commission of 10 per cent on the sale of each range and water heater, based on the cash price and not the partial-payment price. A quota was set for each salesman, based on his record during the previous campaign, and a bonus of $20 was offered to each man who made his quota. In addition each week a sum based on $2 per range for all ranges sold during the week was

divided, in the proportion of three, two and one, among the three city salesmen who sold the highest percentage of their respective quotas during that week. The sales in the city of Spokane were handled by five salesmen working full time and one working part time. Sales in the territory outside the city were made by the twenty-five regular district and local agents of the company. The results of the campaign, with data on the value of the business and total number of ranges in use, are given in the accompanying table.

It is worthy of note that the town of Wilbur, with 257 residential customers, now has 107 electric ranges in service; that is, 42 per cent of the residential users have electric ranges. Of particular interest is the fact that while sales efforts were concentrated on the bungalow range, approximately 20 per cent of the total sold were of larger and more expensive types.

Window Lighting Increased by Display Contest

THE Blackstone Valley Gas & Electric Company, Pawtucket, R. I., co-operating with the merchants' division of the local Chamber of Commerce, recently promoted a fall opening and show-window display contest which has resulted in a general movement toward better commercial illumination in the city. As lighting effects play a great part in

Which Kind of a Report to Stockholders?

CENTRAL MAINE POWER COMPANY

To the Stockholders of the Central Maine Power Company:

With this letter goes a check for dividend No. 68 to each one of the eleven thousand people who own the preferred stock of the Central Maine Power Company. For twenty years—at first once in six months and since then once in three months —this organization has been distributing its earnings to an ever-increasing number of people.

At first the checks were few in number and small in amount. The scene of the signing of the checks for the first dividend stands out clearly as though it were yesterday. It was a dark winter afternoon in the old office on a back street in Waterville. Edward L. Meader, long since dead, stood at an old-fashioned upright desk and wrote the checks. Harvey Eaton signed them. It was rather a solemn occasion. The money wasn't so very large in amount, but the business needed it. On the other hand, those who had intrusted us with their money should and must have their share of the return it had earned, and they did. More than that, they have continued to have it ever since.

How that list of checks has grown as the years have slipped by! First it was less than twenty-five. Then it became fifty and so on to one hundred. After I became treasurer and moved to Augusta the signing of the dividend checks was a small matter. It took fifteen or twenty minutes, then half an hour or so, and then longer. By 1917 it had come to be a real job and took the biggest part of several days. In 1918 I delegated my signature to my secretary, and by 1921 it was taking most of her time for two weeks. Now the signatures are affixed by a machine that signs five checks at once, and still it takes several days. . . .

The growth of the business is astonishing. The use of electricity is creeping into the daily lives of people everywhere. More and more people are asking for electric power. And they must have it. Each day brings some new use or a new application of an old one. And doesn't this suggest the end toward which we in the hydro-electric business are working? Is not our task to harness more and more of the power of our rivers and sell more and more electricity until the day when every bit of work in every home and every store and every factory that can be done by electricity is done by our rivers as they flow to the sea?

That is what is going on all over America, and Maine must do her part. We have the rivers and the water powers. It is of the greatest importance that these rivers be set to work as fast as work can be found for them to do.

I believe we are fortunate in having a great co-operative organization like Central Maine with its 250,000 hp. of undeveloped water power, its broad market and its ever-growing business as a medium whereby this work can be accomplished. The state is to be congratulated on having eleven thousand citizens within its borders who have become partners in this most important work.

You, on the other hand, have obtained what I believe to be a safe and profitable investment in a great business. This business, the possibilities of which have scarcely begun to be known, should become vastly greater and of more value as the years roll on. Sincerely yours,

WALTER S. WYMAN, Treasurer.

Oct. 1, 1923.

FOURTEENTH ANNUAL REPORT OF THE AMALGAMATED POWER COMPANY

To the Stockholders:

Herewith is submitted the annual report of the board of directors of the Amalgamated Power Company for the year ended Dec. 31, 1922.

The consolidated revenue account of the Amalgamated Power Company and its subsidiary companies for twelve months ended Dec. 31, 1922, as compared with the preceding twelve months, is as follows:

(Here is given a cold and dreary tabulation concerning income, expense, deductions, interest on floating debt, amortization and so on.)

From the foregoing it will be noted that the operating revenue increased 16 per cent and operating expenses and taxes increased only 12 per cent, making a consequent increase in the operating income of 27 per cent.

There is also appended a comparative statement of income and expenses of the subsidiary companies for the year 1922 as compared with the year 1921.

(This statement under such a name cannot be located in the report.)

Expenditures for improvements and betterments to the plants and properties of the various underlying companies were made amounting to $212,312.43, and $101,821.85 was expended for maintenance and charged into operating expenses. . . .

The books and accounts of your company have been audited by Messrs. Smith & Brown, certified public accountants, whose certificate forms part of this report. Respectfully submitted,

President.
By order of the Board of Directors.

INSTEAD of issuing a formal annual report with the customary financial statement, the Central Maine Power Company takes advantage of the opportunity to communicate with its stockholders four times a year when the quarterly dividend checks are mailed. Each check is accompanied by a letter addressed to the stockholders which relates, in understandable language, the company's activities and progress. The financial condition of the company is shown in a brief statement of earnings and assets also inclosed with the dividend checks quarterly.

The latest letter, which went out with the October dividend, is reprinted here almost in full. It shows how it is possible to weave into the otherwise dry facts a message of accomplishment and a picture of what the future holds in store.

In contrast with this is also printed part of another utility's annual report, chosen at random from a file of several hundred similar missives addressed once each year to stockholders in typical here-it-is-take-it-or-leave-it style. It is quoted verbatim, names excepted.

BLACKSTONE VALLEY COMPANY'S TWO PRIZE-WINNING DISPLAYS IN SHOW-WINDOW CONTEST

any successful display, the commercial lighting department of the company offered to lend the merchants window-lighting equipment of the latest design and advise with them how to use it to increase the value of their displays. This equipment consisted of color screens, reflectors, spotlights, floodlights and lamps.

The displays were classified as to the nature of the merchandise, and the results attained in lighting effects were a revelation to the merchants and public alike. The Blackstone Valley Gas & Electric Company—working on the basis that "seeing is believing" and that the merchant must be shown the value of good lighting—not only won the highest honors, regardless of class of merchandise, but also won first and third prize in the household goods division. The accompanying illustrations show the winning displays as decorated by members of the company's sales department.

A total of 114 entries in the contest indicates the success of the undertaking, and already the commercial lighting department has been asked to co-operate with the Chamber of Commerce in Christmas and spring mercantile events. When the prizes for the contest were awarded it was found that every prize winner with but one exception had utilized some of the company's equipment.

The Blackstone Valley Gas & Electric Company has been so successful in its new service in Pawtucket that the work is being extended to the Woonsocket division. Through the services of its illuminating engineers the company offers specifications and blue-print layouts showing location of outlets and type of units recommended for both new or remodeled buildings. The co-operation obtained from architects and contractor-dealers is rapidly leading to higher standards of illumination in the territories served, and contractors are now not only installing a "wiring job" but are performing a real electrical service.

As the demand for the services of this newly organized department grows, and as its field rapidly develops, future plans call for extending its work into the industrial areas which Pawtucket and Woonsocket represent. Lectures on lighting, included in the annual Chamber of Commerce industrial lecture courses and before existing manufacturers' associations, have been arranged: Demonstrations and exhibits are planned to be given before the school boards, educational and merchants' associations, with a view to raising illumination standards throughout the company's territory.

This work was carried on under the direction of F. C. Eteson, in charge of the commercial lighting department under R. A. Gordon, sales manager of the Blackstone Valley Gas & Electric Company.

What Other Companies Are Doing

Syracuse, N. Y.—The village of Tully, which for twenty years has operated a municipal electric plant, has abandoned the enterprise because of an annual deficit of from one to two thousand dollars. As a result of a recent special election, at which it was voted almost unanimously to sell the municipal distribution system to the Syracuse Lighting Company and to grant a franchise for operation, the village will soon have an improved electric service at a 12-cent rate for residences, compared with 20 cents under municipal operation.

Salt Lake City, Utah.—A special exhibit by the Utah Power & Light Company at the Utah State Fair, held during October, proved to be one of the most attractive features of the exposition. The company's development and utilization of Bear Lake and Bear River waters was presented by means of a panoramic reproduction, molded in plaster, of the lake, the river and contiguous territory, from the inlet and outlet canals and Lifton pumping plant on Bear Lake down to Great Salt Lake.

Des Moines, Iowa.—The women employees of public utility companies in Iowa, Nebraska, Missouri and Kansas have organized for the purpose of studying the principles of better utility service. Representatives from these four states held their initial meeting at Des Moines recently, where they were given an organization instruction by Miss Isabelle Davie, chairman of the Iowa and Middle Western division of the women's public information committee of the N. E. L. A.

Marinette, Wis. — To stimulate added interest in the erection of a more modern street-lighting system where tentative steps have already been taken by the community for such an improvement, and to act as a forerunner to improved and better illumination facilities, the Menominee & Marinette Light & Traction Company has adopted the method of placing various single types of ornamental street-lighting systems on exhibition in the City Hall Square of Menominee. By this plan an opportunity is afforded the citizens to judge which type will be the best suited from an economical as well as a civic improvement viewpoint.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Test Data on Turbo-Alternators.—Very complete test data on a 1,500-kw. turbo-alternator installed at Aylesbury, England, are given. This turbine generates at 6,600 volts, 50 cycles and 3,000 r.p.m. It is of the Curtis impulse type, the steam passing through one compound impulse stage and six single stages. The steam consumption varies from 13.75 lb. at one-half load to 11.9 lb. at one and one-quarter load. —*Electrician (England)*, Sept. 21, 1923.

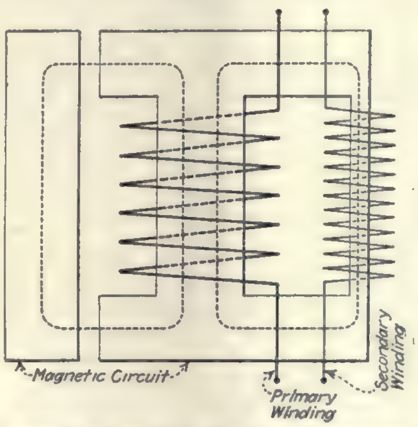
Design of Rotating Disks. — G. ARROWSMITH.—The complete evaluation of the stresses in a rotating disk is a very difficult process, but in view of the present-day tendency toward turbine units of large output running at relatively high speeds it is a problem which has to be carefully considered. Since the grade of steel commercially obtainable for the manufacture of disks has a fairly definite maximum tensile strength, it is essential that the disks be so proportioned that the disposition of stresses will give the highest possible factor of safety consistent with the qualities of material procurable. Various expressions enabling the approximate tangential stress curve to be found show that this curve corresponds to any given radial stress curve. Definite solutions of the differential equations of stress have been obtained only for a few particular cases where the radius and the axial thickness of a disk bear a definite mathematical relationship to each other.—*Engineering (England)*, Oct. 5, 1923.

Results of Tests Made on Hydraulic-Turbine Governors.—The Pennsylvania Water & Power Company has recently conducted a series of tests on hydro-electric turbine governors. These tests were made to determine how parallel operation of hydro-electric and steam plants 40 miles apart could be improved. Among the elements investigated were the sensitiveness of governors, effects of kinetic energy in the machine's revolving parts and power-system reactance. The plants in which the tests were conducted are connected for parallel operation through four 70,000-volt transmission lines.—*Power*, Oct. 9, 1923.

Choice of Turbines for Hydro-Electric Stations.—G. GAMBARELLA.—In order to get the best efficiency from a hydro-electric installation, it is necessary to determine the type and the fundamental characteristics of the turbines to be installed according to the height of the fall, the quantity of the available water and the most convenient r.p.m. at which the machines will run. Different types of turbines are considered by the author.—*Elettrotecnica*, Oct. 5, 1923.

Generation, Control, Switching and Protection

Protection System for Parallel Feeders.—H. C. A. KORTLANDT.—A system is described which uses straight overload protection at the generating end and power-directional relays at the receiving end of the line. Enough voltage for operation of the power-directional element even under short-circuit conditions is obtained through a small transformer illustrated herewith. Its magnetic circuit is *ID*-shaped, with the primary winding on the thick second leg and secondary winding on the thin last leg. This insures a high ratio at low voltages and a low ratio at higher voltage.—*Sterkstroom*, Aug. 15, 1923.



POWER-DIRECTIONAL RELAY TRANSFORMER OPERATES SATISFACTORILY UNDER HEAVY SHORT CIRCUIT

Continuous-Current Generator for High Voltage.—S. R. BERGMAN.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. summer convention, July 7, 1923, page 21.—*Journal of A. I. E. E.*, October, 1923.

Transmission, Substations and Distribution

Reduction of Eddy Losses in Butt-Joint Transformer Cores.—H. KRUZNER.—To reduce magnetizing current of transformer cores with butt joints a very careful finishing of the butting surfaces is essential. This is usually done by a shaping or milling process, followed by grinding. No matter how carefully the final grinding is made, it is impossible to avoid a large number of very fine steel fins, which bridge adjacent laminations and cause undesirable eddies. The author found that a very material improvement can be achieved by etching the butt surface with a diluted mixture of sulphuric and nitric acids, after the grinding process, followed by thorough drying. Practical measurements on a small transformer showed a watt loss per kilogram of iron of 1.98, and after etching 1.44, or a decrease of more than 35 per cent.—*Elektrotechnik und Maschinenbau*, Sept. 23, 1923.

Experimental Alternating-Current Transmission System.—O. R. SCHURIG.—The author deals with a three-phase miniature alternating-current system of the network type used for the practical solution of network and transmission problems. The circuit includes synchronous machines, transformers, adjustable resistors, reactors and condensers for complete representation of generating stations, substations, lines and loads. The connections are variable so that any system having not more than the available number of circuit elements may be represented for the correct experimental solution of low-frequency problems. A brief discussion of some of the present problems called up by the miniature experimental methods, full descriptions of the miniature equipment, an outline of the operating procedure in the solution of problems and an example illustrating the application of the miniature equipment are given. This paper was presented at the summer convention of the A. I. E. E.—*Journal of A. I. E. E.*, October, 1923.

Construction and Care of Distribution Transformers.—L. G. MASON.—For mining service only the highest quality of electrical apparatus should be considered. In this article the author considers the selection of the best transformer for the work, fundamental considerations of the iron and copper losses, method of testing and recommendations as to proper care.—*Coal Age*, Oct. 25, 1923.

Units, Measurements and Instruments

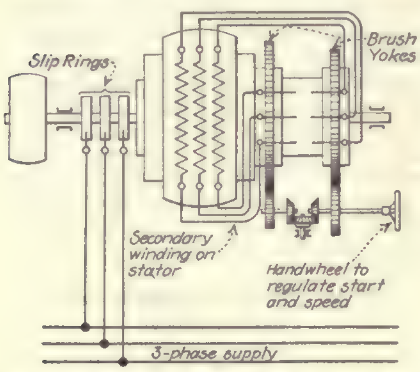
Calibration of Oil-Immersed, Water-Cooled Standard Low Resistances.—B. G. CHRUCHER.—In the accurate determination of low resistances or large direct currents the measurement is made in terms of standard low resistance. In the best types the resistance material is immersed in oil, and when intended for carrying large currents water cooling is also provided. If it is desired to determine the unknown resistance or current to a high degree of accuracy, it is, of course, necessary to know the resistance value of the standard to a high degree of accuracy under the particular conditions of the experiment. Neglecting very gradual changes of time—that is aging of oil—the direct-current resistance value of a properly designed standard varies with the temperature of the resistance material only. This temperature is, however, affected by a number of factors. The author considers the question of when and under what conditions the standard should be calibrated in order that its re-

sistance value may be accurately ascertained under any subsequent experimental conditions. — *Electrician (England)*, Oct. 5, 1923.

Preventing Theft of Electric Service.—I. CLEMENTI.—The author considers balanced and unbalanced induction meters with diagrams showing how a consumer can steal energy. He then discusses methods of detecting and preventing these thefts. — *Elettrotecnica*, Sept. 25, 1923.

Motors and Control

Motors for the Paper Industry.—O. KESSLER. — Difficult starting and frequent falling out of step are the two main reasons why synchronous three-phase motors have rarely been used for the drive of wood-pulp grinders. The difficulty seems to have been overcome by the development of a type of synchronous motor with asynchronous start. The motor is brought up to speed like an induction motor and synchronizes itself to the line when its field is excited. If an overload exceeds its maximum torque, the motor does not fall out of step, but begins to run asynchronously with a certain percentage of slip. As soon as the load falls off again to the normal rating of the motor it synchronizes itself again. At times of low load the machine furnishes compensating current, acting therefore automatically as



VARIABLE-SPEED COMMUTATOR MOTOR FOR DRIVING PAPER MACHINES

a synchronous condenser. If the motor is chosen larger than the grinder would require, this feature of improving the power factor may be realized even during full-load run. Another motor is described for the drive of paper machines at variable speed. It is a commutator motor with a double set of brushes, as shown in the accompanying illustration. A speed regulation of one to three may be accomplished by simply moving the brush yokes, which may be done manually or by remote motor control. At a given brush position the motor will maintain its speed within 1 per cent or 2 per cent regardless of the load. Sparkless commutation and long wear of the brushes are claimed for this motor, which is well suited for the very exacting drive of paper machines or of machines that require similar speed control.—*Siemens Zeitschrift*, August and September, 1923.

Heat Applications and Material Handling

Welding Cast Iron with a Special Nickel-Copper-Alloy Welding Wire.—A. CHURCHWARD.—Recently there has been developed a successful method of welding cast iron involving a new principle of absorbing the carbon contained in the cast iron, forming thereby at the juncture of the weld a new alloy which not only insures strength equal to that of the original castings but also permits ready machining. This is accomplished without preheating, annealing or the use of studs.—*Journal of American Welding Society*, September, 1923.

Selecting Equipment for Vertical Shaft Hoisting.—M. A. MAXWELL.—Drum shapes, types of electric drive and hoist control equipment are described. There are three types of drums, namely, plain cylindrical, conical and cylindro-conical. The proper and most economical type of drum is readily determinable by calculation from the known data for each specific installation. Before the drum shape and several other details can be definitely decided upon a decision must be made whether the "skip" or the "car-and-cage" system is to be used. The three systems of control and the electric drive that are given are the induction motor, the Ilgner-Ward Leonard system and the Ward Leonard system. The second system employs a direct-current shunt-wound motor operated from a motor-generator set with flywheel by Ward Leonard control. The third system uses a direct-current, shunt-wound motor operated from a motor-generator set without flywheel with Ward Leonard control.—*Coal Age*, Oct. 18, 1923.

Electrophysics, Electrochemistry and Batteries

Magnetic Properties of Atoms.—P. LANGEVIN.—In order to account for magnetic properties it is necessary to assume that each atom or molecule possesses in its normal state a quite definite magnetic moment which is proportional to the total moment of the quantity of electron movement. This moment can be zero when the symmetry of the edifice is sufficient and always becomes modified in the diamagnetic sense under the action of an external magnetic field. From the point of view of classical dynamics a system of electrified particles which participates in thermal agitation cannot exhibit when it is isolated, nor assume, under the action of an external magnetic field, any resultant magnetic moment, and consequently cannot possess any magnetic property. The laws of quanta, on the contrary, allow one immediately to predict the existence of molecular magnetic moments which are integral multiples of the Bohr magnetron, and they alone permit one to develop in a completely coherent manner an electronic theory of magnetism in the same way as they have rendered possible a theory of atomic structure and of the emission of spectra. Magnetic measurements contribute their information regarding atomic structure, and atomic models ought to be in quantitative agreement with them. The family of rare gases seems to give rise to some interesting difficulties from this point of view. The variation of magnetic properties with the state of chemical combination furnishes in like manner important indications and confirmations of the theory. The progressive disappearance of ferro-magnetism and para-magnetism when the magnetic atoms (iron, cobalt, platium, etc.) enter into more and more complex combination shows that chemical affinity tends to constitute molecules with no resultant magnetic moment, i.e., to realize electronic edifices which present a higher and higher symmetry. —*Paper presented before the British Association at Liverpool, England*, Sept. 12-19, 1923.

Telegraphy, Telephony, Radio and Signals

Measuring Very Short Radio Wave Lengths and Their Use in Frequency Standardization.—F. W. DUNMORE and F. H. ENGEL.—The paper describes one method of establishing frequency standards employed by the Bureau of Standards which is based on the direct linear measurement of the wave length of very short standing waves on a pair of parallel wires. The wave lengths measured were from 9 m. to 16 m., the currents having frequencies from 33,000 kilocycles to 19,000 kilocycles per second. The method is also of use for calibrating a wave meter at frequencies from 30,000 kilocycles to 352 kilocycles. —*Proceedings of the Institute of Radio Engineers*, October, 1923.

Axially Controlled Magnetron. — A. W. HULL.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. summer convention, July 7, 1923, page 18. —*Journal of A. I. E. E.*, October, 1923.

Miscellaneous

Electrical Structure of Matter.—SIR ERNEST RUTHERFORD.—In this paper the genesis of wireless, the atomic theory, the influence of radioactivity, fixing of the atomic mass, the structure and nucleus of the atom, research on isotopes, energy relations and atomic nuclei are considered.—*Paper presented before the British Association at Liverpool, England*, Sept. 12-19, 1923.

Fire Extinguisher.—F. ANDRESS.—Extended and thorough tests proved to the satisfaction of the author that carbon-tetrachloride is the best fire extinguisher known, especially for quickly putting out burning gasoline, benzol, petroleum, oil and electric arcs in large industrial buildings. It is a non-conductor and quenches flames almost instantly. It is, however, advisable to use this chemical extinguisher only in large and roomy places, because its fumes may otherwise have an injurious effect upon the breathing organisms.—*A.E.G. Mitteilungen*, September, 1923.

Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

Conducted by PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N. Y.*

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Brightness at the Melting Point of Platinum

Observations of the brightness of a series of platinum cylinder black bodies at their melting points have been carried out by a photo-electric photometric method. Similar records of standard lamps permit the determination of the quantity in question. The mean value from a large number of melts for the brightness of the black body at the melting point of platinum is 55.4 c.p. per square centimeter, which is believed to be accurate to within 0.25 per cent. The definiteness with which this point may be determined and the relative simplicity of the apparatus required recommend it for consideration as a primary fixed point or standard in photometry.—*Herbert E. Ives, Western Electric Company, New York.*

Busbar Insulators, Concrete Inserts for

The special size and design of the bus insulators for the Queenston power house required a suitable method of fastening these to the concrete floors, walls and ceilings. Ordinarily a metal plug known as an "insert" and drilled to receive a bolt of proper size is embedded in the concrete at the time the concrete is placed. A number of these inserts were submitted to the laboratory for comparative tests, and it was found that the effectiveness of an insert was almost altogether due to the depth to which it was embedded in the concrete and not to any projections or lugs with which it was embellished; that the only projection required was a shoulder on the end inserted in the concrete to prevent the insert pulling out. With this information an insert was designed having a pull-out strength of 16,000 lb. and which could be made from a drop forging at a cost very much less than that of the cast-iron insert ordinarily used. —*Hydro-Electric Power Commission, Toronto, Ont.*

Insulator Testing in Oil

With the usual method of dry testing of insulator units the applied potential is limited by the flashover of the unit, so that it is impossible to test a piece at a higher voltage than that to which it may be subjected in service under abnormal conditions. By immersing the outer rim of the unit in transformer oil the flashover voltage is considerably increased, so that it becomes possible to test units at a higher voltage than that to which they can be subjected in actual service. This method was described in *Trans. A. I. E. E.*, Vol. XLI, page 732, 1922, and has been since found successful in extended practical use.—*G. W. Lapp, Le Roy, N. Y.*

Porcelain, Porosity Test for

An unglazed full-size porcelain is placed in the center sagger on the bottom layer of each kiln car, the position where underfiring will be first apparent. Upon the withdrawal of each car from the kiln the test piece is broken to expose the center and the pieces are placed in a solution of fuchsine dye and wood alcohol. A pressure of 200 lb. per square inch is applied continuously over a period of two hours. After being removed from the solution, dried and broken open, the pieces must show absolutely no penetration of the dye if the porcelain contained on the car is to be accepted for assembly. This test, when used in connection with the proper method of tunnel kiln firing, is most effective in preventing porous porcelain from passing to the assembly room. — *Jeffery-Dewitt Insulator Company, Kenova, West Va.*

Resistances, Standard, Oil Tank for

An oil-immersion tank has been constructed for the standard resistances and arranged for quick and convenient connection of any unit, as required in standardization work. The units terminate in mercury cups and are thoroughly protected from the effects of moisture and other disturbing influences. At one end of the tank is a small circulating pump, which is driven by an outside motor and serves to keep the oil, when in use, at a uniform temperature.—*Hydro-Electric Power Commission, Toronto, Ont.*

Soil Temperature, Measurement of, with Thermocouples

The apparatus for determining subgrade temperature consists of thermocouples, mercury contact panel, constant temperature unit and potentiometer. The thermocouples consist of two wires, copper and constantan (60 per cent Cn, 40 per cent Ni), soldered together and inserted in glass tubes sealed with paraffin. For details see the *Bulletin of the National Research Council*, 1923, Vol. 6, part 4, page 30.—*Arlington (Va.) Experimental Farm.*

Transformer for a Million Volts

The decision of the electrical engineers of the Southern California Edison Company and the California Institute of Technology to have equipment capable of producing low-frequency alternating potentials of 1,000,000 volts between a free and a grounded terminal made necessary a special transformer which has just been completed. It consists of four separate transformers, each of which is placed on an insulating pedestal. The high potential from the first transformer is used to excite the second and that of the second to excite the third, and so on. In this way the voltage is built up to the desired value.—*Royal W. Sorensen, California Institute of Technology, Pasadena.*

In Progress or Purposed

Dams, Arch Type, Investigation of

An investigation on a large scale is to be made of the strength and other properties of arch dams both on models and on actual dams. A special test dam may be built later to be ultimately loaded to destruction. This investigation is to be made under the auspices of the Engineering Foundation, with the co-operation of several power companies, federal, state and municipal authorities, engineering schools, etc.—*C. Derleth, Jr., University of California, Berkeley, Cal.*

Illumination, Its Effect Upon Industrial Efficiency

The advisory board of the Engineering Foundation has received and is thoroughly investigating the feasibility, cost and probability of support of a suggested experimental investigation of the relation of quality and quantity of illumination to efficiency.

Meters, Watt-Hour, Load Curves

A recurring question has been that of the performance of watt-hour meters on extremely light and heavy loads. The deviations from accuracy allowable on light and full loads are definitely specified in the Code for Electricity Meters. However, it seems desirable to bring about an appreciation of the existence of this requirement by a study of load curves of modern meters. Efforts are being made to obtain comparable data on the performance of several types of meters.—*Meter Committee of the N. E. L. A.*

Refractory Materials, Electrical Conductivity of, at High Temperatures

Reliable and comparable data are needed on the electrical resistivity at high temperatures of the refractory materials suitable for furnace linings. Methods and apparatus for making such measurements have been developed and test pieces prepared from fireclay, kaolin, alundum, diaspore, thoria, silica, zirconia, magnesite, silicon carbide, sillimanite, zirkite and magnesium spinel. Resistance measurements have been run on half of the pieces. Carbon electrodes are employed, measurements being run in an atmosphere of pure nitrogen to a temperature of 1,400 deg. C. in a gas-tight platinum-resistance furnace.—*U. S. Bureau of Mines, Ceramic Experiment Station, Columbus, Ohio.*

Tanks for Light Oil, Welded

To overcome the difficulty now experienced in the riveted tank used for holding light oils, specifications have been drawn up for the welding of these tanks. This promises not only a cheaper but also a better storage tank and opens up a new and large field to which welding is particularly adopted. Several small tanks have already been successfully built in this way, and it is estimated that the saving due to the prevention of loss of oil from evaporation and leakage will pay for the welded tank inside of two years.—*American Bureau of Welding, New York, N. Y.*

Suggestions for Research

Electrometer, Quadrant, for Power Measurement

This instrument can be used to advantage in measurements of power factor and effective resistance in actuating-current circuits, especially at high voltages and low values of power factor. It permits the use of null methods of considerable precision. While these methods are familiar to physicists, it is desired to develop and to try them for industrial measurements, especially in cable testing and in the study of dielectrics.—*D. Owen, Physical Society of London*, 1923, Vol. 35, page 140.

Hydraulic Turbines, Runners for

With regard to the pitting and erosion of runners, it may be said that superturbine development has now reached a stage where this condition is no longer primarily a problem of design but of economics. In other words, the manufacturer can select a specified speed at which the runner will have as long a period of useful life as the other major elements of the installation. Such a specification on the part of the customer would, of course, involve additional capital expenditure for the generator as well as for the turbine, but a modern super-turbine frequently can earn upward of $2,500 every twenty-four hours. Consequently, the lost revenue charge against runner replacement, in a fully loaded unit, may easily run as high as $25,000. It is thus evident that a proper economic specified speed is a factor of at least equal importance with proper gateage, and elevation relative to tailwater.—*H. G. Acres, Hydro-Electric Power Commission, Toronto.*

Light and Music

One of the most interesting phases of the application of colored light is in connection with music. It is a fascinating subject to the experimenter, be he scientist, decorator or musician. To all intents and purposes, it offers a virgin field for constructive effort, and the motion-picture theaters constitute a huge laboratory extending from coast to coast.—*A. L. Powell, Edison Lamp Works, Harrison, N. J.*

Lighting, Mixed, of Sunlight and Artificial Light

In many interiors artificial lighting is used during certain hours to supplement the natural lighting through the windows. It is of interest to investigate the illuminating, physiological and psychological aspects of such a combination under different conditions.

Timing Devices, Electrical

The use of timing devices other than watches is becoming more general, particularly for laboratory work. Some of the difficulties in obtaining measurements of time would be solved by the production of some portable form of timing device, and it is hoped that the manufacturers will direct their efforts to this end.—*Meter Committee of the N. E. L. A.*

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Edison Meets Medalists

Six Recipients of the Honor Named for Him Meet Inventor at Luncheon —Replica Given Him

THOMAS A. EDISON and six of the ten living men to whom the Edison medal has been awarded were guests of honor at a luncheon given at the Engineers' Club, New York, on Friday, Nov. 9, by Edward D. Adams, chairman of the Edison medal committee of the American Institute of Electrical Engineers. Others in attendance were the members of the Edison medal committee of award.

The Edison medal was founded upon the initiative of an organization composed of associates and friends of Thomas A. Edison, who subscribed a trust fund for that purpose and invited the American Institute of Electrical Engineers to assume the responsibility of making the awards. By the terms of the deed of gift and the bylaws of the committee this gold medal is awarded each year to a resident of the United States or Canada "for meritorious achievement in electrical science, electrical engineering or the electrical arts." The award, which is one of the highest attainable honors in the engineering profession, is made by a committee of the Institute consisting of twenty-four members.

The medalists who were present were Dr. Elihu Thomson of Swampscott, Mass.; Frank J. Sprague and Prof. Michael I. Pupin of New York, Benjamin G. Lamme of Pittsburgh, W. L. R. Emmet of Schenectady and Cummings C. Chesney of Pittsfield, Mass. The other living medalists, who were unable to attend, are Charles F. Brush of Cleveland, John J. Carty and Nikola Tesla of New York and Robert Andrews Millikan of Pasadena, Cal. Three medalists, George Westinghouse, William Stanley and Alexander Graham Bell, are dead.

Brief reports were made by Past-president Jewett and Secretary Hutchinson on the presentation of the Edison medal for 1922 to Dr. Millikan at the Pacific Coast convention of the Institute, held in Del Monte early in October, on which occasion Dr. Jewett made the presentation address from New York by means of transcontinental telephone lines and amplifying apparatus installed at Del Monte.

Dr. Elihu Thomson, to whom the first medal was awarded in 1909, and Dr. Michael I. Pupin, the 1920 medalist, made interesting addresses with reference to modern research, including recent developments in electron physics. Gano Dunn spoke feelingly of his contact with and the encouragement he received from Mr. Edison in the early days of the speaker's engineering experience and referred to progress in research work affecting the engineering profession.

Mr. Edison Gets Replica

The culminating act at the luncheon was the presentation of a silver replica of the Edison medal to Mr. Edison as a memento of the occasion, this being the only silver medal that has ever been struck from the dies. In presenting this replica Chairman Adams said:

"As an expression of our great pleasure in greeting you here today in our electrical symposium, we hereby present you with a silver medal struck by the United States Mint from the Edison medal dies, expressly as a souvenir for you and as a reminder of the many friends of twenty years ago who made this conference possible, and of those of today who most earnestly wish you a future of comforts, friendship and achievements as you yourself would welcome them as the crowning features of a useful and happy life."

Dr. Millikan Wins the Nobel Prize for Physics

It has just been announced at Stockholm, Sweden, that the 1923 Nobel prize for physics has been awarded to Dr. R. A. Millikan of the California Institute of Technology, winner also of the Edison medal this year.

Street-Lighting Tables for 1924

FOLLOWING its practice for thirty-five consecutive years, the ELECTRICAL WORLD has prepared tables showing the proper time for lighting and extinguishing street lamps. The 1924 tables will be ready in a few days, and a copy will be sent free to any subscriber upon request to ELECTRICAL WORLD, Tenth Avenue and 36th Street, New York. For more than one copy a charge of 25 cents each is made to cover a portion of the postage, printing and compilation costs.

New Jersey with New York

She Follows the Example of Neighbor in Attacking the Federal Power Commission

A MOTION for leave to file an original suit against the Federal Power Commission was presented in the United States Supreme Court by attorneys for the State of New Jersey on Nov. 12. Inasmuch as the questions raised by New Jersey are similar to those involved in the suit of the State of New York against the commission, the action of the Supreme Court on the motion is problematical.

In the bill of complaint which will be filed if the motion is granted and which was included in the printed motion presented to the court New Jersey seeks to enjoin the Federal Power Commission from acting in that state "by abuse of power without lawful and constitutional authority or in pursuance of wrongful and erroneous interpretations of the provisions" of the federal water-power act and asks the court to declare the act unconstitutional.

Dispute Over Morris Canal

The principal complaint of New Jersey is that the Federal Power Commission is attempting to exercise jurisdiction over the state's proposed development of water power along the Morris Canal, which runs from the Delaware River at Phillipsburg to the Hudson near Jersey City. This canal, started in 1824 and operated in recent years by the Lehigh Valley Railroad, was purchased by New Jersey last year, the formal transfer having taken place on March 1. New Jersey plans to develop power at a number of points along the canal, the proposed bill asserts, with dams at Lake Hopatcong and above Saxton Falls on the Musconetcong River and along the Delaware River, various sites being specified. The state has not applied to the Federal Power Commission for permits and does not propose to do so, the bill recites.

Other assertions made in the bill are that the commission is asserting authority over riparian lands which bring revenue to the state for its school fund and that control by the commission also would interfere with the conservation policy of the state over its potable waters and cause heavy loss to investment in waterworks. The authority of the commission over certain streams and to regulate rates for the sale of electric power within the state is challenged.

Farm Engineers on Rural Electrification

One Day's Sessions Are Devoted to Its Consideration at the Chicago Meeting of Society—Representatives of Other Bodies Take Part in Discussion

THE American Society of Agricultural Engineers, which held its seventeenth annual meeting in Chicago last week, devoted the whole of Friday to the discussion of rural electrification. Seven papers were presented on the subject by representatives from the American Farm Bureau, agricultural engineers, the electric utility industry and manufacturers. The United States Department of Agriculture was also represented in the discussion. Activities of the N. E. L. A. committee on rural lines were outlined, the history of work undertaken so far by electric service companies was related, desirable conditions for supplying rural service were suggested, the work of the Joint Committee on Relation of Electricity to Agriculture was outlined, the relation of central-station companies to the movement was discussed, and even the feasibility of obtaining electric power from the wind was considered.

C. A. Atherton, chairman of the committee on rural power lines, gave a general statement of its activities, calling particular attention to engineering, economic, statistical and commercial studies which are necessary. Methods of financing, erecting and operating rural lines, uses to which electricity may be applied in agriculture, nature of equipment for most economical utilization of electricity and energy required for different jobs were cited as subjects for study, mention being made also of equipment design, the number of farms, nature of crops, extent to which power lines are already accessible, amount of power used and purposes for which it is employed.

PAST PRACTICES IN RURAL SERVICE

Except for the greater amount of distribution equipment required per rural customer, G. C. Neff, general superintendent Wisconsin River Power Company, declared, the problem of rural service is not very different from serving urban communities, where the number of customers per mile may be thirty to a hundred as compared with three per mile in the country. If the farmer can be shown any economy in using five to ten times the energy used by city consumers, the prospects of more extensive rural service will become less remote.

Mr. Neff contended that it is best for all involved for the electric service company to operate and maintain rural service lines. There are two general methods of financing, by the customer and by the company. The first method will bring about more rapid development because utilities hesitate to make the investment in most cases because of the uncertainty of adequate return. With increase of energy consumption per customer this condition will change.

Regardless of who owns the rural service lines, they enhance the value of any farm which can be served from them, declared Prof. E. A. Stewart, University of Minnesota. While present conditions exist, however, utilities will be indifferent to rural service in most cases, because it is generally a gamble. While Professor Stewart agreed that the electric service company should operate and maintain the lines, he expressed the belief that farmers can finance them cheaper than can utilities because of the lower interest rate obtainable. Benefits would redound to the farmer and utility, he said, if the latter employed farm labor for erecting the lines and purchased poles from the farmers. Because rural service is a community benefit the general expense should be divided equally between all customers, only long extensions being charged to the individuals benefited. He favored high fixed charges and a low energy rate to make the business profitable to utilities from the beginning and to encourage large use of power. Core-loss energy should be paid for by the individuals, the professor contended. To show the practical application of his ideas Professor Stewart submitted what he considers a model rural-service contract, features of which will be presented in a later issue.

NO 5 PER CENT MONEY

Arthur Huntington, Iowa Railway & Light Company, called attention to the public confusion regarding maintenance and depreciation. Furthermore, he contended that 5 per cent money is a myth, pointing out that the farmer has to pay at least 2 per cent more for the handling of a loan. Regarding taxation, he said that the state requires a definite amount of money for operation, and it has to be provided by the public whether it pays the taxes or the utilities do.

G. C. Neff thought that no trouble should be experienced in applying rural service rates to late comers if the rate schedules and the boundaries of the district coming under them are filed with the state commission.

In answer to queries raised regarding the great diversity in rate schedules, J. C. Martin explained that they were developed in the early stages of central-station operation and have been so closely woven into the industry that they cannot be radically revised in a short time without friction, although most utility men will admit they are inadequate for changing conditions. He criticised a plan proposed in Professor Stewart's rural-service contract for the same reason, saying that provision should be made for periodic adjustment and that it should not be made unchangeable for twenty years as proposed.

The organization and plans of the Joint Committee on Relation of Electricity to Agriculture were outlined by J. W. Coverdale, its chairman. (These plans have been covered in past issues of the ELECTRICAL WORLD and an interesting phase is discussed on page 1016 of this issue under the heading "Experimental Electrical Farms in Minnesota.") Mr. Coverdale contended that investigations conducted by agricultural engineers as to the maximum economical use of electricity on farms would be the greatest single influence in bringing about a greater degree of rural service.

UTILITIES' ATTITUDE ON PROBLEMS

M. H. Aylesworth, executive manager of the N. E. L. A., said that the work of the joint committee is in no way an exploitation of the farmer. The best proof of this is that the demands for power are already beyond the capabilities of production. Central stations will not seek business before it is forced on them. The only selfish interest which they have is to bring about customer ownership of utility stocks so that the public will investigate their problems and give utilities a fair deal. Furthermore, he pointed out that the utility companies do not want equipment imposed on farmers which is not suited to their use. Greater standardization of equipment must come, and some electrical manufacturers have already indicated their desire to co-operate. Power lines are spreading out so that the country must come to interstate, rather than state, regulation, Mr. Aylesworth declared. He expressed the opinion that unit farm electric plants are the forerunners of service from power lines, although they may become relatively uneconomical after rural service is obtainable. He urged establishment of rural service experiment stations at all agricultural colleges.

ELECTRIC POWER FROM WINDMILLS

Results of tests to determine the feasibility of obtaining electric power for farm operation from windmill plants were presented by Prof. F. C. Fenton, Iowa State College, who referred to an extensive investigation at Ames, Iowa, with a 14-ft. windmill geared forty to one to a 36-volt generator charging a 240-amp.-hr. battery. It was found with this plant that the generating range falls between wind velocities of 8 miles and 32 miles per hour, lower velocities not being sufficient to generate any power and greater velocities putting the mill out of action. At 12 miles per hour this particular mill generated 10 amp., although variations ranging from 2 amp. to 25 amp. may occur in a few seconds because of gusts. The summer calm, Professor Fenton said, is a serious obstacle to windmill generation.

Professor Stewart announced that one wind-power generator costs $1,500 to $1,900 installed and that the watt-hour efficiency of storage batteries, according to tests, ranges from 61 to 75 per cent.

Utility Men Discuss Electrification

Superpower, Rural Service, Public Relations, Finances and Commission Regulation Are Topics at Well-Attended Meeting at Charleston, W. Va.

MORE than 150 representatives of the public utilities of the state attended the annual meeting of the West Virginia Utilities Association in Charleston on Nov. 9 and 10. Several notable papers were presented and much constructive work was done.

At the opening session on Friday S. Q. Hayes of the Westinghouse Electric & Manufacturing Company presented a paper on superpower and railroad electrification. He said that West Virginia's enormous coal deposits and water-power possibilities make it a pivotal point for superpower development. Superpower, Mr. Hayes continued, is being realized now. The Virginian Power Company is arranging for or considering tie connections at suitable points with the Appalachian Power Company, the Kentucky-West Virginia Power Company and possibly others. The lines of the West Penn Power Company or the American Gas & Electric Company may later form connecting links in a 132-kv. system that will tie together Charleston, Wheeling, Pittsburgh, Cleveland and other industrial centers. Mr. Hayes then discussed the electrification projects of the Norfolk & Western and the Virginian railways. The latter, he said, is today operating the heaviest trains in the world with the most powerful steam locomotives, but to provide still greater transportation facilities electrification has been determined upon. Power for the Virginian electrification will be supplied from a steam station on the New River at Narrows. The initial capacity of this plant will be four units, each with a maximum rating of 15,000 kw., which will be sufficient for handling approximately double the present tonnage.

INTERCHANGE OF RAILWAY POWER

As the Virginian Railway and the Norfolk & Western Railway parallel each other for a considerable distance on either side of the New River and are only a short distance apart at other portions of their lines, the use of the same general scheme of electrification on the two lines will permit the ready interchange of power between these systems in case of necessity and will allow each system to act essentially as spare capacity for the other.

There is a tie connection between the Appalachian Power Company and the Norfolk & Western Railway through the frequency-changer equipment at Switchback, and there may be a similar connection with the Virginian Railway. The probable interconnection between the Appalachian Power Company and the Virginian Power Company at Scarbro, West Va., and the future tie connections between the Virginian Power Company, the Kentucky-West Virginia Power Company and other power systems may ultimately lead to a general interconnection of the railway and power systems throughout West Virginia and the neighboring states.

In addition to the Norfolk & Western and the Virginian railways, Mr. Hayes said that the Baltimore & Ohio has been seriously considering electrification of certain portions of its lines in West Virginia. At present the general limiting conditions for the Baltimore & Ohio Railway are not due to conditions on the railway lines as they exist in West Virginia, but to the terminal facilities at the ports on the Atlantic seacoast. Particular sections in West Virginia can be greatly improved by electrification. In a somewhat similar manner, terminal facilities for the Chesapeake & Ohio Railway are possibly limiting features rather than its lines in West Virginia. However, when the terminal facilities of the Baltimore & Ohio and the Chesapeake & Ohio at seaboard have been increased it will then be advisable to increase their railway facilities.

At the afternoon session J. A. Morris, district manager of the American Railroad Association, reviewed the transportation situation.

UTILITIES' FUTURE PROBLEMS

W. B. Clarkson presented a paper on creating favorable public sentiment. The future, he said, presented two problems—first, the adequacy of earnings on plant put in at post-war prices when existing rates are based on pre-war plant and, second, the obligation of utilities to meet the demands for service. New capital in great quantities must be supplied by the public. Publicity, customer ownership, co-operation of employees and good service were the essential aids.

Major Alexander Forward of the Virginia Corporation Commission predicted a bright future for the utilities and held that no better method had been devised to secure proper development than regulatory commissions.

At an evening banquet Martin J. Insull made an excellent address on the two most important problems facing the utilities. In his opinion an enlightened and sympathetic public opinion was a fundamental necessity of prosperous utility growth. He outlined methods to bring this about. The other great problem, in the opinion of Mr. Insull, was to obtain adequate funds to permit the utilities to realize the opportunities for service. With financing rates are bound up.

RURAL SERVICE

On Saturday a series of fifteen-minute talks were given on various phases of utility business. A. H. Grimsley, general manager of the Virginia-Western Power Company, presented a paper on rural service in which he gave the main features of the rules proposed for Virginia. In view of the great interest now being taken in rural service, these summaries of the rules are printed here:

First—The term "rural customer" refers to the farmer or other consumer of electrical energy who is not within the corporate limits of any city or town or any other territory having similar character or density of population.

Second—When one or more prospective rural customers make a request for electric service the utility will investigate the extension, ascertain the number of customers who can be advantageously served and the number willing to contract for service under the terms prescribed, and will estimate the construction cost.

Third—Construction cost should be divided into two classes:

1. Cost of general equipment, which includes cost of all labor and material directly chargeable to the rural extension from the point where this extension originates to the local equipment on the customer's premises. Items of freight, cartage, purchasing and storeroom expenses should be included, to which should be added a proper percentage covering engineering and superintendence, etc.

2. Cost of local equipment should include all cost of labor and material required for the installation of step-down transformers supplied customer, together with secondary wires, services, protective apparatus, etc., including freight, cartage, purchasing and storeroom expense, to which should be added a proper percentage for engineering and superintendence.

3. Meter equipment will be supplied by the utility at its own expense.

Fourth—Prospective customers shall pay the utility the estimated cost of the general equipment, together with the estimated cost of the local equipment, the latter to be apportioned in accordance with the expenditures required for the various individual customers.

Fifth—An additional rural customer will be connected to an extension upon the payment of a connection charge plus the cost of the local equipment necessary to serve him. This connection charge will be determined by dividing the total cost of general equipment of the original extension by the number of original customers. If the cost of general equipment required to serve the additional customer is less than the connection charge, the additional customer shall pay the connection charge and the cost of local equipment, whereupon the utility will make the connection. The difference between the connection charge and the cost of general equipment shall be refunded to the customers on the extension (including the additional customer) in proportion to the amounts advanced.

Sixth—Rates for rural service shall be regular city rates plus a rural charge. This rural charge shall cover the amount by which the fixed charges, energy losses and operating expenses incident to rural service exceed the corresponding items for equivalent revenue from said rates.

Seventh—The rural charge is arrived at in the following manner: Ten per cent of the total construction cost of the extension plus the total transformer core losses computed at $1\frac{1}{2}$ cents per kilowatt-hour minus 27 per cent of the annual revenue from the extension resulting from the application of regular city rates.

(Note.—For rural extensions the items of depreciation, taxes, excess operating expenses, hazards, etc., have been found to be equal to about 10 per cent of the construction cost as follows: Excess maintenance and operating expenses, $4\frac{1}{2}$ per cent; depreciation, 4 per cent; taxes, $1\frac{1}{2}$ per cent. City rates are designed to cover taxes, depreciation and return on the investment in the city distribution system as follows: Taxes, $1\frac{1}{2}$ per cent; depreciation, 4 per cent; return, 8 per cent; total, $13\frac{1}{2}$ per cent on the investment. The average investment in city distribution system is equal to about twice the annual revenue. These fixed charges carried by city rates can, therefore, be expressed as 27 per cent of the annual revenue.)

Eighth—Adjustments will be made in the rural charge at the end of each calendar year to allow for changes and number of customers, revenue from line, etc.

Ninth—When the capacity, size or character of any general or local equipment needs to be increased or changed in order adequately to take care of the rural service customer or prospective customer whose requirements necessitate the change, pay for the same. Apportioning of such payments shall be the same as for new extensions.

Tenth—The title to all extensions, whether on private property or public highways, shall be vested in the utility.

Swope Gives First Aldred Lecture at M. I. T.

Gerard Swope, president of the General Electric Company, as stated last week, addressed the faculty, post-graduate and senior students of the Massachusetts Institute of Technology at Cambridge, Nov. 9, upon "The Engineer's Relation to Society," this being the first of a series of lectures provided for by J. E. Aldred. In a brief introductory talk Mr. Aldred emphasized the vital importance of common sense in engineering and the need of persistence.

Mr. Swope pictured the benefits conferred upon society by the engineer as illustrated in the development of hydro-electric energy, by the reclamation of arid wastes through irrigation, and by the improvement of industrial processes through electrical applications. Discussing the problem of management and labor, the speaker drew a broad sketch of the opportunities before the modern engineer in the direction of bringing about improved relationships and increasing the efficiency of production, pointing out that high wages and low costs are not inconsistent, provided production is at a maximum. Production at lower cost spells progress to civilization, and the engineer is, he said, better fitted to undertake this work, including that of industrial relations, than any other professional man.

The next lecture will be on Nov. 23, by Julian C. Smith, vice-president Shawinigan Water & Power Company, Montreal, on "The Development of a Water Power." John W. Lieb, vice-president New York Edison Company, is scheduled to speak on Dec. 7.

Weeks Leases Sheffield Plant to Alabama Power

The Sheffield steam plant at Muscle Shoals has been leased for another period of a year to the Alabama Power Company, which has been operating it. Secretary of War Weeks, in announcing recently that the lease probably would be renewed, said it would continue to be revocable. Thomas W. Martin, president of the power company, said his company would pay the government $350,000 for the use of the plant this year.

Good Attendance and Program for Supply Jobbers

The annual winter meeting of the Electrical Supply Jobbers' Association, held at the Hotel Statler, Buffalo, this week, attracted the largest attendance for years. Executive committee and merchandising committee meetings were held on Monday and Tuesday, executive sessions on Wednesday and open meetings on Thursday. Excellent addresses were given, including "Credit and Collection Conditions," by Frederic P. Vose, general secretary National Electrical Credit Association; "The Radio Situation," by David Sarnoff, vice-president Radio Corporation of America; "The 'If' in Electrify," by O. Fred Rost, Newark, N. J., and "Contrast Between Jobbing Electrical Supplies and Hardware," by H. O. Smith, Akron, Ohio.

President Nicholson Reviews Work of A. M. E. S.

In connection with the section meetings of the Associated Manufacturers of Electrical Supplies in New York on Nov. 7 to 9 a general meeting of the association was held, at which matters of common interest to all sections were discussed. S. L. Nicholson, president of the association, who presided, reviewed broadly the general work of the association. It is anticipated that the new organization and working rules will facilitate the work of the association and the sections on matters of standardization. He outlined the procedure of the American Engineering Standards Committee.

Work of the Electrical Manufacturers' Council, in which the Associated Manufacturers of Electrical Supplies is one of three member bodies, and of some of its most active committees was also discussed by Mr. Nicholson. He directed attention to the importance of the activities of the casualty and fire prevention committee and to the taxation committee and the newly authorized industrial relations committee.

Mr. Magnus W. Alexander, National Industrial Conference Board, discussed the problems handled by that organization in matters of taxation and immigration and labor.

Other features of the association work were presented by Thomas M. Debevoise, the counsel of the association, and C. A. Bates chairman of the committee on rules of procedure.

S. E. D. Directors Meet

Plans for Greatly Increased Membership Bear Fruit—Revenues Have Been Tripled

THE concurrent meetings of the board of directors of the Society for Electrical Development and the Advisory Publicity Council functioning for the S. E. D. and the Joint Committee for Business Development were held in New York last week, when W. L. Goodwin and F. M. Feiker, the operating vice-presidents of the society first named, presented reports of various developments.

Full discussion took place over the plans for greatly increased membership in the society. In this discussion it developed that it has not been generally realized that the annual dues have been reduced more than 50 per cent in the last two years, and that the present budget of the society, while more than three times the total collected on original dues, actually represents less than half the cost to each individual member. In other words, the membership has increased enough to triple the revenue of the society.

DIRECTORS OF THE SOCIETY FOR ELECTRICAL DEVELOPMENT LEAVING ELECTRIC TAXIS

Reading from left to right, they are H. B. Crouse, Crouse-Hinds Company, Syracuse, N. Y.; Fred Bissell, F. Bissell Company, Toledo, Ohio; James Smieton, Jr., secretary-treasurer, S. E. D.; E. W. Rockafellow, National Pole Company, New York; J. Robert Crouse, Crouse-Tremaine-Kulas Company, Cleveland; James H. McGraw, McGraw-Hill Company, New York; F. M. Feiker, operating vice-president S. E. D.; Frank D. Van Winkle, Post-Glover Electric Company, Cincinnati; W. I. Bickford, Iron City Electric Company, Pittsburgh; W. H. Morton, Sanborn Electric Company, Indianapolis; L. P. Sawyer, National Lamp Works, General Electric Company, Cleveland; John F. Gilchrist, Commonwealth Edison Company; J. E. Montague, Niagara Electric Service Corporation; C. L. Edgar, Boston Edison Company, and W. L. Goodwin, operating vice-president S. E. D.

Davenport Opposes New Dam in Mississippi

Considerably more hydro - electric power will be developed at Davenport, Iowa, if a dam across the Mississippi on which United States Army engineers have been working goes through as planned. The dam, however, would close the channel of the Mississippi River since it is designed to rise 7 ft. above the low-water mark, and such opposition from Davenport, Bettendorf and Princeton has arisen that the project may be stopped. Davenport asserts that its water supply would be threatened, and a state investigation is to be made.

At the present time a dam extends up river from Rock Island. This dam runs parallel to the Illinois shore. At right angles to this dam, at its up-river end, a second dam runs out into the river. This wing dam is opposite the mouth of Duck Creek, a stream entering the river from the Iowa side. On the Iowa shore below the mouth of Duck Creek a second wing dam runs out into the river. The government engineers had begun to close the gap between these two dams.

This move would have diverted into the Moline pool or canal all of the water coming down stream except during high-water stages of the river. The Moline pool furnishes the "head" for the Davis hydro-electric plant, which sells its power to the Moline Rock Island Manufacturing Company, which in turn sells to the Tri-City Railway & Light Company, the parent company and the main cog in the United Light & Railways Company. The Moline pool also furnished the head for the government hydro-electric plant on Rock Island. The arsenal there is at the present time almost shut down and its surplus power is sold to the Moline Rock Island Manufacturing Company. The Moline pool also constitutes a canal by which steamboat traffic passes around the rapids which stretch up river from Davenport for several miles.

Hetch Hetchy Committee Reports to City

That the city of San Francisco should petition the California Railroad Commission to prepare a valuation of selected portions of the distributing systems of the Pacific Gas & Electric Company and of the Great Western Power Company within the city was the recommendation presented to the San Francisco Board of Supervisors by the citizens' advisory committee on Hetch Hetchy power. The committee did not recommend further attempts to purchase either of the systems at the present time.

The committee announced that the city will have a power house generating 70,000 kw. by Jan. 1, 1925, and that the city will also have a transmission line leading into San Francisco by that time. The recommendation was made that the city refrain from entering into any contracts for the distribution of the power by any private corporation.

At a meeting of the Board of Supervisors it was unanimously agreed to call upon the Railroad Commission to make the valuations suggested by the advisory committee.

Stratton Talks of Europe

Closer International Co-operation Between Engineers a Vital Factor in Maintaining World Peace

"A MORE intimate interchange of ideas and a closer co-operation between scientific and technical men in this country and their professional brethren in foreign lands will tend more than any other factor to promote international peace," declared President S. W. Stratton of the Massachusetts Institute of Technology to a representative of the ELECTRICAL WORLD a few days ago. Dr. Stratton recently returned to Cambridge after a summer vacation in Great Britain and on the Continent, during which he visited a number of educational and research institutions. He made the foregoing observation in response to an inquiry as to conditions overseas in engineering education and research.

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S. W. STRATTON

Referring briefly to engineering education, Dr. Stratton said that England, France and Germany are thoroughly alive to the importance of technical instruction and that not even the difficult economic conditions prevailing in these countries has halted such training. The necessity for adequate general training before specialization is, as in America, widely recognized. During the war many technical institutions gained valuable additions to their equipment. These are now available for service and constitute a sort of surplus of *materiel* which is being turned to excellent account in instruction and investigations. Hard-pressed as Germany is at present, technical education is being kept up, and to many boys whose families have been unfortunate financially engineering training and daily sustenance are being given by the authorities. This care of individuals led Dr. Stratton to touch upon the importance of opening the doors of intensive expert training to exceptional young men in America by the removal of certain pecuniary handicaps which in many cases impair the opportunity such men might otherwise embrace to develop to the full their capabilities for very unusual and exceptional accomplishment. The establishment of a discretionary fund without "strings" attached would make this possible.

Interchange of Post-Graduates

The interchange of graduate students between America and Europe, said Dr. Stratton, is being advocated more and more overseas, and the exchange of technical professors, it is felt, should be brought about and will yield as valuable results as the well-tested exchange of teachers of non-technical subjects. The work of the Scandinavian Foundation in New York is most promising in this direction. Germany and France are both interested in graduate student interchange with America and are taking steps toward its effective establishment. Dr. Stratton pointed out the deep interest manifested by engineering societies abroad in all phases of trade and technical training. These organizations of engineers are solicitously concerned in the educational facilities available to even the humbler workers in the engineering industry—an interest which might well be duplicated more generally among similar organizations in America.

Going beyond this desirable international liaison between educational institutions, one finds in the professional engineering societies here and abroad means for promoting international understanding that have so far been relatively unused in comparison with the possibilities. Interchanges of view, the sharing of information and experiences by scientists and engineers and the development of international relations on a fact-finding rather than a fundamentally political basis will do far more, in Dr. Stratton's opinion, to insure peace than the diplomacy of self-seeking statesmen. This international contact includes the field of research, in which Great Britain and Germany are and long have been keenly interested, toward which France is turning with ability, and which has attained of late so rapid a development in the United States. The worldwide need of research for government and for industry demands a far greater supply of qualified specialists than are at present receiving adequate training. Industries throughout the world will do well to make more comprehensive provision for research and for the extremely technical training demanded of those who participate in it. Progress hinges upon a liberal policy, through which science will attain new triumphs in the service of humanity.

Ample Program for Southeastern Division, N. E. L. A.

Thirty-one addresses and papers, in addition to the reports from officers and committees, are scheduled for presentation at the four-day convention of the Southeastern Geographic Division, N. E. L. A., which is to be held at the Hillsboro Hotel, Tampa, Fla., on Monday to Thursday of next week, Nov. 19-22. There will be general, technical, commercial and accounting sessions, as follows:

GENERAL SESSIONS

Monday, 2 p.m.—Address by Mayor and response by T. W. Martin, president Alabama Power Company; address, W. R. Sammons, president Knoxville Power & Light Company; reports by officers and safety committee.

Tuesday, 10 a.m.—Public Relations Section in charge. Reports by P. S. Arkwright, chairman of section, by public-speaking committee and by women's committee on public information; addresses by Ross Murphy, George Oxley, W. H. Hodge, E. F. Wickwire and Chairman H. T. Sands of the Public Relations National Section.

Wednesday, 10 a.m.—Addresses by M. H. Aylesworth, C. B. Scott, T. J. McManis, H. M. Atkinson and M. R. Bump.

Thursday, 10 a.m.—Addresses by R. Hudson Burr, chairman Florida Railroad Commission; A. J. Maxwell of the North Carolina Corporation Commission and F. M. Feiker of the Society for Electrical Development.

TECHNICAL SESSIONS

Tuesday, 2 p.m.—"Carrier-Current Telephony for Power Systems," C. C. Jackson; "Lightning - Arrester Grounds," H. M. Towne; "Demand Meters," W. A. Gentry; "Carrier Systems from the Standpoint of Co-ordination," H. S. Osburn; "Our Neighbors on the Highway," K. L. Wilkinson.

Wednesday, 2 p.m.—"Three-Wire Railway Distribution," C. E. Bennett; reports by the meter, inductive-co-ordination and electrical apparatus committees.

ACCOUNTING SESSIONS

Tuesday, 2 p.m.—Reports of committees: Budget, classification of accounts, customers' records and billing methods, accounts payable records, fixed capital records, payroll standardization, purchasing and storeroom accounting.

Wednesday, 2 p.m.—Report on merchandising accounting; round-table discussion.

COMMERCIAL SESSIONS

Tuesday, 2 p.m.—Address by F. P. Cummings, chairman of section; reports of Lighting and Appliance Bureaus; "Building the Domestic Lighting Load," D. A. White; "Merchandising with the Local Contractor-Dealers," J. S. Sutherland; "The Electric Range as a Revenue Builder," I. H. Morchead; address, S. A. Chase.

Wednesday, 2 p.m.—Reports of Power Sales Bureau and customers relations committee; "Service to Municipal Pumping Plants," G. S. Jones, Jr.; "Industrial Heating," P. E. Shacklett; "Training Salesman," Martin L. Pierce; "Selling Service to the Public," W. R. Waggoner; address by F. P. Cummings, chairman of section.

Empire State Association's Electric Meeting

The Empire State Gas and Electric Association, which will henceforth hold the annual meeting of its Electric Section in the fall instead of the spring to avoid any possible conflict with the National Electric Light Association convention, has arranged the following program for the first of these fall meetings, to be held in the Edison Club auditorium, Schenectady, next Wednesday and Thursday, Nov. 21-22:

WEDNESDAY, NOV. 21

Morning.—"Essentials of a Modern Distribution System," H. W. Watt, chairman distribution lines committee; "Cost of Joint Line Construction in Rural Districts," J. C. Robbins and A. W. Underhill, chairman rural transmission committee; report on public relations from the New York State Committee on Public Utility Information.

Afternoon.—"The Underground Network System of the United Electric Light & Power Company," C. T. Sinclair; "High-Tension Cables," L. A. Zima, Brooklyn Edison Company; "Is the Overhead Ground Wire Necessary?" C. A. Bacon, chairman transmission lines committee.

THURSDAY, NOV. 22

Morning.—Report of water-power committee, Franklin J. Howes; "Interconnection," E. P. Peck, chairman committee on interconnection; "Methods for Phasing Generators and Transformers to Insure Parallel Operation with Rest of System," A. C. Jordan, chairman operation committee.

At 2:30 p.m. on Thursday an inspection trip will be made to the new Rotterdam substation of the Adirondack Power & Light Corporation.

Public Service of Colorado's Stock-Selling Campaign

The Public Service Company of Colorado launched a ten-day "whirlwind" campaign on Nov. 10 to sell 10,001 shares, or $1,000,000 par value, of its preferred stock to its employees and the public in the territory it serves. This is the first stock sales activity since the recent consolidation of the Denver Gas & Electric Light Company and the Western Light & Power Company of Boulder into the Public Service Company of Colorado, with headquarters in Denver. The price will be 93½, making the yield about 7½ per cent. The stock will be sold by the employees and the local banks on a commission basis.

Brief News Notes

Montreal Light, Heat & Power Plans New Plant. — It is reported from Montreal that the Montreal Light, Heat & Power Consolidated is planning a new plant, which is likely to have an ultimate capacity of 100,000 hp. According to the report, the new plant will be built at Lachine, on the edge of Montreal Island.

Interstate's Purchase of Jeffersonville Company Approved.—Authority to buy the Jeffersonville Water, Light & Power Company has been extended by the Indiana Public Service Commission to the Interstate Public Service Company. The Interstate is to pay $168,750 cash and the $98,500 indebtedness.

Iowa Company to Serve Nine More Towns.—As soon as a transmission line connecting Volga City and Elkader, Iowa, can be constructed, the Northeastern Iowa Power Company will begin to serve nine more towns in that vicinity with electric service, this company having entered into a contract with the People's Electric Service Company of Elkader to furnish the latter with energy for Elkader and eight other places.

Electricity Supersedes Gas in Port Townsend, Wash. — The Washington Coast Utilities has discontinued the manufacture of gas at Port Townsend, Wash., and electric cooking and heating service is now furnished instead. This change ensued on the acceptance of a contract submitted to the City Council, the company agreeing to compensate customers for their gas equipment, now rendered useless.

Vernon (Tex.) Citizens Advocate Sale of New Municipal Plant.—Citizens of Vernon, Tex., have fathered a proposed ordinance by which that city would sell its new municipal electric plant to the Vernon Electric & Ice Company, which, the committee estimates, could serve the city at a large saving to the taxpayers as compared with the operation of a city plant. The city has just been halted in its efforts to finance the plant by an injunction from the Court of Civil Appeals based on contentions of illegality.

New Plant for Middle Georgia. — Engineers have started a survey near Macon, Ga., for a 13,000-hp. generating plant on which work will start within three or four weeks, it has been announced by L. A. Magraw, manager of the Macon Railway & Light Company. The plant will provide power for industrial operations in the Middle Georgia territory and will cost $1,500,000 or $2,000,000. It will serve as an auxiliary plant to the Central Georgia Power Company's hydro-electric plant at Jackson, Ga.

Utility Course of University of Arkansas.—The College of Engineering of the University of Arkansas, Fayetteville, Ark., has just given its sixth special utility men's course under the direction of W. B. Stelzner, professor of electrical engineering. The first four courses were given for metermen. Last year the work was confined to steam practice, and this year the course dealt with general electrical practice.

Indiana Electric Rates Ordered Cut.—The Northern Indiana Gas & Electric Company, under an order of the Indiana Public Service Commission, will reduce its energy rates in Hammond, Whiting and East Chicago on Dec. 1. It is estimated that the new rate will entail an annual saving of $110,000 to consumers, being divided between residential and commercial users in the proportions of $75,000 and $35,000 respectively. This Indiana utility is under the control of Samuel Insull and his associates, who purchased the property last June from the United Gas Improvement Company, which still retains an interest.

Birmingham Company Reorganization.—Further steps have been taken by the receivers of the Birmingham Railway, Light & Power Company toward the payment in full of its main bonded indebtedness, and complete reorganization is expected to come soon

after Jan. 1, following the maturing of the $4,600,000 refunding and extension mortgage 6 per cent bonds, which is definitely indicated as a result of the federal court directing the receivers to make default of payment of interest due.

An Oklahoma Company Changes Name.—The name of the Lawton & Duncan Electric Company of Lawton, Okla., has been changed to the Southwestern Light & Power Company, according to an announcement by President E. R. Ernsberger of Oklahoma City. The company has expended approximately $300,000 on the steam plant at Lawton, including the installation of a new turbine, and 100 miles of high-tension lines will, is is expected, soon be constructed.

Terms of Cahokia Lease Altered.—The petition of the Union Electric Light & Power Company of St. Louis to lease the new Cahokia plant owned by a subsidiary of the North American Company has been amended following the rejection of the original petition by the Missouri Public Service Commission on the plea by the city of St. Louis that under its terms power consumers would not benefit from a reduction in construction costs. The new application provides that if construction costs are reduced the customers and not the company shall reap the advantage.

Pan-American Commission to Promote Intercontinental Electrical Communication.—Secretary of State Hughes has been authorized by the governing board of the Pan-American Union to appoint a special committee to fix a date for a meeting at Mexico City early next year of the Inter-American Electrical Communication Commission. The commission, which will be composed of not more than three delegates from each member state of the Pan-American Union, will, as its name implies, meet for the purpose of developing closer co-operation between the American republics by cable and wireless.

Fynn-Weichsel Motor Exhibited at St. Louis Electrical Board of Trade Meeting.—Although normally discussion of a specific product manufactured by a member company is strictly forbidden by the St. Louis Electrical Board of Trade, an exception was made in the case of the Fynn-Weichsel motor on Nov. 6, it being considered of such far-reaching importance to the electrical industry that the Wagner Electric Corporation was permitted to exhibit it, and the whole session was devoted to a discussion of its merits into which competing companies entered in a broad-spirited way.

Rail Electrification Plans in New York City.—As a preliminary to carrying out the electrification of its lines within the limits of Greater New York in accordance with an act of the last Legislature which makes electrification by Jan. 1, 1926, compulsory, the New York Central Railroad has asked the Transit Commission to order the elimination of all the railroad's grade crossings on the western edge of the city. If this is done, the state and the city must bear jointly half the expense, the railroad bearing the other half. The New York Central maintains that the abolition of grade crossings must precede electrification.

Another Iowa Utility Purchase.—The Iowa Railway & Light Company of Cedar Rapids has bought the property of the Springville Electric Company, Iowa, and will make it a part of its system. The people of Springville at a recent election refused to vote a bond issue for the building of a municipal electric lighting plant.

Ford's St. Paul Plant.—The Ford Motor Company, it is announced, has made all major decisions as to the layout of its Mississippi power and manufacturing plant to be built at the government dam at St. Paul. Modifications in the power-house substructure, built by the government, which were found necessary to take advantage of later developments in waterwheel design are nearing completion. The changes will permit installation of modern turbines and, besides improving flow conditions, will increase efficiency. The hydro-electric development is the company's most extensive undertaking of this kind. The power house will be 160 ft. long by 74 ft. wide and 48 ft. above the foundation. Four waterwheels of 4,500 hp., in conjunction with four vertical generators, under normal conditions will produce approximately 18,000 hp. A steam-power house will be erected to supplement the water power in case of emergency.

North Carolina Companies Expanding.—The Carolina Power & Light and its auxiliary, the Yadkin River Power Company of Raleigh, N. C., are extending their operations in the eastern section of North Carolina by purchase, according to Paul A. Tillery, vice-president of the Carolina company. The Carolina company has purchased the Franklin Light & Power Company of Franklinton, and the Yadkin company has bought the Carolina Electric Company of Maxton. Both the purchased companies have heretofore purchased power from the Carolina and Yadkin companies, distributing it in their respective towns for lighting, heating and small industrial purposes. Under the terms of the purchase the purchasers will retail power in the affected communities as well as wholesale.

Constantinople Turns to Electricity.—Constantinople, with a population of 1,200,000 persons of seventeen different nationalities, is the last large city in the world to take up electricity, the recent announcement of the installation of electric street lighting and street cars marking the final triumph in that city of modernity over superstition and inertia. A central station has been built near the Golden Horn to generate energy, 27 miles of single-track street railroad now carry the inhabitants back and forth, and electric street lights have been set on poles, each of which is surmounted with the national fez and crescent.

Associations and Societies

Denver Electrical Co-operative League.—The organization, purpose and general field operations of the Electrical Co-operative League of Denver were recently discussed before seventy-five representatives of the Denver central-station company by S. W. Bishop, executive manager, and Frank J. McEniry, field representative of the league, with the object of acquainting the central-station employees with the work and problems of the league.

Accounting Section, N. E. L. A.—The Accounting National Section of the N. E. L. A. will hold group meetings at the Hotel Muehlenbach, Kansas City, Mo., on Dec. 10, the following committees being scheduled to meet at 10.45 a.m.: Budget, classification of accounts, customers' records and billing methods, fixed-capital records, merchandise accounting, mortgage and trust agreements, payroll standardization, preservation of records, purchasing and storeroon accounting, security holders' records. At 9.30 a.m. on both Dec. 10 and Dec. 11 there will be a general meeting, and at 2 p.m. on Dec. 11 the section's executive committee will meet.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

Electric Power Club—French Lick Springs Hotel, French Lick, Ind., Nov. 19-22. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Southeastern Division, N. E. L. A.—Hillsboro Hotel, Tampa, Fla., Nov. 19-22. Charles A. Collier, Georgia Railway & Power Company, Atlanta, Ga.

Electrical Credit Association, Central Division—Hotel LaSalle, Chicago, Nov. 20-21. F. P. Vose, 1341 Marquette Bldg., Chicago.

Commercial National Section, N. E. L. A.—Group meetings, Salt Lake City, Nov. 21-22.

Empire State Gas and Electric Association—Electric Section, Edison Club, Schenectady, Nov. 21-22.

American Physical Society—Ryerson Physical Laboratory, Chicago, Nov. 30-Dec. 1. H. W. Webb, Columbia University, New York.

American Society of Mechanical Engineers—New York City, Dec. 3-6. C. W. Rice, 29 West 39th St., New York.

National Association of Railway and Utilities Commissioners—Hotel Urmey, Miami, Fla., Dec. 4-7. J. B. Walker, New York Transit Commission, New York City.

Accounting National Section, N. E. L. A.—Hotel Muehlenbach, Kansas City, Dec. 10-11.

American Engineering Council (F. A. E. S.)—Washington, Jan. 10-11. L. W. Wallace, 26 Jackson Place, Washington.

American Institute of Electrical Engineers—Midwinter convention, Philadelphia, Feb. 4-8. F. L. Hutchinson, 33 West 39th St., New York.

Commission Rulings

Obligation to Serve Chartered Territory.—A public service company, said the Pennsylvania Public Service Commission in adjudicating a complaint against the People's Natural Gas Company, is obliged to supply service within its chartered territory and to make at its own expense all reasonable extensions therein for that purpose, where the loss which would have to be passed on in the way of increased rates to other patrons of the company would be comparatively insignificant.

Reparation for Charges Found Unreasonable After They Had Been Paid.—The Pennsylvania Public Service Commission has declared the Phoenixville, Valley Forge & Strafford Electric Railway Company entitled to reparation from the Philadelphia Suburban Gas & Electric Company in the amount of the difference between charges paid under a rate schedule and charges later found to be reasonable by the commission, there being an absence of countervailing evidence and complaint having been filed by the consumer before the effective date of the schedule.

Property Used and Useful.—Land and a cottage occupied by a company employee were included by the Missouri Public Service Commission in the property used and useful of the People's Gas & Electric Company of Chillicothe, Mo., since the occupancy of this property eliminates the expense of employing a watchman and, in addition, is a source of revenue. An appraisal by commission engineers, based on the average of opinion of local real-estate dealers, was considered the best evidence of the value of lands. It was an error, the commission said, "to add to the amount taken as the fair present value of the lands the further sums calculated on that value which were embraced in the items of 'engineering superintendence,' 'legal expenses,' 'contingencies' and 'interest during construction.'"

Bills and Schedules—Change to Meter Service.—In settling a complaint made against the Branchville Electric Power, Water & Light Company, the New Jersey Board of Public Utility Commissioners decreed that bills rendered for past electric service in accordance with schedules should be paid, notwithstanding that the schedules were not filed with the commission and the consumer alleged lack of notice. The adoption of a schedule of meter rates for electric service which has been furnished at flat rates must, the commission said, be determined by the selection of a schedule which has apparently been equitable in communities of a somewhat similar character and size, since it cannot be based upon a valuation of the property coupled with a study of earnings and expenses, owing to the fact that operating costs for unmetered service are likely to be quite different from such costs after meters are installed.

Massachusetts Commission Approves Large Stock Issue.—To facilitate financing now under way at the Weymouth (Mass.) generating plant and other improvements, the Massachusetts Department of Public Utilities has approved the issue by the Edison Electric Illuminating Company of Boston of 64,881 additional shares of capital stock at $140 per share. The yield from the anticipated sale is $9,083,340. The commission found that the price fixed "is not so low as to be inconsistent with the public interest," and while refraining in view of the pending rate case from passing upon the expenditures represented by outstanding notes exceeding the above yield, declared itself satisfied with the proposed issue and declined to override the judgment of the company that stock should be issued at this time rather than bonds.

Recent Court Decisions

California Budget Bill Did Not Impliedly Repeal Section of Utilities Act.—The Railroad Commission of California applied for a writ of mandate against Riley, State Controller, owing to a disputed interpretation of a budget law passed by the Legislature. The California Supreme Court has found that this law did not, as contended, impliedly repeal the section of the utilities act appropriating to the Railroad Commission fund fees directed to be collected by the commission, but merely required the appropriation by previous statute to be used first. (218 Pac. 415.)

Claim for Reparations Not Defeated Because Contract for Service Is Discriminatory.—The Supreme Court of Illinois, in Jefferson Deposit Company vs. Central Illinois Light Company of Peoria, has reversed a decision of the lower court which upheld an order of the state commission. The commission refused to entertain a petition from the Jefferson Deposit Company for a refund of amounts charged in excess of contract rates for steam heating, the commission asserting that the contract was discriminatory. The court holds that a discriminatory contract can be attacked only by methods prescribed in the public utilities act and that a contract for service by a utility cannot be set aside by inference or as an incident to a proceeding on a petition seeking a different relief. Until a contract has been properly set aside any charge above the amount specified in it is an "excessive charge" under the act and a basis for a claim for reparations. (140 N. E. 817.)

What Is the Essential Element of a Public Utility? — Declaring a water-supply business carried on by one Richardson not a public utility, though the California Railroad Commission had held it to be such, the Supreme Court of California said: "To constitute a true public utility the devotion to public use must be of such character that the public generally, or that part of it which has been served and which has accepted the service, has the legal right to demand that that service shall be conducted, so long as it is continued, with reasonable efficiency under reasonable charges." (218 Pac. 418.)

Court Should Not Refuse Utility Permission to Amend Pleading Raising Question of Confiscatory Character of Rates.—The Supreme Court of Ohio, in United Fuel Gas Company vs. City of Ironton, overruled the lower court, which refused to the company permission to amend its plea. This, the Supreme Court held, was an abuse of the discretion lodged by the statutes in the court because in the proceeding referred to the confiscatory character of the rate in dispute was a proper issue, and if determination of such issue should result in a finding that the rates were confiscatory, the denial of leave to amend would amount to a denial of the rights of the utility under the Fourteenth Amendment. The court also decreed that under the state law neither a city nor a public utility company can contract as to the price of the commodity furnished for a longer period than ten years. (140 N. E. 884.)

Oklahoma Commission's Regulation of Ice Companies Upheld.—A petition from the Oklahoma Light & Power Company of Holdenville for a writ of prohibition against the Corporation Commission of the state restraining it from assuming jurisdiction over the prices charged for ice by that company was denied on Oct. 30 by the Oklahoma Supreme Court, which upheld the right of the commission to regulate an ice business as to rates and practices where the facts disclose that it falls within the provisions of the anti-trust act of 1908. This decision is of vital interest to electric utilities in the South and Southwest engaged in the commercial manufacture of ice. The act cited provides in substance that any public business is subject to regulation by the state when it has a virtual monopoly. About two years ago the Corporation Commission assumed jurisdiction over a number of ice companies under the provisions of the act, and the suit just decided was brought as a test case. It is interpreted to apply to all electric light and power companies which manufacture and sell ice.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Frank H. Gale Receives New Appointment

Frank H. Gale, who for the past seventeen years has been in charge of the space advertising of the General Electric Company, has been assigned to the staff of Dana R. Bullen, assistant vice-president. Mr. Gale will assist Mr. Bullen in the many activities of his new work and especially will have charge of conventions and exhibits with the title of manager of conventions and exhibits.

F. H. GALE

The change will be effective Dec. 1. Mr. Gale was in the service of the Thomson-Houston Company at Lynn, Mass., when it was merged into the General Electric Company in 1892. His work took him first to Schenectady and then to various parts of the country, but he returned to Schenectady in 1895 and four years later was transferred to the commercial department. In 1901 he had charge of the company's interests at the Pan-American Exposition at Buffalo, and since then he has had supervision of such work at all exhibits and conventions. Subsequently he was placed in charge of the company's advertising in periodicals, and later he received the title of advertising manager. Mr. Gale is a member of the N. E. L. A., the A. E. R. A., the Association of National Advertisers and the Engineers' Club and an associate member of the A. I. E. E.

R. J. Snare has been made efficiency engineer of the Texas Power & Light Company at Waco, Tex. Mr. Snare has had considerable experience in power-plant operation and construction and goes to Waco from the test course at the Lynn works of the General Electric Company.

J. D. Farmer, formerly associated with the South Bend office of the Indiana & Michigan Electric Company, has been made manager of the company's new-business department at Elkhart, Ind.

William N. Fenninger, who recently resigned his position of expediting engineer with the Brooklyn Edison Company, is now supervisor of electrical courses at the Mechanics' Institute, Rochester, N. Y.

T. L. Beauchamp, formerly district manager of the Alabama Power Company at Decatur, Ala., is now superintendent of the Tuscaloosa Railway & Utilities Company, Tuscaloosa, Ala., of which property the Alabama Power Company recently took control.

Benjamin Shertenlieb, chief engineer of the Cape May (N. J.) Light & Power Company, which is controlled by the American Gas & Electric Company, has been transferred to the Atlantic City Electric Company, also an A. G. & E. property.

Francis Tingley, formerly supervisor of overhead lines with the Washington Railway & Electric Company, Washington, D. C., has resigned to become a member of the firm of Over & Tingley, to engage in general engineering work in the vicinity of Philadelphia.

D. E. Byerley, formerly general manager of the Hattiesburg (Miss.) Traction Company, a Doherty property, has been transferred to the Lenawee County Gas & Electric Company, Adrian, Mich., recently purchased by the Doherty organization.

Carroll A. Dean, merchandising manager of the Connecticut Light & Power Company, Waterbury, Conn., has resigned to enter the waterworks field at Pepperill, Mass. Mr. Dean was formerly manager of the Pepperill Electric Light & Power Company, which was merged into the Middlesex County Electric Company, and prior to that was appliance sales manager of the Cambridge (Mass.) Electric Light Company.

Frederick W. Carlson, who until recently had been connected with the Westinghouse Electric & Manufacturing Company, is now associated with the Skagit River development of the city of Seattle, Wash., as electrical engineer.

R. G. Manifold and **C. O. Poole** have reopened their engineering offices in Los Angeles, where they will do a general consulting engineering business, including hydraulic, electrical and mechanical engineering, designing and supervising, making examinations, reports and appraisals.

S. L. Pearce of Manchester, England

S. L. Pearce, consulting and chief electrical engineer and manager of the Manchester Corporation Electricity Department, Manchester, England, was born at Crewkerne, Somerset, in 1873. He received his technical education at Finsbury Technical College under Prof. Silvanus P. Thompson and later gained the honorary degree of master of science from Manchester University. Mr. Pearce served as assistant engineer with the British India Steam Navigation Company and subsequently with the Metropolitan Electricity Supply Company and the British Thomson-Houston Company in the same capacity. He then became superintendent engineer with the Central London Railway Company. Affiliating himself with the

S. L. PEARCE

Manchester Corporation as deputy chief electrical engineer, he was advanced to the position of chief electrical engineer and is at the present time consulting and chief electrical engineer and general manager.

Mr. Pearce is a past-president of the Incorporated Municipal Electrical Association, past-president of the Institution of Civil Engineers (Manchester Section) and past-chairman of the Institution of Electrical Engineers (Northwest Territorial Section). He is a member also of the Institution of Mechanical Engineers and a fellow of the American Institute of Electrical Engineers. Mr. Pearce has taken an active part in the movement which led to the legislation for improving the national electricity supply of his country.

W. H. Warner has been made superintendent of aerial construction of the New York & Queens Electric Light & Power Company, succeeding E. M. Anderson.

E. R. Dickerson, superintendent of the Cedar Valley Electric Company at Hampton, Iowa, has resigned to go to Uniontown, Pa. Mr. Dickerson's successor at Hampton has not yet been named.

William B. Anthony has been appointed manager of the Shawnee (Okla.) Gas & Electric Company to succeed C. B. Owens, resigned. From 1919 to the spring of this year Mr. Anthony was city manager at Walters, Okla., where he had charge of the local electric light and power plant.

Ralph Lillie, who has been in charge of the purchasing department of the Wisconsin Valley Electric Company at Wausau for many years, has assumed the division managership of the company's properties at Tomahawk, succeeding M. R. Frederickson.

Valère A. Fynn has recently opened offices in St. Louis as a consulting engineer and patent adviser. Mr. Fynn has had thirty years' experience in the design and development of mechanical and electromagnetic apparatus, in manufacturing, consulting engineering and in patent work in the United States and Europe.

Frank H. Schubert, district manager of the Wheeler Condenser & Engineering Company, and **William G. Christy**, secretary of the St. Louis Section of the American Society of Mechanical Engineers, formerly with the St. Louis Boat & Engineering Company, have organized the Schubert-Christy Construction & Machinery Company with offices in St. Louis. The new firm will render general engineering service and specialize in the design and construction of water-cooling equipment for refrigerating and power plants, design of special machinery, process development and construction work.

Walter J. Rey, formerly with the Chicago, Milwaukee & St. Paul Railway Company, is now connected with the Allis-Chalmers Manufacturing Company's electrical department.

P. M. Duncan has severed his connection with the Hawthorne plant of the Western Electric Company to become development engineer with the Allen-Bradley Company, Milwaukee, Wis.

Walter R. Roxbury has left the engineering department of the New York Edison Company to become an engineer in charge of the public utilities division, power plant equipment, of the McIntire Corporation, Newark, N. J.

David S. Brigham, formerly treasurer of the Tri-City Electric Company, Newark, N. J., has been appointed treasurer of the Southern New England Electric Company, electrical supply jobber, with headquarters at Hartford, Conn.

Clark A. Terry, formerly construction engineer with the General Electric Company, Schenectady, N. Y., has become superintendent of the Sherman Island Hydro-Electric Development Company of the International Paper Company at Glens Falls, N. Y.

C. O. Mailloux, consulting engineer of New York, sailed for Europe on Tuesday, Nov. 13, on the Aquitania to attend the second international conference on electrical superpower systems, to be held in Paris from Nov. 27 to Dec. 1.

W. E. Wickenden to Direct Technical Education Investigation

William E. Wickenden, assistant vice-president of the American Telephone & Telegraph Company, has been appointed director of the investigation of engineering education about to be conducted by the Society for the Promotion of Engineering Education with the appropriation made for that purpose by the Carnegie Corporation of New York. Details of the organization and program of the investigation appeared in last week's issue of the ELECTRICAL WORLD.

Mr. Wickenden is well qualified for the work he has been chosen to conduct, for since 1917 he has been engaged in a study of educational and personnel problems. In that year he made a study of personnel problems for the engineering department of the Western Electric

W. E. WICKENDEN

Company which led to the creation of a personnel department, of which he became manager in 1918. During that year he served also as supervisor of personnel methods for the Students' Army Training Corps. In 1921 he was transferred to the headquarters staff of the American Telephone & Telegraph Company as assistant vice-president in charge of the recruiting and development of supervisory and technical personnel for the group of companies making up the Bell System. This work included the promotion of relations with universities and colleges throughout the country.

Before affiliating himself with the Western Electric Company, Mr. Wickenden spent four years at the University of Wisconsin as student and later instructor in physics and electrical engineering and nine years as assistant professor and associate professor of electrical engineering at the Massachusetts Institute of Technology. Mr. Wickenden is chairman of the educational committee of the A. I. E. E., of the committee on relations with engineering colleges of the American Management Association and of the committee on business training of the S. P. E. E.

Dana Pierce, formerly a vice-president of the Underwriters' Laboratories, has been elected president of this organization, succeeding the late William H. Merrill.

C. A. Bacon has been appointed electrical engineer of the Adirondack Power & Light Company, with offices at Schenectady, N. Y.

C. B. Wright, formerly connected with the Duquesne Light Company, Pittsburgh, is now with the Kansas Gas & Electric Company, Wichita, Kan.

Ralph W. Eaton, public service engineer for the city of Providence, was recently elected president of the Providence Engineering Society.

Robert Timmons of the Kansas Gas & Electric Company of Wichita, Kan., was elected president of the Kansas Public Service Association at its recent twenty-sixth annual convention in Lawrence.

Sidney K. Wolf, who recently resigned his position with the Westinghouse Electric & Manufacturing Company, is now connected with the Sheffield Scientific School of Yale University as an instructor in electrical engineering.

Leland B. Bonnett, formerly connected with the General Electric Company, New York, has become associated with the Brooklyn Edison Company, Brooklyn, N. Y., as inside plant engineer.

Dean K. Chadbourne, manager of the department of the Far East of the Westinghouse Electric International Company, recently sailed from San Francisco to make a survey of business conditions in the Far East. Mr. Chadbourne will visit Japan, China, the Philippine Islands, Java, Australia and New Zealand. He will assist other Westinghouse officials in co-operating with the Japanese in the reconstruction of the area devastated by the recent earthquake and fire.

Frederick W. Bliss, representative of the Edison Lamp Works of the General Electric Company, was recently elected vice-president of the Providence (R. I.) Engineering Society.

E. G. Willson, who for several years has had charge of the Valentine Clark treating plant, has associated himself with B. J. Carney & Company, producers of Western red-cedar poles, as treating engineer.

David D. Gibson, Jr., who has been employed in the capacity of field engineer for Sanderson & Porter at Williamsport, Md., has been transferred to Springdale, Pa., in the same capacity.

C. M. Bunnell, general sales manager of the Torrington (Conn.) Company for almost two years, has resigned his position, effective Dec. 31. Previous to his connection at Torrington Mr. Bunnell was director of sales of the Splitdorf Electrical Company. He was also formerly with the General Electric Company as sales manager of the Edison Lamp Works' automobile department for about fourteen years.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Gaining a Place in the Buyer's Mind

The Competition Between the Things One Desires and Those One Needs—"Straight Selling" Too Costly—Electrical Salesmen Must "Play for Place" Also

By Roy Frothingham

IT IS not the competition of similar appliances that need concern any particular manufacturer or distributor of electric ranges, clothes-washing machines, vacuum cleaners, or other appliances. It is the competition of entirely different articles and ideas, all bidding for a share of the money which the good home manager squeezes out between the millstones of income and operating expense.

For every dollar thus saved there are from one to twenty uses. Consciously or otherwise, the average woman has a mental list of things she wants for the home. She has them arranged in order of importance to her. She may desire an electric washer or ironing machine, but as likely as not from one to five other things take precedence. Furniture, musical instruments, rugs, kitchen equipment, china, clothes and an automobile all run in competition with the electric washer and electric ironer. Competitively the advantage is with articles that give comfort or pleasure such as a victrola, a new davenport, furniture, a piano and a parlor rug.

When it comes to convenience and labor-saving articles, there is the competition of the kitchen cabinet, whose advantages are never permitted to get far out of the housewife's thoughts. Likewise the enameled-steel gas range with oven-heat regulator, the sanitary ice box with cork insulation, aluminum ware, oven glassware and enameled utensils. These and similar articles are attractively presented so as to preoccupy the niches of her mind. It is entirely possible for minor items of household equipment to gain and maintain precedence over major electric appliances.

There is a streak in most of us that encourages us to labor on in dull and unimproved fashion so long as we can balance the monotonous routine of work by pleasant diversion. Many a merchant has an automobile but not a cash register. And many a woman will wash clothes all morning without complaint so long as she can later delight herself with the harmony of music and the beauty of pretty furniture.

> **MANY** manufacturers of electrical appliances — likewise jobbers and dealers who distribute and sell them—are overlooking or disregarding an interesting and most important point that bears directly on their market. Being electrical men, they accept the idea of using electrical labor savers in the home (although, alas! they themselves actually may not use many) and they get into the habit of expecting the average householder who represents the market for the goods to think the same way—which he does not. In this article Mr. Frothingham, for some time an electrical man and now in the general advertising field, discusses the competition of other devices that cause the housewife to hold a viewpoint quite different, thus hampering the sale of electrical equipment to the American home.

A handsome rug or a mahogany table to win the admiration of a neighbor may mean more to her than an efficient washer in the basement. For the home is one place where the light of attractive furnishing will never be hidden under a bushel.

There are those in the appliance industry who believe that theirs is a straight selling business—a man-power, house-to-house, unending solicitation business where enough men making enough calls will sell enough washers. They believe that each woman without a washer has got to be "sold" individually on the idea of doing the washing electrically at home. To persuade her and to get action requires a man who can get inside the door, demonstrate his machine, get her to move the electric washer idea from number six in her mind to number one, and get a first payment with a signed installment contract. The man who can get inside the door and get his washer idea a front seat in her mind will sell his machine regardless of make, style or price.

But this method is amazingly expensive in terms of salesmen, selling price, commissions and increasing indifference on the part of women to the salesman who calls. It is very expensive in terms of dealer discontent. It is expensive in terms of consumer objection to prices that seem unreasonably high—an objection which, when coupled with prejudice or indifference to electric washing and ironing, seriously affects the whole appliance business from factory production to consumer selling.

If the idea of electric washing at home is a good idea, and if it is deserving of as much consideration by women as other ideas such as those concerning linoleum, rugs, furniture, kitchen cabinets, piano and phonograph music, house heating, hardwood floors and open plumbing, then certainly the electric washer idea deserves adequate treatment along lines of educational publicity such as are used in co-operation by manufacturers of davenport beds, wall paper and hardwood floors and by the associated commercial laundries.

There is both tendency and temptation among electrical men to assume that all women are attracted by the electric washer and ironer idea and that it is simply a matter of getting the "down" payment and installing the machine. Opinion here depends on what is meant by getting an idea "sold." A real selling job these days, whether it be selling Eskimo pie or electric washers, requires steady, hard-hitting publicity to pave the way for salesmen and back them up and persuade

women to put electric washers, ironers and ranges at the top of their shopping lists without granting precedence to anything else. As things stand now, the appliance industry is granting precedence to a whole league of articles, some of which are mentioned in this article. *What* a woman thinks and *when* she takes action depend on how the electrical man maintains his place in her mind.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

REPORTS from important electrical centers of the United States show some contrasts in the business as a whole. In a number of items production and distribution are at high levels, while in other lines one or the other of these factors is below normal conditions. The present lack of balance in the market is indicated by an unprecedented demand for all household appliances and novelties, while the industrial side of the industry is left with few orders of importance. The situation has been of this character for a number of weeks, although the general market has seen continued improvement. Power equipment is fair, with a slacking off in transmission towers and equipment.

An interesting development of the week is the increased buying power in the agricultural districts as reported by the large mail-order houses of the country. Sales of farm-lighting sets are improving in the Southeastern section and in New England, but no special activity is reported in any other territories. In the East sales of electrical merchandise and supplies are running substantially above last year's figures, but are not up to the majority quotas set last January. Central-station expansion in the East continues strong, mostly in connection with extensions and with building operations.

In the South manufacturers report excellent sales of outdoor transformer equipment, with deliveries running at from five to six months. Smaller sizes are running from six to sixteen weeks. Turbo-generator sales in the South are smaller than expected. In the Middle West the demand for rubber-covered wire has been enlivened by small price reductions effected several weeks ago. Transformers there have been reduced approximately 10 per cent owing to increased manufacturing facilities. Cautious rubber-covered wire buying is reported on the West Coast, where, as in other sections of the country, household appliances are attracting most attention.

Record Electrical Toy Sales Expected in Retail Trade

RECORD sales of electrical toys will be made in the retail trade during the coming holiday season if the volume of sales by the manufacturers to jobbers and dealers is taken as an index for estimating the volume of retail turnover of this merchandise. The electrical toy situation is greatly improved over that of 1922 and 1921 in that the manufacturers received many easy orders during the spring and early summer which enabled them to start production promptly and arrange for shipping the goods soon enough to meet the requirements of the retail trade.

One manufacturer of electrical railway trains and toy motors, commenting on the improved conditions in the industry resulting from the placing of early orders, said that because orders were placed with his firm during the spring months it had been possible to keep prices down in spite of increases in labor charges and materials. Continuous production enabled his company to reduce certain elements of factory cost enough to offset these increases in expense.

More than $7,000,000 worth of electrical toys was bought from the United States for the children of the world during 1922, and it is conservatively estimated by the makers that the retail value for 1923 will certainly reach $10,000,000. It is pointed out that during recent years there has been a remarkable development in the toy industry, the product of a marked change in the character of playthings for older children. This has come about in response to the demand for toys for both boys and girls with which they can do something useful and with which they can develop their minds. Today children are gaining knowledge from their electrical cooking sets, electrical railways, motors, sounding devices, batteries and miniature lamps, and all of the other playthings in a long list of practical toys which only a short time ago no one would have dreamed of buying for these youngsters before they entered high school.

One of the questions asked the electrical toy manufacturer is, "What toy or novelty is making the biggest hit this year?" It is the opinion of these manufacturers that there are no overnight successes in the toy industry. Toys have been an evolution from the crude beginnings of savage times. The process of improvement and development is the same as with appliances used in the home, office and factory. A little refinement here, a little change there, year by year, with no great difference at any one date, but in a generation the dealers' shelves show that a complete change has taken place. Occasionally there comes a new toy which is as totally different from the old toys as the automobile was from the horse and wagon, but both came because there was need for them. The iron train which ran when pulled by a string changed into the mechanical train operated by clockwork. This was followed by the appealing reproduction of the latest electrical railroad equipment.

An interesting aspect of toy buying is the fact that children are outgrowing the novelties faster than they did years ago. This tendency is the same in the educational institutions, since subjects that were once taught only in colleges are now taught in high schools and the former high-school courses are getting into the grade schools. Toys that a few years ago might have been appropriate for children of nine and ten years are now demanded by younger children. There is also a growing appreciation on the part of children of quality in toys, just as the fathers and mothers are buying better office and domestic appliances, rugs, furniture and pictures.

Farmers' Increased Buying Power to Help Lighting Plants

ALTHOUGH reports from manufacturers of farm-lighting equipment contain little news in the way of increased sales, an interesting indication of the farmers' returning purchasing power may be gathered from the October reports from the mail-order houses. Several of the largest mail-order houses in Chicago state that their sales for last month have been larger than those of any preceding month in 1923 and that the gains over the same period in 1922 range from 25 to 50 per cent. The farm-lighting-plant manufacturers are considering this evidence of increased buying power by the farmers as an excellent barometer of what they may expect in business for 1924.

The general farm-lighting-unit situation does not appear to have changed much during the past summer and early fall. The hoped-for opening up in business this fall or early winter has not appeared. Others who have felt this slump in the agricultural districts are the automotive industries, the implement manufacturers and the general construction field. Although the present buying is largely in the corn belt of the Middle West, average conditions have been general during several months, and it is difficult to say which territory is leading. A great deal of selling effort is still required to "sell" the farmer. Two years ago a farmer would mortgage unmarketed crops to make purchases, but today he waits until he has the actual money in his pockets to do with as he chooses.

Few price changes are contemplated because of the fairly stable prices of raw materials. Little decline in the costs of distribution, advertising and other sales effort can be expected. In

all cases where questions of high prices are discussed manufacturers are stressing their services which are available after the equipment is once sold and the high cost of which will tend to keep prices at the present levels. Manufacturers' stocks are ample to meet most demands since a close connection with this field has prevented overbuying of raw materials. While the manufacturers are not over-optimistic, there is little pessimism to be heard today because it is generally felt that once the farmer gets firmly established on his feet he will be in a position to take advantage of all the pioneering work and salesmanship which the farm-plant makers are expending at this time.

Rapid Development of Industrial Heating Devices Continues

RAPID development of new industrial electric heating devices continues to be a striking feature of the market for this class of apparatus. Progress in their application is somewhat handicapped by the lack of interest a good many central-station companies show in the subject, although conditions are far better than a few years ago. Utilities with sales engineers thoroughly informed as to the latest developments in such appliances for factory, mercantile, bakery and laboratory service are building up a fund of valuable experience which is making it easier to deal with this steadily increasing demand, but companies which have displayed a long-standing indifference to the possibilities of industrial electric heating are still far too many.

Manufacturers are now prepared to supply a liberal range of apparatus of reasonably standard characteristics for general industrial heating service along well-tried lines. Along with this growth of demand for standardized products goes an interesting and a suggestive development of equipment for new and particular uses. The marketing of many of these devices is still a matter of sales engineering, but more and more the products of wider application are tending toward the staple class, and the outlook for this branch of the appliance and apparatus trade is very bright.

Considerable Improvement in New York; Wire Orders Fall

CONSIDERABLE improvement is seen in this week's New York electrical market, but outside of the domestic appliance field there seems to be little buying for future needs. Conduit is still selling steadily, but is said to be without feature. The change in wire prices two weeks ago is believed to have cut off some interesting orders pending at that time, and although there is a great volume of material proceeding to the recently constructed apartment houses and office buildings, little new business in wiring materials came in during the week.

Sales for the year are above those for 1922, but are not up to the quotas set by jobbers last January. The heavy holiday buying of this season is expected to add at least 15 per cent to the general business accomplished during the third quarter of the year. A slight pick-up in the motor market for the textile field for replacements and repairs was reported during the week. Lamps continue to sell at an unprecedented rate, which is the result of five or six newspaper campaigns by jobbers in all boroughs.

New England Trade Volume Well Ahead of 1922

SALES of electrical merchandise and supplies in New England are running substantially above last year's figures, although it is not expected that the final quarter will show as large a margin over the corresponding months of 1922 as was the case during the summer. Present indications favor a 10 per cent gain in representative jobbing circles on gross business between Oct. 1 and Dec. 31 inclusive. Wholesale collections have improved within the past four weeks. A heavy volume of appliances is moving into electrical retail stores in anticipation of the holiday trade.

Central-station expansion continues most active, notably in connection with building operations. The latter totaled $31,157,000 in New England for October, a gain of 29 per cent over September, and 18 per cent over October, 1922. Important new office-building construction in Boston is a feature of the present situation, involving extensive installations of electrical material. High-tension cable deliveries are now much shorter than a few weeks ago. Some improvement is evident in the New England textile industry. Other industrial conditions appear healthy in the Northeast, and popular interest in kitchen-lighting campaigns is mounting rapidly.

Chicago Trade Trends Upward; Transformers Reduced

THE electrical trade in Chicago has experienced another good business week. There have been no remarkably large orders placed, but the aggregate total is satisfactory. The demand for rubber-covered wire has been very good, accentuated, no doubt, by the reduction in prices a short while back. Conduit sales have kept up to their previous good record, as many manufacturers report from 25 to 50 per cent more tonnage shipped than at this time last month and that the unfilled orders on their books are equal to those of a month ago. There seems to be no indication at present that there will be an immediate advance in price. The high-tension-equipment sales and pole-line hardware demand are good, although the number of orders placed for pole-line hardware equipment has fallen off.

The only important price change is on transformers. Potential transformers were reduced in price virtually 10 per cent. This was effective about Nov. 7. The reason stated is that increased manufacturing facilities have enabled transformer manufacturers to reduce their prices. It is felt that loom is likely to advance soon, but no higher prices are being asked at the present time. Building activity is continuing, and the prospects are that this month will surpass October, even though October had an exceptionally large number of building permits.

Atlanta Reports 5 per Cent Wire Cut; Lamps Gain 20 per Cent

ELECTRICAL jobbing lines are holding up well, and the electrical retailers report a satisfactory business, though the holiday buying has not yet started. One jobber announced a 5 per cent price reduction on copper wire, effective this week. Lamp sales are approximately 20 per cent in excess of those this time last year, but on account of the reduced prices the money volume is about the same. However, prospects are bright for big business in this item during the winter.

That conditions in the rural districts are getting on a better plane is indicated by the increasing interest that the farmers in the Southeast are showing in labor-saving devices. Sales of the farm-lighting outfits are increasing steadily, and the Georgia distributor for one of the well-known manufacturers reports that his sales of this device during the past three months exceeded the total sales for 1922.

Manufacturers report extraordinarily good sales on the large sizes of outdoor transformer equipment in 500 kw. and over, with the result that deliveries have lengthened to from five to six months. The smaller sizes which ordinarily go into customer substations are still obtainable in from six to sixteen weeks, with inquiries and sales on the increase. The sales of turbo-generators in from 500-kva. to 2,500-kva. capacities have been less than was antici-

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.0354	$0.0354	$0.0304
Cold finished shafting, per lb.	0.0465	0.0465	0.039
Brass rods, per lb.	0.1475	0.1525	0.17
Solder (half and half), per lb.	0.295	0.295	0.275
Cotton waste, per lb.	.10 to .13	.10 to .13	.09 to .11½
Washers, cast iron (½-in.), per 100 lb.	6.50	6.50	6.00
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.38	3.38	3.02
Machine oil, per gal.	0.297	0.297	0.33
Belting, leather, medium, off list	30–10%	30–10%	30–10%
Machine bolts, up to 1-in. x 30-in., off list	40–10%	40–10%	40%

pated, but in the larger sizes for central-station installations the orders have exceeded expectations. Long deliveries are the rule on the larger sizes.

New England Collections Reflect Large Volume of Business

A DECIDED improvement in collections is reported by leading jobbers in eastern New England for October, and this month bids fair to maintain the good record lately established. Settlements are not being handed to credit men on a silver platter, to put it mildly, but buyers of electrical material are responding to the interest of sales organizations in the prompt movement of funds, and, in a word, the hard work of the jobbers is bearing good fruit.

Contractor-dealers are finishing a substantial amount of wiring work and are being paid therefor, although there is some complaint around Boston that retail collections are slower than good practice warrants in many instances. Public utilities are prospering and expanding, railroad buying is fairly good, and money is readily obtainable. With the holiday trade close at hand, the outlook is highly favorable for a sound credit situation to continue well through the remainder of the year. Representative houses are cleaning up accounts in from fifty-five to seventy days.

West Coast Business Better; Cautious Rubber-Covered Buying

GENERAL business conditions in California have improved considerably during the last month, and there is little pessimism to be heard in the wholesale and retail trade, where excellent business exists, particularly in radio sets and all household appliances. Iron conduit is moving nicely, but rubber-covered wire is slower as the last unexpected drop of two weeks ago has made the general class of buyers rather cautious.

Some brisk competition in dry cells exists in central California, and among other interesting developments in this field are increased business in waffle irons after an oversold condition of several months, a successful convenience-outlet campaign and increasing industrial activity in switches, receptacle plates, cross-arm braces, glass insulators and the like. Collections are steadily improving and now average fifty days.

The Metal Market

COPPER selling last week displayed a firmer tone than has been witnessed for many months. The red metal was quoted on the New York Metal Exchange for spot delivery at 12.87½ cents, but the larger producing and selling agencies were quoting a firm market at 13 cents a pound, and many were inclined to hold their supplies at 13⅛ cents. Present prices represent a gain of approximately ½ cent a pound from the low levels of the year established about ten days ago.

Foreign and domestic copper shipments by North and South American producers in October were the second highest on record during peace time, being approximately 210,000,000 lb., against 160,000,000 lb. in September. The highest shipments of the year were 215,000,000 lb. in March, the peace-time record.

The official contract price for lead by the American Smelting & Refining Company remains at 6.75 cents, New York. This is the price that other producers are also asking and receiving. The market in St. Louis has varied between 6.45 cents and 6.50 cents. One sale at 6.40 cents is reported. Bonded lead for prompt delivery in New York is scarce and commands a premium.

NEW YORK METAL MARKET PRICES

	Nov. 7, 1923 Cents per Pound	Nov. 14, 1923 Cents per Pound
Copper, electrolytic	12.62	12.87½
Lead, Am. S. & R. price	6.75	6.75
Antimony	8.50	9.25
Nickel, ingot	27.00 to 32.00	27.00 to 32.00
Zinc, spot	6.35	6.35
Tin, Straits	42.02	42.05
Aluminum, 98 to 99 per cent	25.00 to 26.00	26.00 to 27.00

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Canadian Firm Amalgamates with Babcock & Wilcox

R. O. McCulloch at Toronto announces a deal whereby the Goldie & McCulloch Company, Ltd., Galt, Ont., has amalgamated with the Babcock & Wilcox Company of New York in a new Canadian company to be known as the Babcock, Wilcox, Goldie, McCulloch Company, Ltd. The new concern has secured a charter with a capital stock of $3,000,000 and, according to official announcement, is now operating under the direct management of R. O. McCulloch and A. R. Goldie.

The new company has taken over all of the local business, except part of the steel works—the latter to be operated separately by a different company, to be known for the present as Goldie & McCulloch—and will continue manufacturing operations in its present quarters, although it is announced that a new plant will be erected in Galt for this undertaking in the not distant future.

Reduces Price of Electric Tools

Effective Nov. 12, 1923, a new price of $58 was announced on the Black & Decker Manufacturing Company's half-inch special portable electric drill. One year ago the price of this tool was $85 and on Jan. 1, 1923, the price was reduced to $68. Another reduction is also announced on the Black & Decker electric valve grinder to $34 from $45.

Large Locomotive Order Placed

Twelve electric locomotive and two railroad machine shovels to be operated inside the Moffat tunnel now being pushed through the Continental divide west of Denver have been ordered from the General Electric Company.

It is estimated that the locomotives and shovels will cost in the neighborhood of $40,000. Six of the locomotives ordered will be used in the tunnel at each portal. Other locomotives electrically driven which are to be used for hauling trains through the 6-mile bore have also been ordered from Schenectady, N. Y.

Blaw-Knox Opens Buffalo Office

The Blaw-Knox Company, Pittsburgh, manufacturer of steel transmission towers, has recently opened an office in Buffalo at 622 Genesee Building. J. C. McQuide has been transferred from the Pittsburgh organization to manage the Buffalo office, which now will serve northern and western New York and adjacent territory.

Randle Machinery Officials Organize Radio Firm

Officers identified with the Randle Machinery Company, 1822 Powers Street, Cincinnati, Ohio, rebuilder of power-plant machinery during thirty-seven years, have organized the Randle Radio Company at 1723 Powers Street with a capital stock of $100,000 for the manufacture of radio equipment. It is said that actual production will be started within a week.

Westinghouse's Larger Business

The Westinghouse Electric & Manufacturing Company began the third quarter of its fiscal year auspiciously with incoming orders for October somewhat in excess of the $10,600,000 received in September and with sales billed somewhat ahead of the $13,600,000 of the previous month.

The company has now booked between $100,000,000 and $100,500,000, with five months still to go to reach the $152,328,564 received in the fiscal year ended March 31. Bookings for the next two months are expected to be comparable with those of October.

The net earnings on operations since April 1 exceed those of the 1922 period substantially. Practically all departments continue to operate at capacity, at levels which were only exceeded during the war years.

Burgess Battery Wins Suit

The Burgess Laboratories have been the victors in their fight stretching over a period of years against the French Battery & Carbon Company concerning alleged infringement of patents of the Burgess chromate process. Both concerns are electrical manufacturers in Madison, Wis. Judge E. Ray Stevens of the Circuit Court has ordered the French battery concern to pay the Burgess firm the sum of $46,998 for use of the process during May, 1922, and September of this year.

The French company has been ordered to pay court costs of the case, which amount to approximately $10,000. Owing to the length of the litigation, it is estimated that the suit has cost the French people all of $100,000.

W. N. Matthews & Brother Open New Offices

W. N. Matthews & Brother, Inc., St. Louis, have announced the opening of new offices in Atlanta, Denver, New Orleans and Richmond, Va., in charge of the following men: C. C. Schoen, 138 Marrieta Street, Atlanta; J. A. Lalor, 1633 Tremont Street, Denver; F. J. Commagere, 509 Conti Street, New Orleans, and J. E. Leavy, 317 American National Bank Building, Richmond.

To Sell Hugro Property

Negotiations are in progress for the sale of the plants and property of the Hugro Manufacturing Company, Warsaw, Ind., manufacturer of electric washing machines, a subsidiary of the Dollings Company, bankrupt. Three plants are operated by the company, two being at Warsaw and the third at St. Louis. One of the first noted is conducted under the name of the Laco Manufacturing Company, and the last mentioned by the Remmert Manufacturing Company, another subsidiary. Bert McBride has been appointed the receiver.

New Chicago Battery Plate Maker

The Monarch Battery Plate Manufacturing Company, 215 West Illinois Street, Chicago, has been organized as a partnership by I. Abrams and S. Malina for the purpose of manufacturing lead storage-battery plates. A manufacturing space of 5,000 sq.ft. has been obtained at this location for a production of 10,000 plates per day. Mr. Abrams was formerly secretary and sales manager of the Battery Plate Manufacturing Company of Minneapolis and the Author Storage Battery Company of Chicago.

Lombard Governor Establishes New York City Office

The Lombard Governor Company, Ashland, Mass., manufacturer of waterwheel governors and Diesel-type oil engines, has established a sales office at 30 Church Street, New York City, in charge of W. Merton Rice, formerly with Cox & Stevens. Mr. Rice has had many years' experience in power-plant design and installation, and through the establishment of the New York City office the Lombard Governor Company expects to extend greater sales engineering service to the trade.

Electric Crane & Hoist Changes

H. W. Gledhill, Eastern sales manager of the Shepard Electric Crane & Hoist Company, 30 Church Street, New York City, has opened offices in the City Center Building, 121 North Broad Street, Philadelphia. G. M. Rumsey is connected with the office as assistant sales representative.

The New York office will be managed by A. J. Barnes, who will be in charge of export sales and advertising. H. A. Baugh will have charge of the Pittsburgh office, D. B. Patterson of the Baltimore office, W. B. Briggs of the Chicago office, W. H. Ringe of the San Francisco office and F. R. Quigley of the Birmingham office.

Geier Firm Appoints N. A. Barnell Assistant Sales Manager

Announcement is made of the appointment of N. A. Barnell as assistant sales manager of the P. A. Geier Company, Cleveland, manufacturer of the "Royal" line of electric household appliances. Mr. Barnell is, in point of service, the third oldest member of the Geier sales organization.

Combine G. E. Publication and Advertising Departments

The publication and advertising departments of the General Electric Company will be combined on Dec. 1, with Martin P. Rice, as manager of the publicity department, in charge.

Frank H. Gale, advertising manager, will on Dec. 1 become assistant to D. R. Bullen and manager of conventions and exhibits. Mr. Bullen was recently appointed assistant vice-president, and Mr. Gale will do important association work.

C. H. Lang, who has been assistant to Mr. Rice as manager of the publication department, will continue as assistant manager of the newly created publicity department, and T. J. McManis, who has been manager of the department of publicity for the Edison Lamp Works of the General Electric Company at Harrison, N. J., will also become an assistant manager of the new department.

In addition to the above announcement made by President Gerard Swope, an advertising council has been created, with the following members and with Director B. G. Tremaine, Vice-presidents J. R. Lovejoy, George F. Morrison and F. S. Terry and A. D. Page as ex officio members of this council: Chairman of the council, J. G. Barry; manager of publicity department, M. P. Rice; assistant manager of the publicity department, T. J. McManis; P. B. Zimmerman, George C. Osborne, L. P. Sawyer and G. P. Baldwin; advertising counsel, Bruce Barton, and secretary of the council, C. H. Lang.

"Crescent" Agent for New Jersey

Announcement is made that the Lincoln Products Corporation, 320 Market Street, Newark, N. J., T. P. Cunningham, president, has taken over the sales rights of the "Crescent" electric industrial trucks and tractors for the northern part of New Jersey. Mr. Cunningham and his associates have wide acquaintance in that state and have been selling and installing material-handling equipment for a number of years.

New Agent for Ward Leonard

The Ward Leonard Electric Company, Mount Vernon, N. Y., announces the appointment of W. A. Gibson as its selling representative in the Southwestern territory. Mr. Gibson will make his headquarters in the Roos Building, Elm & Akard Streets, Dallas, Tex., and will handle the complete line of "Vitrohm" resistor units, field rheostats, theater dimmers, motor starters and "Ribohm" rheostats in Dallas and its vicinity.

Frank Adam Electric Business

The Frank Adam Electric Company, 3650 Windsor Place, St. Louis, reports that its business during the past year has been exceptionally good. The volume of business in the month of October was greater than that for any other month in 1923, as well as being the largest single month's business in the last three years. Prospects for future business seem to be bright.

British Manufacturers and Dealers Open Electrical Home

In an effort to establish that £160 will buy more conveniences if expended for electrical equipment in the home than it would if expended in any other way, the British manufacturers and dealers have opened an electrical home in London.

Electric heaters which provide for the British insistence on an open fire are shown in operation. The dining-room equipment includes another appeal to British taste in including an electrically heated dish to keep muffins warm. In addition to fans, washers, irons, vacuum cleaners and the more generally used electrical equipment, the bathroom is equipped with a hot-towel rail, a violet-ray apparatus, a hair drier and a massage device.

Benjamin Window-Trimming Contest to Push Two-Way Plugs

Following the excellent results of an October Hallowe'en window trimming contest, the Benjamin Electric Manufacturing Company, 847 West Jackson Boulevard, Chicago, is now announcing another cash prize contest terminating Thanksgiving week.

All distributors and jobbers are to have a free package of Thanksgiving window-trimming material, and fourteen prizes will be given for the best displayed windows. The first prize totals $100, while the lowest prize is $10. This window-trimming material is used to serve as a background for pushing the sales on the Benjamin two-way plugs.

Kerr Turbine Sales Changes

The Kerr Turbine Company, Wellsville, N. Y., manufacturer of "Economy" turbines and gears, announces several changes and a number of extensions in its sales organization, in which the following new agencies appear: Starkweather & Broadhurst, Inc., 79 Milk Street, Boston; H. R. Hanson, 832 Real Estate Trust Building, Philadelphia; Mechanical Engineering & Equipment Company, 209 South High Street, Columbus; Southern States Equipment Company, 712 Canal-Commercial Building, New Orleans; L. D. Howland, 606 Howard Street, San Francisco, and Henry C. Ashmead, 824 Brown-Marx Building, Birmingham. In addition to the above agencies, the company's representation in Chicago has been increased by the addition of R. N. Turner as salesman.

Manhattan Supply Profits Drop

Net profits of $134,600 after expenses were deducted are shown for the Manhattan Electrical Supply Company, New York City, for the nine months period ended Sept. 30. The income account compares as follows:

	1923	1922
Sales	$5,303,387	$4,923,662
Costs	4,105,464	3,626,794
Gross profit	$1,197,923	$1,296,868
Miscellaneous income	94,091	165,087
Total income	$1,292,014	$1,461,955
Expenses, etc.	1,157,414	1,025,331
Net profit	$134,600	$436,624

Master Electric's Cleveland and Philadelphia Appointments

The appointment of E. R. Locke as Cleveland district manager has just been announced by the Master Electric Company, Dayton, Ohio, manufacturer of single-phase, polyphase and direct-current motors. Mr. Locke was formerly engineer in charge of development work for the General Electric Company in Massachusetts.

Announcement is also made of the appointment of Rodda & Wolfe as managers in the Philadelphia territory. Both Mr. Rodda and Mr. Wolfe are former Westinghouse men, having been associated with the Westinghouse organization for many years in various capacities.

Habirshaw Reorganization Plan Opposed by Creditors

The committee representing the dissenting creditors and bondholders of the Habirshaw Electric Cable Company issued a statement early this week in New York City requesting the other bondholders and creditors to co-operate in opposing the present reorganization plan of that company.

According to the committee, bondholders and creditors representing about $700,000 in claims have expressed opposition to the plan, many of them having already deposited their authorizations with the reorganization committee, and others representing $300,000 are ready to join in a "fair and proper reorganization."

Westinghouse Tennessee Contract

The Tennessee Electric Power Company, which serves the cities of Nashville, Knoxville and Chattanooga, Tenn., and the adjacent territory, has placed with the Westinghouse Electric & Manufacturing Company an order for one 15,000-kva. transformer, one 9,375-kva. transformer, three 2,000-kva. transformers and one 7,500-kva. synchronous condenser.

The company has four hydro-electric stations and two steam auxiliary stations and transmits power over a 120,000-volt line. The transformers have been ordered to take care of additional loads on the system, and the synchronous condenser will be used to improve the power factor at Chattanooga.

New Engineering Firm for St. Louis

Frank H. Schubert, district manager of the Wheeler Condenser & Engineering Company, and William G. Christy, secretary of the St. Louis Section of the American Society of Mechanical Engineers, who until recently has been engineer for the St. Louis Boat & Engineering Company, have announced the organization of the Schubert-Christy Construction & Machinery Company, with offices in the Railway Exchange Building, St. Louis.

This new firm will represent manufacturers of power-plant equipment and will render a general construction engineering service.

The Aladdin Manufacturing Company, Muncie, Ind., manufacturer of electrical appliances for household service, has acquired the local plant of the Highlands Manufacturing Company, manufacturer of kindred specialties, in receivership for about twenty-four months past. The purchasing company has work under way on a new plant unit and will remove the Highlands works to this location as soon as the structure is ready and develop maximum capacity. George N. Spencer is president.

The Stow Manufacturing Company, Inc., Binghamton, N. Y., manufacturer of electric tools, is sending German currency, such as a 100,000-mark note, to each of the users and potential users of its products. Here is the world's worst example of depreciation, and the point is made that the cheap tool in the shop is depreciating like the mark and by inference account should be taken of equipment that might well be renewed.

The Dym Lighting Fixture Company, 624 Grant Street, Pittsburgh, is the name of a new lighting-fixture jobbing house just organized by Jacob Dym, who during eleven years was associated with the Universal Light Company.

The Electro Magnetic Loom Company, New York City, organized with capital stock of $100,000, is said to be perfecting plans for the operation of a plant to manufacture electrically driven loom machines for use in the textile field. The machine, which involves magnetic principles, was invented by Charles G. Bauer of Brooklyn.

The Bart Reflector Corporation, Newark, has acquired about one acre of land at 367 Verona Avenue, Forest Hill district, for the erection of a new one-story plant, 80 ft. x 220 ft., to manufacture indirect-lighting fixtures and equipment.

The F. C. Richmond Machinery Company, Salt Lake City, Utah, representative for the Conveyors Corporation of America, Chicago, has moved offices and salesroom to 320 West Second South Street, Salt Lake City.

The Chicago Pneumatic Tool Company, manufacturer of compressor units, has taken over the exclusive sale of the products of the Crescent Pump Company, 743 Baubien Street, Detroit, and hereafter will handle all inquiries regarding the latter.

H. W. Johns-Manville, Inc., Madison Avenue and Forty-first Street, New York City, is arranging for the early installation of machinery at its plant in course of construction at Asbestos, near St. Johns, Que., comprising two units, 150 ft. x 1,000 ft., for the manufacture of linings, asbestos products, etc., to cost more than $500,000 with equipment. It is purposed to have the works ready for service early next year.

The Newman Electric & Manufacturing Company, Eau Claire, Wis., has been incorporated with $25,000 capital stock to manufacture electrical specialties and to rebuild motors and generators. The new company is the outgrowth of a small business which will soon be enlarged and moved into larger quarters.

L. E. Lewis, formerly manager of the Atlanta office of the Walker Electric & Plumbing Company, is now associated with the Mutual Electric and Machine Company, Detroit. Mr. Lewis will handle the "Bulldog" safety switch line for the Southeastern territory and will be stationed in Atlanta.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Antofogasta, Chile (No. 8,088), for electric railway lanterns, dry and storage cell type.

An agency is desired in The Hague, Netherlands (No. 8,085), for radio receiving sets and parts.

Purchase is desired in Basle, Switzerland (No. 8,104), for radio sets, parts and batteries.

The following inquiries have been received by the Philadelphia Commercial Museum, which will furnish names and addresses of inquiries to any desiring them and mentioning the number given: Parties in Guadalajara, Mexico (No. 41,423), would like to get in touch with manufacturers of small rotary electric ovens (such as "Bakerite.") Parties in Wellington, New Zealand (No. 41,451), are interested in hydraulic pipe lines and all things in connection with hydro-electric schemes, and would like to receive from firms manufacturing cement guns catalogs and prices, together with full details regarding capacities, etc. At present they have in mind the lining of a water tunnel about 14,000 ft. in length and about 7 ft. in diameter, as well as other prospective problems. In most cases electric power is available at 400 volts, three-phase, 50 cycles. A party in Rangoon, India (No. 41,456), would like to communicate with manufacturers of boilers, engines, oil engines, electric lamps and electric instruments, etc. Parties in Ponce, Porto Rico (No. 41,460), would like to get in touch with manufacturers of incandescent lamps, table lamps, electric wiring material, etc.

DIVERSION WORK IN CONNECTION WITH ARAPUNI (NEW ZEALAND) POWER SCHEME.—Tenders are being asked, closing early next year, by the Public Works Tender Board, Wellington, New Zealand, for the diversion of the Waikato River in connection with the Arapuni power scheme. The cost of the work is estimated at £500,000.

New Apparatus and Publications

COMMUTATOR STONES.—The Martindale Electric Company, 11-723 Detroit Avenue, Cleveland, is distributing a folder describing its "Imperial" commutator stones and also the "Imperial" commutator grinding tool.

INDUSTRIAL LIGHTING EQUIPMENT.—The Benjamin Electric Manufacturing Company, 847 West Jackson Boulevard, Chicago, has issued bulletin No. 52, covering its industrial lighting equipment. It also contains a series of illustrations showing the results of correct illumination in industrial plants of all types and a demonstration of the more simple calculations for correct industrial illumination.

INCANDESCENT LAMP.—An almost unbreakable lamp is being marketed by the Greater Service Electric Company, 329-331 Broad Street, Newark, N. J. It is an improved mill type, is known as the "Briterlite unbreakable lamp" and is made in 25-watt and 50-watt sizes.

AUTOMATIC COMBUSTION CONTROL.—"Brooke Combustion Control, Electrically Operated," is the title of a leaflet distributed by the Brooke Engineering Company, 411 Perry Building, Philadelphia, covering the "Brooke" automatic combustion control apparatus.

SPINDLE BORER.—The Oliver Machinery Company, Grand Rapids, Mich., has brought out a three-spindle borer, with the motor in the head, designed for the use of woodworkers and furniture workers, etc.

REFRIGERATING SYSTEM.—The Creamery Package Manufacturing Company, 61 West Kinzie Street, Chicago, has placed on the market a refrigerating system, which is to be placed in the cellar near the ice box. It is controlled by a thermostate to maintain the proper temperature.

SAFETY PANEL.—A narrow safety panel, "Naro," in which all parts are removable from the face of the boards and current-carrying parts are protected by a composition covering, has been brought out by the Metropolitan Electric Manufacturing Company, East Avenue and Fourteenth Street, Long Island City, N. Y. A line of shallow wiring devices has also been placed on the market by the company.

SERVICE ELBOW.—An aluminum service elbow, "Gee-Vee," in which the wire can be threaded through the conduit with a straight pull for both conduits, has been developed by the Gillette-Vibber Company, 22 Maple Avenue, New London, Conn.

HORSE-CLIPPING MACHINE.—The Coates Clipper Manufacturing Company, Worcester, Mass., is manufacturing an electrically driven horse and sheep clipper, which is equipped with a suspended or vertical type motor and 8 ft. of Coates "Flex-shaft."

New Incorporations

THE PIKE TOWNSHIP-BRADFORD ELECTRIC COMPANY, Pike Township, Pa., has been incorporated with a capital stock of $5,000 to erect a transmission line in Pike Township. Charles W. Rigg, Pottsville, Pa., is treasurer.

THE LE RAYSVILLE BOROUGH-BRADFORD ELECTRIC COMPANY, Le Raysville, Pa., has been incorporated with a capital stock of $5,000 to erect a transmission line in Le Raysville. Charles W. Rigg, Pottsville, Pa., is treasurer.

THE COUPEVILLE (WASH.) LIGHTING COMPANY has been incorporated with a capital stock of $4,000 by James Zylstra and others.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOSTON, MASS.—The Edison Electric Illuminating Company plans to issue $9,083,000 in capital stock, the proceeds to be used for extensions and improvements now in progress and for proposed extensions.

BERLIN, CONN.—Plans are being prepared by the Donnelly Brick Company for the construction of a power house, to cost about $40,000.

NEW BRITAIN, CONN.—Electric power equipment will be installed in the two additions to be erected at the plant of the Stanley Rule & Level Division of the Stanley Works, to cost about $175,000.

WATERBURY, CONN.—The Waterbury Farrel Foundry & Machine Company plans to build an addition to its power house.

Middle Atlantic States

AVON, N. Y.—The Livingston-Niagara Power Company has been granted permission to extend its transmission lines into the town of Conesus to furnish electric service there.

BROOKLYN, N. Y.—The Brooklyn Edison Company is having plans prepared for a substation to be erected on West Twelfth Street, near Neptune Avenue, to cost about $60,000.

CANANDAIGUA, N. Y.—Plans for a municipal electric plant have been abandoned.

GALWAY, N. Y.—The Adirondack Power & Light Corporation, Amsterdam, has been granted a franchise to supply electricity in the town of Galway.

GOUVERNEUR, N. Y.—Bonds to the amount of $100,000 have been voted for the construction of a municipal electric plant.

MOUNT MORRIS, N. Y.—The Mohawk Valley Company, Utica, has acquired the plants of the Mount Morris Illuminating Company and the Mount Morris Water Power Company. Extensions and improvements are planned. Operations will be continued under the present names.

NEW YORK, N. Y.—The New York Edison Company has filed plans for a substation at 37-39 Jane Street, to cost $140,000. William Whitehill, 409 Sixth Avenue, is architect.

OLEAN, N. Y.—The Olean Electric Light & Power Company has been granted permission to erect a transmission line through Little Valley and the towns of Little Valley and Samamanca. The company will not supply electricity in the municipalities named.

ROCKAWAY BEACH, N. Y.—The board of trustees of the Rockaway Beach Hospital plan to build a power house in connection with a mechanical laundry plant, to cost about $42,000. Resler & Hesselbach, 41 East Forty-second Street, New York, are consulting engineers.

SYRACUSE, N. Y.—Plans are being prepared for a new power house at the St. Joseph's Hospital, to cost about $150,000. Goggin & Goggin, University Building, are architects.

WOODSTOCK, N. Y.—The Hudson Electric Corporation has been authorized to extend its electric system into the town of Woodstock.

BOONTON, N. J.—The purchase of the local power plant of the Powerville Paper Mill, to be owned and operated by the municipality is under consideration. If taken over, extensions and improvements will be made.

CHELTENHAM, PA.—The Rowland Shovel Company, Central Avenue, it is reported, will soon call for bids for rebuilding its plant and power house, recently damaged by fire.

DAWSON, PA.—Plans are being considered for rebuilding the power house at the local plant of the Corrado Coal & Coke Company, recently damaged by fire.

DERRY, PA.—The Derry-Dauphin Electric Company is being organized by W. H. Schubert, L. D. West and J. H. Bucher to erect a transmission line in Derry Township. Cooke & Marvin, Harrisburg, are representatives.

MILLERSTOWN, PA.—The Watts Water Power Company and the Juniata Water Power Company, recently organized for joint operations, plan to build a power plant here. S. W. Fleming, J. D. Carpenter and Farley Gannett, all of Harrisburgh, are interested in the companies.

PHILADELPHIA, PA.—The Philadelphia & Reading Railroad Company plans extensions to its power plant in the Port Richmond section, to cost about $500,000.

PHILADELPHIA, PA.—The French Creek Township, Sugar Creek Township and Sandy Creek Township Power corporations have been incorporated, each with a capital stock of $5,000, to erect transmission lines in the respective territories for which they are named. R. Van Horn, 4929 Catherine Street, is treasurer.

PITTSBURGH, PA.—The West Penn-West Virginia Water Power Company, associated with the West Penn Power Company, plans to build a power plant in Wharton Township.

PITTSBURGH, PA.—Plans are being prepared by the Pennsylvania Railroad Company for the electrification of the Allegheny Mountain stretches of its main line. It is proposed to erect power plants at the coal mines to generate electricity to operate the road.

PITTSBURGH, PA.—The Pittsburgh & West Virginia Railway Company, Pittsburgh, it is reported has plans for the construction of a steam-operated power plant at Rook. Crecelius & Phillips, Hanna Building, Cleveland, Ohio, are engineers.

TOWANDA, PA.—The Leraysville Borough-Bradford Electric Company recently incorporated with a capital stock of $5,000, plans to erect a transmission line in Leraysville Borough. Charles W. Riggs, Pottsville, Pa., is treasurer. The same interests have also formed the Pike Township-Bradford Electric Company, with a capital stock of $5,000 to erect a transmission line in Pike Township.

BALTIMORE, MD.—Plans are being considered by the Department of Water for the installation of electrically operated pumping equipment at the Montebello and Mount Royal water stations.

FAIRFIELD, MD.—The United States Industrial Chemical Company, 110 East Forty-second Street, New York City, which is building a plant for the manufacture of commercial potash and kindred products, including power house, to cost about $1,000,000, is preparing plans for the construction of another unit for the production of fertilizer, to cost about $200,000.

WILLIAMSPORT, MD.—The installation of electrically operated pumping machinery in connection with waterworks extensions is being considered by the Council. Norton, Bird & Whitman, Munsey Building, Baltimore, are engineers.

CHARLESTON, W. VA.—The Virginian Power Company is arranging a fund of about $2,000,000 for expansion, including the construction of a hydro-electric plant on Cabin Creek, with initial output of

25,000 kw. and ultimate capacity of 125,000 kw., with transmission system.

GLEN ROGERS, W. VA.—The Raleigh Wyoming Coal Company contemplates rebuilding its power house and mining plant, recently damaged by fire, with loss reported at $300,000.

WARDENSVILLE, W. VA.—The Wardensville Paint & Mineral Company, recently formed, contemplates the installation of electric power equipment at its proposed local plant.

WHEELING, W. VA.—The West Virginia Match Company plans to install electric power equipment at its proposed plant at McColloch and Thirty-sixth Streets. F. F. Harris, 1117 Chapline Street, is architect.

HAMPTON ROADS, VA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Nov. 27, for three electric motors for the local navy yard. (Schedule 1548.)

LYNCHBURG, VA.—The Consolidated Power & Light Company has issued $1,500,000 in capital stock, part of the proceeds to be used for extensions and improvements.

NORFOLK, VA.—The Ford Motor Company, Detroit, plans to build a power house at its proposed local assembling plant in the Newton Park section, to cost about $400,000.

SALEM, VA.—Steps have been taken to install a new ornamental lighting system on Main Street to cost about $4,000.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Nov. 20, for 50,000 ft. antenna wire (Schedule 1546); also, until Nov. 27, for four electric ovens and spare parts for Eastern and Western yards. (Schedule 1547.)

North Central States

HUDSON, MICH.—The Southern Michigan Light & Power Company, it is reported, has entered into an agreement with the Hudson & Citizens' Light & Power Company for furnishing service at Hudson, North Adams, Addison, Manitou, Prattville and vicinity, heretofore supplied by the Hudson company. A transmission line will be erected from Adrian to Hudson by the Southern Michigan company. The Hudson company will build a similar line to Morenci.

KALAMAZOO, MICH.—The Valley Paper Company, Press Building, contemplates building a power house at its proposed local paper mill, to cost about $450 000. Billingham & Cob, Press Building, are architects.

CLEVELAND, OHIO.—The Cleveland Railway Company plans to erect two substations, one at West Sixty-fifth Street and Lorain Avenue and the other at West Twenty-ninth and Church Streets, each to cost about $35,000.

LORAIN, OHIO.—The Ohio Public Service Company has made an agreement with the City Council for the erection of a transmission line on certain streets, which will extend beyond the city limits for service in this section.

TOLEDO, OHIO.—The Toledo Edison Company contemplates extensions and improvements, to cost about $473,000.

YOUNGSTOWN, OHIO.—The Ohio River Edison Company is negotiating for right-of-way for its proposed transmission line from Toronto to this district, a distance of 39 miles. The project includes the construction of a power house at Toronto with an initial output of 88,000 hp., a 39-mile transmission line and substations.

BOWLING GREEN, KY.—Arrangements have been made by the Kentucky-Tennessee Light & Power Company for the erection of a 33,000-volt, three-phase, 60-cycle transmission line from Bowling Green to Asphalt and Brownsville, a distance of 26 miles. The cost is estimated at $72,000. O. E. Wessel, Bowling Green, is assistant general manager.

BOWLING GREEN, KY.—The franchises and properties of the Kentucky & Tennessee Light & Power Company, operating at Pembroke, Guthrie, Trenton, Elkton and Allensville, Ky., and Adams, Tenn., have been acquired by the Kentucky Public Service Company, Bowling Green, which will change the name to the Kentucky-Tennessee Light & Power Company, with main office at Bowling Green.

LOUISVILLE, KY.—The Louisville Gas & Electric Company contemplates building a garage and repair shop at Seventh and Ormsby Avenues, to cost about $40,000.

FARMERSBURG, IND.—Plans are under way for the installation of electrically operated pumping equipment at the proposed municipal waterworks, to cost about $40,000.

INDIANAPOLIS, IND.—The Indianapolis Light & Heat Company has preliminary plans for the construction of a new plant on the White River, about 8 miles from the city, to cost about $1,000,000.

CHICAGO, ILL.—Bids will be received by Harry E. Wallace, clerk, Room 700, 910 South Michigan Avenue, Chicago, until Nov. 22, for construction of the Calumet intercepting sewer as follows: Division A—sewers; Division B—pumping station substructure; Division C—pumping station superstructure; Division D—pumps, consisting of three 72-in. centrifugal pumps and three 30-in. centrifugal pumps with accessories; Division E—electrical equipment, consisting of three 500-hp. synchronous motors, three 75-hp. synchronous motors, six 667-kva. transformers, six 75-kva. transformers, two 75-kva. motor-generator sets, and miscellaneous electrical equipment; Division F—switchboard, conduit and wiring; Division G—erection of general equipment and furnishing and erecting miscellaneous equipment.

GALESBURG, ILL.—The Illinois Power & Light Company is planning to erect a double-circuit, 66,000-volt transmission line from its power plant at Keokuk, Iowa, to Galesburg, a distance of 60 miles. An extension of the line carrying 33,000 volts, will be erected from Galesburg to Galva, 23 miles. The cost is estimated at $1,250,000.

BIRON, WIS.—The Consolidated Water Power & Paper Company is planning to build a boiler house, to cost about $40,000.

COLBY, WIS.—The Wisconsin-Minnesota Light & Power Company, Eau Claire, contemplates erecting a local substation, to cost about $20,000.

OSHKOSH, WIS.—Plans are under consideration to extend the ornamental lighting system on Jackson Drive from Michigan Street north to the city limits, and also to extend the ornamental lamps on Washington and Algoma Boulevards.

SHEBOYGAN, WIS.—A petition has been presented by the Business Men's Association to the City Council asking for the installation of an ornamental lighting system on Pennsylvania Avenue.

STEVENS POINT, WIS.—The property of the Springville Roller Mill Company, including water rights on the Plover River, has been purchased by E. A. Oberweiser, Stevens Point. The new owner is considering increasing the output of the electric plant.

STURGEON BAY, WIS.—Arrangements have been made by the Fruit & Dairy Box Company for doubling the output of its power house, to include new boiler and other equipment.

LITTLE FALLS, MINN.—The installation of electrically operated pumping machinery at the proposed municipal waterworks, to cost about $100,000, is under consideration. The Claussen & Carroll Engineering Company, Metropolitan Bank Building, St. Paul, is engineer.

RED WING, MINN.—The Wisconsin-Minnesota Light & Power Company, Eau Claire, plans to build a substation in Red Wing, to cost about $40,000.

ROCHESTER, MINN.—Electric power equipment will be installed in the proposed local ice and cold-storage plant to be erected by Matthew Fitzpatrick and associates, to cost about $250,000.

SPRING VALLEY, MINN.—The Northwest Utilities Company has arranged for an increase in capital stock from $1,000,000 to $45,000,000, part of the proceeds to be used for extensions and improvements.

CLERMONT, IOWA.—The Northeastern Iowa Power Company plans to erect a transmission line from Volga City to Elkader to supply electricity to the Elkader Light & Power Company. The latter company furnishes electricity in Elkader and several other towns in this vicinity.

OTTUMWA, IOWA.—The Ottumwa Ice Company plans to rebuild its power house recently damaged by fire.

ROCKWELL, IOWA.—The Iowa Light, Heat & Power Company plans to rebuild its local plant, recently destroyed by fire, at once. About twenty other towns were supplied through this plant.

WYOMING, IOWA.—Bonds to the amount of $35,000 have been voted for to establish a municipal electric plant.

UTICA, S. D.—The Eastern Dakota Electric Company plans to erect a transmission line from Yankton to Utica for local service.

WALTHILL, NEB.—Bonds to the amount of $20,000 have been authorized to install a municipal electric light plant.

Southern States

DURHAM, N. C.—The development of a water-power project on the Flat River, to cost about $2,000,000, is reported to be under consideration by R. W. Rigsby, city manager.

MEBRANE, N. C.—The White Furniture Company has preliminary plans for the construction of a steam-operated power plant. Later on it is proposed to equip the furniture factory throughout for electrical operation.

MURPHY, N. C.—Application has been made to the Federal Power Commission by the Southern Appalachian Power Company for authority to build a hydro-electric project on the Hiawassee River in Cherokee and Clay Counties to develop 50,000 hp. W. N. Garrett, Asheville, is president.

MACON, GA.—Surveys are being made by the Macon Railway & Light Company in connection with the construction of a proposed hydro-electric plant, to develop about 13,000 hp. The proposed plant will provide power for industrial operation in the middle Georgia territory and will cost from $1,500,000 to $2,000,000.

RINGGOLD, GA.—Plans to establish a municipal electric light and water plant are under consideration.

SAVANNAH, GA.—Bids will be received by the Supervising Architect, Treasury Department, Washington, D. C., until Nov. 28, for lighting fixtures for the local marine hospital.

STONE MOUNTAIN, GA.—Plans are under consideration to establish an electric plant in connection with a resort here. Alonzo Atkins, Birmingham, Ala., and others are interested in the project.

AVON PARK, FLA.—Steps are being taken for extensions in the ornamental street-lighting system.

KELSEY CITY, FLA.—Plans for the proposed plant of the American Fibre Corporation, recently organized, provide for a power house. The cost of the project is estimated at $150,000.

CHATTANOOGA, TENN.—Plans are being considered for the installation of an ornamental lighting system on Main Street, from Whiteside to Wilhoit Street, to cost about $19,000.

COPPERHILL, TENN.—The construction of a hydro-electric development on the Ocoee River, 6 miles below Copperhill, to develop 15,000 hp., is under consideration by the Tennessee Electric Power Company, Chattanooga.

HARTFORD, TENN.—A hydro-electric development on the Pigeon River is reported to be under consideration by Mr. Boice, president of the Boice Hardwood Company.

LAUREL, MISS.—The Continental Turpentine & Rosin Company plans to rebuild its power house, recently damaged by fire.

RIPLEY, MISS.—Extensions are contemplated to the local electric plant, to cost about $10,000. Bennett & Gurney are engineers in charge. A. C. Anderson is president.

FORT SMITH, ARK.—The Fort Smith Light & Traction Company contemplates extensions and improvements, including the installation of additional equipment, to cost about $100,000.

HEBER SPRINGS, ARK.—Permission has been granted to the Arkansas Light & Power Corporation, Pine Bluffs, to construct a power dam across the Little Red River, in Clebourne County.

GRAYSON, LA.—Plans are under consideration for the installation of a street-lighting system.

OKLAHOMA CITY, OKLA.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Dec. 7, for the installation of a new deep-well pump, etc., in the United States Post Office, Oklahoma City. For details see Searchlight Section.

PURCELL, OKLA.—The Atchison, Topeka & Santa Fé Railway Company plans extensions to its local power house, to cost about $20,000.

ELGIN, TEX.—K. H. Smith, Austin, Tex., plans to construct and operate a local electric and ice plant to cost about $50,000.

HOUSTON, TEX.—The Houston Lighting & Power Company contemplates improvements to the Gabel Street, to cost about $60,000.

MOUNT PLEASANT, TEX.—The Texas Public Service Company plans to erect a 33,000-volt transmission line to Winfield.

NAVASOTA, TEX.—Extensions and improvements, to cost about $40,000, are under consideration by the Western Public Service Company. The work will include the installation of boilers, new ice-making machine and additional ice-storage facilities.

Pacific and Mountain States

LYMAN, WASH.—Application has been filed by E. Clarence Miller of the Miller Engineering Company, Seattle, for permission to utilize water from the South Fork of the Nooksack River in connection with a hydro-electric project near Lyman, to cost about $1,500,000. Plans provide for a dam on Jones Creek to develop 11,340 hp. The proposed plant will serve Lyman, Hamilton, Concrete, Sedro Woolley, Burlington, Mount Vernon and other towns in Skagit County.

WENATCHEE, WASH.—Plans are being prepared for the installation of a lighting system on South Wenatchee Avenue.

WENATCHEE, WASH. — The Puget Sound Power & Light Company, Seattle, has been granted a permit to erect a substation here, to cost about $120,000. The station will receive power from the White River plant of the company.

WESTPORT, WASH.—Bids will soon be asked by the Superintendent of Light Houses, Portland, Ore., for the construction of a reinforced-concrete power house at Gray's Harbor Light Station, Westport.

WOODLAND, WASH.—The North Coast Power Company plans to install a three-phase system to replace the present system. The cost is estimated at $10,000.

BELDEN, CAL.—The Great Western Power Company, San Francisco, plans erection of a transmission line to the Canyon dam.

GLENDALE, CAL.—Plans are being prepared for an ornamental lighting system on Colorado Street. B. F. Dupuy is city engineer.

LOS ANGELES, CAL.—An ordinance has been passed authorizing the installation of a lighting system on Jefferson Street.

SACRAMENTO, CAL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 6 for a new lighting system, etc., in the United States post office and court house, Sacramento. For details see Searchlight Section.

SAN FRANCISCO, CAL.—The Mount Shasta Power Corporation has applied to the State Water Department for permission to construct a power house on Rock Creek, to cost about $75,000.

TUBBS ISLAND, CAL.—The Pacific Gas & Electric Company, San Francisco, plans to erect a transmission line here for commercial service, to cost about $60,500.

BOULDER, COL.—Steps have been taken by the Retail Merchants' Association for the installation of an ornamental lighting system in the business section. The plans call for 224 lamp standards, to cost about $27,000.

Canada

HALIFAX, N. S.—The Albany Perforated Wrapping Paper Company, Albany, N. Y., will build a substation at its proposed pulp mill at Sheet Harbor, near Halifax, to cost about $300,000. Electricity will be secured from the Nova Scotia Power Commission.

CHELTENHAM, ONT.—A bylaw has been approved by the ratepayers of the township of Chinguacousy granting a franchise to the Cataract Electric Company, Ltd., to supply electricity in the township.

TORONTO, ONT.—Plans are being prepared by the Hydro-Electric Power Commission of Ontario for two auxiliary steam-driven plants, one to be erected in the London district and the other probably at Windsor.

WIARTON, ONT.—The Council has requested the Hydro-Electric Power Commission of Ontario to submit estimates of the cost of developing electric power from the Sauble River.

LEVIS, QUE.—The construction of a hydro-electric plant on Megiscan River, near Temiscamingue, to develop 22,000 hp., is reported to be under consideration by L. N. Hart, Commercial Street, Levis.

QUEBEC, QUE.—Work, it is reported, has started on the plant of the Laurentian Hydro-Electric Company. The company has secured exclusive franchises to furnish electricity in St. Jerome, Shawbridge, Ste. Adele, Val Morin, Ste. Marguerite, Lac Masson and Val David.

Electrical Patents

Announced by U. S. Patent Office

(Issued Oct. 23, 1923)

1,471,913. ELECTRIC HEATER; A. N. Otis, Schenectady, N. Y. App. filed April 2, 1921. Electric resistance heaters for steam boilers.

1,471,922. INDIRECT LIGHTING; P. Ross, Liverpool, England. App. filed Aug. 21, 1922. Series of adjustable deflector reflecting surfaces provided.

1,471,957. ELECTRIC POWER DEVICE; W. C. Hahne, Elgin, Ill. App. filed April 14, 1922. Mechanical rectifier.

1,471,976. SPARK-PLUG TESTER; W. P. Moore, Worland, Wyo. App. filed March 27, 1922.

1,472,001. SYSTEM AND APPARATUS FOR MOTOR CONTROL; J. A. Hepperlen, East Orange, N. J. App. filed Feb. 13, 1923. Controlling speed of motor by electromagnetic switch.

1,472,023. COMMUTATOR FOR DYNAMO-ELECTRIC MACHINES; L. E. Koos, Toledo, Ohio. App. filed July 22, 1918. Method of making commutator bars.

(Issued Oct. 30, 1923)

15,706 (reissue). TWO-WIRE PARTY LINE LOOKOUT TELEPHONE SYSTEM; T. G. Martin, Chicago, Ill. App. for reissue filed Dec. 7, 1921.

15,710 (reissue). ELECTRIC STEAM AND HOT-WATER BOILER; N. R. Forssblad, Vasteras, Sweden. App. for reissue filed Aug. 29, 1922. Control of output effected by raising or lowering insulating tubes surrounding electrodes.

1,472,035. MEANS FOR SIGNALING OVER MULTIPLEX TRANSMISSION CHANNELS; H. A. Affel, Brooklyn, N. Y. App. filed July 29, 1919. Utilizes carrier-current frequencies.

1,472,052. ELECTROSTEAM RADIATOR; F. M. Davis, Chicago, Ill. App. filed April 17, 1922. Combined with regular steam-heating system.

1,472,092. RECEIVER FOR WIRELESS TELEGRAPHY; H. J. Round, London, England. App. filed July 9, 1921. Method of reducing static.

1,472,124. AIR-HEATING ATTACHMENT FOR FANS; F. M. Howe, New York, and C. Naegeli, Long Island City, N. Y. App. filed Dec. 21, 1921. Combined fan and electric heater.

1,472,125. MEASURING APPARATUS; E. A. Keeler, Norristown, Pa. App. filed Oct. 19, 1920. Galvanometer controlled in response to changes in conductivity of a solution.

1,472,137 to 1,472,139. ELECTRIC FURNACE; T. A. Reid, Wilkinsburg, Pa. App. filed Nov. 2, 1921. Resistance type.

1,472,143. CAR-HEATING SYSTEM; K. A. Simmon, Edgewood Park, Pa. App. filed May 11, 1921. Automatically according to temperature of car and load drawn by motors.

1,472,151. BRAKE; E. M. Bouton, Wilkinsburg, and R. Pruger, Pittsburgh, Pa. App. filed May 15, 1919. Electromagnetic brake for hoisting apparatus.

1,472,154. BUSBAR SUPPORTING STRUCTURE; J. M. Brown, Pittsburgh, Pa. App. filed Dec. 31, 1918. Automatically compensates for expansion forces.

1,472,161. SYSTEM OF CONTROL; C. Le G. Fortescue, Pittsburgh, and L. J. Hibbard, Wilkinsburgh, Pa. App. filed May 14, 1921. Method of accelerating railway motors.

1,472,169. ELECTROLYTE FOR ELECTROLYTIC CONDENSERS; E. J. Haverstick, Oakmont, Pa. App. filed March 23, 1921. Solution of sodium aluminate, tri-sodium phosphate and sodium fluoride.

1,472,170. ELECTRICALLY HEATED SOLDER POT; J. D. Haynsworth, Mansfield, Ohio. App. filed March 30, 1921. Method of manufacture.

1,472,171. ELECTRIC HEATER; J. D. Haynsworth, Mansfield, Ohio. App. filed May 14, 1921. For use in rooms containing explosive or inflammable material.

1,472,172. SINGLE-PHASE COMMUTATOR MOTOR; R. E. Hellmund, Swissvale, Pa. App. filed Jan. 26, 1917. Railway motor.

1,472,183. SOLDERING IRON; A. M. MacFarland Wilkinsburg, Pa. App. filed Aug. 18, 1921. Removable heat cartridge.

1,472,184. SWITCHING DEVICE; J. B. MacNeill, Wilkinsburg, Pa. App filed Feb. 4, 1918. For controlling electrically operated circuit interrupters.

1,472,185. VULCANIZING APPARATUS; E. A. Mollenhauser, Spokane, Wash. App. filed Oct. 20, 1921. Electric current imports its heat directly to material.

1,472,186. DIRECTION INDICATOR FOR MOTOR VEHICLES; C. E. Morris, Grimes, Cal. App. filed May 8, 1920. Rear direction signal.

1,472,197. ELECTRIC WATER HEATER; E. E. Sutherland, Mansfield, Ohio. App. filed Oct. 25, 1921. Immersion heater of relatively large size.

1,472,198. ELECTRICAL MEASURING INSTRUMENT; H. B. Taylor, Wilkinsburg, Pa. App. filed Nov. 16, 1917. Galvanometer of unipivot type.

1,472,201. ELECTRICAL HEATER FOR COFFEE URNS; J. C. Woodson, Mansfield, Ohio. App. filed Oct. 20, 1921.

1,472,215. ELECTRODE HOLDER; G. Goughnour, Canton, Ohio. App. filed June 7, 1920. For varying sizes of furnace electrodes.

1,472,218. TRANSMISSION AND RECEIVING SYSTEM; J. H. Hammond, Jr., Gloucester, Mass. App. filed Aug. 5, 1919. Two secondary frequencies used for transmitting radio signals.

1,472,233. VAPORIZER FOR INTERNAL-COMBUSTION ENGINES; A. J. Taylor, Jr., and C. E. Harper, Jr., Chicago, Ill. App. filed Dec. 15, 1921.

1,472,237. TELEPHONE TRANSMISSION SYSTEM; W. H. Bendernagel, Queens, N. Y. App. filed Dec. 6, 1919. Amplifying repeater in subscriber's circuit.

1,472,246. THROTTLE HEATER; P. Daniel, Boundbrook, N. J. App. filed Aug. 26, 1920. Automobile manifold heater.

1,472,254. TELEPHONE SYSTEM; C. Spraks, Chicago, Ill. App. filed May 15, 1916. Multiple-line lamp systems.

1,472,257. SERVO-MOTOR FOR AEROPLANES; M. M. Titterington, Brooklyn, N. Y. App. filed Nov. 9, 1917. Remote control for guiding aircraft.

1,472,281. METHOD OF AND APPARATUS FOR HYDROGENATING UNSATURATED COMPOUNDS; C. M. Page, Chicago, Ill. App. filed Feb. 24, 1921. Constant and automatic regeneration of catalytic agent electrically.

1,472,289. RADIO-WIRE CONNECTING CIRCUITS; R. Brown and E. L. Nelson, East Orange, N. J. App. filed April 26, 1921. Link circuits for establishing connections between wire lines and radio systems.

1,472,335. MAGNETO FLASHLIGHT; A. Luzy, Paris, France. App. filed May 1, 1922. Self-contained spring-driven generator.

1,472,341. REED TELEPHONE RECEIVING; G. W. Pickard, Newton Center, Mass. App. filed Nov. 19, 1920. For radio or wire communication.

1,472,351. AUTOMATIC SWITCH FOR INTERCONNECTING LINES; F. Aldendorff, Wilmersdorf, Berlin, Germany. App. filed Nov. 28, 1913. Quick-acting line finders for automatic telephone systems.

1,472,359. MANUFACTURE OF DRY-BATTERY CANS; W. H. Finkeldey and W. McG. Peirce, Palmerton, Pa. App. filed Jan. 12, 1922.

1,472,391. TERMINAL SEAL FOR STORAGE BATTERIES; B. Ford, Philadelphia, Pa. App. filed June 15, 1920. Wedge means arranged between post and cover.

1,472,451. PHANTOMED SIGNALING CIRCUITS; M. K. Akers, East Orange, N. J. App. filed Sept. 3, 1920. Telephone lines capable of being phantomed.

1,472,453. PRINTING TELEGRAPHY; J. H. Bell, South Orange, N. J. App. filed Jan. 20, 1920. Characters are printed in continuous line.

1,472,458. NUMBER-INDICATING SYSTEM; E. H. Clark, Richmond Hill, N. Y. App. filed Dec. 26, 1919. For use in automatic telephone exchange systems.

1,472,460. TELEPHONE SYSTEM; H. P. Clausen, Mount Vernon, and C. L. Goodrum, New York, N. Y. App. filed Dec. 28, 1918. Arrangement for controlling automatic switches over long-distance trunks.

1,472,463. TELEGRAPH REPEATING SYSTEM; A. J. Eaves, New York, N. Y. App. filed April 30, 1921. Operated according to half-duplex method.

1,472,469. TELEPHONE-EXCHANGE SYSTEM; C. L. Goodrum, New York, N. Y. App. filed Nov. 26, 1920. Machine-switching apparatus.

1,472,470. METHOD OF AND MEANS FOR PRODUCING ALTERATING CURRENTS; R. V. L. Hartley, Brooklyn, N. Y. App. filed March 30, 1918. Vacuum-tube discharge type.

1,472,477. ELECTRON DISCHARGE DEVICE; R. W. King, New York, N. Y. App. filed Aug. 14, 1919. Audion type for high voltages and large operating currents.

1,472,483. TELEGRAPH SYSTEM; R. C. Mathes, New York, N. Y. App. filed Oct. 21, 1919. Method of winding and connecting ratio arms of duplex network.

1,472,485. TELEPHONE SYSTEM; J. S. Morrill, St. Louis, Mo. App. filed Dec. 11, 1920. Loaded lines for system with several substations.

1,472,501. MACHINE-SWITCHING TELEPHONE-EXCHANGE SYSTEM; R. L. Stokely, Floral Park, N. Y. App. filed Dec. 8, 1920. Improved circuit arrangement to take care of toll calls.

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Agreement Essential to Water-Power Development

INASMUCH as water power must be an integral part of any superpower system, it is essential that the general public, and especially state executives, shall have a clear perception of the problem. So long as there is conflict between state and national authorities over supposed rights infringed or fancied powers usurped, so long will water-power development be stopped and so long will the people be deprived of the benefits accruing from water powers harnessable and utilizable.

To what purpose do the States of New York and New Jersey, for example, seek to restrain the Federal Power Commission from granting permits on navigable streams within their borders? Any development in either state is certainly for the benefit of the citizenry and is subject to the regulation of the state. It is the public which gains, not the Federal Power Commission, because the latter is not a profit-making body. If the venture is unprofitable, the owners and no one else stand the losses. Thus these contentions really withhold from the public something of benefit merely because authorities cannot agree on some minor details of procedure. There is no question as to the desirability of water-power development. On that point state and national governments are in agreement, and it is unfortunate that work of such essentially beneficial character should be held up while lawyers quibble and argue over trifles.

Any system of pooling the power resources of the nation must of necessity be interstate and must be based on a sound economic operating structure. Our present power development stands unrivaled. The men who are responsible for it are the ones who are now working out on an economic basis the power destinies of the country. Superpower is not for novices, but for men of experience and ability. Men possessing both are willing to erect hydro-electric plants which would be a credit to any state or nation. The public wants developments of this kind, and the public can have them if its officials will sanction what both agree is worth while and settle their differences in a way which will not deprive the public of the benefits of constructive work.

Dana Pierce

An engineer and executive who has contributed greatly in the field of safety promotion in which the development of the National Electrical Code has been the outstanding product.

FOUR things stand out in the history of the National Electrical Code during the past few years: Many progressive ideas have been incorporated which have tuned it closer to the spirit of the electrical industry. The establishment of the new developments committee of the National Fire Protection Association has provided a mechanism whereby the code may be more easily adapted to changing conditions. The 1920 code has been accepted as an "American standard" by the American Engineering Standards Committee. The 1923 code has been revised in a new form that adds greatly to its clarity and usefulness.

All this has very naturally attracted the attention of the electrical industry much more closely to the work which is being done by the Underwriters' Laboratories and the N. F. P. A. for the reduction of fire and life hazards from electrical causes. The man above all who personifies this work is Dana Pierce, for some years chairman of the N. F. P. A. electrical committee and vice-president of the Underwriters' Laboratories and now just elected president of the laboratories.

Dana Pierce was born in New Hampshire in 1871. Graduating from Amherst College, he became an instructor in Hotchkiss School, Lakeville, Conn., and while teaching took special work in physics at Harvard and Cornell. In 1899 he resigned from Hotchkiss and spent a year as a graduate student at Johns Hopkins University and then joined the instructing staff at Pratt Institute, Brooklyn. In 1906 he was placed at the head of the electrical department of the Underwriters' Laboratories. For six years he was in Chicago in charge of electrical and signaling work. In 1912 he established a testing station at New York while still directing electrical work at Chicago. In 1916 he was made vice-president of the laboratories. Meanwhile for many years Mr. Pierce had been prominent in the electrical work of the National Fire Protection Association, and in 1918 he was appointed chairman of its electrical committee, which has entire charge of the code. Later he was made secretary of the Electrical Safety Conference. In this time he has written much.

Mr. Pierce has been both the leader and the wheel horse in the work of developing the code. Possessing a rare ability to see clearly, with patience and sympathy, both sides of a question and then, using words that cannot fail to be understood, to interpret his opinions in logical sequence, he has long wielded a wide influence for progress. His poise as a presiding officer and the fairness of his judgment have contributed greatly.

Editorial Comment

Electrical World, November 24, 1923

Volume 82 Number 21

A Briton's Tribute to Our Industry

LLOYD GEORGE'S first utterance to the reporters who greeted him on his return to England was one of admiration for Canada and the United States. What apparently impressed the noted Welshman most, judging by the jubilant way in which he expressed himself about it, was the tremendous use made in this country of wireless and the opportunity it gave him to address unseen millions. The average Englishman is not so readily impressed. He does not comprehend the phenomenal growth of the electrical industry in this country or the extent to which people employ electricity in their homes, factories and shops, because he has not seen it. Every ingenious youngster here dabbles in wireless. We number our radio "fans" by the millions and sell radio parts in every five-and-ten-cent store. In England, however, the use of wireless is limited because the government has placed too many restrictions upon it. We imagine that if Lloyd George had his way all this would be changed. He saw and believed, he experienced and appreciated what electricity can do. Two years from now a large party of English engineers and commercial men expect to visit this country to see its electrical developments. Every opportunity will be given them to study electrical conditions and applications so that when they return to England they too may be just as enthusiastic over the possibilities of electricity as Lloyd George was over wireless. Then increased development may be looked for, and if a friend at court is needed to help remove some barriers, the industry there ought to find him in the doughty ex-Premier, who left such a wonderful impression and who in turn was himself so visibly impressed.

Bringing Gifts to the Modern Crœsus

THE wealth of old King Crœsus was so great that people used to say "as rich as Crœsus." Of course, that was before the days of Henry Ford. And yet what a pity it is that people interpret "To him that hath shall be given" so literally that they would like to present to Mr. Ford such valuable gifts as power plants or such high honors as the presidency of the United States. Usually a man possessing the wealth of Mr. Ford is made miserable by persons seeking favors and gifts of money, or by inventors and promoters who want to heap further riches upon him by letting him in on the ground floor, but only in return for capital advanced, or by enthusiastic dreamers who with his assistance can convert this world into an Elysium. We can account for the diverse motives impelling all these supplicants, and so can Mr. Ford, we dare say. But when it comes to placing free and stringless gifts on silver platters at his feet, asking him to play the rôle not of giver but of receiver, we are lost in amazement. And yet that is what a Congressman seriously proposes to do. The government having sold the steam plant at Muscle Shoals and having thereby caused Mr. Ford to become somewhat peevish, it is proposed to spend more good money on another steam plant so that the Muscle Shoals project shall be just as attractive as ever. Of a truth this world possesses many queer inhabitants; but fortunately there is enough sanity left in it to keep it attractive still and a place worth living in, even though shared with demigods and demagogues.

The Three "Urges" in Man—To Know, to Think, to Act

THE most coveted award in electrical engineering, the Edison medal, was presented this year not to a practical pioneer, like Brush, Bell or Sprague, but to a pure physicist, Prof. R. A. Millikan, formerly of the University of Chicago and now on the staff of that rising scientific center on the Pacific Coast, the California Institute of Technology. In a masterly response, after the presentation of the medal at the recent A. I. E. E. convention in California, the new medalist brought out in a striking manner the relationship of pure science to engineering and to all practical activities as well. He spoke of the great primitive "urge to know," which from the earliest days of humanity has prompted observation of physical facts and exploration of unknown regions, in spite of great obstacles and hardships. The knowledge so acquired dispelled superstition and led to new ways of thinking.

The way men think, according to Professor Millikan, is the most important and practical thing in the world, because the things they accomplish and the manner in which they act are largely determined by their thinking. This is then the newly expressed connection between pure and applied sciences: The urge to know leads to scientific discoveries; these discoveries change man's ways of thinking, and the new attitude toward the world causes men to build bridges and to put up transmission lines, so as to be nearer their fellow men.

Hartford Scores a Commercial Triumph

TO "SIGN UP" more than 25 per cent of a city's wired homes for improved kitchen lighting in a month's campaign—in other words, to place seven thousand 150-watt lamps in circuit, with an estimated gain in annual revenue of $55,000—is no small achievement. It arouses both admiration and enthusiasm. Such was the record of the Hartford Electric Light Company in October, and the end is not yet. The story is told elsewhere in this issue.

The results speak for themselves, but a few words upon methods may not be amiss. The Hartford experi-

ence clearly emphasizes the importance of careful advance planning of procedure, the vital necessity of picking high-grade canvassers to meet the public, the value of intensive and original local advertising, and the appeal of a demonstration contrasting old and new methods to the utter disadvantage of the former. Unquestionably the fact that Hartford's two-part residence lighting rate carries an energy charge of only 5½ cents per kilowatt-hour was a most favorable factor in selling the public a 150-watt unit. The deferred-payment plan was naturally an essential part of the scheme. And too much emphasis can hardly be laid upon the importance of arranging for a flexible and an adequate supply of material in view of the snowballing of the popular demand in the Hartford case.

There is a public-relations angle to such a campaign, however, which deserves recognition. The use of salesmen of superior quality and provision for meeting the popular demand for installations with speed and courtesy, involving thorough local organization, co-operation between manufacturer, jobber, central station and dealer, are all cardinal points in such a drive. When the campaign began it was hoped to sell five thousand units in three months. That the electrical interests concerned were able to expand their facilities to meet a demand rate something over four times that anticipated speaks well for their internal and external co-operation, and the industry is to be congratulated upon the achievement of the Hartford company and its associates.

Flexible Rates and Adequate Financing Needed

LOOKING a short way into the future, W. B. Clarkson made two rather important points in his address last week before the West Virginia Utilities Association. In his opinion a situation requiring serious study is the necessity for adequate earnings in the future. Rates at present are based largely on pre-war investments, yet the enormous expansion of utilities has resulted in a great investment in equipment under post-war conditions. In a few years, therefore, the major position of a utilities investment based on financing cost, material cost and labor cost made under peak conditions will be fixed, and a very serious problem will be encountered unless rates can be made to return earnings on this investment, even though investment costs in the future should greatly decrease.

Another problem to be faced as a future condition is based on the oft-mentioned fact that utilities are under obligations to meet the demands for service when they occur. The very rapid growth in service demands today means that the utilities must obtain a large amount of new capital each year to provide adequate service facilities. The magnitude of capital requirements even now is great, and yet the need will be doubled every five or six years if the present rate of expansion is maintained.

Fortunately, both these problems depend for their solution upon hand-in-hand work by the utilities and the public because of their unity of interest. Good public relations are a fundamental in the utility business and have as their cornerstone good service supplemented by publicity, customer ownership and the co-operation of employees. The future should give no cause for alarm so long as the facts of the utility business are understood by the public.

Lighting an Entire City Presents Interesting Problems

IT IS indeed fortunate, as Rolf Toensfeldt remarks in his article in this issue, that the city of St. Louis has made it possible to approach the problem of street lighting there as a city-wide and all-inclusive undertaking. No illuminating engineer whose business is street lighting could desire any greater opportunity, provided there are no "provisos" to limit exercise of his professional discretion. As to the degree of perfection attained by any one engineer, varying opinions from other engineers might, of course, be expected. But all would admit that the problem was presented on a desirable basis. The magnitude of the work of lighting one thousand miles of street in one job, of expending nine million dollars wisely and in a way to give public satisfaction and render effective service economically, is immediately admitted.

The basis of the solution which Mr. Toensfeldt presents will undoubtedly meet with general approval. That greater intensity should be used in the business districts than in outlying sections is natural. The manner of its portrayal by map is at once effective to the engineer and useful for public information. The debate on the solution will doubtless center on three principal points—one, the intensities used; two, the selection of units, and, three, the method of distribution and control.

It has not been long since there appeared a calculation of what cities should be expected to spend for street illumination. If memory serves correctly, the intensities there recommended as good practice were considerably above those determined upon for St. Louis. This does not mean that the St. Louis intensities are not a great advance in general street illumination practice. But it does indicate either that cost is still unfortunately too much a controlling factor or else that the knowledge with reference to the effectiveness of higher illuminating intensities spreads slowly. On the question of units selected manufacturers of competitive products will probably have reasons to show why the best has not been chosen. But if the one mentioned by Mr. Toensfeldt is finally installed for the production of the different intensities proposed, it will provide a demonstration which all illuminating engineers will be eager to study. To say the least, it is a courageous departure to equip a thousand miles of streets with a newly designed unit which has not seen extensive field trial, and it is to be hoped that this bold move will be followed by successful performance.

The decision of the city of St. Louis not "to tie in too closely" with the service company's feeders because the service company is not one and the same as the agency owning the lighting installation, the city, may provoke comment from the central-station industry. The determination has been made largely from a continuity-of-service standpoint. The position of the local electric company on this question is not known, but surely the light and power industry in general must rise to the challenge as to continuity and dependability of service. Among all the factors of its service of which the central-station industry is most proud and jealous, its policy and record on continuity of service are conspicuous. As Mr. Toensfeldt says, multiple distribution for street lighting is now both dependable and economically justified. It would have been at least a fitting experiment, in line with the boldness and the

apparently good engineering of the rest of the program, to have installed a multiple system.

The St. Louis undertaking is bound to attract the attention of illuminating engineers, of central-station executives and commercial managers and of city officials in general. On account of its magnitude its various features will have more than usual interest, and while, as already indicated, there may be debate on some points, there will undoubtedly be general approval of the plans as described, and judgment will be based only on actual performance.

Limiting Factors in Distribution Transformer Service

THE question has been raised in informal discussion whether overemphasis has not been laid upon temperature rise as a factor limiting the application of distribution transformers to service in residential districts. It is averred that voltage regulation is the controlling consideration in many installations rather than temperature, and that modern transformer design and construction have reached a plane of service reliability that warrants dismissing the heating problem from the serious consideration of central-station engineers in assigning the later products of the factory to field service. Without attempting a categorical discussion of this point at the moment, it is well to realize the increasing importance of studying transformer applications in neighborhoods with rapidly changing or growing loads, of taking periodical engineering inventories of loading conditions, determining the existence of excess capacity and the possibility of utilizing it elsewhere, and checking the quality of service rendered to consumers making more and more use of appliances and higher-powered lamps.

Much splendid work has been done along the line of studying diversity factors; some excellent methods of inventorying transformer duty are available, and the possibilities of forcing the output of fairly old transformers are by no means exhausted. If the experience of operating companies generally shows a marked diminution in the importance of temperature rise as compared with regulation capabilities, it would be of interest to the entire industry to establish the facts under differing conditions.

Why Not Publish a List of Stockholders?

NOT long ago a writer in one of the prominent weeklies asked the question, "Why not publish lists of stockholders?" One of the important banks of Boston had just taken this courageous forward step. It has published a complete list of its stockholders so that every one can see and know who own the bank and thus appreciate what kind of people believe in the institution to the extent of investing their money it it. There could not be a better index to the character of the bank.

Gradually, albeit slowly, we work up out of the darkness. Time was when most business was conducted in profound secrecy. "That's my business" is a phrase that indicates the degree of privacy that was imposed. But most of those hobbles have been shaken off until today corporations and their customers have begun to act like friends. It has become quite common to publish how many stockholders there are and even to go into particulars as to what kind of people these stockholders are. Then why not take the final step and tell *who* they are as well?

For a public utility the idea has much to commend it. The electric railway industry is right now conducting a publicity campaign that is featuring photographs of employees shown at their work, with the statement: "I am Bill Smith of the Podunk Street Railway. When you talk about the electric railway, that includes me." It is a very human appeal. Naturally, it would not be appropriate or necessary to tell how much money stockholders have invested in a company. That is their affair. But a list of the names of those who own the securities of a central-station company would be mighty interesting reading for the stockholder himself and a powerful defense against the raiding politician. Publish these names and tell the stockholder, "When they say things against your central station, that includes you!" and he becomes possessed of a new sense of responsibility to his company. It is one more thing to do to give personality to the public service corporation.

Division of Engineers by Functions Instead of by Subjects

NEW brands of engineers are being created all the time—for example, radio engineers and acoustic engineers—to recognize new and growing branches of our art. These subdivisions in most cases refer to the purely external and specialized forms of activity rather than to the psychological, deeply seated functional aptitudes of the mind. Thus a man who loves construction work will enjoy erecting bridges as much as putting up transmission lines or building sugar refineries. He is a construction engineer by temperament, rather than an electrical, a civil or a chemical engineer. Similarly, a born designer will be just as satisfied designing gas engines as designing induction motors, his specialty depending upon the training that he happened to get. A good sales engineer can handle various kinds of products with almost equal success. Therefore, instead of dividing engineers into civil, mechanical, electrical and so forth, it is more rational to pay more attention to their specialization into designers, production engineers, operating men, sales engineers, executives, researchers, etc.

This is not a purely academic question of nomenclature, but one of properly directing young men where they can be most useful. It is almost impossible to say whether a normal, healthy and intelligent young man will make a better civil or mechanical engineer, granted a thorough training as either. It is much easier to predict whether he will like construction work or sales, management or research. Perhaps the day will come when college training will be available more in accord with these fundamental propensities of men, and not according to purely secondary "brands" of engineering. An intimation of such a trend is seen in a recent article by Prof. Edward Bennett on functional divisions of engineering (*A. I. E. E. Journal*, 1923, Vol. 42, page 1145) and also in a monograph on engineering research as a career by Dean A. A. Potter (published by the National Research Council, Washington, D. C., October, 1923). After all, the change is not so radical as it may appear at first sight, and by a slight readjustment of courses in the junior and senior years each man may be allowed to follow more freely his natural trend of mind.

Power Plants of Milan Edison Company

THE Adda River, canalized centuries ago by the Italian engineer and painter Leonardo da Vinci, has been further utilized by the Milan Edison Company. Three hydro-electric stations on the river supply electrical energy to Milan and other cities of northern Italy. The upper picture shows the Calusco station, rated at 3,000 kw., and the 35,500-kw. Robbiate station is shown below. These stations supply energy to a great industrial section of Italy.

KINGSWAY, LONDON, ONE OF THE CITY'S CHIEF THOROUGHFARES, LIGHTED WITH HIGH-PRESSURE GAS

Electrical Development in England

Observations and Analysis of Electrical Conditions Made by W. H. Onken, Jr., Editor of the "Electrical World"—Handicaps Under Which Great Britain Is Struggling and Plans for Co-ordinating Electricity Supply in Numerous Power Districts

AN AMERICAN electrical engineer passing along the streets of London, or for that matter through any other part of Great Britain, would appreciate the feeling which St. Paul must have had as he walked through the streets of Athens up to Mars Hill and found the altar with the inscription "To the Unknown God." For it would appear, with evidences of gas lighting on all sides (and excellent gaslighting it is), that electricity is almost, but not quite, as unknown in Great Britain as the Christian's God was in ancient Athens. But just as the Athenians erected an altar to a dimly comprehended deity, so in Great Britain evidences of aspiration for better electrical service are to be seen. The demand, already vocal, is growing in volume. It bids fair to become so insistent and vociferous that the electrical industry will find it no easy task to satisfy the clamor.

INDUSTRY THROTTLED AT THE OUTSET

That the use of electricity in Great Britain will ever approach the record reached in the United States is hardly to be expected, because the generation and distribution of electricity there is for the most part in the hands of municipalities, and as we have reason to know in the United States, that is a severe handicap. Government has never shown the same enterprise and initiative in encouraging the use of electricity as private corporations have done, and in Great Britain the situation is even worse than elsewhere, because the government has deliberately placed obstacles in the path of the electric light and power industry and greatly handicapped its progress.

The basic legislation of 1882 governing the establishment and operation of electric light companies was framed at a date when the generation and distribution of electrical energy on a commercial scale was still in an experimental stage. And, as though that were not bad enough, the companies were expressly prohibited from associating themselves with any other company or persons supplying energy under any license, order or special act. Under such circumstances, and in view of the competition of the gas industry, the progress made by the electric light and power industry in Great Britain has been less rapid than in other countries. Thus, in twenty-six years, from 1888 to the outbreak of the European war, the largest output in any one year from the whole of the electric generating stations in the United Kingdom (numbering over 500) amounted to about 2,000,000,000 kw.-hr., which is less than one company in Chicago now generates; and the present estimated output for the United Kingdom is approximately 5,000,000,000 kw.-hr., or less than the total amount of the electricity generated in the metropolitan district of New York. The United Kingdom has approximately 45,000,000 people and the metropolitan district of New York 7,000,000.

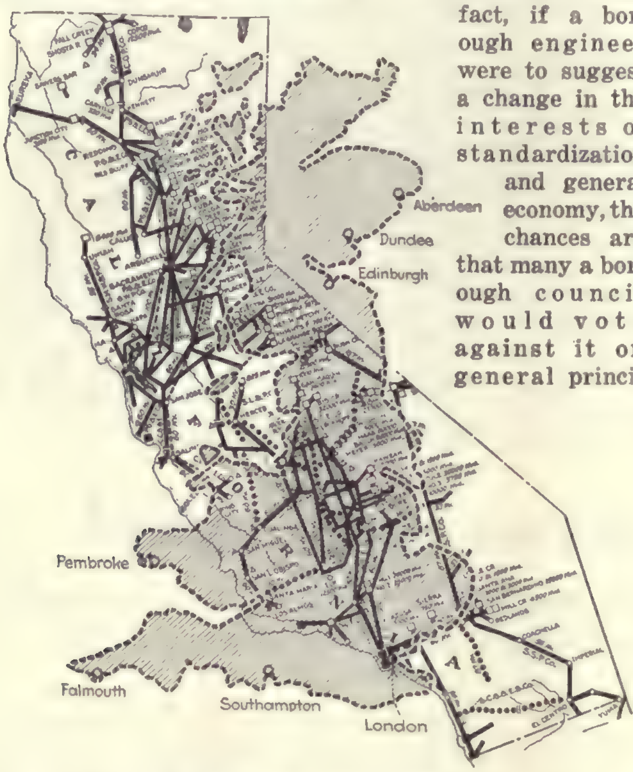
The advantages of the regulatory system which obtains in the United States are therefore instantly apparent. Here public utilities are regulated monopolies and combine the zeal, energy and initiative of private enterprise, encouraged to do its best and restrained only in matters of service and rates and in the prudent use of capital.

SERIOUS LACK OF STANDARDIZATION

The one great drawback to the wider and more intensive use of electricity in Great Britain, however, is the lack of standardization, and until this is remedied great progress is impossible. The Britisher recognizes that there should be regularity in the sizes of hats,

shirts, collars, underwear, screws, nuts and bolts, but when it comes to the voltage and frequency of his electric supply, he has thus far evinced no interest, because the industry itself has shown none.

Those whose business it is to provide service oftentimes encourage variety in the mistaken idea that it provides security, particularly of jobs, and that too great uniformity and efficiency would be suicidal. In fact, if a borough engineer were to suggest a change in the interests of standardization and general economy, the chances are that many a borough council would vote against it on general principles. The experiences of Great Britain's electricity supply commission show that it is almost as hard to get agreements on questions vital to the growth and expansion of the electrical industry as it is "for a camel to go through the eye of a needle."



GREAT BRITAIN AND CALIFORNIA

The former has 40,000,000 more inhabitants than the latter and comprises one of the greatest industrial districts in the world. Its electrical output, however, is no larger than California's, and while Great Britain is planning restricted power districts made up of interconnected systems, California already possesses an interconnected network stretching from one end of the state to the other. The maps are drawn to the same scale.

Confronted with almost as many varieties as a dog has fleas, the manufacturer is also in a dilemma. Big production is out of the question; distribution of supplies is difficult; stocks are as numerous as the stars, so that costs must necessarily be higher.

LONDON'S VARIETIES

The largest city in the world offers an excellent example of what electric supply ought not to be and serves as an illustration of the complexity of the electric light and power industry in Great Britain. In the area of Greater London alone there are some seventy generating stations, representing between them fifty different systems of supply, twenty-four different voltages and ten different frequencies. London is asleep. It knows, but knows not that it knows, and therefore needs to be awakened. There is no telling what the outcome will be when that awakening takes place, for the city's bankers are rich, its artisans skillful, its engineers excellent, and its public utility operators the peers of any in the world. But there is class to be reckoned with, tradition to be overcome and comforts to be appreciated.

There is too much worship of the past in Great Britain. The country is filled with and handicapped by ancient monuments. If it be a weakness to preserve the monuments, it is a weakness that yet deserves praise; but there is no justification for the handicap, for it is possible to preserve the monuments and at the same time remove the handicap. And that lesson is being surely although slowly learned. The inevitable outcome of independent development is apparent in the existence of many hundreds of comparatively small generating stations supplying electricity to restricted areas and operating at different voltages and frequencies. Even the interconnection of adjoining electric light and power systems for the purpose of mutual assistance and interchange of energy is often technically difficult or financially impracticable.

The accompanying map of a section of London, on which is indicated the location of the various generating stations, and the table giving the statistics on these stations are worth pondering. A look at both reveals wonderful opportunities economic as well as engineering, and yet a well-known Chicago utility operator who had excellent plans for remedying the situation received scant thanks for his trouble and was out of pocket a considerable sum of money besides. His proposition for a huge power station in the lower Thames based on sound economics and engineering, and which if accepted would have been a boon to the users of electricity in London, was put into the form of a bill which got as far as a second reading in the House of Commons and then was done to death by the very industry in whose interest he was working.

Of course, it is now recognized as one of the lessons learned during the war that the lack of co-ordination in the electric light and power industry of Great Britain has resulted in unnecessary expenditure of capital, wasteful consumption of coal and generally higher charges for electricity than would have been the case had there been larger areas of supply, a greater concentration of generating plants in large units and more economically situated power stations.

The need for improvement and for the development of a comprehensive system of generation, transmission and distribution has resulted in the appointment of elec-

STATISTICS ON SOME OF LONDON'S CENTRAL STATIONS

Municipal Plants	Station Rating, Kw.	Yearly Output, Kw.-hr.	Load Factor, Per Cent	Average Price Obtained—Cents
Battersea	12,350	12,323,573	25.43	5.06
Bermondsey	7,800	7,002,215	23.64	6.60
Fulham	6,850	8,686,294	24.18	6.22
Hackney	18,200	17,426,605	17.65	4.46
Hammersmith	10,300	15,262,130	17.73	5.52
Hampstead	5,950	7,437,695	19.76	10.18
Islington	9,125	11,665,601	15.06	8.18
Poplar	16,000	22,526,506	26.51	3.86
St. Marylebone	27,000	24,218,918	17.39	6.74
St. Pancras	10,300	13,557,768	19.35	8.14
Shoreditch	9,080	10,739,150	17.97	5.86
Southwark	3,300	2,928,269	16.44	9.06
Stepney	16,000	27,888,661	25.61	4.28
Stoke Newington	1,217	1,184,281	16.06	10.58
Private Plants				
Brompton	5,400	5,236,675	25.83	10.56
Central	25,000	39,857.690	20.22	3.04
Charing Cross	34,100	39,417,563	24.54	8.08
Chelsea	3,400	5,268,420	20.10	11.14
City of London	42,000	42,605,947	18.86	7.86
County of London	......	58,241,758	.....	7.08
Kensington	1,070	7,506,015	25.28	9.16
London	51,800	49,675,886	26.11	3.50
Metropolitan	20,000	29,624,044	24.30	8.68
Notting Hill	3,500	4,074,512	23.74	11.90
St. James	11,550	13,464,418	16.68	8.46
South London	......	10,532,615	.....	7.06
South Metropolitan	20,000	20,705,387	.....	5.02
Westminster	30,924	26,688,671	17.43	7.54

EBB TIDE PROBLEMS ON THE THAMES

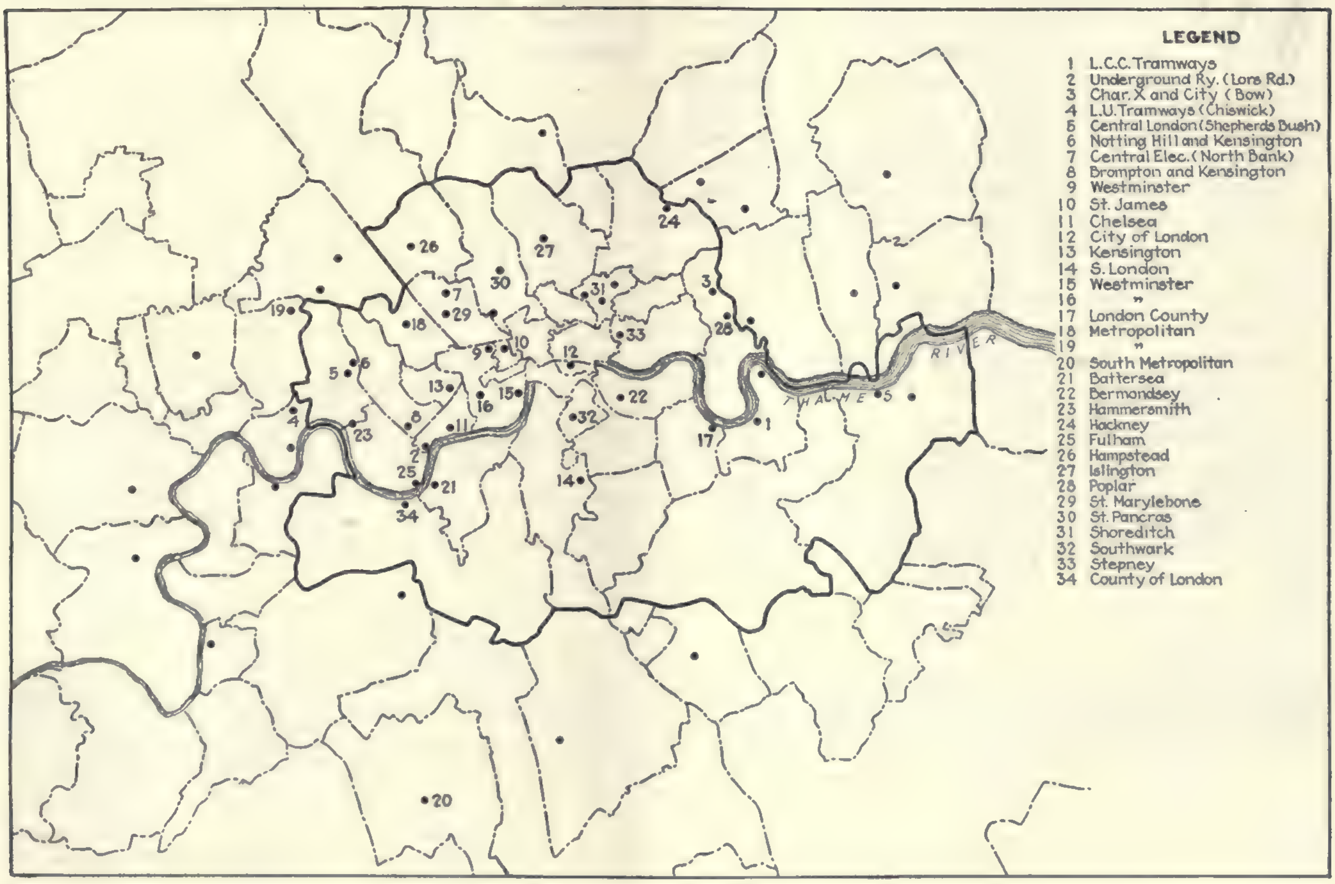
PARLIAMENT SQUARE IS LIGHTED WITH GAS

tricity commissioners with certain statutory powers and duties. The commission, which is composed of high-grade men of experience in the electric light and power industry, is deeply sensible of its task.

To develop a comprehensive and standardized system of generation, transmission and distribution on the basis of present-day knowledge and technical practice would be an easy matter, but there already exists an extensive and heterogeneous development representing the unco-ordinated growth of years and an expenditure of vast sums of money. Moreover, there is a multiplicity of interests involved, and it is necessary to secure the co-operation and agreement of those concerned in a given district concerning any scheme of reorganization of the supply of electricity.

Even after the engineering problems have been solved, financial considerations offer a barrier to the speedy development of the various schemes in different parts of the country. Experience had also indicated many legal handicaps which must be overcome before any great progress can be shown. Despite the handicaps, however, the electricity commissioners are making headway.

Unfortunately, there are in all countries dreamers whose eyes are fixed everywhere but on the earth and whose habitat should be Utopia. These men would like to wipe out the many hundred generating stations in Great Britain and replace them with a dozen or more superpower stations of huge size and unprecedented efficiency. We should like to do the same in the United



MAP OF LONDON WITH LOCATIONS OF POWER STATIONS INDICATED

States, but as practical men we know only too well that there is a limit to the amount of junk that can be bought at any one time if a corporation or community desires to remain solvent.

What the electricity commissioners of Great Britain are trying to do is to bring order out of chaos, to discard what is useless and inefficient, and to evolve a workable scheme of co-ordination in power districts in the interest of ultimate unification of systems and an abundant supply of electricity. So far as future work is concerned, the task of the commissioners is quite simple. No new generating station can be built and no existing generating station can be extended without their permission. Their chief difficulty is to rectify the mistakes of the past, utilize what is at present in existence, and evolve a standardized system without jeopardizing investment or running foul of innumerable legal, technical and financial pitfalls.

From a physical viewpoint, however, the situation in Great Britain presents less difficulty than would be normally met here. The country is small and compact; the density of population and service is greater, and since all of the energy must be generated in steam stations, the possibilities for the unification of distribution networks and the improvements of steam-station efficiencies are enormous. Greater progress would be made, however, if wider powers were granted to the electricity commissioners. The machinery at present set up for getting the municipal as well as private plants to pull together without too much disturbance of the principle of local self-government and in accordance with a well-defined plan is rather cumbersome. Joint boards made up of representatives of municipal as well as privately owned systems have so large a membership as to make them unwieldy. A single responsible administration would be more likely to get results quickly and efficiently than a town meeting of local authorities. However, it is a condition and not a theory which confronts the electricity commissioners, and, all things considered, they have done remarkably well.

The Cleveland 66-Kv. Cable Joint

Investigation and Extensive Tests of Wrapped Joints and of Joints Insulated with Tubes and Compound Resulted in the Adoption of a Combination Joint as Best Adapted to Service Conditions

By H. L. WALLAU
Electrical Engineer Cleveland Electric Illuminating Company, Cleveland, Ohio

WHEN designing the new 132,000-volt transmission line between Cleveland and Akron, the Cleveland Electric Illuminating Company was faced with the problem of carrying the line through thickly settled urban territory for a distance of about 8 miles. Since it was obviously impracticable to carry the 132,000-volt overhead construction through this territory, it was determined that underground cable of the highest practicable voltage should be used. Accordingly a 500,000-circ.mil single-conductor lead-covered cable to operate at 66,000 volts was chosen. The cable specifications were so drawn as to permit each cable manufacturer to use the technique he considered best. While the making of satisfactory cable was regarded as a manufacturer's problem, the design of a satisfactory cable joint, on the other hand, was purely a local problem, since even the manufacturers had no data on joints at all approximating this voltage.

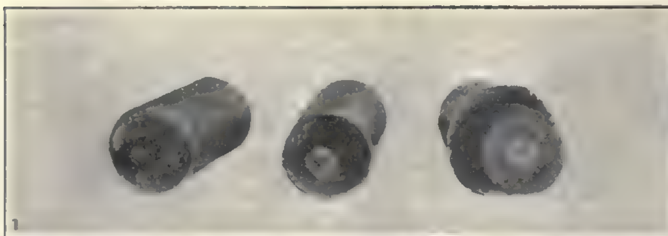
The joints now being made in Cleveland are the result of systematic research work covering a considerable period of time. There will be more than 900 of these joints on the two three-phase circuits to be installed. The details of their design and construction show many radical departures from joints heretofore used. Use is made of a combination of a wrapping of impregnated paper tape and a shellac-paper tube. This type combines many of the advantages and eliminates some of the disadvantages of either type of insulation used separately. In starting the joint the lead and paper of the cable are removed by a square cut which exposes about ¾ in. of the conductor. This step is shown in the sample at left in Fig. 1. By the use of a special cutting tool designed for this purpose the paper insulation is then undercut at an angle of 15 deg. from the axis of the cable (Fig. 1, center) leaving a conical space next to the conductor. How this work is done is shown in Fig. 2.

Special Connector Used

A thin brass shell made in the form of a truncated cone is next placed in each cavity. This shell is made in the exact form of the sloping paper surface, having holes provided for use later in sweating the connector and filling the shell with solder. The conductor ends are inserted in the ends of an ordinary copper connector. The two cable ends to be joined are then crowded together by the use of a geared device designed and built for this purpose, illustrated in Fig. 3. This operation brings the cable ends together in true alignment, fitting the ends of the brass shells closely. By pressing the shells so tightly against the sloping paper surfaces no air is entrapped between the brass surface and the paper of the installation. The copper connector is then sweated at a high temperature, and the entire conical space within the cones is filled with solder at a lower temperature.

On account of the short truncated form of the conical brass shell a portion of the solder comes in direct contact with the paper of the insulation. It was found that the hot solder can be poured against the paper with no undesirable effects, while the use of a full conical shell was found to introduce difficulities due to entrapped air. This results in a metallic connector for the conductor, which has the same diameter as the factory-made insulation of the cable and has no sharp corners. As will be pointed out later, this reduces the stress on the surrounding insulation at this point.

The lead armor is then removed for a distance of



FIGS. 1 AND 2—MAKING THE JOINT

In preparing the cable joint (A) a square cut exposes about ⅜ in. of the cable when the insulation is undercut at an angle of 15 deg. (B) by the tool shown in Fig. 2. To lower excessive stresses at the lead sheath the ends are belled up as in (C) to allow for a better contact between the candle wicking and the sheath.

FIG. 3—DEVICE FOR JOINING CABLE ENDS

Pulling the copper connectors together in true alignment is accomplished by this device. It is clamped directly onto the cable, which operates by means of two gears.

FIG. 4—APPEARANCE OF INCOMPLETE JOINT

18½ in. from each side of the center of the joint. A winding of impregnated paper tape extending for 12 in. each way from the center is then applied to a thickness of ¾ in. in the central 13 in. and tapering to the cable insulation at the ends. The appearance of the joint at this stage is shown in Fig. 4.

Tape Is Machine-Wrapped

Before any cable was available or any general procedure determined it was conceived that any narrow insulating tape used in a joint might be wrapped by machine to obviate the objections to hand wrapping—i.e., the lack of uniformity in laps, uneven tension and the excessive inclusion of air and moisture. Such a machine (Fig. 5) was used throughout the experiments, and similar machines will be used to apply all tape in the service joints. This machine is built in such a way that it can be easily operated in a standard manhole and can work within a space of 6 in. between the cable and the wall. It also permits the application of compound over the successive layers of tape at a temperature above the boiling point of water. Over this is slipped a shellac-paper tube large enough to clear the maximum diameter of the tape wrapping by ⅜ in. This is held rigidly in place by spacers placed between the tube and the tape wrapping; it is also centered in the outer sleeve by spacers cut from the same diameter tube as shown in Fig. 6.

The outer sleeve of the joint is constructed of brass and is 8 in. in diameter at the center. It is made in two sections, which telescope together at the center, one being slipped over each end of the cable before any jointing work is done. Experiments showed excessive stress on the insulating compound in the angle where this sleeve joins the cable sheath. This difficulty was overcome by filling this space with a wrapping of cotton candle wicking which has been previously impregnated by a vacuum treatment. In order to secure

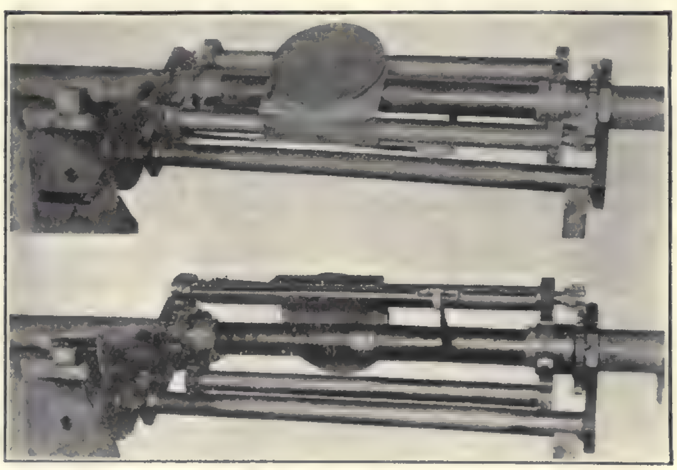


FIG. 5—THE 24-IN. TAPE-WRAPPED JOINT IS BUILT UP BY THIS MACHINE, WHICH IS SMALL ENOUGH TO OPERATE IN A STANDARD MANHOLE

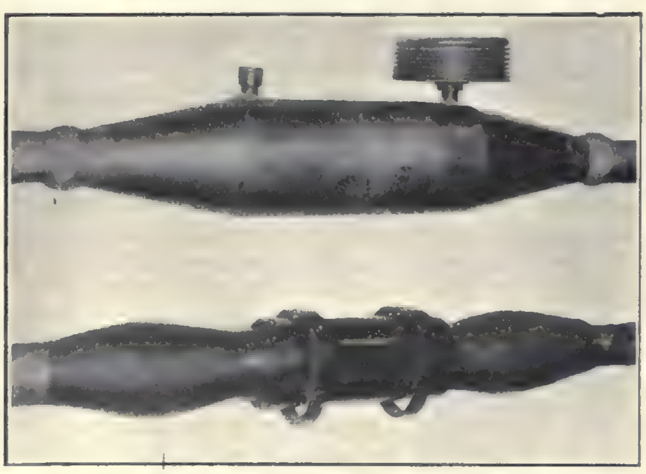


FIG. 6—BEFORE AND AFTER PLACING THE OUTER BRASS SLEEVE, SHOWING THE CANDLE WICKING TO LOWER STRESSES NEXT THE LEAD SHEATH

intimate contact between this candle wicking and the metal surfaces the lead of the cable armor is slightly belled with a tool devised for that purpose and the candle wicking forced under it. The manner in which the lead sheath is belled is shown in the sample at right in Fig. 1.

The filling compound used in this joint is thinned petrolatum. This is poured into the joint at a temperature of 250 deg. F. and allowed to run through and out a second opening at the top of the sleeve until all traces of air and moisture have disappeared. One of the filling openings is then closed with a cap, and compound under pressure is applied to the other opening for a period of approximately eighteen hours. After this period a diaphragm reservoir (Fig. 6) made of soft brass and filled with hot compound is substituted for the pressure cylinder. The corrugations of this reservoir permit expansion and contraction sufficient to care for the changes in volume of the compound in the joint as it passes through temperature cycles in operation. The complete details of the joint are found in Fig. 7.

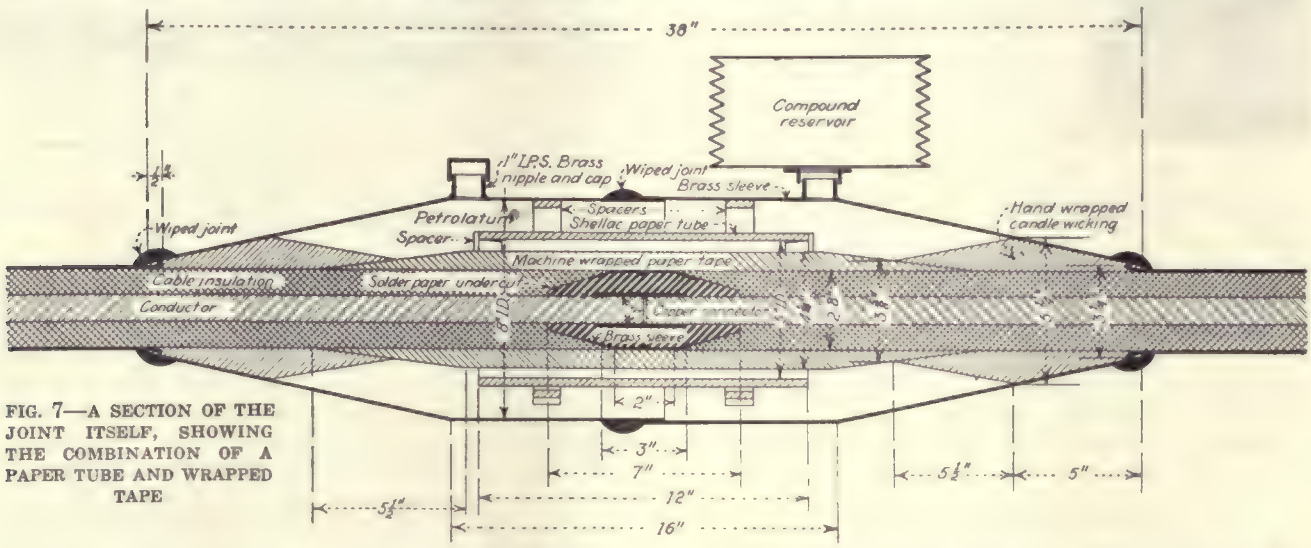


FIG. 7—A SECTION OF THE JOINT ITSELF, SHOWING THE COMBINATION OF A PAPER TUBE AND WRAPPED TAPE

Joint Development History

The development work which the Cleveland Electric Illuminating Company engineers have done on this 66-kv. joint has taken considerable time. The earlier experiments were somewhat delayed owing to the fact that no cable was available for test purposes. Development was in progress on similar cable for 44-kv. construction, although no installation had been completed and no operating data were obtainable in this country. But during 1922 the Cleveland Electric Illuminating Company placed orders for 300,000 ft. of single-conductor lead-covered cable for use in three-phase, 66-kv. circuits. The first series of joints was made with ordinary copper connectors and no insulation except a filling of thinned petrolatum. The sleeves had abruptly belled ends and were 8 in. in diameter with various lengths. The purpose of these joints was to indicate the length required to prevent longitudinal breakdown. A length of 36 in. or more was indicated by the test voltages at which breakdown occurred.

The second series was made with the same connectors and insulated with impregnated paper tape applied by the tape-winding machine. The factory cable insulation was cut in steps of uniform length and depth, the number of steps being varied from two to nine, in order to determine the most effective number. Five steps each way from the connector were indicated by the test results as being most effective.

Two Joints Studied

Simultaneous development was then started on two fundamental types of joints—first, a joint using all insulating wrappings and no filling compound, and, second, a joint using tube insulation and filling compound but no insulating wrapping. A number of joints of each type were made up for test purposes. Those joints depending entirely upon insulating wrappings were in all cases made with five steps in the factory insulation of the cable, with diameters varying from 3 in. to 5¼ in. and lengths from 27 in. to 48 in. The insulation applied consisted in most cases of ¾-in. impregnated paper tape from 6½ mils to 8 mils in thickness. In some cases impregnated muslin was tried, which gave some increase in longitudinal strength while decreasing the radial strength. It was found that the surfaces between the factory and the applied insulation were weak and that none of the joints of this type developed the full breakdown strength of the cable.

The joints without insulating wrappings in which the factory insulation of the cable was not stepped were then made up with tubes of oil-impregnated paper and the joints filled with hard compound. These joints also failed to develop the full strength of the cable. Both oil-impregnated paper tubes and hard compounds therefore were abandoned, and a series of joints was made using a petrolatum filling with shellac-paper or bakelite paper tubes. The initial weakness in this type of joint was in the center, owing to high stress on the end surfaces of the factory insulation. No solid insulation was applied on the connector because experience with other types of joint had shown that the junction between the applied insulation and the end surfaces of the factory insulation would be weak, even with insulating material tightly jammed against them. Tests were made on this type of joint with the space from the conductor to the surface of the factory insulation completely filled with a large metallic connector of cylindrical shape. This did not prove to be any better than a small connector. The reason for this evidently was the concentrated stress on the filling compound at the sharp edges of the large connector.

The conclusion was reached that a large connector

without sharp edges to concentrate the stress might be developed. This was accomplished by forming a conical recess in the factory insulation of the cable and filling this space with solder flush with the outside of the factory insulation. The use of this connector without other changes in the type of joint added about 50,000 volts to the test result previously obtained.

Various sizes and lengths of insulating tubes were then tried in test joints, variations being made successively on joint diameter and length. Requisite dimensions were found to be 8 in. in diameter and 42 in. in length. It was also found that the desired radial strength could not be obtained with one insulating tube, and so a design was tentatively adopted making use of two tubes, the inner one longer than the outer. This combination finally resulted in a joint which on time tests was stronger than the cable. At about this time it was determined that the joints of wrapped insulation could be made satisfactorily by increasing the diameter of the inclosing sheath to about 8 in. When this was done the diameter of the joint over the applied insulation was left at about 5¼ in. The intervening space was filled with petrolatum. Immediately joints were obtained which also withstood test voltages sufficient to break down the cable.

Combination Considered Best

At this point in the work joints of two fundamental varieties had been developed. Each was stronger than the cable itself and had certain advantages and disadvantages. It was recognized that a joint made with paper tubes depends for its success on maintenance of perfect filling. On the other hand, such a joint would show on test little or no evidence of distress until the breakdown point was approached. A joint with wrapped insulation, however, could be made with a higher instantaneous breakdown point, but there is the possibility of damage to the paper insulation at lower sustained voltages. It was therefore, decided that a combination of the two types could be made which would more nearly approach service requirements. Impregnated paper tape was substituted for the inner tube, thereby reducing the absolute necessity for perfect filling and preventing a continuous chain of moisture of foreign matter lining up between the conductor and the joint sleeve. Joints of this type properly constructed have in every case withstood time test voltages sufficiently to break down the cable.

BREAKDOWN TEST DATA, SHOWING COMPARISONS BETWEEN CABLE AND JOINT

	Cleveland Joint	Average Cable
N. E. L. A. Test to Failure:		
100 kv. for five minutes plus	260 kv.	265 kv.
10 kv. increase every thirty seconds.........	(One failure)	*220 kv.
Time Test:		
175 kv. for one-half hour plus...............	No value	220 kv.
200 kv. for four hours plus..................	(Cable failures)	½ to 2 hours
225 kv. to failure...........................	....	....
High-Frequency Test:		
50,000 cycles of damped wave oscillation, starting at peak wave value of 140 kv. with 14 kv. increase every thirty seconds	No value	250 kv.
to 310 kv., plus time at 250 kv. to failure..	(Cable failures)	1 to 3 minutes

* After cold bending.

Later tests on this type of joint developed the fact that, although the end of the sleeve met the cable at a small angle and great care was taken in filling, high stress was developed under the sleeve at the end of the joint. Although this stress in itself was not sufficient to break down the joint, it was high enough to overstress the filling compound and sometimes damage a few layers of insulation near the ends of the joint. To prevent this damage impregnated cotton wicking was wrapped over the cable insulation at each end of the joint, as previously described. This breaks up the oil at this point into thin films, and by the higher dielectric strength introduced by the oil in films this difficulty was overcome.

The filling of the joints required in itself a long series of experiments. It was early determined that pressure must be used during the cooling of the joint to insure the filling of all voids. First, a steel cylinder with a movable weighted piston was used to obtain this pressure. This was entirely satisfactory and has been modified for use in the field. The brass diaphragm described above was the subject of considerable experimental work. When filled with compound and placed on the joint this reservoir is hermetically sealed and atmospheric pressure is relied upon for maintaining a perfect filling of compound in the joint during the load-temperature cycles. The breakdown test data are correlated in the table. The credit for this development belongs to Messrs. C. N. Rakestraw, superintendent of lines; A. R. Askue, general foreman of underground lines; E. C. Willman, chemist, and D. C. Ober of the Electrical Engineering Division of the company, and to members of their staffs who contributed valuable suggestions.

Repulsion Motors Extensively Used in Saxony

THE Saxon textile industry has adopted to a considerable extent the use of special electric motors on spinning machines, and this use is gradually increasing. For connection to three-phase power lines repulsion motors or three-phase commutator motors are used extensively. Both types are especially adapted for use in spinning mills. They are totally inclosed and well protected against dust and damage. The smooth and simple construction of the motors enables easy cleaning and attention. Cooling air is provided through underground ducts, the circulation being produced by fans inside the motor. Where air ducts are not possible, water cooling is provided for three-phase commutator motors.

The switching on, starting and regulating of the speed is arranged by only one hand lever fixed to the motor. Speed regulating is achieved by brush shifting, i.e., without ohmic losses in regulating resistance. In the spinning-technical sense the two types of control are of equal value. They differ only in their interior power factor, phase shifting, etc., and in the cost of production. Which of the two types is more adaptable in one or the other shop depends on individual requirements.

The repulsion motor which is used most extensively may be connected to single-phase, two-phase or three-phase networks operating at voltages up to 550 without intervening transformer. The number of brushes and brush holders on these motors is very small. Equal loading of the three phases of the network is achieved by distributing the motors to be erected equally upon the three phases. The three-phase commutator motor is preferred on account of its slight phase shifting and very small power consumption. Both types are constructed for regulation by hand or for automatic regulation.

Control and Checking System for Automatic Stations

Description of the Apparatus Developed for the Use of the System Dispatcher in Controlling and Checking Operations in Distant Automatic Generating Stations and Substations

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ALTHOUGH the automatic equipment for central stations has been developed to a high degree of perfection, even to the extent where its performance during periods of stress seems uncanny, yet system emergencies arise which cannot be anticipated in the design of the automatic switching. There are times when the exigencies of system operation require that certain feeders be opened, although no electrical condition of the circuits indicates the fact to the automatic relays. Under these circumstances there is no substitute for the guiding intelligence of the human brain. The apparently simple and obvious method would seem to be the use of multi-conductor control cable from the operating center of the system to each station. While simple, the annual charges would exceed the cost of manual operation. Under this condition it should be manifest that good engineering practice would not permit the use of such a system for the remote supervision of stations.

In many ways the ideal means of connection is the simple telephone circuit. If it were but possible for the central intelligence to call the unattended station and transmit orders that would be fulfilled automatically the problem would be solved. However, while many wonderful means have been invented for the transmission, conversion and amplification of audible speech, there are no practical means yet available for the electro-mechanical conversion of the voice waves into actual operations.

Since the earliest method of electrical transmission of intelligence, the telegraph has been in wide use, and since there are many ways for the translation of dots and dashes into specific mechanical operations, the dot-and-dash code offers a desirable method for the automatic transmission and execution of orders emanating from the central intelligence. The most highly developed art in which dot-and-dash codes are automatically translated into mechanical operations is that of the automatic telephone. And yet the machine-switching equipment used in this art is not perfect and occasionally a wrong number is obtained. This is not such a serious inconvenience to the telephone subscriber, but should the unattended substation receive an incorrect translation of an order, there might be disastrous consequences.

Supervisory Control Developed

Recognizing the impossibility of perfect signaling by such means, various methods of automatically checking the accuracy of the receiving equipment have been developed. A typical equipment of the self-checking type is that recently installed by the New York & Queens Electric Light & Power Company. It is for the control of one unattended switching station from an adjacent attended station. Each of the control keys which are of the telephone type, with two large indicating lamps and one small lamp, is mounted on a plate, lamp-and-key assembly (Fig. 1) occupying a space of only 1¼ in. x 4⅝ in. One of the steel relay cabinets used with these control keys is shown in Fig. 2. A similar cabinet is used in the unattended station. The control keys are moved up to close and down to trip the circuit breakers in the distant station. Electrically locked relays respond to momentary contact of the keys so that the latter need not be held during the complete operation. An error button, similar to the one on an adding machine, permits the cancellation of any operations should the error be discovered prior to the completion of the operation. When any key is operated, the small indicating lamp is lighted and remains so until the corresponding operation is completed and checked back. The operator is thus enabled to ascertain quickly which of the switches he has elected to operate and to know when the operation is completed. Any or all of the keys may be operated simultaneously, a sequence switch compelling the sender to forward the various signals in a fixed order.

Code Operates Relays

The code which is originated in response to the key operation consists of twenty-five impulses, twenty-two of which are dots, the remaining three being dashes. One of the latter is always the last in the code, while the distinction between the various codes is obtained by the location of the remaining two. The codes are originated on a twenty-five-point rotary line switch through connections established by the key relays through the sequence switch. Two electrical connections are established to two of the points on the switch. The switch is caused to pause temporarily whenever it reaches one of these points, thus creating a dash in the code.

At the receiving end a similar twenty-five-point switch is stepped around by impulses received from the above switch. To various points of this latter switch are connected selection relays. When a dash is received, time is given to a slow-acting relay to operate, thus putting the battery on the switch point and picking up the selection relay connected to that point. Connections are so made that the combination of any two of the selection relays will select some certain operation. Although this operation is selected, it is not performed until the sender pauses on its twenty-fifth point. This pause permits another slow-acting relay to put the battery on the

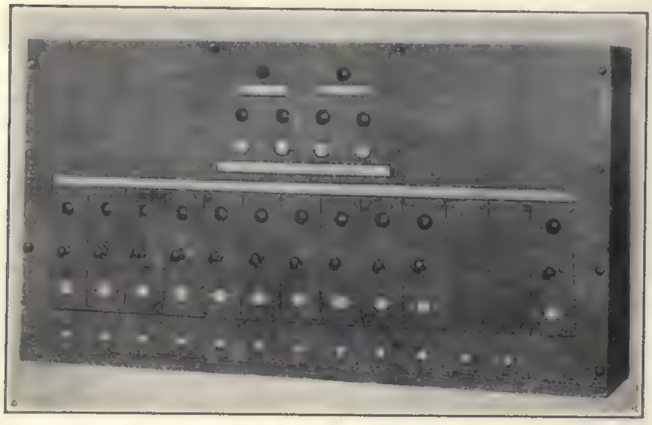


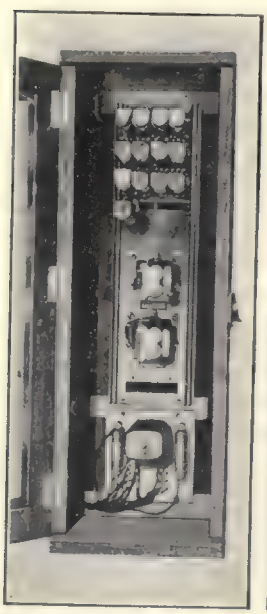
FIG. 1—DEVICE FOR AUTOMATICALLY CHECKING THE RECEIVING EQUIPMENT

twenty-fifth point of the receiver. If the receiver has reached this point, an operating circuit is established through the path previously selected and the desired operation performed.

Similar means are provided for sending signals back to the control station. The signal is initiated by the movement of auxiliary contacts on the circuit breakers or other apparatus. The mode of operation is much the same except that lamp relays are selected and operated instead of apparatus relays, as in the first case.

The sender, once started, will continue to repeat the code or codes until the correct answers have been obtained. Each key relay is connected so as to be opened by the operation of its corresponding lamp relay. Each code sent to the unattended station causes the answering code to be sent for the particular piece of apparatus involved. In this manner an endless chain is created which can be satisfied only by the correct functioning of all the apparatus involved.

Thus it may be seen that the completed signals are carefully checked to see that the full number of impulses have been received. The liability of a corrective error is so remote as to be unworthy of serious consideration.



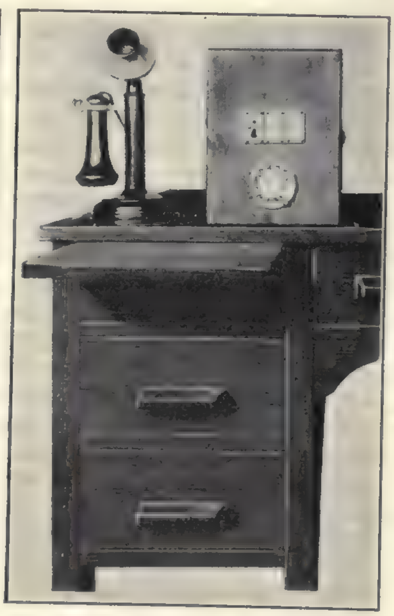


FIG. 2 (LEFT)—STEEL RELAY CABINET USED WITH AUTOMATIC CONTROL KEYS FOR CIRCUIT BREAKERS. FIG. 3 (RIGHT)—CONTROL DESK OF CLEVELAND RAILWAY COMPANY FOR USE WITH FIFTEEN AUTOMATIC SUBSTATIONS

Should the number counted be more or less than the correct total of twenty-five, no operation takes place, but the code is repeated. Therefore, if the equipment fails to function as it should, the consequences are not serious since it means only a slight delay while the code is repeated. Should the correctness of the lamp indications be questioned, a checking key is provided, in response to which the entire series of "answer-back" signals will be sent, thus verifying the positions of the apparatus at the remote station.

Some extra signal lights are provided for this particular installation to indicate abnormal conditions in the feeder voltage regulators and constant-current street-lighting equipment.

Typical Installations

Four supervisory control equipments of this sort were recently furnished the United Railways & Electric Company of Baltimore. They include graphic ammeters at each substation with extra contacts on the pen carriage. Each contact corresponds to 500 amp. and is connected to a different code on the sender. A row of lamps on the dispatcher's desk provides the indicating means for advising him of the approximate output in amperes.

A somewhat different scheme of operation is used by the Cleveland Railway Company (Fig. 3). Space is provided on the operator's desk for controlling and indicating conditions in fifteen substations. Limitation of space precluded the use of individual keys on this desk. Instead, a keyboard resembling that of an adding machine is provided. This necessitates the use of a different method of checking. The desired code is set up by the dispatcher and a "prepare" button is pressed. The code is sent to the remote station, where it locks up the required relays but does not operate the apparatus. It does cause the return signals to actuate a lamp signal at the control point just as though the actual operation had been performed, thus enabling the dispatcher to check the remote condition brought about by the control impulses before pressing the "operate" button. The latter operation momentarily switches the indicating lamps back to their original condition; if the desired operation of apparatus is obtained, the lamps will be changed to show the actual position of the equipment supervised. Should the first answer not check with the dispatcher's intentions, a release key is operated, restoring the relays to their idle position. The code is again set up and prepared and the response again noted before the "operate" button is pressed.

Chances of Errors Remote

With this equipment as with the other the chance of a corrective error is extremely remote. In addition to indicating the condition of apparatus, there are lamps to give a rough indication of transfer bus voltage, the existence of current in the alternating-current feeders and the presence of load-limiting resistance in the converter circuits. To aid in keeping track of the maintenance men in their daily rounds, a contact on the door of the station signals the dispatcher whenever the door is opened.

One of the important uses of the supervisory control equipment in Cleveland is in the obtaining of better system efficiencies by the reduction in running time of all but a few converters on the system. Since the automatic control must bring the station into service under certain predetermined conditions, and since the station must be held on the line during periods of rather light

load, in response to some predetermined minimum load, there are frequently periods at night when the station would come on and shut down again owing to the intermittent loads caused by night car service. Lockout positions are provided so that the dispatcher may take any of the stations out of service when there is not sufficient load to permit their economical operation. This naturally requires a fairly accurate knowledge of the loads in the various substations. Hence graphic instruments are installed at the central control point which function in response to impulses controlled by contacts on the watt-hour meters in the various stations. Four impulses of each polarity are sent alternately for each revolution of the meter. At the dispatcher's office these impulses are counted by a polarized armature and an escapement wheel in a manner similar to the action of the well-known cycle counter. A register driven by the escapement will give integrated results. Indications of load from moment to moment are provided by a mechanical device which compares the rate of reception of the impulses to a standard rate obtained from a clock. This ratio is the load at that moment.

All of the electrical paths between the dispatcher's office and any one substation are provided by two pairs of standard telephone wires leased from the telephone company. Elaborate tests conducted by telephone engineers failed to discern the slightest inductive interference.

A Simple Form Available

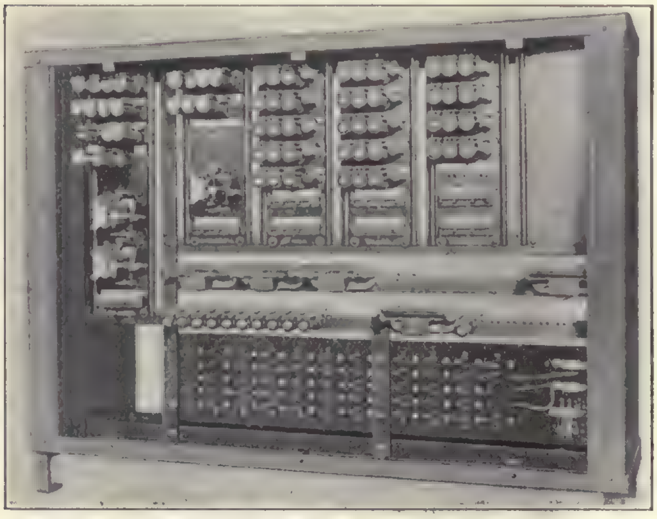
A much less elaborate and less expensive form of supervisory control is illustrated by Figs. 4 and 5. This type permits of the control of ten stations on one pair of telephone wires. The control station is exceedingly simple, consisting only of a dial, line keys and a telephone. Each receiving station consists of a cabinet containing the necessary selectors and relays and a box containing a microphone with a single-stroke bell and two or more buzzers.

Four such equipments are employed in as many automatic hydro-electric generating stations at Connersville, Ind., by the Interstate Public Service Company. These plants are on an old barge canal which is now utilized for a power canal; the plants replace the old locks. A fifth plant is installed at the steam-power station with remote control from the switchboard. The dial box is also installed in the steam station.

One of the first things to be ascertained about a hydraulic station is the amount of water available as indicated by the height of the forebay. To ascertain this the line key is closed and the number of the desired station is dialed in the same manner as with an automatic telephone. The selectors in all four stations are advanced to the point corresponding to the number of the station desired. If this should be station No. 3, a code sender in that station will be started while relays in all the other stations lock out the stepping mechanism as long as the line relay is closed. The code sender in station No. 3 causes a single-stroke bell to tap three times repeatedly as long as the selector remains on this point. The microphone in this station enables the central operator to hear the bell and assure himself that he has the right station.

Dialing one more step, the code sender is connected to a ten-point float switch in the forebay, which causes a buzzer to operate a certain number of times corresponding to the point on which the float switch is resting. By multiplying the number of buzzer notes by a constant, depending on the station, the dispatcher obtains the actual available head. By dialing to successive points the units may be started or stopped. Another step connects the code sender to a ten-point switch connected to the waterwheel gate so that the gate opening may be ascertained. Knowing the head of water and the gate opening, a rough approximation of kilowatts may be obtained. Two differently toned buzzers are used to indicate the position of the circuit breaker. After completing any one series of operations in a given station the line key is opened, thus resetting all selectors to zero.

The availability of these flexible and relatively inexpensive means of station control is bound to have a considerable bearing on the design of future distribution systems. When used in conjunction with the automatically controlled rotating machinery and directly for the operation of switching stations, the item of operating labor may be almost entirely eliminated. Many operators erroneously include only the cost of the actual operators' wages as a saving, but it should not be forgotten that a reliable automatic device makes no errors, calls no strikes and never asks for a raise.



FIGS. 4 AND 5—A SUPERVISORY CONTROL EQUIPMENT WHICH CAN BE USED ON TEN STATIONS THROUGH THE OPERATION OF ONE PAIR OF TELEPHONE WIRES

One Thousand Miles of Street Lighting for St. Louis

City Lighting System on Zone Plan—Graded Intensities Used—Plan of Installation and Details of Equipment—Nine Million Dollars to Be Expended in Improving the Illumination of Missouri's Chief City

By ROLF TOENSFELDT
Chief Electrical Engineer Department of Public Utilities, St. Louis

IT IS fortunate indeed that the city of St. Louis made up its mind to modernize its entire street-lighting system and voted sufficient funds for doing it all at one time. It can thus avoid the inevitable waste attendant upon doing a work of this magnitude piecemeal, a little here, a little there. When studied and designed as a whole, it will not only be electrically and artistically a complete unit, but will lend itself to most economic methods of construction.

In order that this unity shall exist, the first step was the preparation of a map of the entire city, tentatively laying out streets through property which had not been subdivided. Upon this map were indicated the streets which had previously been designated by the City Plan Commission as major thoroughfares or boulevards. The City Plan Commission also prepared a zoning plan of the city, designating the use to which the various streets and areas of the city might be put. The conclusion was reached that a heavy-traffic thoroughfare would naturally be desirable for business use, and the commission established virtually all of the major thoroughfares or boulevards as commercial or secondary business streets. The usual differentiation between boulevards and secondary business streets has therefore not been made in the street-lighting program of St. Louis.

The map was then colored, street by street, to indicate what intensities of illumination were desirable in every individual section. In general, the plan divides the city into zones surrounding the heavily lighted downtown business district. A glance at Fig. 2 will more clearly indicate this. Each of the zones as it diverges from the downtown district will have a somewhat reduced intensity, so that the lighting will be gradually stepped down from the very high intensities, until beyond Grand Boulevard the lower intensities for residential streets will be attained. The residential district will be traversed by brightly lighted major thoroughfares. By adopting this scheme any sudden variations in intensities and consequent appearance of darkness will be avoided.

Having done this, it was possible to predetermine the approximate loads necessary for the illumination, and consequently to determine roughly the boundaries of the district which could economically be served from one substation. It was also possible to determine the most economical circuits to use and to rough them in.

TABLE I—ZONE INTENSITIES USED

District	Maximum	Minimum	Average
Downtown retail	2.25	0.96	1.68
Intermediate zone 1	1.60	0.64	1.20
Intermediate zone 2	0.94	0.40	0.70
Intermediate zone 3	0.63	0.26	0.47
Major streets outside of the [illegible]	0.40	0.16	0.30
Residential, heavy traffic	0.22	0.08	0.16
Residential, outlying	0.13	0.05	0.09

FIG. 1—TYPICAL STANDARD FOR PARK USE

The maximum, minimum and average intensities determined upon for the various zones are given in Table I.

In order to attain these intensities most economically, a comprehensive study of the available luminaires was made, and a test section of street was equipped with six of the kinds which seemed most promising. All of these, however, were rejected and the design of a new luminaire in the form of a refractor lantern was begun. By proper combination of reflector and refractor plates this lantern can be made to give symmetric, asymmetric, four-way or almost any other kind of distribution desirable. In the meantime one of the manufacturers had developed a lantern form of luminaire, with internal refractor and reflector, which, with an asortment of additional refractors, could be made to do all that our development could accomplish. The latter has the advantage that breakage will probably occur only at the outer glass, which is inexpensive but easily broken, while the former has the virtue of less absorption of light and probably much less breakage owing to the heavier though more expensive plates. It is therefore problematical which of the two devices would be the more economical in operation, though either would exceed the usual one, two or three-piece units in economy.

Another factor which will enter largely into determining the final choice will be the appearance of the units both lighted and unlighted. At the present time the manufacturer who has produced the lantern with internal refractor has not fully determined on a satisfactory glassware, so that his lantern cannot be finally judged. The refractor-plate luminaire is, however, a distinct achievement as regards both day and night appearance.

The electrical system will be somewhat unusual. It was deemed advisable to maintain a potential of not more than 300 volts to ground at the post head. It is possible to attain this end in several ways—by means of individual transformers for each lamp, group transformers, short straight-series circuits or multiple circuits.

Multiple System Not Used

Strange as it may seem, the multiple circuit can be justified as to installation cost, and data gathered from cities where such a system is in service indicate that its operating costs do not seem excessive and that its reliability of service is excellent. It means, however, that the street-lighting system must be more or less tied in with the general commercial feeder system and will depend upon the feeder system for continuity of service. Where commercial feeders are all underground, and where the street-lighting system is installed and operated by the same interests that control the service company, such an installation may be desirable. A city installing, owning and operating its own street-lighting system will, however, scarcely find it advisable to tie in too closely with the service company's feeders, nor would it find it desirable to depend for continuity of service upon overhead construction, which is subject to lightning, rain, sleet and wind.

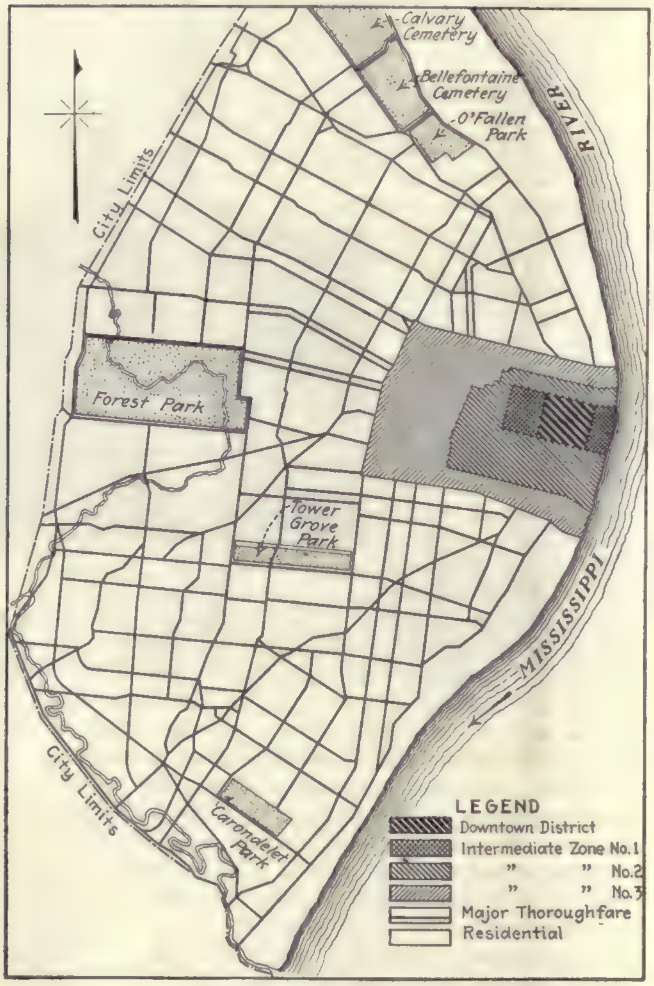


FIG. 2—INTENSITIES ARE GRADUALLY REDUCED AS ILLUSTRATED BY SHADED ZONES

Short series circuits are out of the question where approximately a thousand miles of street are to be lighted, unless, again, they are tied in with the service company's system, as was done in Kansas City, Mo. This, too seems undesirable.

The choice between individual and group transformers rests largely with the size of lamps to be used and their spacing. The street layout also has an important bearing on the selection. It was found that for St. Louis the most economical arrangement consisted in individual transformers for the downtown high intensity district and for Zones 1 and 2. The remainder of the city will be supplied by means of group transformers. The series circuits will be grounded at the midpoint, cutting the potential of cables to ground in half, thus making possible the use of cheaper lower-voltage cable. In order that circuits under this arrangement shall not be thrown out of balance, two constant-current transformers will be used on each circuit, the transformers being connected in series and their mutual point of connection being grounded. Under all normal conditions each transformer will bear its proper share of the load with no current flow through ground. Should an "open" occur on either side, one side would continue to operate through ground.

Where the group system is used, the large number of lamps dependent upon one main circuit has led to the contemplation of a third wire, or neutral, connecting together the grounded points. This cable would be sectionalized at all transformer manholes by means of disconnecting potheads and would act as a balance wire normally, and as a quickly available spare when necessary, making it possible to get a main circuit back into service after a breakdown in a very few minutes. All lamp circuits would be so installed that no one circuit would take in both sides of any one street, so that should failure occur only one-half of the lamps on that street would be out.

Automatic Substations Used

The city has been tentatively divided into eleven districts. One of these will serve the downtown district and the intermediate zones, the other ten being scattered throughout the city. The substations will be located centrally in their respective districts. The downtown substation will distribute to approximately thirty circuits and will have a demand of 2,000 kva. The other substations will distribute to four circuits each and will each have a demand of about 400 kva. All substations will be operated entirely by automatic equipment.

Energy will be purchased from the service company in St. Louis at 13,200 volts and will be distributed at from 5,000 volts to ground in the downtown district to 15,000 volts to ground in the residential district. This may seem to be somewhat incongruous, yet our purpose in holding down the voltage in the downtown district and in the first zone was to allow for the inevitable expansion of the downtown district into the first zone and the necessity of following this expansion with a more intense lighting. Allowance has also been made for increased lighting in the residential part of the city, this, however, being chiefly confined to the major thoroughfares.

The mileage of streets to be lighted is approximately one thousand, the number of lamps to be installed between forty and fifty thousand, and the total connected load approximately 6,000 kva. The installation will cost about $9,000,000, $700,000 of which has so far been expended in emergency installations in the parks of the city and on some of the streets that have been reconstructed.

Service Interests Public More than Price

When of High Quality It Forms the Basis of Good Public Relations that Keeps the Public from Questioning Costs —Elements by Which Standards of Service Are Set Up

By JOHN S. ALLEN
Consulting Engineer, Madison, Wis.

IT IS sometimes to be feared that in the discussion of public relations the talk drifts too much to the education of the public and too little toward a discussion of some of the fundamentals on which good public relations are founded. Mr. Allen, who, in addition to his experience in the utility field, was the engineering member of the Wisconsin Railroad Commission for four years, brings up some of these phases which need the most careful consideration. His experience has laid emphasis on some of the things the lack of which makes for poor public relations. In the issue of the *Electrical World* for May 5, page 1034, J. Howard Matthews, service engineer of the Illinois Commerce Commission, outlined some work in grading utilities that can well be studied again after reading what Mr. Allen has to say on the setting up of standards for judging utility service.

THE public, whether it be consumer or municipal official, is not very much interested in the price which is paid for public utility service, but all are tremendously interested in the quality of service rendered by that utility. This statement is made without fear of contradiction after twenty years' experience as a builder, operator and manager of public utilities, four years as a member of the Wisconsin Railroad Commission and three years as a consulting engineer. During that time the writer has had much to do with hundreds, if not thousands, of cases of public utilities seeking increased rates or of consumers or municipalities seeking a reduction of rates, and invariably the quality of service was the determining factor in the attitude of the public.

Within the last two years a tremendous improvement has been made in the quality of service rendered by public utilities, nearly every utility having progressed in this direction to a remarkable extent. Trains are being run more nearly on schedule, there are fewer interruptions to electric service, the quality of gas is less erratic, street-railway trainmen are much more courteous and deferential, and telephone service is more prompt and less irritating.

The effect of this general improvement has been that average service has improved to an extent never before experienced. This rapid improvement and the high excellence of the present average service makes it necessary that the management of every utility should now test the quality of service being rendered by his company and make himself thoroughly familiar with what it is doing. This can be done only by comparing the quality of his service with well-known standards.

UTILITY SERVICE REQUIRES STANDARDS

The quality of service rendered by public utilities requires standards by which it may be measured just as much as standards are required by which distance, weight, time and light may be measured. These standards are not difficult to establish since their application is comparatively simple, and methods have been devised by which the personal equation of the individual making the examination is very largely eliminated. The judgment of the manager of a public utility, when unassisted by standards of comparison, is not sufficient in determining the quality of service which he is selling.

The application of standards by which the quality of service may be accurately determined is the only method by which a manager can be enabled to judge of the quality of service which he is furnishing. A drop in gas pressure at a customer's burner is reflected by the proper application of reasonable standards of service for gas companies. It is not sufficient that the manager should have complete records of the operation of his property. It is essential that he should apply standards to these records so that he may accurately determine the quality of service which he is producing.

The elements of service in an electric property by which its quality is measured consist of such fundamentals as outages, voltage regulation, meter testing and courtesy in the office. The seriousness of outages is determined by their length, the time of day at which they occur and the proportion of the system which they affect. An outage during the latter half of the night is not so serious as one that occurs between 6 p.m. and 10 p.m. On the other hand, an outage during the daytime in a manufacturing city is of much greater importance than one that occurs between 6 p.m. and 10 p.m. An outage of two minutes in a milk condensery or a foundry may cost the customer thousands of dollars. An electric service outage of fifteen minutes in a city of forty thousand persons was recently caused by a defective pilot light on the switchboard. This slight negligence had a disastrous effect upon the quality of service rendered by the utility. The standards of excellence must, of course, be applied in such a way as to reflect accurately the losses to the customer and the mental irritation caused.

Good voltage regulation is particularly necessary. Lack of regulation is aggravating to lighting customers and is disastrous to good power service. The range of allowable variation should be somewhat greater for power customers than for lighting customers, but this range should also be sufficiently flexible to reflect the greater importance of good regulation at times of peak loads. All electric meters should be tested at regular intervals, and a failure to do this should be reflected in the quality of service rendered by the company. Transformer loading is of great importance and requires much study on the part of the distribution department to see that transformers do not run long periods on light loads or that they are not overloaded.

One of the most common failures on the part of a

public utility organization is its inability to realize the important position which it holds in its community.

In a long experience covering every phase of public utility activity I have found this failure to be the most prevalent and the hardest to correct. It may be stated broadly that a public utility organization in every phase of its existence occupies a more important position than is usually realized by its members.

The personal appearance of the meter reader is of great importance. The location of the company's office, the appearance of its windows and of its sign are matters of comment. The appearance of its repair wagon and of its automobiles means much. The slightest inadvertence on the part of the manager of the company is the subject for prolonged discussion. A patron who calls on the manager will frequently for days think about and recite to others the incidents that take place and observations made in the office during a fifteen-minute interview. Whether the manager stood up or sat down is in his mind a matter worth mention. The little things which to the manager appear to be nothing may be of considerable importance to the person who comes to his office occasionally.

Little Things Count

The same thing is true of the entire organization, but to a somewhat less extent. The casual remarks of a cashier to a woman customer while receipting a bill are often recited many times. To the cashier his remarks are idle pleasantries, a part of the day's work. To the patron they are matters of importance. This phase of human nature and the position held by the public utility companies make it of the greatest possible importance that the service rendered should be carefully scrutinized and its excellence or shortcomings accurately determined.

A telephone operator with the fine instincts of a lady in a gas or electric company office is of such importance that her value cannot be overestimated. Never was there another place in the world where it could be so truly said that "A soft answer turneth away wrath." A smile which comes over the telephone is enhanced in value a hundredfold. The telephone has a peculiar power of magnifying a smile to many times its usual worth. A smile, with the mental attitude which produces it and an engaging voice to accompany it, as the interpreter of a public utility, is invaluable.

A well-known manager of a large public utility recently said in the presence of other managers: "The quality of service rendered by my company has now been brought to such a grade of excellence that it is virtually perfect. We receive almost no complaints, our public relations are excellent, and our relations with the governing commission, our city councils and other civic bodies are very satisfactory."

As a matter of fact, the service rendered by his company, if tested by the usual standards, would have been found to be very poor. His relations with the public were not good and his relations with the commission and governing bodies were not what they should have been. All these facts were known by each of his listeners, but he himself was in ignorance because he had no standards by which to judge the quality of service which he was producing. If he had used established standards by which he might test his outages, voltage variations, gas pressure and public relations he would have known that he had no right to say the service furnished by his company was good.

Examinations to determine the quality of service being rendered by a public utility should be made by engineers other than those in the regular employ of the company. The regular employee is unable to obtain the point of view which comes readily to an outsider who visits the property occasionally. A large part of the benefit to be obtained by service examinations comes from the fact that the engineer doing the work is an outsider and unfamiliar with the daily routine of the operation of the property. He does not know the causes which may have brought about certain failures. A regular employee is at a disadvantage in his endeavor to appreciate improvements in the quality of service which may have been made since the last inspection.

The service engineer who comes to the property once a month or once in three months has, then, a decided advantage over the regular employee. He has clearly in mind the conditions as he found them during the last inspection, and any changes either for better or worse strike him forcibly. His record of previous inspections is before him, and comparative conditions guide him in reaching his conclusions. To have an outsider who has had a broad experience in the business come into the office and go through the plant is of great value to any utility. Many times one of the most important suggestions that can be made is that the windows of the office be washed or that the sign in front of the office be kept fresh and clean. On a recent inspection it was suggested that the arrangement of the office could be changed with great advantage both in convenience and in appearance. On the next inspection it was found that the changes had been made and the effect was very advantageous. The manager was not at all enthusiastic when the suggestions were made, but after the work had been done he realized fully the benefits of the change. This manager is very keen, alert and anxious that his property should be well operated. His position in his own office made it impossible for him to see many things which were screaming at the inspector.

Commending good performance is a large part of the duty of a service engineer. The excellent points of his service are just as obscure to the manager as are its shortcomings. I have not infrequently called the attention of a manager and of his organization to points of marked excellence in their service and found that they did not realize that their service possessed distinct points of superiority.

Employees Should Be Consulted

It is very important that all of the employees of a company should be carefully instructed and frequently consulted on the quality of service rendered by the company. Each employee has a very important part to perform, and if the manager makes an effort to do so, he will find it easy to interest his entire organization and keep them all at their best. A public utility cannot render the best service of which it is capable unless its entire organization is thoroughly posted on these fundamentals: (1) What good service is; (2) what the standards are by which the quality of service is measured, and (3) an accurate interpretation of these standards.

Every public utility faces the prospect of having to contest a rate case before some governing body. It is either looking forward to the time when it may ask for an increase in rates or it should be preparing for an investigation when a request is made for a reduction in rates. Its rate level is a subject which may bring on a controversy at any time. As long as the present

method of governing public utilities obtains this will, no doubt, be true. Every rate controversy presents an admirable opportunity for complainants to recite their grievances when the quality of service is not good. On the other hand, when the quality of service is of high excellence, these rate controversies are of inestimable value to the company as opportunities to receive due credit. It would appear that, however far apart rate controversies may be, customers do not fail to remember the instances when the service rendered was unsatisfactory. Frequently persons are heard to complain about instances of poor service which occurred several years before. On the other hand, as a rule, they do not fail to express their appreciation of good service.

Advertising by every method at his command the quality of service which he is rendering should be the constant aim of the manager of every public utility. The greatest asset of any public utility is good service. Cultivating good public relations means that he must look to his service. Rates are of secondary importance. The public is ready to pay any reasonable rate provided that it receives good service.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

The Seven-Day Week Is Strongly Condemned

To the Editors of the ELECTRICAL WORLD:

In the very interesting letter from "An Experienced Engineer" that appears in the ELECTRICAL WORLD for Oct. 27 the statement is made that there are a "multitude of operators who simply thrive on power-plant operation seven days a week."

While the effects of seven-day employment are sometimes not apparent, they are nevertheless very real and always harmful, as is evidenced by the physical appearance and the mental attitude of men who have been engaged in power-plant work for a period of several years. The seven-day working week has no more right to existence in the central-station industry than has its original companion, the twelve-hour shift, and it is a fact that many men cannot work seven days a week and keep "their minds alert and clear to grasp new ideals and situations."

All employees engaged in power-plant operation should be required to cultivate a mental attitude that is intelligent and constantly alert, in order to be prepared to cope with any operating difficulty or emergency that may instantly arise. But such employees cannot be expected to remain mentally alert if subjected to the constant strain of a seven-day working week or of twelve-hour shifts.

It is quite possible that a forty-eight-hour working week is not economically justified in many small plants, and if such is the case, the answer seems to be to make them entirely automatic. But a station in which an apprentice engineer can profitably spend any amount of time is usually too large to be made absolutely automatic in its operation, and when it is of this size sufficient men should certainly be employed to put an eight-hour, six-day week into effect.

The greater efficiency that can properly be demanded from an operating force working eight hours six days per week will usually compensate for the increased labor charges, but, if not, the public will generally not object to the slight increase in rates necessary to enable the utility to put a forty-eight-hour working week, or its equivalent, into effect.

It is true that a man employed in an executive or managerial position will at times be well-nigh overwhelmed with perplexing problems, and it is equally true that more than forty-eight hours per week will be required to enable him to dispose of these and to formulate plans and policies. But it must be remembered that the executive does not solve his problems in a dirty, dark boiler room, in a noisy generating room, or even on a cold thrust deck; and his employment is more interesting, inspiring and broadening in its effect than that of watching stokers, regulating voltage, synchronizing, maintaining frequency, blowing out generator windings, sweeping, wiping and polishing brass. Neither is he required to alter his working hours every week or two, as is the operating attendant.

I am very glad that the "Young Engineer" has come forward with a justified criticism of a condition that is a reproach to the central-station industry. That industry is to-day great enough and of sufficient importance to offer ideal working conditions to every operating man, whether he be a wiper or a station superintendent. And I believe that no utility should utter one word advocating good public relations until all of its employees work under good conditions at fair wages. A seven-day working week cannot, under normal conditions, be considered as a desirable condition of employment in any central station.

Further, those executives of broad vision and high ideals who have, of their own accord, abolished the twelve-hour watch, along with the seven-day working week, are to be congratulated. Those other executives who are waiting until forceful action on the part of a labor organization, or hostile public opinion, requires them to improve working conditions are, so it seems to me, not serving the central-station industry in a manner that is really best for all concerned.

AN EXPERIENCED OPERATOR.

Illumination of Generating Stations and Substations

To the Editors of the ELECTRICAL WORLD:

E. D. Tillson's article on substation illumination, which appeared in the Oct. 27 issue of the ELECTRICAL WORLD, is timely and brings up a matter that should receive a great deal more attention from station designers and operators than it apparently does.

With the advent of the tungsten lamp central-station executives began to preach better illumination in earnest, yet within this period a good many generating stations and substations have been placed in operation in which the lighting, to say the least, is poor and unsatisfactory. In addition, there are many stations in which the degree of illumination is today about the same as when installed twenty years or more ago, little attempt having been made in the interim to practice in the way of lighting what has been preached to the public.

A survey of lighting intensities found on central-station properties would doubtless prove of interest and disclose a peculiar condition existing within this industry. It appears that lighting systems are even today laid out along the rule-of-thumb lines possibly considered good practice thirty years ago, before actual intensities could be so easily determined as is now possible.

FIAT LUX.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Successful Operation of Turbo-Generator as a Synchronous Condenser

By N. D. Holmes

Chief Engineer Farmingdale Station, Central Maine Power Company, Gardiner, Me.

FREQUENTLY it is necessary for an electric power company operating both steam and hydraulic generating plants to run one or more steam units at light load and low power factor in order to maintain normal voltage during periods of ample water supply or else to install synchronous condensers for use during the high-water period. Until recently the New England Power Company has operated a turbo-generator at not less than 10 per cent full load, this being as light an output as is considered advisable to carry, and this demanded a considerable amount of fuel chargeable to voltage regulation as the power output of the unit was not needed. To obtain better economy it was decided to try to operate a 12,500-kw. Curtis turbo-generator as a synchronous condenser, using the exhaust steam from the station auxiliaries for circulation through the turbine to prevent the rotor overheating. The unit is a nine-stage machine running 1,800 revolutions per minute and driving an 11,000-volt generator and directly connected exciter.

Arrangement of Equipment

A 3½-in. hole was drilled in the high-pressure head. This was connected with the main exhaust steam line by a 4-in. steam pipe fitted with a 4-in. gate valve near the turbine. Opening this valve allowed steam to flow from the main exhaust line into the first-stage exhaust chamber of the turbine, provided that the chamber pressure was less than that in the exhaust line. A 1½-in. live steam connection was also made into the 4-in. line for supplementary use.

To determine whether the exhaust steam from the steam-driven auxiliaries was sufficient to prevent the turbine rotor overheating, to find out whether the unit would be overspeeded by this quantity of steam should the generator oil switch be opened, and to learn what effect the vacuum in the condenser had upon the turbine temperature, a test was made. Thermometer wells were placed in the first-stage exhaust chamber, the fourth and sixth-stage diaphragms and on the exhaust side of the blading near the ninth-stage wheel, all the wells being as near the wheel blading as possible and the thermometers installed to permit easy reading with the machine in operation. All auxiliaries in this plant are steam-driven, exhausting into a common header leading to an open heater and also through a relief valve into the atmosphere. During the test the relief valve was set to open at 1½-lb. gage, and the valve leading to the heater was adjusted to admit only enough steam to heat the feed water, the remaining steam being forced into the turbine.

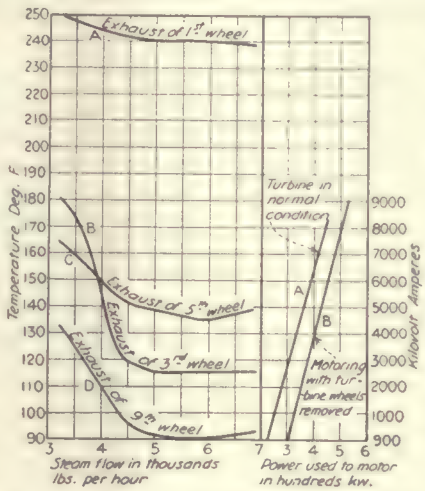


FIG. 1 (LEFT) — TURBINE TEMPERATURE VARIATIONS WITH STEAM INPUT. FIG. 2 (RIGHT)—INPUT OF TURBO-GENERATOR AS A SYNCHRONOUS MOTOR

On test the unit was started up and put on the line in the usual way, a light load being carried until the usual running temperatures were reached. The load was then dropped and the valve admitting the exhaust steam was opened wide; the 1½-in. valve controlling the live steam was opened, and the turbine throttle valve closed tight, the unit being, of course, motored at full speed by the power system to which it was connected. Frequent readings showed the temperature to be dropping all through the turbine, so the valve admitting the live steam was closed. This connection was later removed as it was found to be unnecessary.

The test was continued, using various quantities of the exhaust steam and noting the effect on the temperature.

The results of this test run are shown in Fig. 1. The fact that a higher temperature is shown in the sixth stage than in the fourth is due to the influence of the excess shaft-packing sealing steam, which is admitted to the turbine near this point. It appears that the exhaust steam from the turbine-driven auxiliaries contains considerable superheat, as shown by temperature curve A (Fig. 1), and that with less than 4,500 lb. of steam per hour the rotor heats very rapidly. The test was run with a 29-in. vacuum. With the exhaust-steam valve wide open, the rotor started heating very rapidly when the vacuum was lowered to 26½ in.

The test for overspeeding was made by opening the generator oil switch with the exhaust-steam valve wide open. The unit slowed down to 1,350 r.p.m. and held there, which proved that while the exhaust steam alone would not overspeed the unit, throttle leakage, etc., would have to be guarded against.

These tests were run in 1921, and the unit has since been operated during high-water periods in practically the same manner as on the test. Under normal conditions the unit is run from 6.45 a.m. to 5.30 p.m. It is started in the usual way and a light load carried for about twenty minutes; then the load is dropped and the exhaust-steam valve

opened wide. The unit is available for load at any time, and it is often changed from motoring to generating on very short notice. The kva. carried varies with the voltage conditions, but a normal load is 8,000 kva. To shut down the field is adjusted until unity power factor is obtained and then the generator oil switch is opened.

Fig. 2, curve A, shows the kilowatt input of the unit when motoring with various kva. loads.

In December, 1921, while generating, this turbine threw some blades from the seventh-stage wheel, and the result of the subsequent inspections was a decision to return the entire rotor to the factory for overhauling and to install a more modern type of shaft packing. In order not to cease operating the unit as a synchronous condenser during the time that the rotor was at the factory, use was made of a duplicate shaft, without wheels, which was procured from the manufacturers.

The turbine rotor was removed and the shaft without wheels installed in its place, connected with the oil pump, etc. The cover was replaced, and the unit is now being operated as a synchronous condenser without, of course, any steam at all being used. A new rotor has recently been installed.

The unit is started by tying the leads from the generator with those of a 5,000-kw. unit in the same plant, through an air-break switch. The 5,000-kw. unit is started in the usual way, warmed up and then stopped. The air-break switch is then closed; field current is applied to both generators, and steam admitted to the 5,000-kw. turbine, which starts both machines with a very small flow of armature current. After the machines are synchronized with the system the air-break switch is opened and the 5,000-kw. unit is shut down.

Curve B, Fig. 2, shows the kilowatt input required to motor the 12,500-kw. unit at various kva. loadings, since the bare shaft was substituted for the turbine rotor.

Demand-Meter Attachments to Prevent Errors

By R. L. Weber

Electrical Engineer Kansas City Railways, Kansas City, Mo.

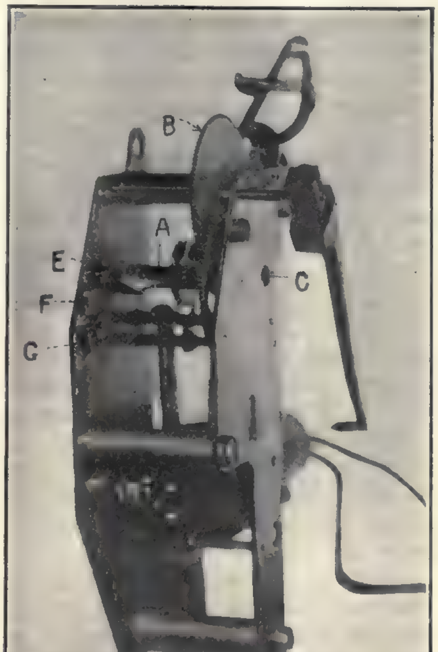
By PROVIDING a stop on an intermediate shaft of a demand meter, insuring an accurate zero starting of the stylus, the Kansas City Railways has rectified a hidden defect in one of its large consumers' meters which caused an annual loss of $450. Had the demand charge been determined upon the registration, during a single half-hour period instead of the average of three, the annual loss would have been $1,350. This demand meter has a seven-day chart with thirty-minute registrations, the stylus being actuated by a ratchet mechanism energized by a contact device attached to the watt-hour meter.

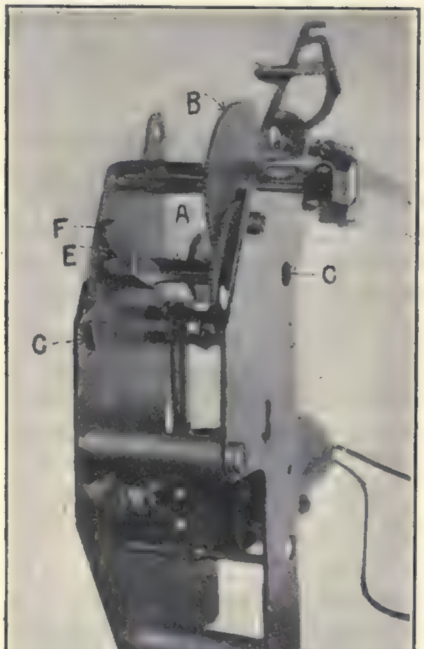
Owing to the character of the customer's load, it was anticipated that his largest demand would occur just preceding Christmas. Therefore a special observer was sent to check the operation of the demand meter and also to compare it with the power company's and customer's watt-hour meters installed at this point. The observer recorded the time in seconds between the operations of the contact device in the watt-hour meter, each movement of which represented a definite number of kilowatt-hours, and also at intervals recorded the watt-hour meter-dial readings.

For moderate loads the operation of the stylus was regular in every way. But after the stylus had returned to zero following the registration of a high demand it was noted that there was no apparent movement of the stylus for several ratcheting operations, the registration being sometimes as much as five steps low. The irregularities occurred only on cycles following heavy demand registrations, which was of special importance because that was just the time when especial accuracy was desired. The accompanying photographs show the attachment made to the meter to insure an accurate zero starting of the stylus. They are explained below.

In Fig. 1, which shows the stylus in the zero position, gear *B* on the stylus shaft is driven by a small pinion on the shaft *A*. There is a stop on the gear *B*, but when the stylus drops following a large registration the speed of return is so high that the inertia of the parts mounted on the shaft *A* is sufficient to carry them beyond the true zero; so that the slack in the mechanism, which is exaggerated by the small pinion, is taken up in the wrong direction. In other words, the backlash in the mechanism displaces the zero, so that observation through the hole *C* shows that the large gear on the shaft *A* overtravels one-half the diameter of the hole *C*. The meter was less than a year old when this error was discovered.

In remedying this defect three rectangular blocks of brass were made and installed by our meterman. Block *G* is a rigid stop sweated onto the side plate. Block *F* is loose upon the shaft *A*, while block *E* is securely soldered to shaft *A* and has a pin set at such a radius as to clear the inside of block *G*. Shaft *A* revolves more than 360 deg., so that a simple mechanical stop cannot be installed on this shaft, thus requiring the addition of block *F*. The





ATTACHMENT INSURES ACCURATE STARTING OF STYLUS FROM ZERO POSITION

Fig. 1—The position of the attachments when the meter stylus is in the zero position. Fig. 2—On resetting after high demands the pin in block *E*, which is below block *F*, revolves, coming to a stop on the upper side of block *F*, as shown in Fig. 1, thus insuring accurate starting of stylus on the next cycle of operation by preventing lost motion between shaft *A* and the stylus of the meter.

functioning of this stop is shown in Fig. 2.

Again referring to Fig. 1, which shows the stylus in the zero position, it will be noted that the pin in block *E* rests upon the upper side of block *F*, the stylus arm pointing downward. In Fig. 2 the pin in block *E* is on the underside of block *F* since block *E* has revolved about 360 deg. while the stylus arm has risen to approximately the horizontal position, indicating a high demand. When the mechanism resets and the stylus arm drops rapidly from the horizontal to the zero position, block *E* revolves counter-clockwise, coming to rest when the pin strikes the upper surface of block *F*, which has already been stopped by the rigid block *G*. It is possible for block *F* to be carried over the vertical dead center, but this has been found to be of no effect since block *E* will carry it around with it satisfactorily. By this additional zero stop no lost motion needs to be absorbed before the meter will start registering.

A pawl spring in the center of the device was increased slightly in tension by cutting off a small section. This was done by the meterman on his own initiative, and it is not certain that this would be required under all circumstances. The meter now functions equally well under all conditions, and while these new parts have been in service for only a few months, the attachments seem substantial and free from unusual strain.

Regarding demand measurements, our experience has been such as to lead us to continue them throughout the year; that is, to cover off-peak as well as on-peak periods. Some of our older contracts were drawn so that the demand during the off-peak periods had no effect upon the payments, but quite frequently we have found the records for the off-peak periods to be of very substantial financial value in negotiating new agreements and in setting fair rates for service rendered.

Incorrect Meter Registration

An early trouble resulting in incorrect registration, but one which was easily corrected, was caused by the improper insertion of the demand charts which were installed eccentric with the recording movement. Arrangements had been made with the power customer for his operators to insert these charts. Despite the small clearance between the hole in the chart and the boss over which it is supposed to fit, it is possible for the inner edge of the hole in the paper to be curled at right angles to the plane of the chart, producing an eccentricity of nearly a sixteenth of an inch. This, of course shows carelessness on the part of the installer of the chart, but it also represents a money loss to the power company. By instructing the men to exercise care when replacing the charts these losses were eliminated.

THIRTY POLES A DAY ERECTED WITH THIS 26-FT. GIN POLE

Setting Poles at a Cost of $4.48 Apiece

By J. K. Himes
Superintendent Distribution Dayton (Ohio) Power & Light Company

In order to rush through the installation of the two 66,000-volt circuits from Dayton to Cincinnati, the Dayton Power & Light Company mounted the gin pole illustrated herewith on a 3½-ton truck at a total expense of $156.10. Regular galvanized-iron pipe was used for the triangular support of this hoist. Two of the legs were built of 3-in. pipe, while the rear leg was constructed of 4-in. material. Then a pulley was fastened at the apex of this triangle. A ⅝-in. steel cable is used with a 10,000-lb. winch connected directly to the motor by two forward and one reverse gear.

Standing 26 ft. from the bed of the chassis, this gin pole has been able to set thirty poles a day at an expense of $108.46, or an average cost of $4.48 a pole. The costs of various days' operations were as follows: Twenty-three poles set, $105.67; thirty poles set, $108.46; fifteen poles set, $90.10; twenty-six poles set, $117.37.

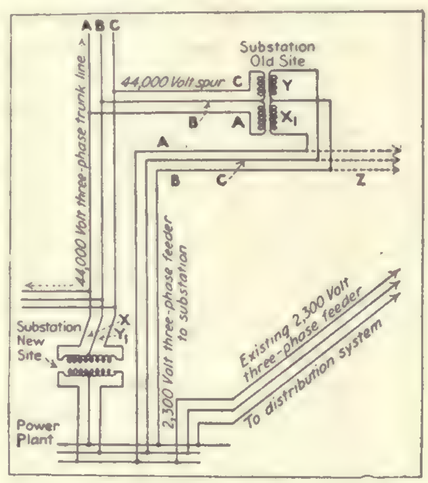
In these expenses are included all the costs charged against the truck and the driver, the total number of men in the construction gang and all the necessary tamping. Although 50-ft. poles were installed in this line, this construction crew set eighty-eight 40-ft. poles on a highway which had no telephone wires to interfere with the raising. The nicety of control of this gin pole may be seen from the fact that a 65-ft. pole was set in a tobacco patch without damaging any tobacco.

Substation Moved Without Interrupting Service

By A. P. Broadhead
Superintendent of Power New York State Gas & Electric Corporation, Oneonta, N. Y.

Recently a 44,000-volt substation of the New York State Gas & Electric Corporation was moved a distance of two miles without interrupting or curtailing service. The original location of the substation was about two miles from a small hydro-electric plant that served the local system. Owing to low water conditions this station was unable to supply all of the 2,300-volt load.

The substation contained two 500-kva., 44,000/2,300-volt transformers connected in open delta, and there was an extra 500-kva transformer in stock. The new substation was erected about 75 ft. from the power plant and the spare transformer *X* was connected in parallel with transformer X_1, after which X_1 was cut out of service and taken to the new site and installed at Y_1 without interrupting service. Transformer *Y* was then cut out and held as a spare.



MOVING A SUBSTATION TWO MILES BY USING ONE SPARE TRANSFORMER

The change was made more difficult because of the fact that on the original installation the phases were crossed, and this arrangement had to be carried through to the new site until such time as the phases can be brought out symmetrically. The 2,300-volt, three-phase feeder which fed the old substation was utilized as a feeder from the power plant to the local distribution system and is shown on the illustration at *Z*.

Omitting Generator Bus Effects Saving

By R. W. SHOEMAKER
Superintendent Electrical Department, Turlock Irrigation District, Turlock, Cal.

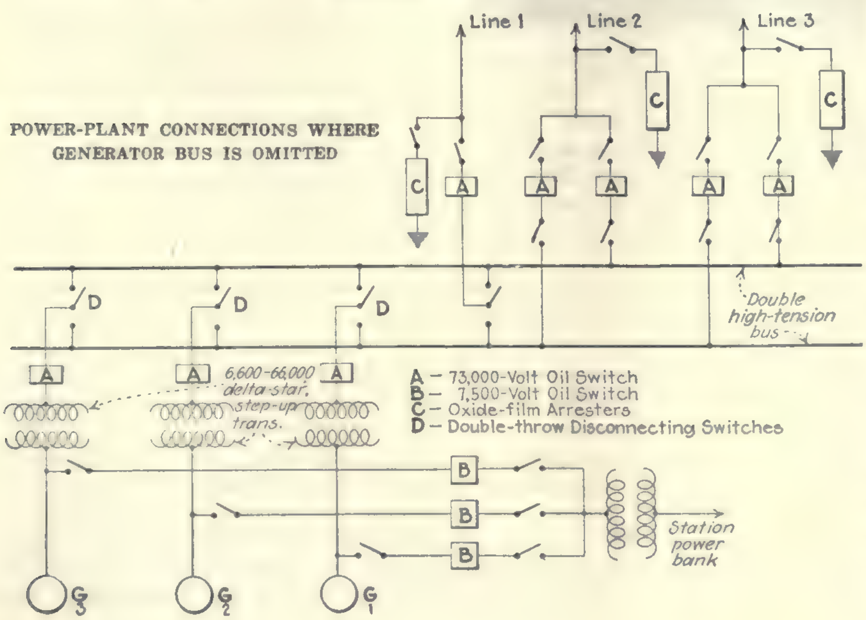
THE present tendency in hydroelectric power-plant design seems to be toward the elimination of the customary low-tension or generator bus, low-tension oil switches, etc. In the Don Pedro power house of the Modesto-Turlock Irrigation District the leads from the three 4,000-kw., 6,600-volt generators are connected direct to the delta-star 66,000-volt step-up transformers. As will be noted from the accompanying diagram, the usual low-tension bus, oil switches and disconnecting switches have been omitted. Each generator and its transformer therefore operate as a unit. The high-tension leads of each transformer are connected to a double high-tension bus through a 73-kv. oil circuit breaker and a set of double-throw disconnecting switches. The outgoing 66,000-volt lines are connected with the high-tension bus through 73-kv. oil circuit breakers and each line is provided with oxide-film lightning arresters. Two of the lines are connected to the bus through two oil circuit breakers by means of which the buses may be paralleled or a line transferred from one bus to the other without interrupting the service.

Two sets of synchronizing buses are provided on the switchboard. One of these is energized from potential transformers on the generator leads and the other from potential transformers on the high-tension lines. Each generator has a direct-connected exciter which is provided with an individual Tirrill regulator. Any one exciter can handle one generator besides its own, but the exciters cannot be paralleled. Any one of the generators may be connected through a 7,500-volt oil circuit breaker to the station power-transformer bank, but these switches are interlocked so that only one switch may be closed at a time, making it impossible to parallel.

No figures have been prepared to show the saving in expense resulting from the type of construction employed, but it is safe to say that at least $75,000 was saved by the omission of the generator bus, low-tension oil circuit breakers, disconnecting switches, etc., in this particular station. The writer is not, however, in entire sympathy with the use of double-throw disconnecting switches between the high-tension transformer leads and the two high-tension buses, as shown at *D* in the accompanying diagram. It would have been preferable to make this connection with two oil switches in the same manner as lines 1 and 2 are connected to the double high-tension bus.

It was proposed at one time to construct the plant with lines 2 and 3 on double-throw disconnecting switches and one switch in a manner similar to line 1, but this would have prevented transferring the load from one bus to the other in case of trouble without an interruption to the service. For this reason additional oil switches were provided, as indicated on the wiring diagram. Actual operation of the plant as constructed shows that this change has increased very greatly the flexibility of the plant operation over what it would have been had the extra oil switches not been installed.

POWER-PLANT CONNECTIONS WHERE GENERATOR BUS IS OMITTED



The generators and transformers are protected independently by time-limit relays of the induction type connected differentially.

New Corona Shield for 165,000-Volt Line

IN DESIGNING the 100-mile, 165,000-volt transmission line for the city of Seattle's Skagit River project the electrical engineer, in cooperation with the engineers of the insulator manufacturer, worked out a simple, inexpensive and effective corona shield differing radically from

NO EXTRA ATTACHMENT OR HARDWARE IS NECESSARY WITH THIS TYPE OF CORONA SHIELD

those now in use on high-voltage lines of the Pacific Coast. The shield, which is shown in the accompanying illustration, is made from a $\frac{1}{16}$-in. circular sheet-steel plate 15 in. in diameter. This is stamped into a saucer shape, and on the flat part or the bottom of the saucer two parallel slots are stamped out so that the shield may be dropped over the clevis of the line-conductor clamp. In this way no extra attachment or hardware of any kind is required to support the shield. After stamping the plate the edges are rolled and the shield is dipped in asphalt paint and baked.

This type of static shield not only distributes the electrostatic stress equally along the insulator string, but serves as well as a splash plate to wet the under side of the lower insulator unit. In addition, there is sufficient metal to withstand several flashovers without impairing the effectiveness of the shield. The insulation of this line will consist of ten insulator units on suspension, twelve units on angle towers and fourteen units on dead-ends.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Seven Thousand 150-Watt Kitchen Lighting Units Sold in Thirty Days

Intensive Campaign Methods of Hartford Electric Light Company Surpass All Expectations—How the Work Was Organized — Commercial Lighting Campaign to Follow

TO SELL 7,000 kitchen lighting units within thirty days in a city having 36,000 residential customers, although the original bogey called for 5,000 units in three months, is certainly a remarkable achievement. This is a net sales figure with cancellations deducted and was attained during October by the Hartford (Conn.) Electric Light Company. All four branches of the electrical industry participated in the campaign, which developed so rapidly that it was most difficult to keep up with the popular demand for fixtures. Nothing like this campaign has ever been experienced in the long and striking history of the Hartford company.

Plans for the campaign were prepared last summer, and the intensive sales effort was launched on Oct. 1. The appeal to popular interest was based on a thirty-day free trial offer of a 150-watt "Daylight" kitchen unit, acceptance being followed by instalment payments of 75 cents per month until a total of $7.50 shall be reached. The whole campaign was keyed upon an effort to place kitchen illumination upon a plane comparable with high-grade office lighting; to establish a base for further improvement of home lighting by carefully selected fixtures and methods, and, it goes without saying, to increase revenue.

Preliminary Organization

In planning this campaign the Hartford company from the outset sought to insure an arrangement profitable to all the interests concerned. In August an understanding was reached with the Edward Miller Company, Meriden, Conn., for the use of that company's lighting hanger No. 593, finished in white enamel. In general, these fixtures were equipped with a Lavolier canopy switch wired complete with a 6-in. lead. The glassware selected was the Ivanhoe Trojan No. 5264x12. This material was handled from the warehouse of the Southern New England Electric Company, a local supply jobber. The J. A. Corcoran Electric Sales Service was engaged to canvass the 36,000 residence-meter lighting customers at Hartford, with an average of about forty men in the field.

STANDARD DISPLAY FOR CONTRACTOR-DEALER'S WINDOW

Arrangements were made by the Hartford company to pay these salesmen on commission and also to pay for sales supervision through a weekly settlement with the Corcoran organization.

The Hartford Electric Light Company contracted with local contractor-dealers to hang the fixtures, if possible within five days from the date of the salesman's order, at the lighting company's expense.

The Miller company supplied 40,000 "broadsides" with return postal card attached—the postage and printing being at the cost of the lighting company—as well as cuts and other advertising copy and material for the lighting company and the local contractors. The lighting company furnished the necessary order forms for salesmen, who took orders for convenience outlets in kitchens where no other place for the use of an appliance other than the present ceiling outlet existed. It was agreed that the manufacturer's selling organization should receive no commission for fixtures sold by local contractors in their own stores nor for sales made by employees of the lighting company in its own store.

Participation by Contractor-Dealers

Local contractor-dealers were invited to a dinner early in September, the occasion being utilized to inform them of the plan of campaign and to seek their co-operation. It was arranged at this time that all electrical stores in Hartford should sell the Miller fixture with Ivanhoe-Trojan glass to their customers in their stores during the campaign period at the same price as the Hartford Electric Light Company. The Southern New England company agreed to keep this fixture in stock during the campaign and afterward and quoted the local dealers minimum price regardless of quantity ordered.

During the campaign the lighting company agreed to carry all accounts for kitchen unit sales and installations by contractors. It announced to the contractors that the most extensive advertising ever undertaken by the Hartford company would be a feature of the campaign, and it offered to share in group advertising by contractors in this connection. It was also agreed that no house-to-house canvassers except the Hartford company's would be used during the campaign, as otherwise great confusion would result. Signs for contractor-dealers' window displays and other publicity material, including exhibits of units, were furnished by the Miller company. Telephone solicitation and the solicitation of commercial installations was agreed to be permissible for

contractor-dealers during the campaign.

As a new development for this campaign, the American Wiremold Company of Hartford designed an attachment for the Miller fixture to serve as a convenience outlet for the use of appliances. In this way the Miller fixture can be sold with or without a convenience outlet as the case may require. This convenience attachment consists of a run of "Wiremold" 15 in. long, extending from the Miller canopy and terminating in a ceiling rosette, from which a reinforced lamp cord is hung with a keyless socket. Where no ceiling outlet already existed "Wiremold" was also used, running from a sidewall outlet to the center of the ceiling for the new kitchen unit. The sales price of these two outlets was $1.50 and $5 respectively.

For hanging the fixtures on ceiling outlets already existing contractors received 75 cents each. The contractor received 50 cents and $1.50 for the "Wiremold" extensions. In case of cancellations the contractor agreed to take down the fixture and put up the old equipment, leaving things in a workmanlike condition, within a week from receipt of order, for $1 apiece, and returning material to the stockroom. No trials were allowed of convenience outlets, these installations being final and left connected to old fixtures.

How Advertising Started

In the week end preceding the beginning of the campaign a model kitchen, 10 ft. x 13 ft. in size and 8 ft. 9 in. high, was installed in the lobby on the first floor of the lighting company's main office building. It was provided with removable panels of beaverboard which permitted it to be closed on the show-window side during the daytime and opened into the office lobby. At night the office side of the model kitchen was paneled off and the entire display opened to window inspection. In this model kitchen an old-style illumination by a pendent 60-watt lamp was contrasted with one of the new 150-watt units. An electric range, washer, water heater and other apparatus were shown in the model kitchen. More than a thousand units were sold out of this model kitchen alone. The Ann Street show window in the Hartford company's substation (see ELECTRICAL WORLD, Oct. 27, 1923, page 871) was effectively used during the campaign to stage a display of electrical equipment for kitchen service, including the "Daylight" units. This equipment was compared with old methods under the respective designations of "Gloomlight" and "Gloomchaser."

MODEL KITCHEN SET UP IN COMPANY'S OFFICE

By removing panels this was turned into a striking window display at night.

On Sunday, Sept. 30, a full-page advertisement was run by the Hartford company in the local press, and at the same time the broadside with attached postal card was mailed to all residential customers. The newspaper advertising throughout the month was naturally concentrated upon the theme of providing daylight conditions in the kitchen, contrasting office illumination with kitchen lighting, offering the thirty days' free trial of the unit installed and emphasizing the low cost of the improved service on the 5½-cent energy rate lately established by the company in connection with its well-known two-part rate described in the ELECTRICAL WORLD for April 21, 1923, page 917.

A survey of kitchen lighting in 200 residential installations at Hartford before the campaign disclosed an average unit of about 59 watts per kitchen. The additional expense to the householder with the 150-watt unit should not exceed 50 cents per month, but the total increase in revenue per year for the Hartford company is estimated at $40,000, based on 1,000 hours' annual use. The increase in illumination is roughly from 2 ft.-candles to 6 ft.-candles total.

Hanging Crews Unable to Keep Up with Demand

Before the campaign it was hoped that it would be possible to install all fixtures within three days from receipt of order, but so great was the demand that this was not feasible. Hundreds of fixtures were awaiting installation on Nov. 1, and to assure customers that every effort would be made to serve them a postal was sent to those awaiting trial installations telling the Hartford Electric Light Company's gratification at the receipt of the trial order and promising to install the fixture as soon as its men could get to the customer's house and find him or her at home. The post card pointed out that more than a thousand customers placed their orders for these fixtures within the first week of the sale and that the fixture proved so popular that the crews hanging it were being badly strained to keep up with the sale. It was announced that the facilities were being increased for doing this

OFFICE RECORD

Date Compl.________

Contr. ________

H. E. Lt. Ord. No.________

Kitchen Unit	$0.75
Conv. Outlet A	0.25
" " B	1.50
Outlet C @ 0.50	____
Total due Contr. $	

________ Contr.

Installation, as ordered, has been completed satisfactorily.

________ Customer.

THE HARTFORD ELECTRIC LIGHT CO., 266 PEARL STREET, HARTFORD, CONN.

The Hartford Electric Light Co.: *Date________ 1923:*

You may install on the ceiling outlet in my kitchen, for 30 days' free trial, your DAYLIGHT KITCHEN UNIT, complete with lamp. At any time within 30 days, if I notify you, you will remove it and replace the old fixture at your own expense. If I do not notify you within the 30 days' trial, I agree to pay $0.75 each month until I have paid $7.50; these payments to be paid with my light bill.

Also install CONVENIENCE OUTLET Style A @ $1.50 / Style B @ $5.00 for which I agree to pay $0.75 each month until paid for, following Kitchen Unit payments.

Agt. No.____ Ord. Fm. F.P. Total Amount of Sale________

Ed. M. Co.________

________ Customer.

CARD USED BY SALESMEN IN TAKING ORDERS FOR LIGHTING UNITS AND CONVENIENCE OUTLETS

work and that the orders would be filled just as promptly as possible.

It was planned to bring the active sale of these units to a head toward the end of November, after the remarkable results for October had been recorded. This was scheduled for announcement in a newspaper advertisement calling attention to the fact that by a stated date the opportunity to secure the fixture installed at the established price would cease and briefly referring to the success of the drive. Of course, the sale of these units by local contractors and retailers would continue indefinitely on their own terms after the regular campaign ended.

LEFT—A CARLOAD OF KITCHEN-LIGHTING UNITS. RIGHT—BILLBOARD LIGHTING FEATURED THE CAMPAIGN

Separate Department Created

To facilitate the sales routine, the Hartford company set apart quarters on an upper floor of its office building for the use of the staff handling the campaign and virtually created a separate department for this work. Clerical records, salesmen's meetings, conferences, mail and telephone orders were cared for here. The routine of procedure from the receipt of an order to its completion was plotted graphically, and a corresponding chart was made up for procedure in case of withdrawal or cancellation.

Order cards stamped by addressograph were supplied to canvassers by the Hartford company. These carried the customer's name and were sorted according to streets to save time in the field. All sources of orders were given a serial number and recorded in a "daily register" which proved of the utmost value in keeping track of the orders and in making up the weekly payments to the sales organization. Buff cards were used to record orders taken in person and white cards (from the broadside) for mail orders. After being addressographed, the buff cards were turned over to the salesmen for use in the field.

Upon receipt of orders the cards were sorted by street numbers and registered; orders were then placed on the lighting company's stockroom for lamps; the Southern New England company received corresponding orders for lighting units, and the Corcoran Sales Company received orders for the payment of commissions, while the contractors received orders in geographical groups to execute the work. The lamps, wiring material and fixtures were delivered to the contractors by the lighting company and the jobber, and upon completion of the installation a signed report was turned over from the purchaser by the contractor to the lighting company and registered. After being held for thirty days each order was forwarded to the lighting company's accounting department for billing with the lighting bill. A reverse routine was followed in case of withdrawals or cancellations.

The contractors have been able to install from fifteen to twenty kitchen lighting units per day per man. Four girls were required for the routine of following out the orders. All sales were recapitulated daily on the register, with classification by agent number, date of sale and withdrawals.

Cash prizes were given to the salesmen by the Hartford company to a total of $500 and the commission was increased after the bogey originally set was passed. The following letter was sent to each trial customer upon the expiration of thirty days:

> The "Daylight" kitchen light which we put in for you on thirty-day trial has been in use for that length of time. Not having heard from you to the contrary, we would understand that you wish to keep it. We are therefore charging it to your account and inclose our bill. We hope that it is giving you just what it is made to give, a perfect light, like daylight, for less than 1 cent an hour.
>
> Any customers who choose to pay for this light in full instead of by installments with their light bills will receive a receipt in full if they remit for the total bill or for the balance due at any time.
>
> Thanking you for trying this new light and trusting that it is entirely satisfactory, we are, at your service,
>
> THE HARTFORD ELECTRIC LIGHT COMPANY.

It is planned to follow the kitchen unit campaign immediately by one to sell improved equipment to stores. This will probably consist of a 200-watt lamp with suitable fixture, and the territory will be canvassed with a smaller number of salespeople. It is hoped to sell at least a thousand such units in about one month.

Public Relations Foremost Utility Problem

THE inestimable value and great importance of harmonious public relations were emphasized again by Martin J. Insull at the fifteenth annual meeting of the Indiana Electric Light Association at French Lick Springs recently. From the electric service companies' viewpoint public relations cannot be anything but the best possible, otherwise the

individual companies will lose out and the damaging effect may even extend to neighboring companies or over the entire nation, declared Mr. Insull.

To secure the highest degree of good will, the best possible service must be rendered at the lowest possible rates, and in addition the importance of the utilities to the public as well as the peculiarities of the business must be carefully and fully explained.

Because electrical men know the utility business they are apt to think every one else does, said Mr. Insull, but it is very complex to the laymen. The educational process must be continuous. Because the older generation is ever giving place to a younger one the public must be made to realize that the owners of public utilities are the public, represented through banks, insurance companies and many small stockholders. It must be clearly explained how money invested in utilities will always redound to the prosperity and well being of the community and nation.

In endeavoring to acquire this much-sought good will of the public, companies must remember the difference between utility and commodity business, Mr. Insull warned. First of all, the public must be shown the necessity of a monopoly in the utility business. Then there is the financial difference. A commodity business may turn over its capital five times a year with 25 to 50 per cent return on its investment, whereas a utility can turn over its capital only once in five years, with only 6 to 8 per cent return. Another difference is that utilities do not sell packages; they sell service available on instant demand. How can the public know these things, asked Mr. Insull, if utilities do not explain them?

Commenting on a utility company's duties to the public and its security holders, Mr. Insull said that while a utility is obligated to give the best service at the lowest rates, the rates must not be so low that they endanger the possibility of procuring money for rendering this service. Rates might better be too high than too low. A utility's duty to its security holders is to handle the money intrusted to it so wisely, honestly and judiciously that their investment is safeguarded and a regular return assured. As a means of securing favorable public opinion Mr. Insull suggested:

1. Study and local application of the National Electric Light Association's public relations methods.
2. Bringing home to the utility employees the importance of improving public relations.
3. Co-operation with the public by laying all cards on the table. If a utility is honest, there is nothing to hide; if it is not honest, it should not be in business.
4. Co-operation with civic clubs and organizations.

In closing, Mr. Insull declared that a fully and correctly informed public offers sterile soil to the seeds of discord sown by demagogues.

Selling Appliances of Proved Quality Only

IN CONNECTION with its recent opening of an electric appliance shop, the Concord (N. H.) Electric Company put into effect the policy of selling only electrical household devices of tested quality. The accompanying advertisement, emphasizing the stability of the central station and other local merchandisers as compared with "here today and there tomorrow" concerns trying to unload devices of inferior grade upon the public, was inserted in the local press and aroused much favorable comment.

> **We Can't Run Away**
>
> ***Why not take advantage of that fact?***
>
> A few days ago a woman asked our assistance in repairing a certain electric appliance.
>
> It was an inferior appliance. It had been sold to her by a salesman who burst into town, "worked fast" and disappeared.
>
> There was no one to reimburse her, no one to make proper adjustment.
>
> A local merchant would not have sold her that inferior appliance. This company—which submits all types of appliances to careful tests—would not have sold her that appliance.
>
> And if we had, by error, she could have found us—like your other local merchants—right here in town, ready and willing to rectify that error.
>
> **If you haven't an electric vacuum cleaner, you aren't taking full advantage of your electric service. Let's bring a Eureka vacuum cleaner to your home and show you how it saves your time, your strength, your health. No obligation whatsoever for the demonstration.**
>
> **CONCORD ELECTRIC CO.**

CENTRAL STATION ADVERTISES PERMANENCE OF ITS BUSINESS

What Other Companies Are Doing

Kansas City, Mo.—The Kansas City Light & Power Company has opened a safety school for industrial superintendents. Sessions are to be held one night a week in the company's auditorium. More than 900 foremen, superintendents and employment managers have enrolled for this course, and over 500 have attended each of the sessions held so far.

Seattle, Wash.—The Puget Sound Power & Light Company recently held in Seattle the first electric cooking school conducted by a central-station company in the Puget Sound district. Heretofore such schools have been sponsored and conducted by one of the leading newspapers of the city in which the school was held. During the five days that the school was maintained more than 1,200 housewives were in attendance. Miss Bernice Lowen, electric cooking expert of the Edison Appliance Company, conducted the classes. The success of the undertaking was so pronounced that the company has determined to conduct a similar school at least three times a year to supplement the work of the company's own demonstrator, who gives weekly demonstrations and is prepared to give daily instructions to customers.

Fitchburg, Mass.—The saturation point on electric flatirons is still afar off for the Fitchburg Gas & Electric Light Company, judging from its sale of about one iron for every nine residential customers during the nine months ended Sept. 30. Washing-machine sales for eight months totaled $30,032, or nearly double the revenue from gas-range sales on this system. There are about seven thousand residence lighting customers on the electric lighting system.

Logansport, Ind.—Floyd Kearns, superintendent of the municipal electric light plant at Logansport, Ind., is taking steps to promote good will between the city and citizens through a series of inspection days at the plant. On two evenings recently the plant was thrown open to the public, at which time guides were provided to explain all the details of equipment. All buildings have been painted recently, and the plant has been equipped with a new ash-carrier system.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Hydro-Electric Development and Steam Equipment

Operating Hydro-Electric Plants to Obtain Most Economical Output.—RALPH BROWN.—The method of keeping record of plant performance to obtain best economy of available water, operating in parallel with steam plants and obtaining maximum output from hydro-electric units are among the subjects considered.—*Power*, Oct. 16, 1923.

Power-Plant Problems of Steel Mills.—L. B. BREEDLOVE.—The efficiency of various forms of prime movers, importance of frequency, blowing and electric generating equipment and selling off-peak power are discussed. Several tables give actual operating figures, cost of plant and of operation and a comparison of consumption for two types of power-plant equipment.—*Iron Age*, Oct. 18 1923.

Study of Irregularity of Reaction in Francis Turbines.—ROY WILKINS.—Irregularity of reaction in hydraulic machinery causing vibration has up to the last few years been of relatively little importance and treated as a more or less necessary evil. With the advent of larger units, particularly for high heads, it became of prime importance that there be little or no vibration. In cases where vibration occurred a cut-and-try system of remedying it was usually resorted to and as little publicity as possible given to the procedure. For the study of such phenomena as vibration caused by irregularity of reaction manifesting itself in several impulses per second the electrical methods long since developed are admirably adapted, and this paper gives a brief description of a successful method of study.—*Journal of A. I. E. E.*, November, 1923.

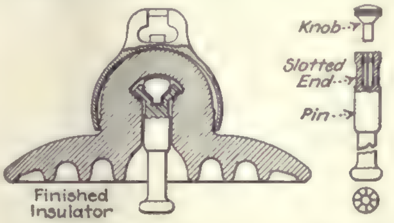
Generation, Control, Switching and Protection

Minimum Number of Hydro-Electric Units to Have in Service.—RALPH BROWN.—Factors that determine the number of machines to have in service, how loading of machines affects efficiency of the plant and methods of supplying wattless current to the system are considered.—*Power*, Nov. 6, 1923.

Simplified Method of Analyzing Short-Circuit Problems.—R. E. DOHERTY.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. summer convention, July 7, 1923, page 18.—*Journal of A. I. E. E.*, October, 1923.

Modern Metal-Clad Switch.—The conditions which have to be met in rupturing large amounts of power, a general description of the switch gear as it is being designed and manufactured, control and operating details, speed of break, constructional details and contact design are among the subjects discussed.—*Electrician* (*England*), Oct. 19, 1923.

Cone-Head Insulator.—E. ALTMANN.—The recent attempts to develop a suspension-type insulator without a cemented joint between the disk and the metallic pin have resulted in a number of designs. The present article describes the features of a new series of these insulators, the basic principle of which is the locking of the metallic pin within the conically hollow head of



SUSPENSION-TYPE INSULATOR WITH NO CEMENTED JOINT BETWEEN DISK AND METALLIC PIN

the porcelain, as shown herewith. The head of the soft-steel pin is tubular with several radial saw cuts. Within the hollow head of the porcelain is lodged a small pointed knob. The end of the pin is heated to dull red heat in an electric resistance welding machine, is inserted into the neck of the porcelain and by means of a simple toggle press the hot end of the pin is pressed against the internal knob, which spreads out the individual members of the slotted end of the pin and bends them against the inside of the hollow cone in the head of the porcelain. It is claimed that 10 tons tension is required to withdraw the pin, a tension far in excess of any practical occurrence and beyond the resistivity of the porcelain itself.—*Der Elektrische Betrieb*, Aug. 29, 1923.

Remote Control of Networks Without Pilot Wires.—J. BETHENOD.—A system for adjusting from a substation meters used for consumers who are supplied at two different rates, or to switch street lights on and off without the use of pilot wires, is in successful operation on the Marseilles (France) distributing system. To the middle wire of a three-wire direct-current supply line a small condenser and a 1,000-cycle single-phase generator are connected, one terminal being grounded. On the consumer's premises a relay in series with a condenser is placed between the middle wire and ground. This relay will either change the gear ratio on the meter, to make it record a different rate during a certain period, or it will close and open a switch controlling any desired circuit. The high-frequency current will in no way affect the normal direct-current supply. On the alternating-current supply lines a direct-current impulse accomplishes a similar purpose.—*Revue Générale de l'Electricité*, Oct. 13, 1923.

Transmission, Substation and Distribution

Underground Transmission with Substations Designed for Mines.—At the Lynch (Ky.) mines steam pressure of 200 lb. and 100 deg. superheat is furnished by three 750-hp. Stirling water-tube boilers to two turbo-generators each rated at 1,875 kva., 6,600 volts, three-phase, 60-cycle. In this large mine underground transforming and converting substations supplemented by ample copper feed the lines from which the power is drawn. Among the features considered are the power plant, the load variation and the distribution system, each of which is described.—*Coal Age*, Oct. 11, 1923.

Remodeling of an Industrial Substation.—E. C. SOARES.—When it became necessary to make changes in a step-down transformer substation at an industrial plant to receive energy purchased from a central-station system at 13,200 volts, some construction details of transformer house, buses and wiring layout were worked out that held the completed cost of the 1,450-kva. substation, including the building changes, to $6.20 per kva. The bill of material and installation details given show how the work was handled.—*Industrial Engineer*, November, 1923.

Transmission-Line Transients.—V. BUSH.—This paper, presented before the Swampscott convention of the A. I. E. E. in June, presents the results of an investigation on transmission-line transients recently performed at the Massachusetts Institute of Technology. The object of the research was to test experimentally part of the theory of transients and transmission lines and to investigate qualitatively certain phenomena of reflection and wave form.—*Journal of A. I. E. E.*, November, 1923.

Units, Measurements and Instruments

Determination of Mechanical Performance by Means of Vibration Tests.—C. BETHEL.—There are several methods of testing machines that are subjected to vibration. Testing apparatus of this type is advisable because by its use weakness of design can be quickly eliminated. Several machines for this purpose are described.—*Electric Journal*, October, 1923.

Mechanical Computation of Root-Mean-Square Values.—L. A. UMANSKY.—After reviewing some prominent labor-saving methods the writer points out that the root-mean-square value can be quickly calculated by a mechanical device, which he describes.—*Journal of A I. E E.*, October 1923.

Illumination

First Low-Voltage Gas-Filament Lamp.—D. McFARLAN MOORE.—For many years all luminosity due to the action of electricity in gases was associated with high voltages. The light beween the two terminal electrodes of a small Geissler tube, or of a tube lamp such as was used in the Moore long-tube system, is positive column light, which in a measure accounts for its much greater intensity and efficiency. Several years ago it was found that luminosity in gases could be produced solely by voltages as low as 110, but it was a negative glow light of low intensity that surrounded the metal electrodes in a bulb of rarefied neon gas. Although the problem was partly solved by the negative glow lamps, there remained the far more difficult problem of obtaining positive column light on low voltages. This paper announces the production of such lamps and contains also a brief résumé of the history of gaseous conduction and its many points of contact with electrochemistry. — *Paper presented before American Electrochemical Society at Dayton, Ohio,* Sept. 27-29, 1923.

Motors and Control

Operation of Polyphase Motors from a Single-Phase Supply.—G. WINDRED.—By connecting two phases of a motor winding in series across the mains, while the terminal of the other phase is connected to a point which is formed by the junction of an inductor and a resistor connected in series, and which are also connected to the main, it is possible to run polyphase motors on a single-phase supply. The characteristics of the machines when operating in this manner indicate that the majority of them are inferior to those of the polyphase motor proper but are sufficiently superior to the single-phase working to recommend this system where only a single-phase supply is available or where the application of polyphase presents difficulties, as in certain railway work where the elimination of the extra conductors represents a considerable saving in money and avoids awkward constructional work.—*Electrical Review (England)*, Oct. 12, 1923.

Effect of Insulation on Design.—R. E. FERRIS.—Insulation affects the design of the machine primarily in three ways—space required, heat-insulating qualities and mechanical qualities. These factors are treated theoretically and illustrated by actual examples.—*Electric Journal*, October, 1923.

Adjustable-Speed Motor Drives.—R. W. DAVIS.—Adjustable-speed motor drives as used in steel mills can be divided into four general groups: direct current, Sherbius or alternating-current commutator, frequency converter and Kraemer or rotary converter. The direct-current method is the oldest, a little later the Kraemer and Sherbius systems were brought out almost simultaneously, and the frequency-converter system is the newest application. Each of the four systems is described in detail. The author, summing up the three types of alternating-current variable-speed motors, claims that the Sherbius and frequency-converter system are best suited for 25-cycle operation and the Kraemer type for 60-cycle operation.—*Proceedings of Association of Iron and Steel Electrical Engineers*, October, 1923.

Heat Applications and Material Handling

Lifting Magnets.—Some recent types of lifting magnets are described with eleven photographs illustrating their adaptability to various shapes of materials. Circular, square or rectangular magnets with flat-pole surface are chosen for handling ingots, bars or plates. A hollow, spherical pole surface gives best results for lifting a ball-shaped scrap breaker. When materials with very uneven surface have to be handled, magnets with spring-mounted movable poles are the best suited. It is mentioned that magnets are not safe for lifting loads of a temperature of more than 950 deg. F., because iron loses most of its magnetic properties above this heat, becoming non-magnetic at 1,400 deg. F. Modern magnets are wound with aluminum conductors with no other insulation but aluminum oxide applied by a special chemical process. To avoid a rush of current a controller with a resistance step on the first contact is used. The same controller permits current reversal to drop the load quickly. A standard circular magnet of about 50 in. diameter weighs 1.1 tons, consumes 3.3 kw. and has a theoretical lifting force of 28 tons. — *Bulletin Oerlikon*, September, 1923.

Industrial Applications of Welding and Cutting and Their Respective Possibilities.—A report covering all branches of the welding art, divided into sections dealing with arc welding, gas welding, thermit welding, carbon cutting and gas cutting. A clear picture of the extent and importance of these applications at the present time is given in this thirty-seven-page article.—*Journal of American Welding Society*, October, 1923.

Electrophysics, Electrochemistry and Batteries

Discharge Phenomena on Large Rectifiers.—M. SCHENKEL.—The author describes extended research work, done to solve the problem of why it is necessary to insulate the negative electrode from the metallic vacuum vessels on large mercury-arc rectifiers. It has been found from exact measurements that the metallic vessel participates on the discharge. This will cause a gradual loss of the vacuum, a pitting of the metallic walls, "backfiring" and short-circuits. It is recommended not only to insulate the vessel completely but also to keep all metallic guides for the arc far away from the arc itself. Rectifiers built according to these rules show marked safety against internal short-circuits.—*Elektrotechnische Zeitschrift*, Oct. 11, 1923.

Crystalline Form of Electrodeposited Metals.—W. BLUM and H. S. RAWDON.—A simple theory of the probable mechanism of crystal formation in electrodeposition is outlined. The principal types of crystalline structures observed in electrodeposits are classified and the conditions which tend toward the formation of the different types are discussed.—*Paper presented before the American Electrochemical Society at Dayton, Ohio*, Sept. 27-29, 1923.

Origin of Ions in the Unsustained Glow Discharge.—K. T. COMPTON and T. E. FOULKE.—It is shown that there are sufficient residual ions present in any gas to start a discharge when a sufficiently high voltage is applied. Attention is drawn to the application of the Einthoven galvanometer registering minute currents for very short intervals of time.—*General Electric Review*, November, 1923.

Telegraphy, Telephony, Radio and Signals

Telephone Distribution Systems in Large Buildings.—F. M. SIMPSON.—Owing to the type of buildings generally employed and the number of telephones to be served, the work will either be unsightly in spite of all precautions to the contrary or costly alterations will have to be made after the completion of the building to insure effective concealment of the wires, unless suitable facilities are provided in advance for accommodating the telephone cables and wires and for running these through the walls and floors. Methods for determining the best type of construction for a particular building are given.—*Construction*, October, 1923.

Study of Radio Signal Fading.—J. H. DELLINGER, L. E. WHITTEMORE and S. KRUSE.—During the years 1920 and 1921 a study was made of the variations of intensity of received radio signals of high frequency or short wave length. The investigation was conducted with the assistance of the American Radio Relay League. During the tests from five to ten radio stations transmitted signals in succession. These signals were received simultaneously at about a hundred receiving stations, whose operators were provided with forms for recording the variation in the intensity of the signals as received. Particular attention was given to the intensity of signals, the fading of signals, the prevalence of strays or atmospheric disturbances and the weather conditions existing at the time of transmission. An analysis was made of the reports received, and summary tables are given which point out possible relationships between the received signal intensity, fading and strays and the weather conditions existing at the time.—*Scientific Paper No. 476 of the Bureau of Standards.*

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Madden Backs Ford Plan

Chairman of House Appropriations Committee for Power Plant to Replace Gorgas

ACCEPTANCE of Henry Ford's offer for the Muscle Shoals water-power and fertilizer project, through government construction of a new steam auxiliary power plant to replace the Gorgas plant disposed of recently to the Alabama Power Company, is provided in a bill prepared by Representative Madden of Illinois, chairman of the appropriations committee, for introduction in the new Congress.

The bill will be introduced either by Mr. Madden or by Representative McKenzie of Illinois of the committee which originally brought forth the legislation which died in the last Congress. It will be similar to the original legislation except for the addition of a section designed to meet conditions resulting from the sale of the Gorgas plant. Under the new section Mr. Madden would have the government, through the War Department, substitute an auxiliary steam-power plant capable of developing 40,000 hp. The bill would authorize construction of the plant directly by the government or its construction under contract by Henry Ford or his corporation. Another provision would authorize the War Department to acquire, by condemnation or otherwise, a site for the steam-power plant on the Black Warrior River near Lock 17 and a strip of land connecting Dam 2.

It is stipulated that the cost of the new plant should not be more than the amount received by the government—about $3,500,000—from the sale of the Gorgas plant.

Fertilizer-Production Feature

Mr. Madden's attitude admittedly increases the likelihood of the Ford plans being indorsed by Congress. Entirely apart from the importance of his position, he possesses powerful influence among the conservative Republicans, the portion of the House membership relied upon to defeat the Ford bill.

In conversation with the Washington correspondent of the Electrical World, Mr. Madden admitted that he is not informed as to the important offers for Muscle Shoals which are said to be in prospect, but he reiterated his belief that Mr. Ford is in a better position than any one else to develop that property. Mr. Madden confirmed the statement that he is backing the Ford offer principally because of its fertilizer feature, under which Mr. Ford would be required to make an immediate investment of about $50,000,000. The government can afford, Mr. Madden believes, to write off its expenditures at Muscle Shoals if it assures the farmers adequate supplies of fertilizers at low cost.

Bernard M. Baruch, formerly chairman of the War Industries Board, is quoted by Senator Ladd of North Dakota as favoring the Ford proposal.

New Jersey and New York Suits to Be Heard Jointly

The United States Supreme Court on Nov. 19 granted a motion permitting the State of New Jersey to file an original bill against the Federal Power Commission to enjoin the commission from exercising authority over water-power development within New Jersey and to test the constitutionality of the federal water-power act. The New Jersey case will be expedited and will be heard jointly with a similar suit against the commission by the State of New York soon after the first of the year.

Said McKinley Interests Have Kansas City Company

It is reported that the Illinois Power & Light Corporation, which is the consolidation of the McKinley and the Studebaker interests organized last spring, has acquired $5,000,000 par value common stock of the Kansas City Power & Light Company from J. Ogden Armour of Chicago and his associates, thus gaining control of the Kansas City company for the Illinois Power & Light Corporation's parent company, the North American Light & Power Company, which has its head office at Portland, Me.

Southern Power Company Has Resumed Full Service

The curtailment program of the Southern Power Company which had been in effect for several weeks terminated on Monday of this week, when full service was resumed. There has not been any great rainfall since the restriction began, but the full co-operation of the manufacturers in the curtailment program has brought about a filling of the reservoirs and the water heads are now back to a normal basis. The company believes that with this normal water supply and hoped-for frequent rains there will not be any more trouble.

For Sale of City Power

Two Plans in Political Fight in Washington State—Opponents of Both May Enter Contest

THE development of hydro-electric power in the State of Washington promises to be the battleground on which the next state election will be fought, with the possibility of a three-cornered fight looming.

State Representative Homer T. Bone of Tacoma has announced that he will carry the fight for the free sale of power throughout the state. He attacks the utility companies, declaring that for taxation purposes they file figures about one-sixth the size of those filed for rate making. Mr. Bone introduced into the House at the last session a bill providing for unrestricted sale of electrical energy by cities and fought the bill successfully through the lower branch of the Legislature. The bill failed to get out of the Senate committee, but succeeded in drawing out a substitute bill, known as the Reed bill, after its father, Mark E. Reed, Speaker of the House.

The Reed bill, admittedly the less obnoxious to the power companies, provides for the sale of electrical energy by municipalities outside their limits, but provides also for a 5 per cent gross earnings tax. This bill, Mr. Bone maintains, would in a measure cripple the effectiveness of the municipal power plants by detracting from net earnings. The Reed bill will go before the voters.

Owing to the mass of voters in cities directly interested in the power-sale question, it is believed by politicians that this will be the main issue of the coming political campaign. Seattle and Tacoma both have municipal power plants, Bellingham has acquired a site for one, and Aberdeen has plans for such a project. Adjacent to these cities are numerous smaller communities desirous of cheap electric power.

One New Unit at Essex Plant Ready; Two More Follow

The first unit of the new installations at the Essex plant of the Public Service Electric Company at Newark, N. J., has already been placed in service, adding 33,300 kva. to its rating. In addition to this unit, two more will be completed early in 1924, adding 66,600 kva. more. The company, according to Vice-president John L. O'Toole, expects that its total energy sales in 1923 will exceed a billion kilowatt-hours.

Interrelations of Manufacturers' Societies

President Timmerman of Electric Power Club Discusses Them at French Lick Meeting—Procedure for Setting Up Standards—Rural Electrification

THE Electric Power Club held the largest meeting in its career at French Lick Springs, Ind., this week, with 130 or more in attendance. Since the adoption of standards has been delegated by the club proper to its sections, the actual decisions at club meetings are very few, the meetings of the sections being largely devoted to the preparation of standards for subsequent action by letter ballot.

In his presidential address A. H. Timmerman discussed the proposed enlargement of the club and counseled that such action should not be taken without full study of the effect of further consequent subdivision and of making the club too clumsy. He said that a study was being made of the possibility of more intimately articulated action between the club and the American Manufacturers of Electrical Supplies, thus relieving the Electrical Manufacturers' Council of some of its present routine burdens. At present any matters mutually concerning the club and the A. M. E. S. must be taken up through the council. Mr. Timmerman also pointed out that the club and the American Institute of Electrical Engineers are now formulating methods of arriving at standards which interest both, so that ultimately there will be but one set of American electrical standards—these to be American Engineering Standards Committee standards found to be satisfactory after actual experience.

Mr. Timmerman further urged that manufacturers quickly adopt the plan of keeping records or statistics of production on the basis of capacity or units produced, rather than (or in addition to) monetary value. Fluctuating money value in the past ten years has made statistics on the latter basis most unsatisfactory and meaningless as a measure of real manufacturing activity, he said. He avowed his belief that the present available business in horsepower is fairly well fixed and that it is only by opening up new applications that a large increase in demand will be made.

RURAL ELECTRIFICATION

J. C. Martin of the Middle West Utilities Company, and formerly Western editor of the ELECTRICAL WORLD, made an address on the present situation in rural electrification and pointed out the opportunity of the future in the way of supplying electrical equipment to the farm. This is, of course, Mr. Martin pointed out, not an immediate possibility; but he said he was endeavoring to enlist the interest of electrical manufacturers in the program now under way to find out how to electrify the farms.

As shown by the interest in and discussion of the progress report presented by F. M. Kimball, the club is studying very carefully the question of how long manufacturers of electrical equipment should keep patterns and dies in order to supply renewal parts quickly. Involved in this question are not only the length of life of the equipment and the consequent determination of how long a manufacturer may thus be obligated to be ready to supply renewal parts, but also the business policy of maintaining good will by being able to furnish renewal parts at any time. Practices of various companies were discussed, but no decision was made till further study could be followed out.

S. L. Nicholson talked entertainingly of his trip to New Zealand, Australia and India and indicated to the club members the possibilities for export business in those countries. The tariff situation in the British dominions he visited, coupled with the desire to buy British goods, is one detriment to American export business; but nevertheless Mr. Nicholson concluded as a result of several months' study that a real and growing opportunity does exist which should be watched closely and followed up by American manufacturers.

To Boost Electric Ranges

N. E. L. A. National Commercial Section Discusses Problems at Salt Lake Group Meetings

THE National Commercial Section of the N. E. L. A. met in Salt Lake on Wednesday of this week for a two-day session with a large and representative attendance from both the East and the West. The group and committee meetings were characterized by unusual interest and enthusiasm as well as by the constructive nature of their work. The interest shown indicated that the plan of delegating the major portion of the detail work to the geographic divisions is stimulating interest in association activities. This in turn is leaving to the national section the needed opportunity to work on the larger problems and at the same time to coordinate its work.

The plans of the Lighting and Power Bureaus were presented, and the unusual opportunity for developing the classes of business with which they are concerned was brought out. The Appliance Bureau outlined a constructive program, especially in the range meeting, which was of more than usual interest. The plan of the Northwest Geographic Division to make a thorough investigation of every phase of the electric range problem was unanimously indorsed. The executive committee of the National Commercial Section has been asked to make the necessary appropriation to carry on this work in a thorough and satisfactory manner.

A general meeting was scheduled for the second morning, to be followed by an executive committee meeting in the afternoon and a banquet in the evening, at which the delegates were to be the guests of the Rocky Mountain Electrical Co-operative League.

Credit Problems to Fore

Speakers at Chicago Condemn Long-Term Commitments and Discuss Delinquent Debtors

SPEAKING at the twenty-eighth annual meeting of the Central Division of the Electrical Credit Association, held in Chicago on Nov. 20 and 21, E. B. Seitz, secretary of the American Washing Machine Manufacturers' Association, condemned the tendency toward building up sales by long-term commitments. When the present period of high labor and commodity prices ends, he said, the companies surviving will be those that have paid strict attention to tangible investments and not fixed assets. Mr. Seitz declared that in his own field, through educating the contractor-dealers, washing-machine manufacturers have reduced their time of payments from ninety-seven to eighty-two days.

National President E. W. Shepard, New York, urged that credit men teach their customers the relations between gross profits, selling expense and turnover. He contended that the losses during the past three years could have been avoided had credit men known more of their customers' problems.

Much interest was shown in a system explained by S. C. Greusel, Milwaukee, whereby the electrical credit men and contractor-dealers pay the expenses of a traveling accountant to check over the books of local contractor-dealers. He felt that credit men should be liaison officers. A committee was appointed to look into this system.

"Creative credit management" was considered by O. J. Condon, who outlined various means of cultivating good will. A discussion of how slow-paying customers should be handled took place, D. W. Parsons of Chicago advocating a sympathetic attitude and the use of the E. C. A. forms.

The high cost of distribution was ascribed by Frank E. Watts of Cleveland to too much competition and too many retail dealers. M. F. Bacon discussed collection correspondence from the sales manager's viewpoint.

Wednesday afternoon was experience day. A general feeling seemed to exist that the forms had not been employed frequently enough in reporting delinquents since only 65 per cent of the members used them.

The following officers were elected for the ensuing year: President, J. H. Taylor, Chicago; vice-president, W. Scott Long, Chicago; national board member, B. P. George, Chicago. Frederick P. Vose was re-elected secretary-treasurer. The total attendance was 143.

Wisconsin Rate Settlement

Agreement Between Central Station and Forty-nine Cities Is Before State Commission

LOWER electric light and power rates will be placed in effect on Jan. 1 by the Wisconsin-Minnesota Light & Power Company in forty-nine Wisconsin cities and villages served by it if an agreement finally reached by officials of the company and representatives of the cities meets with the approval of the Wisconsin Railroad Commission. The basis of the projected settlement has not yet been made known, but it is announced that the reduction in electric rates in La Crosse alone will be between 14 and 15 per cent, or about $60,000 a year.

For nearly two years these forty-nine cities have been fighting before the commission and the courts for lower rates. The fight centered on a method of determining rate schedules according to the proximity of cities and villages to the source of generation instead of under the "loop system," by which cities remotely situated from the source of supply were charged the same rates as those near by, the "loop" system having been declared illegal by the Wisconsin Supreme Court. Following the Supreme Court's decision officials of the company applied for emergency rates from the commission, but this request was refused. The case was then carried to the federal courts, and the rates now in effect were established by federal court proceedings. When the Byllesby interests acquired the Wisconsin-Minnesota Light & Power Company efforts to reach a settlement were at once begun, and it is considered probable that the commission will approve the agreement.

Oklahoma Electrical Men Hear About Good Will

Features of the Tulsa conference of the first and second districts, Electrical Division, Oklahoma Utilities Association, on Thursday, Nov. 15, were addresses by C. L. Proctor of Joplin, Mo., general manager of the Empire District Electric Company and chairman of the electrical division of the Oklahoma association, who suggested that public utility officials had become little less than public officials in the importance of their responsibility to the people and urged complete fidelity in the discharge of this responsibility, his remarks being in response to the address of welcome by William Holden, secretary of the Tulsa Chamber of Commerce; by J. F. Owens of Oklahoma City, vice-president and general manager of the Oklahoma Gas & Electric Company, who spoke on "Public Relations" and said that public good will today is an absolute essential in the successful operation of a public utility; by C. H. Kretz of Okmulgee, general manager of the Oklahoma Power Company, who discussed "Local-Plant Versus High-Line Service"; by Fred W. Insull, president of the Public Service Company of Oklahoma and of the Oklahoma Utilities Association, who urged closer co-operation of utilities in handling their problems of a mutual character, and by E. F. McKay, manager of the association, who declared that newspapers today reflect rather than create public sentiment and that by a constant effort through the news and advertising columns of the press the public can be educated into a proper attitude.

H. N. Bates of Tulsa, district manager of the Public Service Company of Oklahoma, was elected president, and William H. Crutcher of Muskogee, district manager of the Oklahoma Gas & Electric Company, secretary, of the joint first and second districts of the Electrical Division. Muskogee was chosen as the meeting place for 1924.

Plans of Central Maine Power Will Cost $10,000,000

Plans for further hydro-electric developments aggregating $10,000,000 on the Androscoggin and Kennebec Rivers were announced this week by the Central Maine Power Company. To a representative of the ELECTRICAL WORLD Walter S. Wyman, general manager, stated that it is hoped to start work on one or both of these developments during 1924. The Androscoggin project includes the construction of a dam above Lewiston for the development of 50,000 hp., and the Kennebec project involves the building of a dam 90 ft. high above Bingham, with an ultimate development of 65,000 hp. and a storage capacity of about 1,000,000,000 cu.ft. Both projects include extensive generating-plant construction, with substation facilities and additions to the present transmission system. About two years will be required to complete the work.

Rapid progress is being made upon a steam-plant extension at Lewiston, which is interconnected with the hydro-electric system of the former Androscoggin Electric Company, now a part of the Central Maine system, and with the main lines of the latter at Gardiner. An interconnection between the Central Maine and Cumberland County Power & Light Company (Portland) systems is also under way.

Southeastern N. E. L. A. Men Gather in Tampa

The eleventh annual convention of the Southeastern Division, National Electric Light Association, opened in Tampa, Fla., at the Hillsboro Hotel, on Nov. 19, with an attendance of two hundred. The meeting lasted four days, with President W. R. Sammons, Knoxville Power & Light Company, in charge of the sessions. The program as published last week was carried through successfully. The ELECTRICAL WORLD's report is necessarily held over.

Jobbers' Open Meetings

Delegates at Buffalo Hear Recommendation for Institute to Develop Contractor-Dealer

THE concluding day of the annual winter convention of the Electrical Supply Jobbers' Association, held this year at Buffalo, as noted last week, was devoted to open meetings. Frederick P. Vose, general secretary of the National Electrical Credit Association, who for several years has appeared before this body in the guise of a mild pessimist, expressed himself as confidently optimistic of the immediate future before the electrical industry. His address appears at length in this issue.

David Sarnoff, vice-president and general manager of the Radio Corporation of America, sketched present conditions in the radio business and gave a graphic picture of its future. About 90 per cent of the sales of the Radio Corporation of America up to date, he said, have gone to the electrical trade, and the electrical jobber and dealer is well intrenched as a distributor of radio outfits and parts.

An interesting analysis of the present condition of the electrical contractor was made by O. Fred Rost, president Newark (N. J.) Electrical Supply Company, who characterized the electrical industry as a four-cylinder motor, the cylinders to represent manufacturer, jobber, central station and contractor-dealer, and the contractor-dealer's cylinder missing fire. Mr. Rost urged a serious effort on the part of the electrical industry working co-operatively to study the contractor-dealer as a common problem and establish an institute, preferably under the guidance of the Society for Electrical Development, to train men to do field work among the contractors for the purpose of making them better merchants and business men. From experience he has had in his territory he showed how immediately profitable it was to the jobber and the manufacturer to increase the individual prosperity of contractor-dealers and expressed the belief that a part of the appropriation now being spent by manufacturers in publicity might well be apportioned for this educational work.

Comparison with Hardware Men

A comparison of conditions confronting the hardware jobber and the electrical jobber was presented by H. O. Smith, Hardware & Supply Company, Akron, Ohio. There are about ten times as many electrical jobbers as there are hardware jobbers, he said. The hardware man pays far more attention to efficient material handling and habitually locates his warehouse by the railroad siding in a low-rent district. He does not make so many direct shipments as the electrical jobber. The electrical jobber, on the other hand, has developed as a far more effective distributor of specialties and is doing a better selling job. There are many practical lessons, however, which he may learn from a careful study of the older wholesaler.

Federal Power Commission Kept Busy

The Diamond Creek Dilemma—Projects for Tallapoosa, Yuba, Merced, Wynoochee, Collitz and Gasconade Rivers Seek Board's Authorization

THE Governor of Arizona has declined to extend the time of the state license covering the Girand development at Diamond Creek on the Colorado River. Mr. Girand has filed the Governor's letter with the Federal Power Commission. This puts it squarely up to the commission to take action in this case, which involves a ninety-million-dollar transaction. If the commission refuses to take action before Dec. 26 on the Girand license, it will mean, unless the Governor reverses himself, that the Arizona copper companies will no longer be committed and may decide to rely for a longer period on fuel oil. The decision to turn to hydro-electric power was made at a time when the prospect for obtaining adequate supplies of fuel oil at reasonable prices was not so good as it is at present. Arizona would be the greatest sufferer were the scheme to fall through. For that reason some are of the opinion that the state executive may change his mind once that he is sure the commission will not grant the Girand license before Dec. 26.

On the other hand, the Federal Power Commission must face a heavy moral, and possibly a legal, responsibility if through failure to grant a license Mr. Girand, who has complied with all the conditions of the preliminary permit, should be subjected to great losses.

PROJECTS IN MANY REGIONS

The Alabama Power Company has applied for a license covering the remainder of its project on the Tallapoosa River. A year ago the company secured a preliminary permit for a series of developments. In June a license was issued covering the company's Cherokee Bluffs unit, which develops 100,000 hp.

The company now has completed its survey of the entire stream, much of the work being done by aërial photography. The survey discloses that it will not be possible to obtain enough storage capacity in the manner planned. For that reason it now is proposed to increase the height of the Cherokee Bluffs dam from 105 ft. to 150 ft. This change will entail very great expense, involving the relocation of a section of railroad, the raising of highway bridges and approaches and the removal of two cemeteries.

Five additional dams are to be constructed above the Cherokee Bluffs dam, which will have a combined head of 306 ft. The fifth dam will be 140 ft. high. The combined installed power at these additional dams will be 114,000 hp.

The Excelsior Water & Power Company of San Francisco has applied to the commission for a license covering a 4,000-kva. project to be developed by enlarging the old Excelsior ditch, which was built for mining purposes in 1854. The plan is to install a penstock to utilize a fall of 750 ft. to a power house on the South Fork of the Yuba. This project is in conflict with the scheme for a comprehensive power and irrigation project proposed by the same company, and whenever the large project goes through the smaller development will have to be scrapped.

With the idea of utilizing portions of power resources during the period that arrangements are being made for larger developments, the commission is expected to grant a license to Thomas C. Clarke for a small project on the South Fork of the Merced River in Mariposa County, Cal. The proposed development is in conflict with the large project of the San Joaquin Light & Power Corporation.

The question which has been raised by the engineers of the commission as to the safety of a dam as thin as that proposed by the Merced Irrigation District will not delay work on the structure. Col. William Kelly, the chief engineer of the commission, has just returned from a visit to the site and has agreed that the company shall proceed with the construction to a point 60 ft. above bedrock. The plans call for a dam 320 ft. high.

Sanderson & Porter, lumber manufacturers and the operators of a public utility power plant which serves the Gray's Harbor area in the State of Washington, have taken up with the commission a proposed development of water power in the Wynoochee River, a tributary of the Chehalis River.

The Cascade Power Company has filed a declaration of intention with the commission announcing its plan to develop 17,000 hp. on the Collitz River at a point between Portland and Seattle, Wash.

Clarke E. Jacoby and E. L. Williams of Kansas City, organizers of the Central Missouri Power & Water Company, have applied to the commission for a preliminary permit covering a development on the Gasconade River.

Byllesby Acquires Coast Valley Gas & Electric

In acquiring the property of the Coast Valley Gas & Electric Company of California H. M. Byllesby & Company have obtained a 380-mile transmission and distributing system serving an area of 3,400 square miles. This utility company supplies fourteen communities having a total population of 25,000, including the towns of Monterey, Pebble Beach, Pacific Grove, Salinas and Coburn. The principal industry in the Salinas Valley and the adjoining territory is fruit growing and the raising of sugar beets.

The energy supplied by this company is purchased on a long-time contract from the Pacific Gas & Electric system, although it has reserve generating plants at Monterey, Salinas and King City. Present gross earnings are at the rate of $750,000 annually. Although no official confirmation has been made, this property will possibly be operated as a subsidiary of the Standard Gas & Electric Company and ultimately merged with one of the larger subsidiary operating companies of the Standard Gas & Electric Company in California.

Arkansas Utility Men Have Optimistic Outlook

The sixteenth annual convention of the Arkansas Utilities Association, held in Pine Bluff on Nov. 15 and 16, was attended by 125 utilities men from all parts of the state. One business session was held each morning, the afternoons and evenings being devoted to special and social events.

Optimism characterized the proceedings. President S. A. Lane in his address called attention to the prosperous conditions of the public utilities of the state. He commended the members for their hearty co-operation with the publicity department of the Arkansas Public Service Information Bureau, and dwelt upon the part that the public utilities play in the upbuilding of the resources of the state and the reaction of the state's prosperity on the public utilities.

Governor McRae addressed the delegates, saying: "We cannot develop our state unless we develop its public utilities, and I want you to feel that I am in sympathy with your programs of development."

A technical paper on "Three Phases of the Solution of the Power-Factor Problem" was read by W. A. Layman, president Wagner Electric Corporation, St. Louis.

Frequent mention was made of the Remmel dam and hydro-electric station under construction on the Ouchita River by the Arkansas Light & Power Company, one of the largest projects in the Southwest, and of the possibilities of Arkansas becoming a leading manufacturing state when its water power has been developed. On the day before the convention met the tenth annual managers' meeting of the Arkansas Light & Power Company was held at the dam site. The construction work on the dam was inspected, and speeches were made by company men.

The next meeting of the Arkansas Utilities Association will be held in Hot Springs at a date to be fixed by the executive committee. Officers were elected as follows: President, J. L. Longino, vice-president and general manager Arkansas Light & Power Company; first vice-president, R. C. Coffy, vice-president and general manager Fort Smith Light & Traction Company; second vice-president, S. R. Brough, superintendent Arkansas Water Company; secretary-treasurer, Rex Brown, commercial manager Arkansas Central Power Company.

Merrill's Recommendations

Suggests to Congress Improvements in Water-Power Act—Insists on National Power

IN THE forthcoming report to Congress of the Federal Power Commission, prepared by O. C. Merrill, its executive secretary, it is recommended that the water-power act be amended so as to place the administration of all projects, whether authorized under this law or prior to its enactment, in the commission. At present the individual departments continue to administer the water-power permits issued by them prior to the enactment of the water-power act. Suggestion is also made that the act should be amended so that the commission may employ a sufficient force to carry out the duties which the act imposes upon it. The report recommends further that the act be amended so that the amounts collected for the purpose of reimbursing costs of administration, including the portion now being set aside in the headwater improvement fund, be placed in a special fund to be devoted exclusively to the purpose for which collected and to be expended under the direction of the commission.

National Character of Power

"Since water powers will form an essential part of any comprehensive superpower system," Mr. Merrill says, "the controversies concerning them require early solution in order that the way may be cleared for carrying out the general program. This program will be much wider than the territory or the authority of any individual state. State interests nevertheless must be harmonized in policy and program, which will be to the common interests of them all. This will require co-operative action and reasonable uniformity of legislation. There must be no state barriers against the interchange of energy. There must be no type of development that cannot become an integral operating part of the combined system. Legislation which interferes with the program should be repealed or modified; necessary affirmative legislation should be had; public officials of both state and nation should lend the program their support and the industry itself should harmonize its own conflicting interests. It should no longer be permissible for any utility to draw plans for future extension except in such manner that interconnections may be effected readily whenever its territory merges with that of any other utility."

Control of Iowa Southern Utilities Changes

The controlling interest in the Iowa Southern Utilities Company, which, with operating headquarters at Centerville, serves forty-one cities and towns of Iowa with electric light and power and gas and operates a street railway and an interurban line, has been sold by David G. Fisher of Davenport, to George M. Bechtel, a well-known Iowa capitalist. Mr. Fisher has resigned as president and director of the corporation.

This utilities company owns a network of transmission lines in Iowa, south of Des Moines and southwest of Ottumwa. The corporation was organized by Mr. Fisher and his associates in 1916 to serve Leon and three adjacent towns. Since that time the company has extended its lines until town, farm and mine districts in twelve counties are served. In 1919 the corporation purchased control of the Centerville (Iowa) utilities and in 1921 of those of Newton.

Government Appointments for Farm Survey Made

William A. Durgin, chief of the Division of Simplified Practice, Department of Commerce, has been assigned by Secretary Hoover to represent the department on the Joint Committee on the Relations of Electricity to Agriculture, which, as already announced in the ELECTRICAL WORLD, is with the help of the federal government to make a world survey of the farm power situation. Mr Durgin will be actively in charge of the survey to determine how much electricity is being used in foreign countries in agricultural work, how it is being utilized, how the service is being taken to the farms, and so forth. The development of a plan for the standardization of electrical farm equipment will also be worked out under the direction of Mr. Durgin.

Charles A. Bissell, Bureau of Reclamation, Department of the Interior, has been assigned by Secretary Work to represent that department on the committee. The details of the program to be undertaken by the Department of the Interior have not yet been made public, but naturally they will concern the development of water power and other natural resources.

Street-Lighting Tables for 1924

FOLLOWING its practice for thirty-five consecutive years, the ELECTRICAL WORLD has prepared tables showing the proper time for lighting and extinguishing street lamps. The tables for 1924 are now ready, and a copy of them will be sent free to any subscriber upon request to ELECTRICAL WORLD, Tenth Avenue and Thirty-sixth Street, New York. For more than one copy a charge of 25 cents each is made to cover a portion of the postage, printing and compilation costs.

Big New Mississippi Plant

United Light & Railways Company Is to Build One at Davenport Larger than Keokuk

A SUPERPOWER steam plant costing $10,000,000 and generating eventually at least 200,000 hp., where electricity will not only be manufactured for the consumption of the surrounding industrial community but will be stepped up to 66,000 volts or 132,000 volts for long-distance transmission, will be built on the banks of the Mississippi River, 2 miles above Davenport, Iowa, according to an announcement of Vice-president and General Manager B. J. Denman of the United Light & Railways Company, which, with its headquarters at Grand Rapids, Mich., controls the Tri-City Railways & Light Company, serving Davenport as well as Rock Island and Moline, Ill., and other places.

A tract of 91 acres with a considerable water frontage has been purchased by the United Light & Railways Company, and surveys preliminary to actual construction have already been begun. Construction will commence in a short time and will be pushed through the winter, and it is expected that electrical energy from the new plant's first unit will be sold next year.

Territory Will Be Tripled

The new plant in its ultimate stage wil have a larger capacity than the Keokuk Dam water-power plant. It wil be the largest station between Chicago and Kansas City and between the Twin Cities and St. Louis. Located along the right-of-way of the Clinton, Davenport & Muscatine interurban railway and also along the line of the Milwaukee road, the power site will be easy of access for coal deliveries. It will have river wharfage in case coal-barge transportation on the Mississippi from lower Illinois and Ohio River mines proves practicable in the future. A network of high-tension lines, tapping a rich manufacturing territory within 100 miles of the Tri-Cities, will eventually radiate from the new plant at Davenport, Mr. Denman states. By means of it the territory served will be tripled.

The first section of the plant will be 160 ft. x 220 ft. in ground dimensions and 110 ft. in height, of concrete and steel construction with brick exterior. This first unit will require an approximate investment of $2,500,000. It will contain a 35,000-hp. Westinghouse turbo-generator, which was purchased nearly a year ago, together with the necessary boilers, stokers and condensing equipment. The steam pressure at the boilers will be approximately 425 lb., making the Davenport development one of the high-pressure plants in the country.

Originally options were obtained on two sites in Iowa and three in Illinois. At one time it was about decided to locate the plant at Moline or elsewhere on the Illinois side, but the site desired could not be had.

Texas Companies Spending Great Sums This Year

Electric power and light companies in the larger cities of Texas are spending more than $15,000,000 this year in improvements, extensions and betterments, as shown by figures compiled by C. E. McBride, assistant secretary and treasurer of the Dallas (Tex.) Power & Light Company. The compilations of Mr. McBride show that Dallas leads the list of Texas cities in such expenditures with its budget of $15,000,000 covering a five-year period.

The 1923 outlay for Dallas, which includes improvements under way and proposed at outlying stations and the addition to the Dallas plant of the Dallas Power & Light Company, is $5,000,000. The Houston outlay for 1923 is $6,000,000, which includes the first unit of the new four-million-dollar power plant which is now being built and improvements at outlying stations. Fort Worth is expending $500,000 in improvements for 1923, while San Antonio's outlay amounts to $2,000,000. A new electric plant is being built at Eastland at a cost of $2,000,000.

Mohawk Valley Company Takes Over Two Others

The Mount Morris Water Power Company and the Mount Morris Illuminating Company have been taken over by the Mohawk Valley Company of New York City, which controls the Rochester Gas & Electric Corporation. The two companies thus absorbed will retain their old names, and Robert M. Searle, president of the Rochester company, will act as president of both.

C. L. Ladle, former State Superintendent of Public Works, will have supervision of the Mount Morris properties, as well as of the project of installing a new storage dam in the Genesee River there. T. E. Barnard will have immediate charge of the companies.

Manila Electric Company Expands Plant

A material enlargement of the generating plant of the Manila Electric Company in the capital of the Philippine Islands is about to be made by the addition of a 12,500-kw. Allis-Chalmers steam turbo-generator to the equipment already installed. The latter consists of two 2,000-kw., two 2,500-kw. and two 5,000-kw. units, and energy is transmitted at 3,400 volts, two-phase. The new generator will operate at 13,800 volts, three-phase, and four transmission lines at that tension will carry energy to six substations. All the equipment of the Manila central station is 60-cycle. Part of the load is delivered to the street railway company.

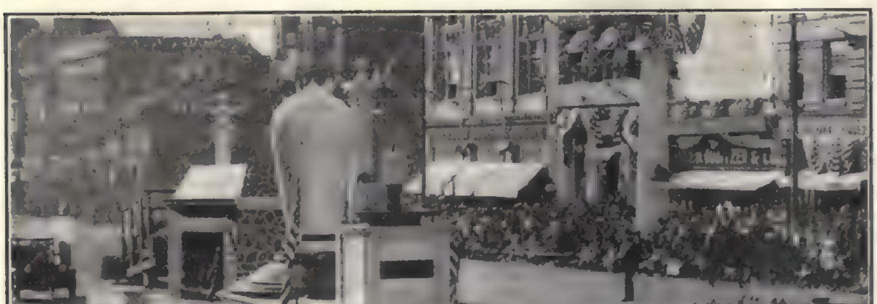
The new equipment will be the initial installation in a power house which is ultimately to contain four such units. As they are installed the old plant will gradually be abandoned. There will be a steam pressure of 325 lb., temperature 650 deg. Switchboard and switching equipment has been ordered from the Westinghouse Electric & Manufacturing Company. The J. G. White Engineering Corporation is in control of the work.

Rome (N. Y.) Gas & Electric Changes Hands

Interests owning the Northern New York Utilities, Inc., and the Power Corporation of New York have purchased the entire common stock of the Rome Gas & Electric Company, according to an announcement by F. L. Carlisle & Company, Inc. Application will be made shortly to the Public Service Commission for permission to merge the purchased company with the New York Utilities.

The Rome company, which furnishes electricity and gas in the city of Rome, N. Y., was purchased from the National Gas, Electric Light & Power Company of Philadelphia. The output of the combined companies will, it is announced, exceed 250,000,000 kw.-hr. a year. The Northern New York Utilities, Inc., and the Power Corporation of New York control a large portion of the inland water-power resources of New York State. The former deals chiefly in light and power for domestic use; the latter sells water power wholesale to public utility companies.

Candle Versus Electric Light



DURING the celebration of the one hundred and seventy-fifth anniversary of the founding of Reading, Pa., the Metropolitan Edison Company showed the tremendous advance electric light and power have made over the candlelight and horsepower of those early days by means of a very attractive float, one of the conspicuous features in a city parade.

Brief News Notes

Cambridge City Municipal Plant Sold Again.—The Indiana Public Service Commission has authorized the Cambridge Light & Power Company of Cambridge City to buy the Cambridge City municipal electric plant and system, which was purchased by Robert S. Ashe some time ago.

Union Gas & Electric May Buy Hamilton Municipal Plant.—The Cincinnati Union Gas & Electric Company is negotiating for the purchase of the Hamilton (Ohio) municipal electric plant. The purchase price has been set at $500,000, it is indicated. Purchase of the municipal plant would give the Union Gas & Electric Company an exclusive light and heat franchise in Hamilton.

Federal Power Commission Expenses Less Last Year than Year Previous.—The Federal Power Commission expended less money during the last fiscal year than during the fiscal year which preceded it. The total cost of administering the act during the fiscal year 1922-1923 was $134,000. This is $20,000 less than the total expenditures of the preceding fiscal year. Eighteen per cent of the total is represented by the amounts paid out of departmental appropriations for salaries of the employees loaned to the commission.

Southern Edison Pushing Work on Florence Lake Tunnel.—Work on the Florence Lake tunnel beneath the Kaiser hills, in the High Sierras, is being pushed by the Southern California Edison Company. This work began in 1912. When it is finished the waters of Florence Lake will be poured into Huntington Lake, 14 miles distant through the mountain, and, according to estimates, enough additional electrical energy to supply a million domestic consumers will be available. All of this, company officials say, will

be needed in from five to seven years. The tunnel will be more than twice as long as the Rogers Pass Tunnel on the Canadian Pacific Railway, which is at present the longest on the American continent, and more than a mile longer than the Simplon Tunnel through the Alps in Switzerland—now the world's longest. The construction camps on Lake Florence can be reached in the winter only by dog sledge.

Beck Has "Retaliation" Plan.—That Ontario should retaliate for the diversion of Great Lakes water through the Chicago Drainage Canal by appropriating for herself more water at Niagara Falls was suggested in an address the other day by Sir Adam Beck, chairman of the Ontario Hydro-Electric Power Commission. "If they insist on being pirates," he said, "they cannot object to our being bandits, and when we find we are short at Niagara through the diversion at Chicago may we not assume we can also take an extra 12,000 or 14,000 feet a second? Why should we go on starving our canal? That would be one method of doing business."

Uncle Sam's Electric Dredges.—The United States Engineer Corps' new sea-going dredge, the *A. Mackenzie*, uses electricity for every possible purpose, from propelling the ship to blowing the whistle. She is the largest vessel to use the Diesel-electric drive. She and three sister ships which are rapidly nearing completion at the yards of the Sun Shipbuilding Company, Chester, Pa., will be used to keep the channels of the harbors open and are expected to decrease greatly the cost of this operation. All of her electrical equipment was supplied by the Westinghouse Electric & Manufacturing Company.

Nova Scotia Commission Makes Contract to Supply Canadian Plant of Albany Company. — The Nova Scotia Power Commission has recently signed a contract with the Albany (N. Y.) Perforated Wrapping Paper Company to furnish it with 4,600 hp. of electrical energy at West River, Sheet Harbor, N. S., for its Canadian plant. The price for this power delivered at 2,300 volts is about $21.30 per horsepower-year. For the purpose of furnishing this power the commission will erect a second generating station on East River, Sheet Harbor. This station will operate at a head of about 100 ft. and will have an ultimate capacity of about 9,000 hp. It will be erected at Tidewater, about 4 miles below the development at Malay Falls on the same river which the commission is just now completing.

Consolidated Gas, Electric Light & Power Changing Frequency.—The Consolidated Gas, Electric Light & Power Company of Baltimore has ordered from the Westinghouse Electric & Manufacturing Company two 9,000-amp., 469-r.p.m., six-phase, 62½-cycle booster converters; two 3,075-kva., 55-deg. oil-insulated, self-cooled indoor transformers and two sets of switching equipment for use on the high-voltage side of the transformers. The transformers are for three-phase, 62½ cycles, with 13,200 volts at high tension and 250 volts and 275 volts direct current at low tension. The converters are to be started by the star-delta method. This is the first substation apparatus of this frequency purchased by the Baltimore company. Future expansion will be made on the basis of 62½ cycles.

Wisconsin Utility to Build 5,600-Hp. Hydro Plant. — The Wisconsin Valley Electric Company is about to start construction of a dam and power plant in the Wisconsin River about 3 miles above Merrill, Lincoln County, at a site known as Rocky Carry or Upper Merrill. This dam will have a head of approximately 23 ft., and the power plant will be designed for a capacity of 5,600 hp. Bids are now out for quotations on waterwheels and generators. The construction work will be done by the company's engineering department, and the power plant has been designed by L. A. De Guere, Wisconsin Rapids. This will be the fifth hydro-electric plant controlled by the Wisconsin Valley Electric Company. The company has four undeveloped water-power sites, of which Rocky Carry is the smallest. When completed the energy generated will be fed into the high-tension transmission system supplying Tomahawk, Merrill, Wausau, Mosinee and Stevens Point.

Ithaca Central-Station Company May Absorb Six Others.—Six public lighting companies serving small communities in central and southern New York have made application to the Public Service Commission for consent to the transfer of their franchises and other property to the New York State Gas & Electric Corporation of Ithaca. These companies are the Madison Power Company of Oriskany Falls, the Waterville Gas & Electric Company, the West Branch Light & Power Company of Stamford, the Delaware County Electric Light & Power Company of Delhi, the Fleischmanns Light, Heat & Power Company and the Moravia Electric Light & Power Company.

Rotterdam Substation Nearly Completed.—The new Rotterdam (N. Y.) substation of the Adirondack Power & Light Corporation, which is to be a central dispatching point for all the energy generated by that company, will, it is officially announced, be in full operation in a week or two and will then rank with the large power centers of the country. The company also announces the beginning of work on the erection of a 66,000-volt power line, extending from Glens Falls to Spier Falls, 11 miles. The new line will carry 60-cycle energy, in keeping with the corporation's plan of standardization, and will furnish energy for the Glens Falls Portland Cement Company and the Moreau Manufacturing Company, which last firm is developing the Feeder Dam project near Glens Falls.

Consolidation of New Hampshire Utilities Planned.—The New Hampshire Power Company, 70 State Street, Boston, has petitioned the New Hampshire Public Service Commission for authority to purchase the Newport Electric Light Company, Sunapee Electric Light & Power Company, Contoocook Electric Light Company, Antrim-Bennington Electric Light & Power Company, Canaan-Enfield Electric Company, Hillsboro Electric Light Company and Lake Sunapee Power Company. To effect the purchase the New Hampshire Power Company is seeking permission to issue bonds and preferred stock to the amount of $1,200,000.

Associations and Societies

Wisconsin State Association of Electrical Contractors and Dealers.—This association will hold its annual convention at the Pfister Hotel, Milwaukee, on Jan. 17-19, 1924.

Tennessee Contractors Meet. — The twelfth annual convention of the Tennessee Association of Electragists and the Central South District Association of Electragists International was largely attended at the Hotel Gayoso, Memphis, on Nov. 12 and 13. President E. R. Wright of Memphis was in the chair, and James R. Strong, New York, president of the parent body, spoke. L. W. Davis of New York, Col. Robley S. Stearnes of New Orleans, A. F. Anderson of Nashville, O. C. Small of New York, L. C. Datz of Memphis and J. A. Fowler of Memphis made addresses, and a "get together" luncheon was given by the Memphis Electric League and a dinner by the Wesco Supply Company.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

American Physical Society—Ryerson Physical Laboratory, Chicago, Nov. 30-Dec. 1. H. W. Webb, Columbia University, New York.

American Society of Mechanical Engineers—New York City, Dec. 3-6. C. W. Rice, 29 West 39th St., New York.

National Association of Railway and Utilities Commissioners—Hotel Urmey, Miami, Fla., Dec. 4-7. J. B. Walker, New York Transit Commission, New York City.

Accounting National Section, N. E. L. A.—Hotel Muehlenbach, Kansas City, Dec. 10-11.

American Engineering Council (F. A. E. S.)—Washington, Jan. 10-11. L. W. Wallace, 26 Jackson Place, Washington.

Wisconsin State Association of Electrical Contractors and Dealers—Pfister Hotel, Milwaukee, Jan. 17-19. H. M. Northrup, 23 Erie Street, Milwaukee.

Western Association of Electrical Inspectors—Hotel Fontenelle, Omaha, Jan. 29-31. W. S. Boyd, 175 West Jackson Blvd., Chicago.

American Institute of Electrical Engineers—Midwinter convention, Philadelphia, Feb. 4-8. F. L. Hutchinson, 33 West 39th St., New York.

Commission Rulings

Unprofitable Plant Cannot Be Treated as Obsolete.—In an investigation of interurban railway rates charged by the Detroit United Railway the Michigan Public Utilities Commission said that plants in actual operation and supplying power for interurban railway operation cannot be treated as obsolete and substantially worthless, although their useful life may be about over and they are no longer economically profitable in operation, because of the possibility of purchasing power at a lower cost, since the commission cannot compel the company to contract to purchase power.

Principle Governing Extension Not Immediately Remunerative.—Ordering the North Coast Power Company to extend service to the city of Banks, which is in the company's territory and has no alternative source of supply, but to serve which involves building about 8 miles of line, the Public Service Commission of Oregon said: "As a general rule where a utility has voluntarily entered a field, as the North Coast Power Company has done, and has undertaken to serve that field, it must render adequate service, which naturally involves the furnishing of all reasonably adequate facilities. It is not necessary that the delivery of service to a new community immediately produce a full return. It should, except in extraordinary cases, hold out the prospect of not becoming a permanent burden upon the other users of the utility's service."

Good Service Depends on Proper Rates.—In recent rate proceedings affecting the Potomac Electric Power Company the Public Utilities Commission of the District of Columbia observed: "What is desired by all is good service, and this implies dependability as well as reasonable rates. To insure dependability, and for the business man particularly this is the first consideration, it is necessary that the company shall always be in a position to keep the capacity of its plant well in advance of the demand upon it. To insure economy in generating energy it is necessary that the company shall keep well abreast of progress in the mechanical and electrical arts, installing new and improved appliances promptly when their worth has been demonstrated. To do these things the company must be able to raise funds in comparatively large amounts. To enable this money to be secured at reasonable rates, if at all, requires that the company shall have good credit. It is therefore in the interest of the entire public that rates be not reduced so low as to prevent that healthy growth of the company's facilities without which the entire community might suffer serious losses and inconveniences of various kinds."

Failure to Serve Because of Lack of Co-operation and Insufficient Canvassing.—Asserting that from its own investigations and the evidence offered at the hearing it appeared that up to that time the co-operation between the Portland Railway, Light & Power Company and residents of an outlying district who complained that service had been refused them had not been conducive to a proper understanding of the rules, regulations and practices prescribed by the commission in the construction of service lines by public utility companies operating in Oregon, and that the evidence showed that the defendant company failed thoroughly to canvass the district, and as a result many of the residents along the proposed route were not fully advised as to the conditions under which electric service would be supplied by defendant company, the Public Service Commission of Oregon ordered that the desired service be extended under the rules of the commission.

Recent Court Decisions

St. Petersburg, Fla., Enjoined Against Competing with Existing Central-Station Company.—The court of the Sixth Judicial Circuit, Florida, has refused to dissolve an injunction obtained by the Pinellas County Power Company against the city of St. Petersburg forbidding it to do a general electricity supply business in competition with the company, which has a long-established plant there. The city, after supplying electrical energy from its plant to all the municipal departments requiring it, began to connect up private consumers and had five such connections made when the injunction was obtained. The court pointed to a statute which provides that before rendering private service a municipality must, if there exists a utility company in the same business, offer a fair value for the private company's plant, to be fixed by arbitration if the parties cannot agree, and then purchase the property at the price determined. The company has the right to refuse to sell, and in that event only can the city enter into competition with it.

Wisconsin Commission Wins Suit Involving Its Right to Impose Very Large Fines.—A decision with far-reaching implications has been handed down by the Wisconsin Supreme Court in favor of the Wisconsin Railroad Commission against the Washburn Water Works Company of Washburn. In 1918 the commission ordered the company to make certain extensions to its water mains following requests from city officials and property owners. Owing to the high cost of material and the scarcity of labor during the war the company claimed that it was unable to comply with the commission's order and did not put in the mains until later, the commission in the meantime assessing fines against the company aggregating close to a million dollars. When the case was tried in the lower court at Madison the court held that the commission had exceeded its jurisdiction, and the commission appealed. When the case was called for trial before the Supreme Court representatives of the water company failed to appear, and as a result the court handed down a decision sustaining the original decision of the commission and holding the company liable in the amount of the accumulated fines.

Superior (Wis.) Suit Decided in Favor of Company by Highest Court.—The United States Supreme Court appears to have dealt a blow to the Wisconsin public utilities act of 1907 in a decision rendered Nov. 12 in the suit of the Superior Water, Light & Power Company against the city of Superior. This suit was in opposition to the efforts of the city to acquire by condemnation proceedings the electric, gas and waterworks branches of the company's business. (See Electrical World, March 31, page 766; Sept. 1, page 452, and Sept. 8, page 506.) The Supreme Court, in reversing the decision of the Wisconsin Supreme Court, which had held for the municipality, declared in effect that the Legislature is without authority to invalidate contracts between public utility corporations and political subdivisions. The predecessor of the Superior Water, Light & Power Company had obtained a franchise from the city of Superior to supply water throughout the municipality for thirty years. Subsequently this franchise was amended by mutual agreement to provide that at the expiration of the thirty years it would be extended by the city for twenty-five years or the city should purchase the plant on a fixed basis of payment rated according to income. After this amendment the water company made extensive improvements and extensions. The Wisconsin public utility act of 1907 provided that utility franchises should be indeterminate. The Superior Water, Light & Power Company did not submit to this act. Subsequently an amendment by the Legislature made the indeterminate franchise mandatory. When the franchise expired the company called upon the city for an extension or for purchase of the plant according to the terms of the franchise. The city refused, relying upon the state act, and started condemnation proceedings to acquire the plant by terms other than those in the franchise. The company resisted in the courts. In upholding the contentions of the company the Supreme Court asserted that the franchise and its amendment constituted a valid contract, not subject to abrogation by the state public utilities act.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

C. N. Stannard Elected General Manager of Merger Company

Clare N. Stannard, vice-president and general manager of the old Denver Gas & Electric Light Company, has been elected first vice-president and general manager of the Public Service Company of Colorado, which was formed recently through the merger of the Denver Gas & Electric Light Company and the Western Light & Power Company. Mr. Stannard, who entered the public utility field in 1891, has been associated twenty-five years with the Denver Gas & Electric Light Company and its predecessor, the Denver Consolidated Electric Company, during which period he advanced steadily from a position in the auditing and cashier's department to the office of vice-president and general manager. He is a native of New York State and before going West spent several years with public utility companies in the East and South.

Charles A. Semrad, Boulder, vice-president and general manager of the Western Light & Power Company, has been elected second vice-president and assistant general manager of the new organization.

H. A. Douglas is now manager of the Lancaster (S. C.) Light & Power Company, succeeding J. W. Hendrick.

H. J. Hunsicker has been made chief engineer of the Adirondack Power & Light Corporation, Amsterdam, N. Y., having general charge of civil, electrical and hydraulic engineering.

W. N. Meeker has been promoted to superintendent of District No. 3 for the Indiana Power Company, with headquarters at Dugger, Ind., replacing H. W. Mayfield, who has been transferred to the general office of the company.

Eugene Lyford has become superintendent of transmission lines of the Adirondack Power & Light Corporation, Schenectady, N. Y. Mr. Lyford's appointment lessens the duties of the various resident managers in connection with the proper maintenance of transmission lines.

T. L. Bissell, formerly manager for the Westinghouse Electric & Manufacturing Company at Birmingham, Ala., has been made assistant commercial manager of the Alabama Power Company. Mr. Bissell went to Birmingham in 1916 as sales engineer for the Westinghouse company and for the past three years has been the Birmingham manager in charge of sales work.

Arthur P. Davis, the past-president of the American Society of Civil Engineers, whose dismissal as Director of the Reclamation Service by Secretary Work caused many protests from engineering and other bodies, has been elected to honorary membership by the Washington Society of Engineers. This honor has been conferred on only four others. Mr. Davis is now in England, representing the Department of State on engineering matters coming before the Pecuniary Claims Commission.

Dr. Russell, President of the I. E. E.

Dr. Alexander Russell, president of the Institution of Electrical Engineers, has been associated with the Faraday House Electrical Engineering College, London, since 1890, the year of its establishment, when he became senior lecturer and head of the physical laboratory. In 1909 he became principal of the college, and he is occupying that office at the present time. Dr. Russell was born at Ayr, Scotland, in 1861 and was educated at Glasgow University, from which institution he received M. A. and D. Sc. degrees. He then went to Cambridge. Before identifying himself with Faraday House he spent two years as an assistant lecturer at Caius College and a short time as a mathematical master at Cheltenham College and at the Oxford Military College.

DR. ALEXANDER RUSSELL

Dr. Russell has devoted considerable time to research work in physics and electrical engineering, the results of which he has contributed to the scientific and technical press. His advanced treatise on alternating current, published in 1904, was translated into French. Dr. Russell has served for many years on the council of the Institution of Electrical Engineers and has also been active on the council of the Physical Society of London, of which he is a past-president.

A. R. Small, a vice-president of Underwriters' Laboratories, was elected first vice-president of the organization at a meeting of the board of directors on Nov. 10.

H. W. Mayfield, superintendent of District No. 3 for the Indiana Power Company, with headquarters at Dugger, Ind., has been transferred to the company's general office at Vincennes as distribution engineer.

W. H. Hodge, advertising and publicity manager of the Byllesby Engineering & Management Corporation, is on a business trip in the Far West. He expects to return shortly after Thanksgiving.

Dr. Douglas W. Johnson, professor of physiography at Columbia University since 1901, has been appointed exchange engineering professor to France. Dr. Johnson, who is internationally known as educator, author and scientist, will represent for the next academic year seven institutions—Cornell, Harvard, Johns Hopkins, Massachusetts Institute of Technology, University of Pennsylvania, Yale, Columbia—with which the National Department of Public Instruction in France has established exchange relations in engineering and applied science.

George E. Jaquet, who edited the "Electrical Directory of Canada" for 1923, is now a member of the staff of the Society for Electrical Development. After being graduated as an electrical engineer from the University of Illinois, Mr. Jaquet joined the forces of the New York Central & Hudson River Railroad. Subsequently he was with the General Electric Company and the Shawinigan Water & Power Company, Ltd. Recently Mr. Jaquet has been manager of Philadelphia's first electric home, under the auspices of the society.

Maxwell V. Sauer, formerly hydraulic engineer of design of the Hydro-Electric Power Commission of Ontario, has resigned to become hydraulic engineer of Canadian Vickers, Ltd. Mr. Sauer's headquarters will be in Toronto, but he will also be consulting engineer to Vickers, Ltd., of England, in connection with hydro-electric developments in several foreign countries. During the past five years he has had charge of the design of the hydraulic features of the Queenston, Nipigon, Ranney's Falls and High Falls plants and in addition has made numerous reports on the power possibilities of various sites now undeveloped throughout Ontario, including those on the St. Lawrence River.

Frank E. Watts has joined the organization of the Apex Electrical Distributing Company, Cleveland, in the capacity of director of distribution and publicity. For the past three and a half years Mr. Watts has been identified with the Gage Publishing Company of New York, first as assistant to the president and later as editor of the *Electrical Record* and editorial director of the Spanish publication *Electricidad en America.* He has for ten years made a special study of the economics of distribution.

M. P. Rice Heads G. E. Publicity Department

Martin P. Rice, who was recently made publicity manager of the General Electric Company, as was announced in the Nov. 17 issue of the ELECTRICAL WORLD, entered the service of the company in 1895 and was first employed in the drafting room. After nine months he was transferred to the engineering department, and when the X-ray was discovered he was assigned to that new work. When the publication bureau was organized in December, 1897, he was made manager, a position he has held since that time. In this capacity he had supervision of all company printing, photographs, technical data and general publicity. In June, 1903, he established the *General Electric Review* as an internal publication, but today it is considered one of the important technical magazines of the country. In February, 1921, when the General Electric Company became interested in radio broadcasting, Mr. Rice was made director of radio broadcasting, and in this position he outlined the company's policy in this new field.

F. M. Kollock has resigned as treasurer of the Westinghouse International Company and will leave for Australia about Dec. 1 to look after Westinghouse interests in that country.

Thomas B. Card, formerly assistant superintendent of distribution of the Dayton (Ohio) Power & Light Company, is now connected with Stone & Webster, Inc., as assistant engineer.

John B. O'Connell, formerly engaged in design work for the Pennsylvania Railroad, is now associated with the Public Service Company of Northern Illinois.

R. M. Edwards, superintendent of the Poteau district of the Oklahoma Gas & Electric Company, has been transferred to Shawnee, Okla., as superintendent. E. Spillers has succeeded Mr. Edwards at Poteau.

William E. Rogers, formerly manager of the municipal electric light plant, Leesburg, Fla., is now power sales engineer with the Pennsylvania Power & Light Company at Wilkes-Barre, Pa.

James F. Muir, formerly mechanical engineer for Toltz, King & Day, Inc., St. Paul, has become associated with Stone & Webster, Inc., as engineer in the mechanical division, with headquarters at Boston.

R. C. Rice, district engineer in Arizona for the United States Geological Survey, has resigned to enter the employ of the Southern California Edison Company. W. E. Dickinson of Salt Lake City will succeed Mr. Rice in the Geological Survey position.

Walter S. Gifford was elected executive vice-president of the American Telephone & Telegraph Company at a recent meeting of the board of directors. Mr. Gifford has been associated with the company since 1908, when he became its chief statistician. During the war he obtained a leave of absence to serve as director of the Council of National Defense and upon his return following the war was appointed comptroller of the company. A year later he was made a vice-president in charge of financing and accounting, and for the last two years in addition to these duties he has done executive work for the headquarters organization.

John M. Fernald, for the past four years on the sales engineering staff of the Cutler-Hammer Manufacturing Company, with headquarters at Boston, has been appointed general sales representative of the S. A. Woods Machine Company, South Boston motor division. Mr. Fernald succeeds the late M. J. Fitch in the Woods sales organization.

E. M. Herr the New President of Electrical Manufacturers' Club

Edwin M. Herr, president of the Westinghouse Electric & Manufacturing Company, was elected president of the Electrical Manufacturers' Club on Nov. 14 at Hot Springs, Va. Mr. Herr has been chief executive of the Westinghouse company since 1911, and for six years previous to that he was its first vice-president. When he first entered the electrical industry he engaged in railroad work, but he abandoned this field in 1898 to become assistant general manager of the Westinghouse Air Brake Company. A year later he was promoted to the office of general manager, which position he occupied until his election to the vice-presidency of the Westinghouse company. Mr. Herr is a native of Lancaster, Pa., and a graduate in mechanical engineering of the Sheffield Scientific School of Yale University. In addition to being president of the Westinghouse Electric & Manufacturing Company, Mr. Herr is president of the Westinghouse Lamp Company and vice-president of the Bryant Electric Company, the Perkins Electric Company, Bridgeport, Conn., and the R. D. Nuttall Company, Pittsburgh. He is a member of the A. I. E. E., the A. S. M. E. and the American Civic Federation.

E. M. HERR

Obituary

William F. Brewster, a founder-member of the Edison Pioneers, died on Nov. 9. Mr. Brewster, who was one of the earliest pioneers of the central-station industry, attended Engel's Academy, Port Huron, Mich., when Thomas A. Edison was a student there, and later he was associated with Mr. Edison in the marketing of the electric light. Mr. Brewster went to Chicago about the time of the World's Fair and has since been identified with the Commonwealth Edison Company.

H. H. Hermes, formerly commercial manager of the Oklahoma Gas & Electric Company, died on Nov. 4 in Independence, Kan. Mr. Hermes was well known in Oklahoma City when he was commercial manager, about five years ago.

William D. Packard, a member of the pioneer firm manufacturing "Packard lights," died at his home in Warren, Ohio, Nov. 11 after an illness of several years. Mr. Packard was widely known in electrical circles in Warren through his activities in bulb manufacture. He and his brother, J. W. Packard, were the founders of the Packard Motor Company about twenty-five years ago. Mr. Packard was sixty-two years of age.

William G. Bligh, a retired executive engineer of the Indian Public Works Department, died recently in Calgary, Alberta, at the age of seventy-seven. Mr. Bligh was born at Great Malvern, England, but lived in India for a number of years in the employ of the Public Works Department. He designed and constructed some of the largest irrigation work in Burma and other provinces of India.

Raymond J. Miller, well-known electrical engineer of Atlanta, and for the past two years head of the R. J. Miller Electric Company, died recently at his home in that city at the age of thirty-seven. From 1913 to 1919 Mr. Miller was connected in an executive capacity with the repair department of the General Electric Company, Atlanta branch, and during the latter year he went to New Orleans to enter the electrical business for himself. He remained there for a short time, then returned to Atlanta and organized the R. J. Miller Electric Company.

John E. Moore, power-plant specialist and electrical engineer in charge of plant methods of the Western Electric Company at Chicago, recently died. Mr. Moore had been with the company since 1908 and was largely responsible for the conversion of the power plant and distributing system from direct current to alternating current, the development of a complete line of panel boxes and a power-loop distributing system in connection therewith, and also the development of special applications to many types of machinery of multi-speed alternating-current motors with controlling apparatus. Mr. Moore was a graduate of Purdue and had been a professor of electrical engineering at Princeton.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

A Survey of the Business Outlook*

A Balance of the Favorable Against the Unfavorable Conditions in the Prospect Before the Electrical Industry Gives Encouragement

BY FREDERICK P. VOSE
General Secretary National Electrical Credit Association

A REVIEW of the credit and collection conditions of the country generally and in the industry specifically shows that the business situation is satisfactory to the conservatives. It is not so satisfactory to those of speculative proclivities. Last spring the optimistic outlook ran away with sound judgment. Then business received a setback because of ill-reasoned rumors that foretold panic or serious trade depression. Neither materialized, for there was no sensible ground for either.

F. P. VOSE

FAVORABLE FACTORS

There is now recognized a conservative but encouraging reaction predicated upon the following grounds:

1. The people are generally employed. All who desire to work are busy.
2. The savings deposits are greater than ever before.
3. The Federal Reserve system has proved its worth as a stabilizer of credits.
4. Railroads are making satisfactory headway financially and are operating at high efficiency. They are placing large orders for equipment and supplies for present and future deliveries. Topnotch records of car loadings indicate wide distribution and consumption.
5. Farm products, while lower in proportion to manufactured products, are in line for a substantial increase. The farmers are receiving better prices than last year.
6. Mail-order houses report increased volume of business, proving enhanced buying power on the part of rural communities, which represent over 45 per cent of our total population.
7. Further stimulus to general business is expected to result from the efforts of leaders of the building trades to keep construction going through the winter to make it an all-year-around industry.
8. The country is becoming so solid in its business structure that in spite of the unsettled conditions of Europe we may comfortably look forward to a period of measurable prosperity.

The chain-store systems are showing substantial gains. This is also true of the department-store trade. These, together with mail-order houses, reflect perhaps as accurately and as adequately as any other sources the ability of the buying public generally to purchase and pay for their requirements.

The building records of recent months are being more than sustained generally. Much new work is being projected. Architects and contractors generally agree that there is a large body of construction in hand and in sight. The permit statistics from 262 principal cities reveal a gain of 32 per cent over building in October, 1922.

The foreign trade situation is remarkably encouraging. The October record published by the Department of Commerce on Nov. 13 shows outgoing merchandise of a value of $402,000,000. This is the first time since February, 1921, that exports have exceeded the four-hundred million mark. They have increased both in volume and value over last year.

The total exports for the last ten months were over $222,000,000 greater than in the corresponding months of last year. Our exports to Latin America have increased 33½ per cent over 1922.

While merchandise imports also show enlarged volume, the trade balance favorable to this country for October amounted to nearly $100,000,000. For the ten months of 1923 the net imports of gold were in excess of $223,000,000, compared with $199,687,000 for the corresponding period last year.

UNFAVORABLE FACTORS

One of the recognized barometers of business pointing toward a pause in the expansion of trade is the decrease of unfilled orders reported by the United States Steel Corporation for October, showing 363,000 tons less than in September and leaving the total of unfilled contracts the smallest since March, 1922. Some assume from this that business is headed toward contraction. However, the statistical trend does not square closely enough with the characteristics of a liquidation period to warrant the assumption that business depression has begun or is imminent.

It is significant that the general level of commodity prices is firmer. Prices are neither sky-rocketing nor plunging headlong. The general level is stabilizing.

Has your attention been called to the recent significant statement by Sir Arthur Balfour? He is a manufacturer in Sheffield, England, president of the Associated Chamber of Commerce of Great Britain and personally a leading figure in British industry. Sir Arthur has been in the United States and has made a very careful present survey of this country. On his return home he gave utterance to expressions like this—that he would not exchange England's position for America's today; that he regarded the financial

*An address before the winter meeting of the Electrical Supply Jobbers' Association, Buffalo, Nov. 15, 1923.

and economic situation in Britain as fundamentally much stronger than that in this country. He said:

> The cost of living and the cost of production in America is so high that I am perfectly certain that, except in a few selected articles, we can compete with her for the export trade of the world. The Americans have just passed through a slight slump, but I think they are likely to have a fair internal trade for the next eighteen months. After that I think they will go through three or four depressed years, which will be the only method of re-establishing the economic situation and getting them back to a competitive basis. At present the wages being paid are so high that building is much restricted and rents are impossible.
>
> America is depending very much upon the sale of her wheat crop and her cotton crop in Europe and has only just begun to realize that other parts of the world are in a position to supply the necessary wheat to England for instance, and that in view of the Fordney tariff and the manner in which it is restricting trade with them, England is naturally compelled to buy her foodstuffs in markets where she can create a favorable exchange by trading.

You may have noticed also that when the American Bankers' Association held its last convention, in August or September, its speakers re-echoed the sentiment expressed by Sir Arthur Balfour. It was the sane counsel of the bankers of this country which checked that forward, foolish rush this spring. They knew from their past experience that this country could not stand another period of inflation following so soon on the heels of the previous one.

The spirit of aggressive confidence that was lost last spring has not been regained. Psychology is playing a large part. The effect of the action of the public mind is the same whether the thinking is well ordered or not. The state of business is largely, therefore, the condition of confidence in the minds of the people. One of the elements entering into reactionary thinking which tend to repress enterprise is that the industrial dollar is still sadly out of balance with the agricultural dollar. The policy of labor organizations in forcing wages upward and refusing to make concessions is a serious handicap. The basis of all just compensation is service. Values must be created to sustain every wage paid. There is still being manifested in some of the industries concerted action aimed to cut down working hours but to maintain the wage. Thus the cost of living is being increased by the high wages being paid to those engaged in essential industries. These, in turn, react and create a vicious circle detrimental to all.

These are, roughly and crudely, only some of the elements that have entered into and affected adversely the common mind, leading many to fear that at almost any moment reaction may take place. This may account, in part, for the cautious buying from hand to mouth that has characterized not a few lines throughout the country.

So much for an acknowledged incomplete survey, pro and con, of conditions generally. Happily, on the whole, they may be summed up as distinctly encouraging. I am delighted to be able to say just that, for on two prior occasions in speaking before this body, in 1920 and 1921, I have been rated as a pessimist. Today I am sanely optimistic with respect to the body social and economic.

CREDIT IN THE TRADE

Now, specifically, on a questionnaire that was sent out to a number of electrical jobbers and manufacturers in a widespread number of cities, the first question asked was: "Are your sales for the first ten months of this year greater than for the corresponding months of 1921-22?" The answer among jobbers was ten to one in favor of greater sales. The answer among manufacturers was eight to one in favor of greater sales.

The second question was: "Are you encountering difficulties in collecting your outstanding receivables?" The jobbers' answers were equally divided between encountering greater difficulties and average difficulties. The manufacturers' replies indicated slightly greater difficulties encountered in collections, especially during September, than are averaged normally, and yet in reply to question 3, "Are you encountering greater difficulties than in 1921-22?" the answer was about three to one "No."

On question 4, "What percentage of your outstanding receivables are you compelled to watch and follow closely?" the spread among the jobbers was from 2 to 25 per cent. Among the manufacturers the average ran from 10 to 15 per cent.

On question 5, "What percentage of your outstanding receivables do you report to the E. C. A.?" the replies indicated from 1 to 15 per cent, averaging less than 5 per cent.

On question 6, "What percentage of those reported to the E. C. A. are adjusted by the use of the forms?" the jobbers' record showed a spread of from 30 to 80 per cent, the average being 58 per cent. Among manufacturers the spread was from 33⅓ to 90 per cent, averaging 67 per cent.

In response to question 7, "What percentage of your outstanding receivables do you turn over to attorneys for collection?" the majority of jobbers reported less than 1 per cent. Forty-odd per cent reported from 1 to 3½ per cent. The majority of manufacturers turned over to attorneys less than 1 per cent, whereas those reporting from 1 to 2½ per cent placed with attorneys were about one-third of those reporting less than 1 per cent, and those reporting from 3 to 5 per cent placed with attorneys were likewise about one-third of the number reporting less than 1 per cent.

The amount collected by attorneys averaged among the jobbers 54 per cent, whereas the manufacturers reported 68 per cent, showing apparently greater credit risks being taken and losses suffered by jobbers. The average percentage of losses through bad accounts among the jobbers was seven-tenths of 1 per cent for the years 1921, 1922 and 1923, whereas the manufacturers reported three-tenths, plus, of 1 per cent. Some manufacturers reported much higher losses in 1922 growing out of the depression of 1920-21.

N. E. C. A. RECORD

In the New England territory the claims reported July, August, September and October, 1923, showed a falling off in number as compared with the corresponding months of 1922 and a slight falling off in the average amount of dollars per claim reported.

In the New York territory the number averaged less, but the amounts averaged slightly more. In the Middle and Southern Atlantic States the number of claims was less and the average amount involved was less. In the Central Division the average number was slightly less (with the exception of the month of October, which showed a noticeable increase in number and amount), but the average amount was slightly increased during the last four months. On the Pacific Coast the average number was increased and the average amount was increased also.

On the whole, the number of slow and unsatisfactory accounts this

year shows the tendency to decrease in number, but with a recognized slight increase in the amount involved per claim. This points to the conclusion, which seems to be true, that credit men are more carefully scrutinizing their credit risks and are following more persistently their collections.

In the country collection department of a law office which has specialized for more than a quarter of a century in handling collections for the electrical jobbers and manufacturers the record for the first ten months in 1921 was 244 per cent, as compared with 1919. It was 311 per cent in 1922 as compared with 1919 and 267 per cent for the first ten months this year as compared with 1919, substantially the same number of clients utilizing the service. This would indicate a falling off in number of claims as compared with last year and but a slight increase of the claims this year as compared with the year 1921. The sums collected show an increase over last year.

Commercial failures in the United States for the first ten months this year totaled 15,173, as against 20,125 for the corresponding months of 1922 and 15,220 for 1921.

While the amount of liabilities involved in the reported failures of October, 1923, was $79,301,741, and this has only been exceeded by the month of December, 1921, a separation of the failures of exceptional size shows that five insolvencies alone supplied more than one-half the October liabilities. The number involved for October was 1,673, which is less than in the corresponding month of 1921 and 1922.

From the foregoing statistical review it clearly appears that the records are in complete harmony and consistent with the general underlying business conditions throughout the country, all pointing to a sanely encouraging outlook. All the electrical jobbers and manufacturers who have freshly in mind the losses incurred in 1920 and 1921 through pyramiding and cancellation of orders and sharp deflations in prices will not speedily again place their necks in the noose which caught them then. And what is true of the electrical jobbers and manufacturers is true of the trade generally.

Reasonable conservatism should continue to characterize the market. All should take heart and face the future with full faith that prudent optimism is amply justified.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

NO MARKED change appears in the story of business conditions in important centers of electrical trade this week. Heating appliances, portable lamps and all devices suitable for Christmas gifts naturally hold the center of the stage with both retailer and jobber and will continue to move in increasing volume until the week of Christmas. In both the New York and Chicago territories there has been a falling off of central-station orders for equipment, but the rise in the price of copper has put more spirit in the wire market and there has been much gossip in the Middle West of an intended increase in the price of rubber-covered wire.

General business conditions in New England are good. The electrical business is improving there. Building continues strong in the Middle West. The industrial market on the Coast has been brisk. In the South the popularity of the electric range seems to be growing steadily, with increasing sales reported. The volume of radio business is steadily growing throughout the country, with every indication of a most successful season.

The proposal by the Secretary of the Treasury for reduction of federal income taxes has attracted a great deal of interest throughout the electrical industry, and another gain in export trade has added still further encouragement.

Recommendations on Lamp Cords and Appliance Plugs

FOR the purpose of reducing the stocks that must be carried by the electrical jobber throughout the country definite recommendations were made at the recent meeting of the Electrical Supply Jobbers' Association looking to the elimination of unnecessary styles of lamp cord and fixture wire. Manufacturers of portable lamps and lamp fixtures are requested to use only No. 18 new code $\frac{1}{32}$ approved types of cords, and the National Fire Protection Association was requested to co-operate with and indorse this recommendation. It was also recommended that manufacturers of heating appliances standardize on two types of heater cord, cord with two conductors individually braided and twisted and cord with two conductors individually braided, and that they be produced only in black color. It is also recommended that the varieties of silk and artificial silk cords be hereafter restricted to the following colors: white, brown, old gold, brush brass, maroon and olive green.

It was also reported at the jobbers' meeting that twelve of the manufacturers of heating devices have so far approved the recommendation made by the association some time ago that slow-moving and obsolete types of heating devices be eliminated from the manufacturers' catalogs. To assist in this work, the members of the heating devices committee are furnishing lists of types that are slow-moving and obsolete in their territories, recommending to the manufacturers that they be discontinued, or cataloged and listed separate from standard lines, so that distributors can eliminate handling the slow-moving types, if it is to their advantage to do so, and continue to handle standard types.

Ten manufacturers so far have agreed to conform to a standardization of the pins and plugs on the device ends of appliance cords, but there are a number of manufacturers who still refuse to do so, so that the establishment of any practical standard has not as yet been effected. The jobbers recommended at this meeting that the manufacturer give particular attention to bettering the quality of the plug at the device connection so that present troubles due to poor connections of the cord with the appliance may be relieved.

Simplification in the Fan Line Crystallizing, Jobbers Report

PROGRESS in the simplification of the electric fan line appears to be crystallizing. Reports from jobbers in various sections of the country indicate that discontinuance of production of the six-blade fan, in response to an almost complete cessation of demand, is now practically an accomplished fact. Of the more important manufacturers, seven no longer make or catalog the fan, and most of the remainder will adopt a similar course when present stocks of parts or completed product are exhausted.

Sentiment with reference to the abandonment of the non-oscillating fan is still divided, not only among manufacturers but among jobbers as well. There seems to be a preponderant opinion that the demand for the 16-in. non-oscillator has abated to a point where this type may safely be taken off the market, and several manufacturers have formally committed themselves to the action. Others prefer to continue observing the market, and this is almost unanimously the case with reference to the 12-in. non-oscillator. It seems to be general sentiment within the trade that by abandoning the production of non-oscillating types production costs of oscillators might be lowered, and it is pointed out that the manufacturers first taking advantage of this fact will find their strategic

positions in the industry vastly improved.

The reaction of the manufacturing branch of the industry to proposals that the ceiling fan be made more competitive in price with other types has not as yet been favorable. The demand for this type apparently does not afford the opportunity for quantity production necessary to place it on a level with comparable sizes of desk fans. Many jobbers and dealers feel, however, that if the fan could be brought within the reach of all those desiring it, the opportunity for quantity production would follow as a matter of course.

Heavy Duty Ranges and Heaters Active in New England

ELECTRIC heating equipment for hotel and bakery service is moving vigorously in New England, and the year's sales will undoubtedly close with a total considerably above 1922. Hotel ranges have been making fine records during the last year or two, and repeat orders are beginning to come in as evidence of purchasers' satisfaction. A new hotel under construction at Manchester, N. H., will be equipped with a large range as a direct result of satisfactory service by the controlling interests, which operate an "all-electric" hotel in Portland, Me.

Along the main automobile routes between the larger cities many food shops, tea rooms and restaurants have lately been equipped with electric cooking apparatus. In some cases sales have resulted directly from satisfactory experience by owners with domestic ranges in their homes before the building of these motor inns, and a liberal policy in regard to line extensions has been a factor in securing this class of business.

Rapid advances are being made in the design of all sorts of heavy-duty heating equipment, and in the bakery field many ovens have lately been installed in New England for pie and cake production, with other important installations for bread baking. The better class of summer hotels is swelling the "prospect" list of range distributors, and central stations are showing more interest in rate schedules designed to facilitate economical service in the heavy-duty line.

Increasing Electrical Sales by Ten-Cent and Chain Drug Stores

AN INTERESTING trend in the sales of cheap electrical merchandise now being sold in the five-and-ten-cent establishments and the chain drug stores of New York City is the practice of selling special parts of numerous articles at so many cents apiece. These sales are being made in increasing volume and affect the lamp, wire, fixture, bell-ringing transformer, signal system and radio markets particularly.

During the week silk-covered lamp cord of fair make was selling in the lowest grade stores at 5 cents for one foot, and cotton-covered lamp cord at 5 cents for two feet. Christmas-tree lamps from Japan in the shape of attractive fruit, animals, birds, etc., were selling at 10 cents, with individual sockets priced at 5 cents.

If one cares to search through the great number of parts of the average radio counter, he is able to find enough binding posts, wire, condensers, brass fittings, insulation, etc., at a few pennies apiece to make a radio receiving set which will operate satisfactorily if the tubes, batteries and receivers are purchased elsewhere. The newest practice for those who are not seeking quality but cheap quantity is to buy iron conduit boxes, iron fittings, switch plates, tubes of brass, parts of sockets, porcelain, all at 5 and 10 cents apiece, and place them together into push flush switches, portable lamps, wall brackets and other similar junk which will soon blow out fuses or fall apart.

In the chain drug stores are also found a few parts for assembling at home. Sales in those establishments run at cut prices and to foreign goods, which is causing the first-line manufacturers considerable concern. An electric coffee percolator of aluminum with black wooden handles was selling last week at $3.69, foreign irons at $1.50, curling irons, American made, at $1; table stoves, American and foreign made, at $1.50, and therapeutic equipment at from 25 to 50 per cent below the market price.

Most Interest in Buying Centers in Retail Trade of New York

EXCEPT for a natural growth in the retail end of the electrical business of New York City, the market is without particular feature. The largest volume of sales in the retail end is for the complete line of heating and cooking appliances, a situation which is expected to continue steady until late into December. On the other hand, orders for poles, high-tension insulators and the general line of wire have fallen off considerably during the last two weeks, jobbers and manufacturers report. Moreover, the identical irregularities that have been paramount in the market during the last three months are still present in different quarters. The wire market continues to fluctuate with the changing prices of the raw-material market, and insulator deliveries are still bothering normal progress in that market when orders are not secured by those who are able to deliver in the most satisfactory time.

Proposals for a reduction of federal taxes have occasioned wide favorable comment in the electrical business of this district, and a further gain in export trade has given encouragement to some of the interests. Other conditions affecting the buying power of the consumer are improved, and there is little non-employment at the present time.

Pace Quickens in New England Trade; Deliveries Satisfactory

IN BOTH heavy and light material the demand upon manufacturers and jobbers in the Northeast is steadily improving. With the exception of high-tension porcelain insulators, deliveries are generally satisfactory, although cable and radio equipment is none too plentiful. All signs point to a record-breaking appliance business in the approaching holiday season.

A tendency is apparent among contractors to buy flexible armored conductor in 2,500-ft. and 5,000-ft. lots instead of in smaller quantities. Wire is moving actively, both weatherproof and rubber-covered showing much life, and last week there was a perceptible stir in bare copper wire for up-country transmission-line use.

Building contracts in New England for the week ended Nov. 13 totaled $7,414,400, against $5,574,100 for the corresponding week of 1922, more than doubling any other corresponding week for twenty years. Slow improvement in textiles, a better tone in shoe manufacturing, a steady production in metal-working shops, busy retail trade, increasing central-station earnings and close control of inventories characterize general business. Widespread enthusiasm has been aroused by the federal income-tax reduction proposed by the Secretary of the Treasury.

Atlanta Jobbers Report Difficulty in Keeping Certain Stocks

GENERAL business conditions in the Southeast continues very healthy, and electrical jobbers report their business as entirely satisfactory. Deliveries have been good, and as a result stocks are in fine shape for the anticipated holiday trade.

Heating-device sales continue to be phenomenal, and several jobbers have had to reorder when they thought they had stocks sufficient to carry them through the holiday season. Owing to the very mild weather to date, air heaters have been in demand, and pres-

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.0354	$0.0354	$0.0304
Cold finished shafting, per lb.	0.0465	0.0465	0.039
Brass rods, per lb.	0.1475	0.1525	0.17
Solder (half and half), per lb.	0.31	0.295	0.275
Cotton waste, per lb.	.10 to .13	.10 to .13	.09 to .11½
Washers, cast iron (½-in.), per 100 lb.	6.50	6.50	6.00
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.38	3.38	3.02
Machine oil, per gal.	0.297	0.297	0.33
Belting, leather, medium, off list	30–10%	30–10%	30–10%
Machine bolts, up to 1-in. x 30-in., off list	40–10%	40–10%	40%

ent indications are that there will be no carry-over of this item this year.

Central stations and jobbers are pushing electric ranges, and as a result sales are excellent and the popularity of this item is growing steadily. The sales of ranges are reflected by a considerably increased business in the 10-kw. transformers, and jobbers report their stocks of this size transformer somewhat reduced. Meters of the 25-amp. and 50-amp., three-wire types are going well and reasonable stocks are on hand.

Sales of most classes of schedule material entering into construction work have been good, and jobbers experience some difficulty in keeping satisfactory stocks of certain items. This condition will doubtlessly continue to the first of the year as building construction throughout the terriotry has been very heavy. Several heavy orders for line material for both the 2,300-volt and the high-voltage types have been received by jobbers in the past ten days, and one jobber reports the receipt of one order for twenty-five carloads of 50-ft. to 70-ft. poles.

San Francisco Business Recovers; Excellent Industrial Orders

ELECTRICAL business in the industrial field is very good, as is evidenced by the brisk sale of such installation items as safety switches and other control apparatus. Building seems to be slackening in the San Francisco Bay region but holding up well in the interior, while it may set another high record in southern California. Retail business is very much better. The rainy season is deferred, but this condition as yet has not had any noticeable effect in the agricultural sections.

A recent two-car order for bare copper wire is reported for an irrigation project. Schedule-material business is excellent as more and more stocks are being replenished and certain new plugs and convenience outlets are being featured. Radio batteries are finding a more interested market.

Wire Base Unbalances Chicago Market; Active Conduit Sales

APPARENTLY there is considerable unrest in the Chicago electrical market this week. The advance in bare copper of a 1½-cent base in the last few days would appear to indicate that wire should shortly go to a higher level, at least to its previous figures. The increase in copper amounts to about 13 cents on No. 14 rubber-covered wire at its present price. While there has been no advance in rubber-covered wire as yet, jobbers and purchasers may find it advisable to give this commodity attention at this time. The same situation prevails in magnet wire, which is usually affected to a greater extent by the fluctuation of bare copper and cotton, both of which have been climbing lately.

There appear to be indications that certain interests which control the bare copper wire used by the rubber-covered manufacturers are seeking to establish a set price on such wire for all manufacturers. If this effort should be successful, the electrical industry will possibly see higher prices, with competition reduced considerably. There have been rumors of an advance in loom prices, but up to the present writing no such action has been announced; however, the conference of loom manufacturers this week, with the cotton market in a strong position, should have particular attention for this reason.

Sales of conduit, pole-line hardware and wiring devices have been very good. The intensified building activity in this vicinity keeps the demand up.

French Figures Show Electrical Manufacturing Developments

FRENCH government figures indicate a heavy increase in customs dues on general imports during the first eight months of 1923. This means increased general imports. The electrical industry follows the same course, but the increase in imports is slight as compared with the general average, while on the contrary French exports in the same industry show an increase of more than 41 per cent as compared with those of 1922 for the same period.

With respect to both imports and exports in general, where tonnage has decreased, values appear to have increased in almost every instance. This is notably the case with exports in this industry. The fact is perhaps explained with regard to imports by the shrinkage in the value of the franc as compared with a year ago, but it "jumps at the eyes" as the French view it when exports as well are concerned. It may be inferred that French manufacturing costs in the electrical industry have not been lowered, nor the export selling price either. The situation is anomalous.

Exports in the French electrical industry for the eight-month period were:

	1922		1923	
	Metric Tons	Value, Francs	Metric Tons	Value, Francs
Porcelains, glass, etc.	561	2,163,000	881	3,596,000
Arc and incandescent lamps	144	10,404,000	186	14,238,000
Wire and cables	2,429	28,419,000	1,828	22,675,000
Dynamos and parts	304	5,757,000	455	9,116,000
Electrical machinery and tools	1,578	16,966,000	1,548	17,574,000
Electrical and electrotechnical appliances	1,632	52,227,000	2,310	78,336,000
Batteries and parts	542	2,143,000	415	1,737,000
Total	7,190	118,079,000	5,623	167,272,000

Exports thus show a decrease of 1,567 metric tons and an increase in value of 49,193,000 francs.

Imports in the French electrical industry for the eight-month period were:

	1922		1923	
	Metric Tons	Value, Francs	Metric Tons	Value, Francs
Porcelains, glass, etc.	644	2,069,000	545	2,463,000
Arc and incandescent lamps	178	14,591,000	200	15,703,000
Wire and cables	68	973,000	95	3,583,000
Dynamos and parts	275	4,663,000	356	8,265,000
Electrical machinery and tools	3,636	32,121,000	2,642	31,225,000
Electrical and electrotechnical appliances	866	17,964,000	990	26,589,000
Batteries and parts	382	1,094,000	256	1,391,000
Total	6,049	73,475,000	5,084	89,219,000

Imports thus show a decrease of 965 metric tons and an increase in value of 15,744,000 francs.

Of the outstanding imports, those of dynamos and parts, electrotechnical appliances and wire and cables appear to be significant. The latter item shows a falling off in exports, while the two former have made notable advances in imports.

In all comparisons of these figures with those of the period before the war—above all, with regard to exports—it must not be ignored that the electrical industry of Alsace, which was formerly German but which is now French, cuts a big proportionate figure.

The Metal Market

THE feature in the non-ferrous metal market of the week is the spectacular and steady advance in the price of copper, which has risen about as rapidly as it declined just a few weeks ago. The lead and zinc markets have also improved, so that on the whole the markets have been cheerful ones for the producers. The improvements shown in New York prices have been accompanied by advances in London, despite the drop in sterling exchange. Both copper and lead are in good demand abroad.

NEW YORK METAL MARKET PRICES

	Nov. 14, 1923 Cents per Pound	Nov. 21, 1923 Cents per Pound
Copper, electrolytic	12.87½	13.00
Lead, Am. S. & R. price	6.75	6.85
Antimony	9.25	9.50
Nickel, ingot	27.00 to 32.00	27.00 to 32.00
Zinc, spot	6.35	6.40 to 6.45
Tin, Straits	42.05	43.00
Aluminum, 98 to 99 per cent	26.00 to 27.00	26.00 to 27.00

Zinc prices have improved slightly, carrying them to between 6.40 and 6.45 cents per pound East St. Louis. Sales have been fair to both galvanizers and brass manufacturers. Brass "special" was sold during the week at a premium of $2 per ton over the price of prime Western. Statistics of the American Zinc Institute for October show an increase in stocks of 2,894 tons. Production was 42,098 tons. Shipments were 39,204; stocks, Oct. 1, 22,893; Oct. 31, 25,787; shipped for export, 6,978. Producers look for a renewal of export demand in the near future.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Western Electric Publishes Miniature Newspaper in Chicago Press

In order to tell every Chicagoan something about the Western Electric Company, that organization is publishing twice a month a miniature newspaper in the daily newspapers. It was felt that, inasmuch as the company's employees and their families in Chicago number 120,000 persons, there must exist enough interest in the organization's work to warrant some paid space in the daily newspapers. This miniature newspaper is four columns in length and gives much information of a general nature regarding the development of Western Electric.

Altorfer Appoints R. W. Gorham

Announcement is made by the Altorfer Brothers Company, Peoria, Ill., manufacturers of "A B C" washing and ironing machines, of the appointment of R. W. Gorham as sales manager, effective Nov. 1, 1923. Mr. Gorham brings to the Altorfer company a background of wide experience, having been associated with "A B C" products for the last three years, and sales manager of several large electrical manufacturing companies of the industry in the East and Middle West.

Holland & Monaghan Established as Manufacturers' Agents

Holland & Monaghan, organized by H. Van Cott Holland and Owen Monaghan, who for many years were connected with the Thomas & Betts Company, New York City, manufacturers of conduit and conduit fittings, have established headquarters as manufacturers' agents at 30 Church Street, New York.

Super Safety Switch Enlarges Manufacturing Space

The Super Safety Switch Electric Company has recently completed a new building at 103d and Racine Streets, Chicago, in order to enlarge facilties to take care of the increasing demand for its products. Extra floor space capacity of 840 sq.ft. will allow the production of a complete line of switches ranging from 30 amp. to 200 amp.

H. J. Caffrey Opens Office as Manufacturers' Agent

Announcement is made of the opening of offices at 51 East Forty-second Street, New York City, by Harry J. Caffrey as a manufacturers' agent. For the past thirteen years Mr. Caffrey has been with the Manhattan Electrical Supply Company, New York City, first as outside salesman and later as manager of the company's Harlem store in West 125th Street. After four years at the Harlem store he was appointed district manager for the New England States, operating from Boston as headquarters.

New York Power Show to Include Material-Handling Equipment

Material handling equipment, electrically propelled, will be included in the National Exposition of Power and Mechanical Engineering to be held in the Grand Central Palace, New York City, from Dec. 3 to 8 inclusive. Conveyors, industrial trucks, elevators, hoists and large scales are on the list. The managers of the exposition are Fred W. Payne and Charles F. Roth, with offices in the Grand Central Palace. A list of 250 exhibitors has been issued.

Standard Underground Changes

The Standard Underground Cable Company, 100 Seventeenth Street, Pittsburgh, Pa., announces the following changes in personnel recently made in the Perth Amboy (N. J.) organization: H. W. Fisher has been advanced to technical director of electrical engineering, while continuing also as manager of the lead-cable and rubber departments. R. W. Atkinson has been appointed chief electrical engineer. G. J. Shurts has been made production manager of the lead-cable department.

Aladdin Appliance Firm Acquires Plant of Highlands Company

The Aladdin Manufacturing Company, Munice, Ind., manufacturer of electrical appliances, has acquired the plant and business of the Highlands Manufacturing Company, maker of kindred products, operating under a receivership for about two years. The new owner has construction in progress on new buildings and purposes to consolidate the works at this location and install additional equipment. George N. Spencer is president and William F. Spencer vice-president.

"Mercury" Truck Appoints Agent for Philadelphia Territory

The Mercury Manufacturing Company, 4118 South Halsted Street, Chicago, has granted an agency to Edmund Herbert Jahnz for its electric industrial tractors and trailers in the Philadelphia territory. Mr. Jahnz, whose office is at 2009 Market Street, was formerly with the United States Army and later with the Lakewood Engineering Company.

General Electric Contemplates Doubling Canadian Output

According to officials of the General Electric Company, the outputs of the recently acquired Canadian General Electric Company and the converting subsidiary, the Canadian Allis-Chalmers Company, will be doubled in the near future. It is estimated that the American company will spend more than $15,000,000 on the Canadian company, including the stock purchase, plant rehabilitation and working capital.

General Electric was particularly desirous of obtaining Canadian plants in order to manufacture for sale in the British Empire under the preferential tariff. It has already diverted an important British colonial contract to the Canadian company's Peterboro plant. Formerly the Canadian company was unable to use General Electric patents on Empire orders, while the American company was unable to sell any of its equipment in Canada except through the Canadian concern.

Enough Canadian stock has been purchased in the open market to insure completion of the transaction. While regret is felt over the loss of the Canadian identity, the Canadian plants had an unsatisfactory earning record and intermittent operation. President Dyment at Toronto says that with the output of the Canadian plants doubled they will be used largely for export business.

The O'Neil Manufacturing Company, 715 Palisade Avenue, West New York, N. J., will manufacture electrical equipment for the Audiphone Company of America, 39 Cortland Street, New York City. L. R. O'Neil is head of the company.

Landers, Frary & Clark, New Britain, Conn., manufacturers of electrical appliances, have awarded a contract for a new building of six stories to be erected in Torrington, Conn., this year.

The Fuller Gates Company, Hartford, Conn., recently organized with capital stock of $50,000 to manufacture electrical wiring devices, is about ready to start manufacturing. Fred P. Gates is vice-president in charge of operations.

The Independent Electric Supply Company, 59 Warren Street, New York City, has leased the five-story-and-basement building at 52-54 Murray Street and will occupy it for a new distributing plant and headquarters.

The Remy Electric Company, Anderson, Ind., will lay foundations at once for the construction of a one-story addition to its plant, totaling about 12,500 ft. of floor area, estimated to cost $25,000. It will be used entirely for manufacture.

The Newark Transformer Company, 71 Hamilton Street, Newark, N. J., has been organized to manufacture transformers, specializing in the smaller units up to and including 50 kw. The company has a plant equipped for this manufacture. D. J. Norton is president

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Caracas, Venezuela (No. 8,174), for electrical appliances and supplies and for hydraulic machinery.

An agency is desired in Algiers, Algeria (No. 8,178), for electrical supplies.

Purchase is desired in Teheran, Persia (No. 8,145), for a three-phase, 50-cycle, 225-volt, alternating-current generator, driven by a 350-hp. Diesel engine.

Purchase is desired in Rio de Janeiro, Brazil (No. 8,165), for plates, positive and negative, for setting-up plates for storage batteries.

PROPOSED PLANS FOR THE ELECTRIFICATION OF CZECH RAILWAY.—The Ministry of Railways in Czechoslovakia is considering the electrification of the Prague-Kladno section of the Czechoslovak railways, according to the *Czech Hydro-Electric Herald*, and not of the Prague-Pilsen line, as has been previously reported. The first-mentioned line can be supplied at once with electricity from the power plant at Seestadtl, whereas the Prague-Pilsen road would at first have to obtain energy from the Prague power plants. The electrification of the latter is thus dependent on the carrying out of the Stechowitz dam and hydro-electric project.

ADDITIONAL ELECTRIFICATION OF RAILWAYS IN CHILE.—Work has begun, according to *Commerce Reports*, on the electrification of the Ferocarril del Llano de Maipo, which extends from Santiago, Chile, to Puente Alta. After the existing line is electrified the present rolling stock will be discarded and new equipment consisting of a freight locomotive and two electric passengers cars operated. Energy at 600 volts, direct current, is to be supplied by the Compañia Chilena de Electricidad, which will erect a substation at Bella Vista.

BLOEMFONTEIN POWER HOUSE AVAILABLE.—Two copies of a report on the power plant extensions at Bloemfontein, South Africa, to cost about £180,000, made by the consulting engineers, whose recommendations have been adopted, are available for loan on application to the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., by referring to file No. 108,909.

New Apparatus and Publications

DIESEL ENGINES.—The Fulton Iron Works Company, St. Louis, has issued catalog No. 805, describing the "Fulton-Diesel" engines.

ELECTRIC CLOTHES WASHER.—The Farmelectric Utilities Corporation, division of the Poole Engineering & Machine Company, Woodberry, Baltimore, has placed on the market an electric clothes washer with a capacity of eight sheets.

ELECTRIC HAND LANTERN.—A new electric hand lantern for use in factories and homes, and for railway men, etc., has been brought out by the Federal Electric Company, 8700 South State Street, Chicago.

ELECTRIC CLOTH-CUTTING MACHINE.—The Eastman Machine Company, Buffalo, has developed an electric cloth-cutting machine, model "UA," designed for garment, tent and awning manufacturers, upholsterers, etc.

ELECTRICALLY OPERATED CROSSING SIGNAL.—The Bryant Zinc Company, 600 Orleans Street, Chicago, has developed an electrically operated crossing signal, known as the "Magnetic Autoflag" model 5.

WASHING MACHINE.—A washing machine with a special heat-retaining tub known as the "Thermotub," has been placed on the market by the Boss Washing Machine Company, Cincinnati.

AUTOMOBILE LAMP.—The Lorraine Corporation, 341 East Ohio Street, Chicago, has developed the "Lorraine" controllable driving lamp, designed to fit every model of cars.

ADJUSTABLE GRINDER.—The Stow Manufacturing Company, Inc., Binghamton, N. Y., has brought out an adjustable grinder mounted on a truck.

FLOODLIGHT.—The Brieloff Manufacturing Company, 119 Lafayette Street, New York City, has placed on the market a new floodlighting unit for store windows.

ELECTRIC MOTORS.—The Reliance Electric & Engineering Company, Ivanhoe Road, Cleveland, has issued a booklet entitled, "Electric Motors—How to Choose and Use Them," which contains a few essential facts on electric motors and how to chose and use them to the best advantage.

LIGHTING DATA.—The Edison Lamp Works of General Electric Company, Harrison, N. J., is distributing bulletins L. D. 147, L. D. 148, L. D. 149, L. D. 150, entitled "Lighting for Traffic Control," "Lighting Legislation," "Mazda Lamps in Photography" and "The Lighting of Steel Mills and Foundries" respectively.

New Incorporations

THE ONONDAGA (N. Y.) UTILITIES CORPORATION has been incorporated with a capital stock of $500,000 to generate and distribute electricity in Onondaga, Oswego and Madison Counties. The directors are: W. C. Pearce, 465 Allen Street, Syracuse; Ernest Johnston, attorney, 956 Lancaster Avenue, Syracuse, and C. E. Agan, 100 Bellevue Avenue, Syracuse.

THE COMFORT (TEX.) ELECTRIC LIGHT & POWER COMPANY has been incorporated with a capital stock of $16,000 by Otto Holekamp, A. S. Faltin and others.

THE POTOSI (MO.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $10,000 by F. J. Flynn, H. L. White and others.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BRUNSWICK, ME.—The Thomas Plow Company contemplates the installation of electric equipment in connection with proposed extension at its tractor-plow plant.

NEWPORT, N. H.—The New Hampshire Power Company has petitioned the Public Service Commission for permission to purchase the properties of the Newport (N. H.) Electric Light Company, the Sunapee (N. H.) Electric Light & Power Company, the Contoocook (N. H.) Electric Light Company, the Antrim-Bennington Electric Light & Power Company, the Canaan-Endfield Electric Company and the Hillsboro (N. H.) Electric Light & Power Company; also for authority to issue $1,200,000 in bonds and stocks to finance the project.

MONTPELIER, VT. — Permission has been granted to the Montpelier & Barre Light & Power Company to issue $450,000 in bonds, the proceeds to be used for improvements at the steam plant, work on which is under way, and for erection of high-tension transmission lines between the local plant and Barre.

HOLYOKE, MASS.—Contract has been awarded by the American Tissue Mills Company for the construction of a new power house on Crescent Street, to cost about $30,000.

SPRINGFIELD, MASS. — The Reed Realty Trust Company plans to build a new power house at 99 Cortland Street.

BRIDGEPORT, CONN. — The United Illuminating Company has engaged Westcott & Mapes, Inc., New Haven, engineer, to prepare plans for a new 30,000-kw. generating unit at its plant, foot of East Main Street, to double the output of the station. New switching equipment will also be installed.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by William H. Gompert, architect, Board of Education, corner of Flatbush Avenue Extension and Concord Street, until Nov. 26 for installing electric wiring and fittings in Girls' Commercial High School, on Classon Avenue.

BROOKLYN, N. Y.—Electric power equipment will be installed in the proposed plant to be erected by E. J. Trum, Inc., 55 Third Street, manufacturer of paper boxes, etc., at 764-66 Fourth Avenue, to cost $125,000.

BUFFALO, N. Y.—The Chevrolet Motor Company, Detroit, will install electric power equipment in its proposed local plant, to cost about $700,000, for which general contract has been awarded.

DEFERIET, N. Y.—The Northern New York Utilities, Inc., Watertown, has applied to the Public Service Commission for permission to build a steam-driven plant at Deferiet, to cost about $150,000. The equipment will include a 5,000-kw. turbo-generator. The company plans to purchase steam from the St. Regis Company.

LINOLEUMVILLE, S. I., N. Y.—The American Linoleum Manufacturing Company plans to erect a power plant, to cost about $80,000.

NEW YORK, N. Y.—Bids will be received by William H. Gompert, architect, board of education, corner of Flatbush Avenue Extension and Concord Street, Brooklyn, until Dec. 3 for installing electric wiring and fittings in new Public School 75, on Faile Street, borough of the Bronx.

NEW YORK, N. Y.—The New York Central Railroad Company is considering the construction of a large central substation in connection with the electrification of its system south of Spuyten Duyvil. The cost of the project, including line relocation is estimated at $20,000,000.

ONEIDA, N. Y.—The Adirondack Power & Light Corporation has been granted permission to extend its transmission line from Oneida into Lenox Township to furnish electrical service there.

ROCHESTER, N. Y.—The Public Service Commission has authorized the Rochester Railways Coordinated Bus Lines, Inc., to operate an electric bus line in the city.

WAYLAND, N. Y.—The Wayland Steuben Power Company has been granted permission to sell its electric service lines and other property in Wayland to the Wayland Light & Power Company.

JERSEY CITY, N. J.—Electric power equipment will be installed by the Continental Can Company, Fifteenth Street, in its proposed addition to cost $500,000, for which a general contract has been awarded.

KEARNY, N. J.—Electric power equipment will be installed in the addition to be erected by the Nairn Linoleum Company, Belgrove Avenue, to cost about $110,000.

BETHLEHEM, PA.—The Pennsylvania Power & Light Company plans to build a local substation, to cost about $125,000.

DUNCANNON, PA. — Application has been made to the Federal Power Commission by Frank M. Waring, Tyrone, and associates, for permission to build a hydro-electric plant on the Susquehanna River, near Duncannon, to cost about $350,000, including a transmission system.

McKEE'S ROCKS, PA.—The Pittsburgh & Lake Erie Railroad Company contemplates rebuilding the power house at its local shops, recently damaged by fire, with loss of about $25,000.

MIDDLETOWN, PA.—The Middletown & Swatara Creek Consolidated Water Company, now being reorganized under the name of the Middletown & Royalton Water Company, plans to build an electrically operated pumping plant on Swatara Creek.

PHILADELPHIA, PA. — Bonds to the amount of $440,000 have been voted for radio broadcasting stations and police signal systems.

PHILADELPHIA, PA. — The Walker, Huston, Penn-Huntingdon, Shirley-Huntingdon, Catherine, Lincoln-Huntingdon and Juniata Township Power companies are being organized by C. A. McClure, George W. Crowley, Jr., and F. E. Harshaw, to erect transmission lines in the respective districts for which they are named. James Collins Jones, Bullitt Building, Philadelphia, is representative.

PITTSBURGH, PA. — The West Penn Company has issued $4,000,000 in capital stock, the proceeds to be used to finance its electric light and power subsidiaries, for property extensions and other purposes.

VANDERGRIFT, PA.—The West Penn Power Company has acquired the local power plant and contemplates remodeling the plant and extending the transmission system.

AMCELLE, MD.—The American Cellulose & Chemical Manufacturing Company, Ltd., 15 East Twenty-sixth Street, New York, will install electric substation and power equipment in connection with a proposed new plant unit to cost about $500,000.

BALTIMORE, MD.—The Pittsburgh Plate Glass Company, Pittsburgh, will install electric power equipment at the proposed addition to its plant on Frederick Avenue, to cost about $120,000. Wight & Lockwood, Munsey Building, are architects.

BALTIMORE, MD.—Plans are being prepared for the construction of a new power house at the Children's Hospital, for which bids will soon be called. William G. Beecher, 12 East Pleasant Street, and Smith & May, Calvert Building, are associated architects.

BALTIMORE, MD.—The Standard Sanitary Manufacturing Company, Pittsburgh, plans to build a power house at its proposed local plant in the Canton section, to cost about $3,000,000. Samuel Diescher & Company, Farmers' Bank Building, Pittsburgh, are engineers.

INDIANHEAD, MD.—Bids will be taken at once by the local supply officer, Navy Department, for three transformers, single phase. (Y. and D. req. 1½.)

NORTH EAST, MD.—The Elk River Clay Products Company contemplates building a power house at its proposed local plant, to cost about $85,000.

CHARLESTON, W. VA.—The Pure Oil Company plans to install electric power equipment in connection with rebuilding its plant in the Cabin Creek section, which was recently damaged by fire with loss of about $100,000.

WELCH, W. VA.—Tentative plans are being considered by the Junior Pocahontas Coal Company for the rebuilding its power house, recently damaged by fire.

NORTHFORK W. VA.—The Flat Top Ice & Cold Storage Company is planning extensions to its electric lighting system in Clark.

COEBURN, VA.—The Lakeside Park Corporation is planning to install an electric light and power system on a local 300-acre tract to be developed for resort purposes, to cost about $225,000.

NORFOLK, VA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Dec. 4, for 189 electric soldering irons for the Norfolk and San Diego navy yards. (Schedule 1571.)

RICHMOND, VA.—Plans are under consideration for the installation of a hydroelectric plant, to cost about $150,000, to operate the pumping station of the waterworks system.

WASHINGTON, D. C.—Bids will be received by the general supply committee, Building F, Seventh and B Streets, Washington, D. C., until Dec. 3 for furnishing during the period Jan. 1 to June 30, 1924, certain supplies as described in specifications and proposals for Class 6, including electrical, engineering and plumbing supplies, for use by the executive departments and other establishments of the government in Washington, D. C.

North Central States

CASS CITY, MICH.—The Great Lakes Power Company has been granted a franchise to extend its transmission line to Cass City to supply electricity for the local municipal system. A substation will be built here.

HOUGHTON, MICH.—The Pampa Lumber Company contemplates rebuilding its mill and power house, recently damaged by fire, with loss of about $50,000.

MARQUETTE, MICH.—A special election will be held Dec. 3 to vote on the proposal to issue $275,000 in bonds for extensions to the municipal hydro-electric plant on the Dead River.

CLYDE, OHIO.—Bonds to the amount of $17,000 have been sold to provide funds for extensions and improvements to the municipal electric plant.

MOUNT STERLING, OHIO.—Plans are being considered for rebuilding the municipal electric light and water plant, recently destroyed by fire, to cost about $50,000.

YOUNGSTOWN, OHIO.—The Ohio River Edison Company is securing a right-of-way for a proposed electrically operated freight railroad from Toronto to Youngstown. The right of way parallels that of a high-tension transmission line to be erected by the company from the Toronto steam electric plant to Youngstown.

INDIANAPOLIS, IND.—Bids will be received by the Commissioners of Marion County, Indianapolis, until Dec. 10 for construction of administration building, two cottages, power plant and refrigerating plant for Colored Orphans' Home. D. Graham, Hune-Mansur Building, is architect.

CHICAGO, ILL.—The Commonwealth Edison Company, Middle West Utilities Company, and the People's Gas, Light & Coke Company, affiliated organizations, contemplate an expenditure of $65,000,000 for expansion and improvements during 1924.

CHICAGO, ILL.—The Illinois Power & Light Corporation has arranged for an increase of $4,124,700 in capital stock, part of the proceeds to be used for extensions and improvements.

MOWEAQUA, ILL.—Preliminary plans are being prepared by Holbrook, Greeley & Hanson, engineers, Decatur, for an oil-engine-driven electric plant in Moweaqua, including distribution system, to cost about $75,000.

WILLIAMSVILLE, ILL.—Permission has been granted to the Prather & Hill Company to operate in Williamsville, Sherman and Broadwell. The company has also been authorized to issue bonds for the purchase of the local public utility properties and for reconstruction of the systems.

BARABOO, WIS.—Negotiations are under way for the purchase of the local plant of the Wisconsin Power, Heat & Lighting Company, to be owned and operated by the municipality.

DE PERE, WIS.—Plans are under consideration for the installation of a lighting system on Fairview Avenue.

EAU CLAIRE, WIS.—Plans have been completed by the Wisconsin Telephone Company for the construction of underground conduits to replace its overhead cables. The company will also string new copper wire from Osseo to Whitehall to replace the iron-circuit equipment now in use.

FOND DU LAC, WIS.—The Wisconsin Industrial Commission has recommended the installation of better lighting facilities in all of the city school buildings.

JANESVILLE, WIS.—Plans are being considered by the Middle West Utilities Company, Chicago, for increasing the voltage of the transmission lines of the Janesville Electric Company from Janesville to Orfordville, and the power line of the Wisconsin Utilities Company from Monroe, Wis., to Winslow, Ill., from 33,000 volts to 66,000 volts. The capacity of the local substation will be increased. The Illinois Northern Utilities Company, a subsidiary of the Middle West Company, will erect a transmission line (66,000 volts) from Dixon, Ill., to connect with the new line to be erected from Monroe, Wis., to Winslow, Ill., which will make an interchange of power possible.

MERRILL, WIS.—The Wisconsin Valley Electric Company will soon start work on the construction of a dam and power plant on the Wisconsin River, about 3 miles above Merrill, at a site known as Rocky Carry, to develop 5,600 hp. Estimates are now being asked on waterwheels and generators.

RACINE, WIS.—The lighting committee of the City Council is considering a petition asking for an improved lighting system on Asylum Avenue.

SHEBOYGAN, WIS.—The Eastern Wisconsin Electric Company contemplates erecting a rural transmission line along the state trunk highway No. 17 from Sheboygan north to Cleveland, a distance of about 20 miles. As soon as this line is completed the company plans to extend its light and power lines from this city to all of the rural sections of Sheboygan County.

TRENTON, WIS.—The Trenton Light & Power Company, it is reported, plans extensions from its main line to furnish electric service to farmers in this territory. Energy is purchased from the Wisconsin Power, Light & Heat Company, Madison. Trenton has not a post office.

WESTFORD, WIS.—The Westford Light & Power Company plans to extend its electric light and power lines into the rural farming districts in this part of the state. Energy is secured from the Wisconsin Power, Light & Heat Company, Madison. Westford has not a post office.

GARY, MINN.—The Duluth Edison Electric Company plans to install an ornamental lighting system in the business section.

MINNEAPOLIS, MINN.—A permit has been granted the Northern Power Company to erect a substation at 1075 First Avenue North, to cost about $90,000.

OWATONNA, MINN.—Bonds to the amount of $350,000 have been voted to establish a municipal electric light, heat and power plant.

ROYALTON, MINN.—The Pike Rapids Power Company is perfecting plans for the construction of a 25,000-hp. hydro-electric plant at Blanchard Rapids, Mississippi River. A dam 42 ft. high will be built.

COUNCIL BLUFFS, IOWA.—The citizens have voted to grant the Citizens' Gas & Electric Company a new twenty-five-year franchise to supply electricity and gas in the city. Work has been started on improvements, to cost about $250,000.

WASHINGTON, IOWA.—Bids will be received by S. J. Kellogg, city clerk, until Dec. 6 for improvements to waterworks, consisting of brick building, electrically driven pumps, piping and equipment and a 200,000-gal. elevated tank. Arthur L. Mullergren, Gates Building, Kansas City, Mo., is consulting engineer.

MOUNTAIN GROVE, MO.—An election will be held Nov. 27 to vote on the proposal to issue $40,000 in bonds for an electric light plant.

BEATRICE, NEB.—The Dole Floral Company is planning to rebuild its power house, recently destroyed by fire with loss of about $35,000.

INMAN, NEB.—Bonds to the amount of $10,000 have been voted for the erection of a transmission line and $5,000 for a distributing system.

STAPLETON, NEB.—Bonds to the amount of $39,000 have been voted, of which $32,000 will be used for the erection of a transmission line and $7,000 for a distribution system.

Southern States

FRANKLINTON, N. C.—The Carolina Power & Light Company has acquired the property of the Franklin Light & Power Company and plans extensions.

GREENSBORO, N. C.—Bids will be received by J. F. Foust, president North Carolina College for Women, until Dec. 4 for construction of three dormitories, physical education building, dining hall, new wing and pavillion, including plumbing, heating and electrical equipment. The cost is estimated at $600,000. H. Barton, Greensboro, is architect.

MAXTON, N. C.—The Yadkin River Power Company has purchased the local property of the Carolina Electric Company and plans to make extensions to the system.

NORTH WILKESBORO, N. C.—Bonds to the amount of $85,000 have been approved for extensions to the municipal electric light and water systems.

WADEVILLE, N. C.—The installation of a community electric light plant is under consideration. Further information may be obtained by addressing the principal of schools.

DALTON, GA.—Arrangements are being made by the Georgia Railway & Power Company, Atlanta, for the construction of a third substation at Dalton. The station will have an output of 6,000 kw. and will cost about $60,000.

JACKSONVILLE, FLA.—Plans are being arranged by the Power Bureau for the construction of a substation on McDuff Street, to cost about $20,000.

ST. PETERSBURG, FLA.—Steps are being taken for the installation of an ornamental lighting system in the business district. The West Central Business Association is interested in the project.

SOUTH JACKSONVILLE, FLA.—Bonds to the amount of $500,000 have been voted for extensions to the electric lighting system, waterworks, sewers, etc.

WATERTOWN, TENN.—Plans are under consideration for the installation of electrically operated pumping machinery at the proposed municipal waterworks, to cost about $50,000.

AUBURN, ALA.—Plans are being prepared for a new engineering building at the Alabama Polytechnic Institute, to be provided with electrical and mechanical engineering departments, laboratories, etc. A fund of $300,000 is available for the project. Warren, Knight & Davis, Auburn, are architects.

BOAZ, ALA.—The Alabama Power Company has been granted permission to extend its transmission lines into the towns of Albertville, Boaz and Guntersville.

BUHL, ALA.—The Deal Lumber Company plans to rebuild its mill and power house, recently damaged by fire with loss of about $50,000.

MONTGOMERY, ALA.—The Montgomery Sand & Gravel Company, recently organized, contemplates the construction of a power house at its proposed local plant. H. G. Ireland is president.

TUSCALOOSA, ALA.—The Oak City Furniture Company plans to install electric power equipment at its proposed local plant, to cost about $50,000.

UNION SPRINGS, ALA.—The Cowikee Mills, Inc., Eufaula, plans to build an electric plant at its proposed local textile mill, to cost about $350,000.

JACKSON, MISS.—The Mississippi Power & Light Company, which has acquired electric systems at Vicksburg, Greenville & Columbus, Miss., is planning extensions, including new transmission lines.

HARRISON, ARK.—P. G. Walker, manager of the Carroll County Utility Company, has petitioned for authority to acquire the property of the Harrison Electric Company and for a franchise here. The construction of a plant, to cost about $150,000, is reported to be under consideration.

WESSON, ARK.—The Edgar Lumber Company contemplates rebuilding its power house and mill, recently damaged by fire with loss of about $150,000.

SAINT FRANCISVILLE, LA.—Steps are being taken for rebuilding the municipal electric plant and pumping station, recently damaged by fire.

BARTLESVILLE, OKLA.—The Bartlesville Gas & Electric Company has issued bonds for $246,000, as part of the proceeds to be used for extensions.

CANTON, OKLA.—Plans are being prepared for a municipal electric light and water plant, for which bonds have been voted.

PADEN, OKLA.—The Council is considering the erection of a transmission from Paden to Prague.

PAWHUSKA, OKLA.—Application has been made by J. A. Weislogel for a franchise to supply electricity in Pawhuska.

SKIATOOK, OKLA.—The installation of an ornamental lighting system, to cost about $3,000, is under consideration.

BEAUMONT, TEX.—The Eastern Texas Electric Company contemplates erecting a power plant and distributing station here, to cost from $40,000 to $50,000.

PORT ARTHUR, TEX.—The installation of electrically operated pumping machinery at the municipal water plants in the Port Arthur Heights section is under consideration.

Pacific and Mountain States

TACOMA, WASH. — An ordinance has been passed appropriating $7 500 for the purchase of generator coils, lighting and other equipment for municipal service.

BURNS, ORE.—The Halhour Railroad Company, recently incorporated with a capital stock of $500,000 to build an electric railway from Burns to Seneca, a distance of 40 miles, plans to furnish electricity for light, heat and power. Frank Herrick, James Girard and Frank J. Klobusher are incorporators.

ENTERPRISE, ORE.—The Eastern Oregon Light & Power Company, Baker, it is reported, contemplates taking over the property of the Enterprise (Ore.) Electric Company.

KLAMATH FALLS, ORE.—The California-Oregon Power Company has purchased a site adjoining its present power plant on the Link River for a proposed new power house.

CHICO, CAL.—The Pacific Gas & Electric Company has submitted a proposal to the Council offering to install an ornamental lighting system on Main Street and Broadway.

HANFORD, CAL.—An ordinance granting the Southern California Edison Company permission to construct an underground transformer and to build underground conduits in the alleys of the business section has been approved by the board of trustees.

RIVERSIDE, CAL. — The Nevada-California Electric Corporation has issued $1,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

SACRAMENTO, CAL.—Plans are being arranged for the installation of an ornamental lighting system on Orange Avenue, G, L, M, Mono and Cherry Streets. William Stranahan is city engineer.

SAN FRANCISCO, CAL. — The Pacific Gas & Electric Company plans extensions to its substation at C and Jessie Streets, to cost about $87,000.

SAN JOSE, CAL.—The Guadalupe Portland Cement Company, Humboldt Bank Building, San Francisco, plans to build a power house at its proposed local cement mill, to cost about $1,000,000.

STOCKTON, CAL.—Bids are being received by Davis-Hellar-Pearce Company, Weber and California Street, construction managers for science building, dining hall and gymnasium, auditorium, boys' dormitory and girls' dormitory, power house and stadium for the College of the Pacific. The cost is estimated at $600,000.

SALT LAKE CITY, UTAH.—Plans involving an expenditure of about $1,500,000 are under consideration by the Utah Power & Light Company. The proposed work includes the installation of a 20,000-kw. steam turbine at the Jordan steam plant, west of Salt Lake City. The company has applied for additional water rights on the Jordan River.

Electrical Patents

Announced by U. S. Patent Office

(Issued Oct. 30, 1923)

1,472,503. SWITCHING DEVICE; H. B. Taylor, Westfield, N. J. App. filed June 20, 1922. Switching device for automatic and semi-automatic telephone systems.

1,472,504. ELECTRIC HEATER; E. Thomson, Swampscott, Mass. App. filed March 15, 1921. Induction heater for steel tires or wheels.

1,472,506. TELEGRAPH SYSTEM; C. O. Van Der Vort, East Orange, N. J. App. filed Aug. 24, 1920. Relaying or repeating signal-current impulses from one circuit to another.

1,472,507. ARTIFICIAL LINE; H. J. Vennes, New York, N. Y. App. filed Dec. 28, 1921. For making transmission measurements of electrical circuits.

1,472,530. TELEPHONE ATTACHMENT; J. McComas, Los Angeles, Cal. App. filed Dec. 12, 1922. Combined sanitary cover, memorandum pad and advertising device.

1,472,532. CLOCK MECHANISM; M. Piciotti, Paterson, N. J. App. filed Jan. 7, 1922. Electrically operated clock.

1,472,545. ACTUATING MECHANISM FOR MAGNETOS; P. Brown, Springfield, Mass. App. filed Aug. 5, 1921. Means for retarding spark.

1,472,546. TRIP FINGER FOR MAGNETOS; P. Brown and I. E. Hendrickson, Springfield, Mass. App. filed Dec. 28, 1922. Means for retarding spark.

1,472,561. HAIR WAVER; W. C. Haberkamp, Chicago, Ill. App. filed March 4, 1922.

1,472,581. WELDING ELECTRODE HOLDER; J. Britt, New York, N. Y. App. filed Jan. 10, 1922. Electrodes of different diameters easily and quickly secured.

1,472,583. METHOD OF MAINTAINING ELECTRIC CURRENTS OF CONSTANT FREQUENCY; W. G. Cady, Middletown, Conn. App. filed May 28, 1921. For radio testing or measurement work.

1,472,585. MULTIPLEX SIGNALING SYSTEM; E. H. Colpitts, East Orange, N. J. App. filed July 9, 1919. Means for repeating signals between high-frequency multiplex line and low-frequency circuits.

1,472,595. CALLING DEVICE; J. T. E. Hillhouse, New York, N. Y. App. filed Dec. 24, 1920. Impulse sender for automatic telephone systems.

1,472,604. AUTOMATIC TELEPHONE SYSTEM; T. Lenaghan, Croydon, England. App. filed April 28, 1920. Automatic or semi-automatic operation obtainable.

1,472,610. TRANSMISSION CIRCUITS; R. C. Mathes, New York, N. Y. App. filed Dec. 4, 1919. Two-way repeating system.

1,472,631. MAGNETIC COIL; H. N. Bowman, New York, N. Y. App. filed Feb. 24, 1921. Variable-reactance coil.

1,472,639. INDIRECT LIGHTING UNIT; W. A. Dorey, Newark, Ohio. App. filed Nov. 6, 1920. Double reflecting prisms.

1,472,696. MOUNTING LAMP SHADE; S. R. Schwartz and A. Bostroem, New York, N. Y. App. filed Nov. 17, 1920. For portable lamps.

1,472,704. PERCOLATOR AND ELECTRIC HEATING ATTACHMENT FOR THE SAME; A. Ward, Norfolk, Va. App. filed April 20, 1922. Removable heating element so that percolator may be used on stove.

1,472,718. AUTOMOBILE SIGNAL; I. G. Holland and G. A. Broughton, Norfolk, Va. App. filed Sept. 26, 1919. Rear direction signal.

1,472,750. BURGLAR ALARM; J. F. Gorman and F. C. Gorman, New York, N. Y. App. filed Dec. 13, 1921. For sales.

1,472,762. ELECTRIC IRON; Y. Moore, Indianapolis, Ind. App. filed Sept. 20, 1921. Heating element made of preformed helical coils.

1,472,764. TIRE-WRAPPING MACHINE; J. Scherner, Milwaukee, Wis. App. filed Aug. 4, 1921. Motor-driven.

(Issued Nov. 6, 1923)

1,472,779. THERAPEUTIC APPLIANCE; F. A. Anderson, Milton, Wis. App. filed July 6, 1920. Lamp adapted for therapeutic treatment by radiant energy.

1,472,781. WELDING OR SOLDERING COMPOSITION; A. Baewskin, Chicago, Ill. App. filed Feb. 17, 1923. For gold, silver and their alloys.

1,472,787. KEY; E. A. Bohlman, Chicago, Ill. App. filed Oct. 11, 1920. For selective telephone party-line ringing.

1,472,788. REGULATOR FOR GENERATORS; A. F. Brotz, Kohler, Wis. App. filed Aug. 4, 1921. Governor for internal-combustion-engine-driven farm lighting and power units.

1,472,818. BRUSH TRIPPING DEVICE; L. R. Waller, Westmount, Quebec, Canada. App. filed Dec. 2, 1920. For selector panels of automatic telephone system.

1,472,821. RINGING CHANNEL FOR MULTIPLEX TELEPHONE SYSTEMS; H. A. Affel, Brooklyn, N. Y. App. filed July 29, 1919. By means of carrier current.

1,472,822. CALLING ARRANGEMENT FOR RADIO SYSTEMS; H. A. Affel, Brooklyn, N. Y. App. filed Sept. 24, 1919. Ringing or call signal employed with radio telephone.

1,472,824. PLANER AND SYSTEM OF MOTOR CONTROL THEREFOR; H. L. Blood, Plainfield, N. J. App. filed June 10, 1920.

1,472,829. CARD-PERFORATING MACHINE; J. H. Gault, Philadelphia, Pa. App. filed April 17, 1922. By magnet punches.

1,472,844. POWER TRANSMITTING MECHANISM; A. C. Keller, Milwaukee, Wis. App. filed Oct. 20, 1919. For electrically operated cranes and hoists.

1,472,849. FORWARDING SYSTEM FOR OCEAN CABLES AND THE LIKE; W. H. Martin, New York, N. Y. App. filed June 18, 1918. Combined telegraph and ocean cable system.

1,472,899. CONSTRUCTION FOR INTERNAL-COMBUSTION ENGINES; R. S. Blair, Sound Beach, Conn. App. filed May 9, 1919. Manifold heater.

1,472,914. RHEOSTAT; L. Kebler, Bronxville, N. Y. App. filed March 23, 1920. Dust, dirt and moisture proof.

1,472,923. CELL CONNECTOR FOR ELECTRIC BATTERIES; L. Lyndon, New York, N. Y. App. filed Oct. 4, 1921. Demountable type for storage batteries.

1,472,987. SIGNALING SYSTEM; P. B. Murphy, Nyack, N. Y. App. filed Aug. 28, 1920. Modified carrier-wave system over telephone toll line.

1,473,002. WATER HEATER; J. H. Beckman, Oakland, Cal. App. filed March 9, 1921. Radiator type.

1,473,015. MOTOR-DRIVING MECHANISM; J. S. Coldwell, Milwaukee, Wis. App. filed May 10, 1919. Electromagnetic brake for motor.

1,473,060. METHOD OF ELECTROPLATING; E. N. Taylor, St. Louis, Mo. App. filed Dec. 17, 1921. Article rapidly moved at intervals to remove gas bubbles.

1,473,070. GAP; S. T. Woodhull, Medford, and G. J. Waller, Somerville, Mass. App. filed Sept. 15, 1919. Spark gap of quenched type.

1,473,107. RESISTOR; M. M. Kohn, New York, N. Y. App. filed Feb. 3, 1921. Tube resistance of graphite and silicon carbide.

1,473,108. BATTERY-PLATE-TREATING APPARATUS; J. M. Lea, Detroit, Mich. App. filed Dec. 27, 1921. Liquid under pressure penetrates permeable paste supported by grid.

1,473,167. ELECTRIC DRIVE MECHANISM; C. S. Weyandt, Pittsburgh, Pa. App. filed Nov. 20, 1919. Reciprocatory motor for hammers, drills, etc.

1,473,179. METHOD FOR ELIMINATING UNDESIRED IMPULSES; R. A. Fessenden, Chestnut Hill, Mass. App. filed Nov. 10, 1920. Eliminating static in signaling circuits.

1,473,206. BEARING LINE FOR ELECTRIC AERIAL CONDUCTORS TO AUTOMOBILE MACHINES; H. S. Cassel, Stockholm, Sweden. App. filed Sept. 21, 1922. Gathering-reel trolley conductor for farm implements.

1,473,212. AUXILIARY SWITCH FOR AUTOMOBILE LIGHTS; O. L. Davis, Iowa City, Iowa. App. filed Oct. 13, 1920. Auxiliary lamp beneath mud-guard lights when headlights are dimmed.

1,473,220. RADIOTELEGRAPHY SIGNALING SYSTEM; H. F. Elliott, Palo Alto, Cal. App. filed Aug. 23, 1921. Uniwave signaling system for high-power stations.

1,473,224 and 1,473,225. SWITCH MECHANISM; D. D. Gordon, Chicago, Ill. App. filed April 20, 1918. Lamp socket and switch.

1,473,243. MEANS FOR MAINTAINING EBULLITION; R. D. Mershon, New York, N. Y. App. filed July 20, 1921. In electrolytic condensers.

1,473,255. MAGNETO; W. E. Schwarzmann, Longmeadow, Mass. App. filed Dec. 23, 1920. Driving mechanism.

1,473,292. ELECTRIC TYPEWRITING MACHINE; E. H. Hebern, Oakland, Cal. App. filed Sept. 8, 1919.

1,473,362. CONNECTOR; R. E. Tilton, Columbus, Ohio. App. filed March 3, 1921. For connecting cable or conduit to outlet box.

1,473,363. PHONOGRAPH; E. J. Tomlinson, Newark, N. J. App. filed Jan. 8, 1920. Electrically driven.

1,473,380. LAMPSHADE HOLDER; J. Peterson, Faribault, Minn. App. filed March 6, 1922. Holder furnishes handle by which lamp may be moved.

1,473,385. BUS STRUCTURE; A. M. Rossman, Chicago, Ill. App. filed May 10, 1920. Buses in form of totally inclosed cables.

1,473,407. LOOSE COUPLER ON RECEIVING COIL; L. W. Hatch, Stamford, Conn. App. filed Oct. 3, 1922.

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Bringing the Inspector Into the Family

DURING the past year the electrical inspector has been much in the eye of the electrical industry. We have heard of his right to accept or ignore the code, of his power to favor or oppose new products, of the influence of his work in helping to keep electrical installations safe. But few apparently have stopped to think how great is the opportunity to make him a very helpful influence for creative development in every community by bringing him closer into the circle of the local electrical family.

He has been standing on the side lines as a critic, representing the insurance underwriters or the municipal government. And the other electrical men have been content to allow him thus to isolate himself, forgetting that a little education might make of this neutral a mighty ally in the co-operative effort to interpret to the people the value of higher standards of electrical service.

THE inspector has access to every house where construction work is going on. That is a great privilege. For it brings with it the invaluable opportunity to guide the public to an appreciation of adequate installations, of generous facilities for the use of electrical appliances, and also of a standard of quality in electrical construction that provides a broad margin of safety plus a pride of ownership which is no inconsiderable factor once understood. The electrical industry can well afford to give some thought and time to interesting the inspector in the importance of grasping this opportunity to advise the householder to install better lighting and more outlets and to enjoy a wider variety of appliances.

IN MOST homes there is little knowledge of electrical standards—either of quality or adequacy. Brass pipe and porcelain tubs bespeak quality in plumbing to everybody's mind, but the average man cannot name to you what it is that is the mark of quality in an electrical installation. The inspector is in a peculiarly favorable position to explain.

In Philadelphia, right now, for instance, Washington Devereux, chief underwriters' inspector for that city, ranks as one of the outstanding leaders in the work of public education. In the details of the work that he is doing lies a notable example of what can be accomplished when the inspector functions as a working member of the family instead of as merely a policeman. For as a neutral authority his word carries strongly to the public ear, and he can become a power for progress and achievement both in the bettering of central-station public relations and in the development of a greater use of everything electrical.

Grover C. Neff

A central-station-company executive who has contributed a winning impetus to the movement for farm service.

THE central-station man with a hobby on which he persistently rides is the man who is sure to make a name for himself in the electrical industry, provided that his hobby be a sane and vigorous animal with race-winning propensities in its blood. The hobby that Grover C. Neff, operating vice-president of half a dozen Wisconsin light and power companies which form an important group of Middle West Utilities Company properties, rides is such an animal.

Mr. Neff has been the chairman of the rural electric service committee of the National Electric Light Association since its formation in 1921, and his voice and pen have done great service in giving to this movement the importance it has in recent years assumed. The question of how to serve the farmer is now a topic not only at every convention of light and power men but at every meeting of progressive agricultural societies. The N. E. L. A. committee, under Mr. Neff's leadership, has taken a leading part in bringing together the electrical and agricultural industries in a common study of this problem, and the newly organized Joint Committee on the Relations of Electricity to Agriculture is in large part a result of its efforts.

Mr. Neff is a graduate of Purdue University, class of 1907. He came into the utility business shortly after his graduation as a resident engineer on construction work in Wisconsin. In 1910 he became superintendent of the Southern Wisconsin Power Company, and between 1914 and 1921 became the general superintendent of the Southern Wisconsin Power Company, Wisconsin River Power Company, Wisconsin Power, Light & Heat Company, Mineral Point Public Service Company and Janesville Electric Company, operating hydro-electric stations on the Wisconsin River. He is now operating vice-president in direct charge of these properties and also of the group of properties in eastern Wisconsin known as the Eastern Wisconsin Electric Company which were added to the Wisconsin holdings of the Northwest Utilities Company, another Middle West subsidiary, in 1922. Mr. Neff has been active in the N. E. L. A. overhead-systems and inductive-interference committees and was the chairman of the committee of the Wisconsin Electrical Association which took the lead in formulating the rural-line extension policies and rules now known as the Wisconsin rural-lines rules. He is a member of the American Institute of Electrical Engineers and was chairman of its Madison (Wis.) Section in the year 1920.

Editorial Comment

Electrical World, December 1, 1923

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Favorable Opportunity for Financing Utilities

THE growth and expansion of the electric public utilities of the country continue unabated. It follows therefore that the utilities will require more and more money to keep pace with demands for service. So far this year 10 per cent more money has been raised than for the similar ten-month period of 1922, the advertised public sales of securities exceeding $570,000,000. The actual amount raised is, however, considerably more than that, since the figure given does not include sales of stock to customers, which normally would approximate $175,000,000. Utilities in the East are spending money for extensions and new equipment as fast as they can raise it, and fortunately the signs point to a favorable money market for some months to come. Interest rates show less than a normal seasonal rise at this time, indicating large accumulations of uninvested funds and presaging better prices for bonds in the immediate future. It would be well for utility managers therefore to give consideration to their financial wants at this time.

Information and Misinformation

ADVANTAGE is being taken of the public interest in "superpower" and "interconnection" to gain some publicity of real value for the light and power industry. Publicity men, public relations men, public utility information bureaus are all at it. The amount of this literature, judging from that part of it which it is possible to collect and see, is somewhat awe-inspiring, at least as to quantity; and, on the whole, it is good work.

But a word of warning will not be amiss. This very public interest, the very political aspect in certain territory, make it doubly important that executives watch carefully this publicity in behalf of the industry to be sure that it carries nothing of misinformation along with its information. Wrong information in the sense of misstatement is hardly to be feared. But wrong conclusions which may be drawn because complete information and facts are lacking may be serious. The subject is important enough for constant executive attention.

How easily, for instance, a wrong conclusion may be drawn with reference to power interchange possibilities wherever two places are joined together by a line on a transmission-line map. That such a line exists or is to be built is not enough information. Unless it has sufficient carrying capacity it is only a beginning. A line from "A" to "D" is good for a large interchange of power only if its middle element—"B" to "C," for example—is as large as its other two elements, "A" to "B" and "C" to "D." In this connection it should be pointed out that the recent map of New York interconnection (see ELECTRICAL WORLD for Nov. 17) can be correctly interpreted only when the capacities of the various lines are considered. The closing of a small gap may not necessarily mean that Niagara power can be transmitted all over the state.

This particular example is not meant to detract from the significance of the New York report. It is used to indicate concretely a danger of misinterpretation by the public—and by unthinking men in the electrical business also—of the possibilities of certain developments. Information is valuable. It is too valuable to allow it to become diluted with misinformation.

The Eternal Question Bobs Up Again

FOR one reason or another the question of coal supply seems to appear with singular regularity at this season of the year. Just now the tracks are blocked with accumulations of bituminous coal, and to avoid too great an overproduction many mines have been shut down. But the first of April looms in the distance, and with it comes the possibility of another coal strike. If, therefore, production is curtailed at this time, there is not much likelihood of any great surplus next spring to bridge the emergency if it arises. This makes it necessary for electric public utilities particularly to keep their eyes on the coal piles and especially on the reserves. It is a pity that they must tie up millions of non-interest-bearing capital in coal piles because of the uncertainty of coal deliveries, but service is service in this industry, and if there is no other way of insuring service, they cannot give up the practice of storing coal in huge quantities until operators and miners cease to quarrel and the railroads function continually.

More Liberal Design of Transmission Towers Desirable

AT FIRST sight it does not appear that it should be a difficult matter to design transmission towers and lines so as to insure their stability and permanence under all conditions. The line, considered as a structure, is normally at rest and is subject only to such varying stresses as are imposed by weather conditions. Other structures of many types are subject to very much wider variations of load and stress, including those due to weather, and stand for years without question or doubt as to their reliability. Steel-tower construction for lines of 60 kv. and upward has been in use for more than thirty years, yet, as is well known, transmission-line failures due to causes other than electrical are not uncommon today. This is especially true whenever a step to a higher voltage is made, entailing wider clearances both between the conductors themselves and between conductors and ground.

There are apparently two principal causes of this seeming reproach to designers of transmission lines.

The first lies in the relatively poor mechanical properties of the line material. Good electric conductors of moderate size have low tensile strength, and the limitations of porcelain due to its want of elasticity and to its low tensile and compressive strength are well known. The second and more significant cause is the predominating importance which is always assumed in every new type of development or expansion by the question of economical design. It is only after a new type of engineering undertaking has definitely proved its value that it is found possible to turn the attention to, and to incur the expense of, obtaining such factors of safety as will definitely insure continuity of service. It appears that we are still in the initial period in the case of transmission lines. Voltages are still going up, the methods and constants used for lines of lower voltage are being used in the design of those for higher voltages, and the cost of the new structure is in most cases being pared so as to limit the new capital necessary to the smallest permissible figure. Obviously, in such a borderland between economy of material on the one hand and the considerable uncertainty as to properties of transmission-line material on the other, there is sure to result an occasional error in judgment and consequent failure of the line in operation.

These thoughts are suggested by the numerous papers on transmission-line construction which have recently appeared and which are doubtless inspired by the great interest now attaching to the higher-voltage lines in their relation to superpower projects. Several such lines are in operation, notably on the Pacific Coast, and the result of experiences in winter operation are indicating their weaknesses and the necessary modifications in design. The troubles which have arisen appear to be largely due to winter weather conditions in the mountain ranges. Not only have lines and insulators failed, but it is interesting to note that the great depths of snow in combination with spring melting have in some places resulted in the failure or serious damage of the tower itself. A particularly striking feature is the indication that the suspension method of hanging the conductor has decided advantages over the dead-end method of attachment, in spite of the greater clearances and increased cost of tower which are necessary. From the standpoint of economy W. Dryer, in the November *Journal of the A. I. E. E.*, shows the important bearing the figure of maximum tension allowed in the transmission conductor has on the cost of the tower itself. It has been common practice to string the conductor under tension nearly approaching the elastic limit. By reducing this stress to 60 per cent of the elastic limit the cost of towers and foundations shows a considerable saving, notwithstanding their greater height, and the failures on dead-end insulator strings are greatly reduced.

There is no question that a transmission line can be designed and constructed to the same degree of reliability as obtains in any other type of outdoor structure. In order to do this, however, engineers must know to a certainty the maximum demands which will be imposed upon a line, and then not hesitate to include in their design sufficient material to insure factors of safety liberal enough to cover the normal uncertainties and variations which pertain to the materials required by the electrical nature of the line. Perhaps the ascent of voltage will stop, for a time at least, at 220 kv. and so enable designers to take breath and become familiar with the utmost demands which may be imposed on any line and to lay down values of stresses, strains and other constants which will make it possible to construct a line for any condition with a reasonable certainty that it will develop no failure due to mechanical stresses either from without or from within.

Electric Furnaces Improve the Quality of Foundry Iron

A NEW type of cast iron has been developed lately in Germany which has been used in the Brown-Boveri works in Switzerland. This iron is called pearlitic gray cast iron and is made in an electric furnace as it requires a strictly controlled chemical content and heat condition for its successful manufacture. The material is reported to have physical characteristics far superior to those found in ordinary cast iron and is cast in a hot mold.

Foundry practices and the properties of ordinary cast iron have been little changed in recent years, and yet spasmodic reports from here and there indicate a very important field of investigation for the electrical industry. The electric furnace can make better metal than any other agency, and electrical equipment could rapidly reduce the costs of handling materials in the foundry processes. No reason for the lack of better results in the electrification of foundries exists except inertia on the part of both the electrical industry and the foundrymen. More frequent "get-together" meetings, with resultant profitable discussions between the two groups, should lead to real progress in foundry development, as was proved by the recent meeting of the International Foundrymen's Association in Paris.

Clearing Ideas on a Specific Example

AT THE last convention of the Illuminating Engineering Society a novel symposium was presented under the title of "Eleven Solutions of a Street-Lighting Problem." A definite street was selected by the papers committee, and all the required data were sent out to a number of lighting specialists who agreed to furnish estimates and specifications on lighting this street. As may be expected, the submitted solutions differ widely in the expenditure and foot-candles recommended, the spacing, height of suspension and so on, but the interesting point is that all argument and discussion has thus been centered on a perfectly definite, concrete case, rather than on generalities.

This method of presentation of vital problems at engineering conventions has much to be commended in comparison to the two usual methods—a general article and a description of an actual installation. Let, for example, the subject be the electric control of steel-mill drives. Usually three or four manufacturers will contribute papers on their respective controllers, and a few operating engineers may describe their particular installations. The types of construction, the local conditions and the methods of presentation being all different, it is rather difficult for an outsider not only to come to a definite conclusion but even to form a clear, composite picture of what is what. A better way would be to select a typical steel mill and to ask a number of specialists to specify a control equipment for it, with definite reasons.

It is readily apparent that such a method of treatment is applicable to many of the subjects discussed

at conventions. Switchgear in central stations, transmission-line design, even electrification of railroads, lend themselves to analysis by example in this way. How much more useful at this time would it be for the experts to agree on the mode of traction in a specific project than to disagree on what is best for all railways under all conditions. It is to be hoped other program committees will take a hint from the experience at Lake George.

Warning of Icebergs by the Salinity of Sea Water

WHEN our Coast Guard cutters are on ice patrol duty one of the regular measurements which they make is that of the salinity of sea water. This is done in the hope that a knowledge of the salinity may help in determining shifts of sea currents and the approach of ice floes or bergs. The Bureau of Standards has recently developed a device by means of which the electrical conductivity of the sea water can be measured in a simple manner and the indications made directly in amounts of salts. This procedure is much quicker and more convenient than the usual chemical titration method.

The ELECTRICAL WORLD is glad to note this new and extremely useful application of electricity. It is not a "load" to be measured in thousands of kilowatt-hours per year, but a new service to be measured in human lives and cargoes saved.

Power-Factor Correction and Power-Factor Rates

POWER factor continues to occupy a position of increasing importance as a problem in the electric power business. It is also becoming a more complicated problem because of its size and because as systems grow the engineering problem grows at least in proportion. Yet, in the last analysis, it is recognized that it is the power factor of the individual consumer which must be improved, and that the greatest incentive to him to improve it is a rate system, with a corresponding metering system, which will make it to his benefit to take positive action. It is early apparent to any student that poor power factor is a burden on the generating company. It is not so evident to all, though it is just as definitely true, that, even without a special power-factor rate, it is also at least a detriment to the consumer. To the central-station executive the seriousness of the problem of adding equipment to meet present and future demands naturally turns his attention to means of releasing existing equipment, now devoted to the supply of useless current, to more productive work.

It is apparent, however, that comparatively little is known of what practices have been tried, both in the United States and abroad, in the way of rate systems. An investigation of the practices of some companies in this country is presented in this issue. It shows, even among companies reporting "success," that in general results have not been wholly satisfactory—and it also gives some of the reasons and some suggestions for methods which should give better results. The variety, and consequent inequality, of the various rate schedules is pointedly shown from the fact that an identical customer would have bills varying from $5,332 to $10,500 for the same load conditions on different properties. This alone at least indicates the uncertainty inhering in a search for an adequate rate clause.

The more study is made of the whole situation, the clearer becomes the conclusion that a logical rate plan must be based on a kva.-demand charge and an energy charge. This plan has both the necessary simplicity and the fundamentally correct economic basis of charging for the service rendered. It seems easily practicable to have the kva.-demand charge adequately recompense the utility for the investment charge as well as some other fixed charges and so to relate the kva. and energy rates as to care not only for actual energy consumed but also for added losses resulting from low power factor.

The universal adoption of any such system is limited largely by the non-existence of a kva.-demand meter which is practicable from the standpoint of price, reliability and accuracy. Such a meter should, and doubtless will, be produced in the near future. When it does appear it will mean a most definite step in the solving of the power-factor problem.

But a rate system and a meter, and correct and corrective customer equipment—now available to a considerable extent—will not solve the problem alone. There are still problems of customer relations, perhaps also legal problems, to be met and handled correctly as a part of the whole. And the actual engineering problem of maintaining large-system voltage regulation and load division without seriously low power factor in places is no small one. Yet no part of the solution will be of any use until a satisfactory rate and meter system is evolved.

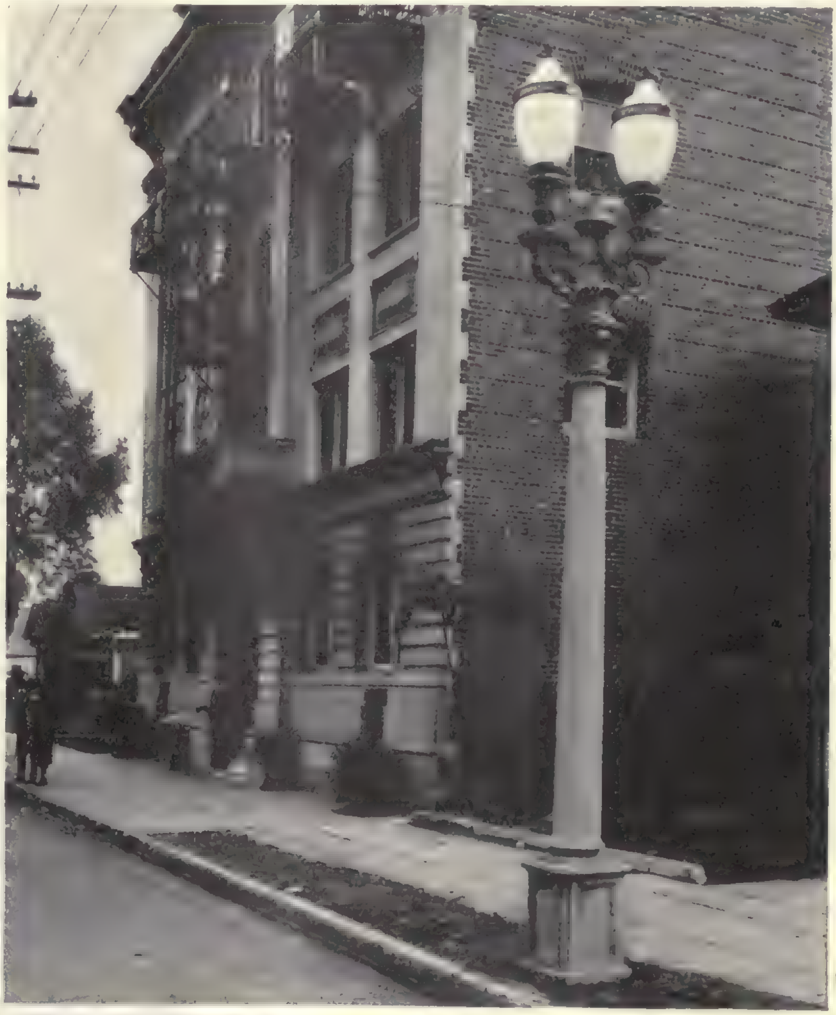
Meanwhile, the attention of executives and of their commercial and technical staffs may well be directed toward the experiences of the past and toward a closer study of the fundamentals involved in the customer-relations problem presented.

Relative Fields of Air Heaters and Economizers Investigated

AIR heaters have been available for years but received scant attention from American engineers until the recent wave of revolutionary steam practices swept the country. Then the air heater was added to the many experimental equipments installed by central-station companies, and some positive data are being obtained on the tube, plate and revolving types.

On a fundamental thermodynamic basis little thermal gain was to have been expected from the use of air heaters, and the mechanical complications and the installation costs were thought to offset the thermal gain. But the experimenters are finding not only a higher thermal gain than was expected from theoretical calculation, but also an operating gain in maintaining better efficiencies under operation at low or high ratings.

The air heater competes with the economizer from a thermal point of view, but investigation should show that each has a distinct field of application and that it may prove economical to use both under certain conditions. The air heater can often be installed to increase the efficiency of older plants and in general should be considered for plants having variable loads and high feed-water temperatures, or where fuel burns better with a warm-air supply or increased boiler capacity is required. The end of this year should make available the actual data on several installations from which preliminary reports have been promising.



Consider Good Architecture as Well as Good Illumination

LIGHTING fixtures can be made to harmonize and blend with their architectural surroundings during the day in addition to adding greatly to the appearance of the buildings by night through the use of good illumination.

Three views from Stamford, Conn., showing well-designed fixtures attractively blending with their surroundings. A view of the tall, graceful fixtures that add to the architectural beauty of the Essex County Court House in Newark, N. J., is also shown.

Experience with Power-Factor Clauses

An Analysis of Existing Practices—Opinions of Some Who Have Tried Out Power-Factor Clauses—Administration and Operation of Typical Provisions in Existing Contracts

SOME kind of a rate clause for securing power-factor correction has been advocated by many utility executives for several years. Several of the utilities have instituted and operated power-factor rate clauses with "more or less success," and an analysis of the experiences of these utilities should be very pertinent now that the subject of power factor is receiving thoughtful consideration from both the producer and the user of electrical energy.

Admittedly the practical aspects of power-factor correction are far from satisfactory from the standpoint of either the utility or the consumer. Both have been educated to realize that the operating and investment losses resulting from poor power factors are very considerable, and both are willing to spend some money to improve the situation. But the best and most equitable method for attaining the desired results is yet to be determined.

MANY ANGLES TO THE SITUATION

Experience gained in the work of the past few years shows quite definitely that power-factor correction is profitable and practicable in many systems. But experience also shows that simply the introduction of a rate clause is not in itself the sole remedy. Much skill, study and money has had to be expended wherever a successful scheme has been instituted for the commercial accomplishment of the objectives. It has been a problem in which executives, engineers, metermen and commercial salesmen are all concerned in achieving success, and it has been found that a co-ordination of their efforts and a pooling of their thoughts were necessary to arrive at a workable plan of procedure.

The principal difficulty, of course, is that it is not a central-station problem alone. It is also a customers' problem, and customer relations are definitely involved. Before any customer is convinced that operation at poor power factor is to his disadvantage financially, both directly and indirectly, the utility must expend time and money in tests, surveys and load studies. In any given factory a conclusive study of power-factor effects requires that tests be made on machines and circuits, that a study be made of production speeds and regulation requirements, that an investigation of investment in equipment and wire be made, and sometimes even an inquiry into the cost accounting of the factory operation is necessary. And then, after real data have been assembled, the executives and engineers of the factory must be educated as to the meaning of power-factor correction, convinced that the data are correct and that remedial measures will save them money.

Even then the work is not finished, for it usually devolves upon the utility to devise ways and means for securing and maintaining power-factor correction with the least expenditure of money and time and the least complexity in operation and administration. Contracts, rate clauses, meters and meter computations, billing, operating rules for corrective equipment and flexibility to accommodate the changes that occur in factory layout or production are a few of the features to be worked out.

From the specific factory the next step is to the utility system as a whole. Power loads are to be classified as to period of peak occurrences, load and power factor characteristics. Average and peak power-factor conditions must be weighed.

Then the financial study must be made as to the cost of applying power-factor correction on the system as a whole. This involves a study of meters and meter costs, costs of corrective equipment, the size and type of load to which correction should be applied and the cost of billing and administration. There is also the question as to whether to make rate clauses applicable to all power factors or only to those below, say, 80 per cent. No universal solution can be determined nor is it to be expected that any particular rate clause will be found universally applicable. But exchange of experience is valuable at least.

In order to get the experiences of those utilities that have attempted the big task of securing improved power-factor conditions on their systems, a questionnaire was sent out by the ELECTRICAL WORLD, and the replies have been analyzed to form the basic material in this article. The magnitude of the task, as outlined in the foregoing remarks, warrants the assembly of all available experiences and their analysis for the benefit of those contemplating active efforts to improve the power-factor situation on their systems.

Some Positive Opinions

Successful operation of power-factor clauses and the reasoning back of the clauses are well illustrated in the following opinions recently received as a result of the power-factor questionnaire:

COMPANY NUMBER I

FOR quite a period of years our rate schedules have contained power-factor clauses.

The administration and operation of our power-factor clause is left to the power sales organization. All the necessary tests to determine the power factor of the consumer's load are made by the meter department at the request and under the supervision of the power sales department. We have thought all along that this question is one which the commercial department should deal with, and it has been so handled in our organization. This policy calls for rather high-grade men in the commercial department, men who are equipped from a technical standpoint with the necessary experience and education to handle the question. They also must be of suitable personality to present the matter as a selling propostion to the consumer.

We have never considered a power-factor clause as a possible means of producing revenue. As a matter of record in our system the bonuses given to consumers having good power factor amount to far more than the penalties inflicted on other consumers having poor power factor.

Although our rate schedules provide that we meter the consumers' power factor, we have made no efforts to do so on account of the fact that simple and reliable equipment for metering the consumer's power factor does not appear as yet upon the market.

The establishment and administration of a power-factor clause is a matter of "give and take" with our consumers. We believe that the par-

ticular type of power-factor clause is of minor importance as compared with the methods and means used to administer and operate the power-factor clause. We believe that if a power-factor clause appears in a rate schedule at all, it should be enforced and should not be used merely as a talking point, forgotten after the contract is closed. Our experience, furthermore, leads us to believe that a power-factor clause should be applicable to all classes of industrial power consumers.

As to how we "sell" consumers, this perhaps can be best answered in part by stating several "don'ts." We do not refer to "penalties" for poor power factor. We do not refer to "bonuses" for good power factor. We prefer to approach the customer and show that it *costs more to serve a poor power-factor load than a good power-factor load,* and that we are willing to make an adjustment in the cost of our service for power-factor conditions. We use three methods in general: (1) Difference in the cost of our service, poor power factor versus good power factor; (2) improved service to the consumer because of good power factor rather than poor power factor; (3) improved service to other consumers on the same line because of good power factor rather than poor power factor.

Our clause for the three power-rate schedules is: The company reserves the right to test or meter the power factor of the consumer's load, and if greater than 85 per cent lagging, then the measured monthly demand shall be decreased for billing in the ratio that 85 per cent bears to the actual power factor (in per cent) as determined. The correction for all leading power factors shall be the same as for 100 per cent power factor.

If the power factor of the consumer's load is less than 75 per cent, then the regular monthly demand in kva. is increased for billing in the ratio that 75 per cent bears to the actual power factor (in per cent) as determined.

About 80 per cent of our output comes under this clause and it is identical in all three of our power schedules, each one of which is applicable to a particular class of consumers. One thing may be noted in reference to our power-factor clause. Since the measured demand is corrected for power factor, not only the billing demand changes according to power factor, but also the energy blocks, because the energy blocks are derived directly from the corrected demand. In regard to the application of the power-factor clause to types of loads and consumers, we try to treat all alike. In other words, we try to bill each consumer in accordance with the average power factor set up by his load.

As to metering:

(a) From an accuracy standpoint: You will note by referring to our rate clause that a neutral zone is provided from 75 to 80 per cent lagging. This neutral zone is intended to take up some of the possible inaccuracy in metering consumers' power factor. It also relieves us from the testing of certain loads which we know to be within a neutral zone. For other loads having power factor above and blow the neutral zone, in general we use the graphic recording power-factor meter. We are not prepared to say that this is the best method.

(b) From cost standpoint: Until the whole question of power factor is more definitely settled, we would not care to make any large investment in permanent metering equipment to be used for power-factor work.

(c) From the operating and billing standpoint: As may be inferred, we do not attempt to meter the power factor of the consumer's load. We do, however, measure the power factor of the consumer's load by means of a graphic power-factor meter, which is installed usually for a period of from two weeks to a month. Also, it is our usual practice to install a graphic wattmeter at the same time that the power-factor meter is installed and thus secure a concurrent record of the load. From the records so obtained we calculate as accurately as possible the average power factor of the consumer's load and apply the power-factor clause to this average. As a rule, we endeavor to make at least one test of the consumer's power factor every six months. In a number of cases consumers have their own graphic power-factor meters. We have several consumers who send in their power-factor charts monthly in the same way as the power meter chart is sent in. We do not hesitate to accept the chart from the consumer's meter, except that we occasionally check his meter with our standard. We are fairly well satisfied with present methods.

We have had no difficulty in establishing power-factor clauses in our rate schedules and no legal difficulties that the writer is aware of. The power-factor clause is accepted by consumers on our system as being a fair proposition, and with very few exceptions we have no complaints regarding it.

A rather striking case of trouble occurred in a large foundry and machine company whose power factor when measured was found to be about 65 per cent lagging. This was rather surprising to every one concerned as the company operated several synchronous motors. Investigation disclosed the fact that the synchronous motors were being operated at very much reduced excitation, and instead of being high-power-factor machines they were actually operating at a power factor worse than the majority of induction motors. When properly excited, there was no difficulty in raising the power factor of the consumer's load to 95 per cent, with a resulting improvement in the voltage regulation at the plant. In addition, the consumer was given an adjustment in his power bills which amounted to over a thousand dollars a year.

This case brings out a particular point which has not been given the attention which it deserves. At the present time, only one large manufacturer of synchronous machinery stamps on the nameplate data giving the excitation required by his machine for 100 per cent or 80 per cent leading power factor as the case may be for the particular machine.

The manufacturers of synchronous motors should stamp this information on the nameplate of the machine.

COMPANY NUMBER II

Our power-factor clause has proved satisfactory as a revenue producer or an incentive for the consumer to improve his power-factor conditions and has been very simple from a metering and billing standpoint, and we can suggest no improvement.

We have no additional organization for the administration and operation of the power-factor clause, since our ordinary organization for power work takes care of this. Whenever we determine that a consumer has a low power factor, we take the matter up with him, calling his attention to the penalty, and suggest that we shall be glad to be of assistance in a study of corrective possibilities. If the customer is satisfied to have a low power factor and pay us therefor, we have no objections, and since we can provide synchronous equipment in our substations to take care of the low power factor as long as we are securing sufficient revenue to cover the cost of the service, including interest, we are not particularly interested in the consumer's power factor.

We have no results showing a definite power factor due to the power-factor clause, because our business is growing too rapidly to make any comparison, but about 85 per cent of our power business is taken care of under the rate with the power-factor clause.

In installations of 200 kw. and over we meter the demand and the power factor monthly by active and reactive printometer meters, and we find this metering equipment the most expensive but the most accurate. For installations of 300 kw. to 2,000 kw. we usually install a General Electric G-4 demand meter and a kilowatt-hour and a reactive meter, and thereby secure the average power factor. For installations of less than 300 kw. we usually use the General Electric M-4 demand meter and measure the average power factor. We have found the average power factor to be an equitable method of measurement for low-tension metering, but not for high-tension metering, and in those cases where the service is metered at high tension the printometer type meter should be used.

We have a customer who has an actual demand of about 1,000 kw. and an average power factor of about 50 per cent, which means that the billing factor is about 1,400 kw., or $500 a month penalty for low power factor. The consumer is an excellent prospect for heat-treating load, and we have recommended that he shall not install a synchronous condenser, but instead about 300 kw. of heat-treating equipmet. It so happens that the consumer's billing demand will not be appreciably affected, and we shall secure the additional load which he can well afford to put on.

Our specific clause for general power customers provides that if the average power factor is more than 85 per cent, the demand for billing purposes will be adjusted to an 85 per cent basis. If the power factor is less than 80 per cent at the time of maximum demand, or 70 per cent average, the demand for billing purposes is adjusted to 85 per cent.

COMPANY NUMBER III

We are still groping our way to find the best solution. It seems to be very difficult to apply a general power-factor clause which works out satisfactorily in all cases.

It is not our object to provide additional revenue. We feel that in every case the customer can—either by the selection of the proper motor or by means of corrective apparatus—furnish

a power factor of at least 80 per cent under average conditions.

We find that by means of a power factor clause such as our later contracts contain the customers also find it advisable to correct the power factor rather than pay any penalty for low-power-factor condition.

The application of a power-factor clause for the first time proves a source of difficulty with the customers. It requires cons derable explanation and attention. We have made it a practice in a large number of cases to make a complete survey of the customer's motor installation in order to determine for the customer what changes are desirable to improve power-factor conditions. This we have done without any expense to the customer. and it has proved of great value both to him and to ourselves.

The best application of a power-factor clause is by means of a demand and energy charge rate, the demand to be measured in kva. rather than in kw.

We have not provided a special organization for administration of pow r-factor clause, but have called upon our metering department for test work and demonstration.

At the present time about 35 per cent or 40 per cent of our connected capacity comes under the power-factor-clause rate.

From the standpoint of accuracy we find measurement of power factor by means of comparison of two watt-hour meters, one measuring reactive kva. and the other one kw., to give us highly satisfactory results, and the same is true from a cost standpoint.

Where the power-factor clause is applied on the basis of power-factor conditions of the entire month, the methods above given also are best. Where it is necessary, however, to confine attention to power-factor conditions to predetermined intervals of the day the graphic representation of power factor is the better scheme. This is true for the reason that if watt-hour meters are employed, it is necessary that they in turn operate a graphic dev ce, so that it is possible for the billing department to determine the power factor during such predetermined periods of time.

We have no actual data on improvements obtained, but in a number of instances there has been great improvement in voltage conditions by the customer correcting power factor by means of using spare capacity in its own generating apparatus.

Our clause is as follows:

"The consumer agrees that it will at all times between 7 a.m. and 6 p.m. on week-days maintain a power factor of 80 per cent or better. In case tests made by the power company shall indicate that the consumer's power factor is lower than 80 per cent at any time between the hours of 7 a.m. and 6 p.m., the consumer shall make the necessary changes in or additions to its equipment to correct the fault, and during each month until such change is made both the demand and kilowatt-hour charge for each month shall be increased by the following percentages for the following power factors as shown by tests:

Per Cent Increase	Power Factor, Per Cent
5	Above 75 and not above 80
15	Above 60 and not above 70
25	Above 50 and not above 60
50	50 or less

COMPANY NUMBER IV

THROUGH careful study, adequate missionary work and the co-operation of customers we have incorporated a power-factor clause in our rates which has proved successful from every standpoint. At present 82.7 per cent of our output comes under the power-factor clause, and on peak load the power factor of the system ranges from 88 to 91 per cent lagging.

We have been able to show customers that the saving in power cost by installing corrective equipment is sufficient to pay 25 to 50 per cent return on the investment. The clause has worked out successfully as a revenue producer, as a practical metering proposition by using active and reactive meters, as a feasible accounting and billing system, and as regards its reaction on customer relations.

The administration and operation of the clause is in the hands of the distribution and power engineers. The rate is applied in two ways:

For general power with incidental lighting with a demand under 15 per cent of total demand the bill is decreased by 1 per cent for each 1 per cent the average power factor is above, or increased by one-half of 1 per cent for each 1 per cent the average power factor is below, the following: 75 per cent for installations of 75 hp. or less, 85 per cent for installations of over 75 hp.

The power factor is determined under this rate as follows: Installations of 75 hp. or less, by measurements periodically (at least once in each six months), or, upon payment of $2 per month, the customer may have power factor determined in the same manner as for installations of over 75 hp., i.e., by computation monthly from the registrations of active and reactive watt-hour meters.

For general power having a high load factor the measured demand is decreased or increased proportionately for billing purposes if the average power factor is above or below the following: 75 per cent for installations with a demand of 50 kw. or less, 85 per cent for installations with a demand of over 50 kw.

COMPANY NUMBER V

OUR power-factor clause is incorporated as part of the general demand billing as follows:

"The average load will be determined for each half-hour period by suitable instruments. Either the average kilowatts or 80 per cent of the average kilovolt-amperes, whichever is highest, will be considered the demand for that period. The average of the 150 highest demands that have occurred in the year preceding the date to which the bill is rendered will be the kilowatts of service for that bill."

The power factor of retail customers' load under 60 kva. has not yet been considered. Results of this clause are very satisfactory from all standpoints.

Low power factor at the private plants requires increased generating capacity. Rates should be only on a competitive basis; therefore. the capacity or demand charge equivalent to overhead on plant should be made on a kva. basis. If rates are irrespective of locality, the copper losses due to low power factor should be overlooked, as are the regular transmission losses.

Power factor does not appear on the customer's bill. In case of complaint, competition or very low power factor, the regular power salesmen investigate each individual case, reducing the connected motor load if possible. Few cases have so low a power factor that condensers will show a profit. Although we sell capacity in kva., we always try to influence the customer against overmotoring.

COMPANY NUMBER VI

WE HAVE had a power-factor clause in operation for over a year with splendid results. The introduction of the clause has raised our system power factor from about 70 per cent to 85 per cent, and about 25 per cent of our total sales for light and power come under the clause. These loads maintain about 100 per cent power factor.

A power-factor clause is only practicable, in our judgment, in the case of large consumers with a demand in excess of 500 kw. The following clause is used by us:

"A deduction or addition of 1 per cent of the bill for each 1 per cent that the monthly average power factor is in excess of or less than 85 per cent.

This applies only to purchasers buying power metered at 13,200 volts and who supply their own transformers and substation quipment.

The power factor is determined by the readings of a reactive volt-ampere-hour meter, the data are taken by our regular meter readers, and billing is done by our usual force. We talk this clause to customers from the standpoint of real reduction in cost of power and usually find the large customer has an engineering staff capable of comprehending the mutual advantages of high power factor.

Some Negative Opinions

Representative opinions of companies which disbelieve in power-factor clauses or have had little success in putting them into operation are as follows:

COMPANY NUMBER VII

WE FEEL that under present conditions on our system it is not advisable to establish power-factor clauses. It would work to the advantage of a few consumers. but in cases where penalties are assessed, dissatisfaction arises.

COMPANY NUMBER VIII

WE HAVE considered this matter at considerable length and, although in one or two cases we have undertaken to include power-factor clauses they have been taken out of the contracts before the contracts were closed.

We are doing a good deal toward the matter of power-factor correction, but it is mostly done in our own substations with synchronous condensers. We have found it difficult to explain to our customers what we mean by power-factor correction. and they generally take the attitude that they are in the market for power and prefer us to handle the technical parts of the question. In one or two cases we have been able to get

customers to install condensers, explaining to them that it has a value to them in the matter of voltage regulation and in reducing the transformer capacity necessary in their substations, but this has been the exception rather than the rule.

COMPANY NUMBER IX

WE HAVE never put any power-factor clause into practice. While we have given the matter some thought, we do not believe that anything of this nature would help us much in the present stage of development in our territory.

The only place that low power factor affects us much is in the distribution system and substation transformers, inasmuch as on account of the fact that our long lines supply a very considerable amount of leading current in the shape of charging current the power factor at our generating stations is quite high. While low power factor is sometimes a problem on the distribution system, we have not found as a practical matter that we could better the situation with a power-factor clause in our rates.

COMPANY NUMBER X

WE HAVE a clause in our tariff which requires a minimum power factor of 80 per cent on the part of any customer purchasing electric service, but we have found no way in which to make this clause actually operative inasmuch as we have no particular rate, discount or inducement to offer the consumer which would induce him to install synchronous motors or other equipment to improve power-factor conditions.

Some companies have adopted the kva. power rates, which in a manner encourages the use of high-power-factor apparatus, but in my opinion as long as the manufacturers sell and encourage the sale of squirrel-cage induction motors of all sizes, and as long as these motors are sold considerably cheaper than synchronous motors of the same sizes, it will be impossible to improve power-factor conditions unless the utilities see fit to make a lower rate for energy to consumers maintaining high-power-factor loads.

It might be possible for utilities having no competition to fix rules and regulations with public service commissions' approval which would tend to force the use of high-power-factor apparatus. My opinion is, however, that this is not a desirable way to bring about the result, which should be accomplished by a campaign of education and some inducement in rate.

COMPANY NO. XI

WE HAVE no power-factor clauses embodied in our rate clauses, although we have made studies at various times to determine the advisability of including such clauses in our rates. But our system consists of very long transmission lines, and the resultant capacity offsets the inductive effects of motor loads to a certain extent and our system power factor is very satisfactory.

We realize that we are being penalized for excessive investment in local distribution and transformer equipment to service low-power-factor customers, but we believe the possible revenues through rate penalties would not offset the expense of administering the clauses and carrying the added meter investment, to say nothing of resulting dissatisfaction, complaints and loss of good will.

Groping for a Solution

Eight companies out of twenty-four to which questionnaires were sent stated they were much interested in power-factor correction and were studying to arrive at some workable and adequate scheme for introduction on their system. Several things give trouble in connection with the introduction of a system. The cost of meters and administration is excessive if applied to all power loads, and the meters available are not entirely satisfactory from an administration standpoint. The introduction of a power-factor-rate clause complicates the rate schedule, is difficult to "sell" to the consumer, is difficult to compute and incorporate in a billing scheme, and is difficult to apply in such a way as to treat all customers equitably.

Yet the visible advantages of good power-factor conditions for both the producer and the consumer are so enticing that these companies believe some corrective scheme should be instituted.

Many Rate Clauses Are Available

The power-factor clauses that appear on rate schedules are not always enforced. Only eighteen of the twenty-four companies recently canvassed enforce their clauses. Many of the clauses are vague and indefinite and are used as a threat when making power contracts and then are laid away in lavender. Of the enforced clauses, a great non-uniformity exists as to basis of billing and application. A study of the table shows the application of the clauses of nineteen different systems to a hypothetical power customer who has the same demand and energy rates for all the systems. Six give an inducement of small value to improve the power factor above 80 per cent. All nineteen penalize low power factors with 80, 75 and 70, as basic starting power factors for penalty applications, depending on the company. A very remarkable difference exists in charges. For 70 per cent the difference between the lowest and the highest bill is $1,650, while for 50 per cent power factor this difference becomes $5,168, which is about equal to the total power bill at unity power factor. Some of the clauses are inequitable and ill-advised and only a very few have any logical basis. A general trend exists toward the use of a clause that involves the use of demand billing on a kva. basis with a bonus and penalty for power factors above and below a specified figure. But a wide difference of opinion exists as to how much bonus or penalty to apply.

The following are typical rates applied by utilities to secure power-factor correction:

1. Bill 80 per cent of the kva. demand instead of kw., if the power factor goes below 80 per cent for a material length of time.

2. When the actual power factor is less than 80 per cent, the demand to be charged and paid for shall be obtained by multiplying the demand shown by the meter at the time of measurement by 80 and dividing this product by the actual power factor.

3. Should in any one month the power factor be less than 75 per cent, the gross service charge will be increased for that month at the rate of 5 cents per kilowatt of demand for each per cent that the power factor is less than 75 per cent.

4. If the power factor is found to average below 85 per cent, 1 per cent shall be added to the contract demand charge for each 1 per cent of average power factor below 85 per cent.

5. When graphic instruments are used for measurement, the contract load is determined by dividing the reading by 9/10; this is on the assumption that the power factor is 80 per cent and we are dividing with the customer the burden of the power factor. Smaller power customers taking less than 100 per cent kw. have their demand measured by Wright demand indicators, in which case we multiply the demand meter reading by 9/10, thus again dividing power factor burden with the customer.

6.

Power Factor (Per Cent) of Customer's Load	Per Cent Increase in Service Charge
75 to 79	7½
71 to 75	15
61 to 70	30
51 to 60	60
50 and below	100

7. For each reduction of ten points in the ratio of reactive kilovolt-ampere-hours to kilowatt-hours for any given month a discount will be allowed on the gross bill computed at the rate of 1 per cent for each such ten points decrease. (Maximum discount 8.72 per cent.) For each increase of ten points in this ratio a corresponding charge will be added to the gross bill computed at the rate of 1 per cent for each ten points increase.

8. The minimum power factor when operating the consumer's normal loads shall not be less than the following: Up to 10 hp., 80 per cent; 10 hp. to 100 hp., 85 per cent; in excess of 100 hp., 90 per cent.

The company may test once in each six months to determine the average power factor under normal operating

conditions, and if the power factor is below the minimum, then the rate for energy metered at 2,200 volts for the month in which the test is made and for succeeding months until another test is made shall be increased for billing purposes in accordance with the following formula:

$$\frac{\text{Schedule rate times required power factor}}{\text{Average power factor in per cent}} = \text{billing rate}$$

9. If the power factor from test is more than 85 per cent lagging, then the measured monthly demand shall be decreased for billing purposes in the ratio that 85 bears to the actual power factor. If the power factor is less than 75 per cent lagging, then the demand for billing is increased in the ratio 75 bears to the actual power factor.

10. If power factor from test is less than 80 per cent, then the demand and energy charges shall be increased as follows:

Per Cent Increase	Power Factor
5	Above 70 and not above 80
15	Above 60 and not above 70
25	Above 50 and not above 60
50	50 per cent or less

Clause No. 2 is the most popular, six systems using it as compared with four systems using clause No. 1. Clause No. 2 is used by one company with the addition of a bonus which is based on the same percentage basis as the penalty. Clause No. 4 is also used with a bonus system, one company granting 1 per cent decrease in bill for each 1 per cent increase in power factor above 85 per cent and another reducing the bill one-half of 1 per cent for each 1 per cent increase in power factor above 85 per cent. The clauses of the type given in No. 1 and No. 2 are favored because they are easy to operate and administer with an existing organization and commercial metering equipment is available for determining kva. demand. This type of clause also is favored because the block energy rates can be related to the demand values, and in this way a convenient method is available to secure both a demand and energy charge for poor-power-factor conditions.

Administration of Clauses

The consensus of opinion is to the effect that the responsibility for the application and enforcement of power-factor correction should be by the power sales department. This is because the many elements involving public relations, customer relations, engineering studies and tests and unusual metering and operating procedure can best be treated by the high-grade commercial and engineering type of personnel found in modern power sales organizations.

Power-factor correction is but one added duty for the consulting service engineers commonly called power salesmen. These men can call upon and supervise the more technical work of the engineering, testing and meter departments when their services are needed and can speak with perspective and knowledge in councils involving the utility executives and ratemakers.

When the magnitude of the engineering and commercial job involved in a real study of corrective possibilities is considered, it is no wonder that hit-or-miss methods have often failed and are entirely illogical. The only practicable way to carry out a power-factor analysis is on a piecemeal and step-by-step basis, and even this is subject to question on account of the system changes that may occur because of the long-time element involved. Yet, once a system is analyzed and known, conditions can be kept up to date quite readily since each new customer can be treated as he comes on.

APPLICATION OF POWER FACTOR CLAUSES IN MONTHLY BILL

Assumed conditions: 500 kw. maximum demand, 150,000 kw.-hr. per month, demand rate $1.50 per kw., energy rate 3 cents per kilowatt-hour and power factors of 50 and 70 per cent lagging and unity.

50 per Cent	70 per Cent	100 per Cent
$6,375.00	$5,302.50	$5,137.50
5,696.00	5,302.50	4,787.00
6,000.00	5,572.00	5,250.00
7,085.00	5,600.00	4,900.00
6,000.00	5,572.00	5,138.00
5,550.00	5,360.00	5,138.00
7,875.00	6,040.00	5,250.00
10,500.00	6,925.00	5,250.00
5,875.00	5,275.00	5,250.00
6,000.00	5,572.00	5,250.00
5,435.00	5,362.00	5,250.00
5,332.00	5,332.00	5,250.00
5,700.00	5,575.00	5,250.00
7,875.00	5,860.00	5,250.00
5,700.00	5,405.00	5,250.00
5,700.00	5,360.00	5,250.00
5,700.00	5,572.00	5,250.00
6,195.00	5,813.00	4,465.00
9,450.00	6,760.00	5,250.00

Conclusions

Some general conclusions to be drawn from past experiences are:

1. Rates should be simple and power-factor correction should be handled without attempting to educate customers as to the meaning of power factor and without specific mention of power factor in the rate clauses.

2. Equipment and methods have been developed whereby it has been found feasible and profitable to apply power-factor correction to large power customers.

3. In order to secure the simplest rate system, customers should be billed on kva. demand and on energy consumption. The greatest drawback to this scheme lies in the inadequacy and cost of kva. metering equipment, and the greatest constructive step toward the adoption of this rate scheme for all customers lies in the development of a kva. demand meter which ranks with a kilowatt-hour meter as regards accuracy, cost and simplicity.

4. Less than a dozen central-station companies really enforce a power-factor-rate clause, and there is a decided disagreement as to the best type of clause to use. Yet executive attention and interest in the question of power-factor correction have never been greater, and the future looks promising.

5. A really workable scheme for improving the power factor of systems will save millions of dollars to the industry through eliminating the necessity for adding capacity to care for increasing loads and through increasing the production and bettering the service of power users.

6. The solution to the power-factor situation involves the use of higher-power-factor equipment, the use of corrective apparatus by both the central station and the user and the adoption of a rate system involving both a capacity and an energy charge.

Model Cotton Mill in China

ONE of the most up-to-date cotton mills in the world was recently put in operation at Shih Kia Chwang, Chihli, China, by the Dah Shing Cotton Spinning & Weaving Company, all the equipment being of Westinghouse manufacture. Power for the plant is furnished by a 1,250-kva. turbo-generator unit which supplies current at three phase, 60 cycles and 600 volts. The switchboard is of standard construction and includes the latest protective devices. Motor drive is used exclusively. There is plenty of coal available near the mill, but good water is scarce and it is necessary to conserve the supply. To do this a spray system and cooling pond have been installed.

Is the Overhead Ground Wire Effective?

BY C. C. MOLER

With Comments by F. W. Peek, Jr.

THERE has been a wide variance of opinion and much discussion regarding the performance and protective value of the overhead ground wire on transmission lines. Several years ago the National Electric Light Association made a study of this subject, sending out questionnaires to about sixty of the leading transmission companies. The questions covered the subject very thoroughly and the replies* ranged from one extreme to the other. Some were based on experience and comparative data, while others were opinions more or less unsupported. The net results, however, were such that no conclusions could be drawn.

Dr. Steinmetz has expressed himself rather definitely in this regard. He supports his opinion by an explanation of the performance of the ground wire, and says that if in operating a transmission system he were deprived of one or the other—the overhead ground wire or the lightning arrester—he would prefer to retain the overhead ground wire. A study of this subject requires a great deal of time and apparatus, whether made in the laboratory or in the field.

The writer has developed a theory which he wishes to present for discussion: The earth is a conductor of varying conductivity, depending upon the place, conditions, seasons, etc. Nevertheless, it is one conductor, and no part of it can be considered as insulated from another. It is often said to be at zero or ground potential, and therefore a difference of potential can exist betwen two points only until the resulting ground current has dissipated or equalized this difference in potential. A discharge of lightning between a cloud and a point on the earth raises that point to a high potential. This potential is dissipated by high-frequency surges through the earth in all directions, probably with the greatest intensity comparatively near the surface. These ground surges themselves set up surges in neighboring transmission systems.

Consider a transmission line 50 miles in length paralleled by an overhead ground wire grounded every 500 ft. and supported only a few feet from the transmission-line conductors. A stroke of lightning taking place near one end of the line—not necessarily a direct stroke on the line—tends to dissipate itself through the earth to more distant points, including territory at the far end of the line. The earth offers some resistance, and therefore at least a part of the discharge finds a convenient path through the overhead ground wire. It reaches the ground wire through many of the neighboring grounds and then takes its course over the ground wire, dissipating itself by returning to the earth through many of the grounds that are near the far end of the line.

These surges taking place through the overhead ground wire only a few feet from the line conductors induce heavier surges in the transmission system than if the lightning discharge had been through the ground only, which discharge, if it did parallel the line, would have been much further from it. Stray trolley currents take overhead ground wires in their return paths. This is proved by the grounds being eaten off by the electrolytic action. As a better example, however, lightning has often been seen to snap at the joints in railroad rails when the storm was miles away. These rails are well grounded at places and grounded to some extent throughout. Similar occurrences have been observed on pipe lines which were actually covered with earth throughout a large part of their length. Therefore there can be little doubt that these manifestations are parts of the original lightning charge and not induced currents.

If this theory be correct, would it not be better to adhere closer to the lightning-rod idea, stringing overhead ground wires, but breaking them up into as many sections as there are grounds by inserting strain insulators? This method would, of course, entirely destroy what has been put forth by some engineers as the action by which the ground wire prevents or reduces surges in the transmission conductors, i.e., its inductive relationship to them. However, is this not looking at the problem as through the wrong end of a telescope? Why not consider the surges existing primarily in the ground wire, thereby inducing surges in the conductors.

VIEWS OF F. W. PEEK, JR.

In commenting upon this theory at the request of the editors of the ELECTRICAL WORLD, F. W. Peek, Jr., said:

"If I understand the author correctly, he believes that during a thunderstorm a difference of potential between points on the ground along a transmission line may cause large transient currents to flow in the ground wire, and that such currents by magnetic induction would cause transients in the transmission line. I doubt very much if appreciable transient currents ever flow in the ground wire owing to the above cause. The earth itself would offer a much easier means of equalization for such currents. Even when two earth points are miles apart, the greater part of the resistance is usually in the contact. Thus, even if the resistance of the wire were low and it did not have a high inductance to earth the contact resistance would still prevent large transient currents from following it.

"However, current does flow in the ground wire during its operation as will appear. The ground wire offers protection (1) by acting as a lightning rod in case of direct stroke, (2) by reducing the voltage induced by electrostatic induction.

"The induced voltages are determined by the 'charge' on the line and by the capacity of line to ground. When a lightning flash occurs from cloud to cloud or from cloud to ground, the charge on the line is released and a wave of voltage and current results. The voltage above ground will be low if the charge is small and the capacity to ground large. The ground wire reduces the voltage by reducing the charge on the transmission line below that on an unprotected line and by increasing the capacity between line and ground. Calculations indicate a reduction of 30 per cent or more.

"In either case (1) or case (2) a current will flow in the ground wire by direct stroke or static induction, but will discharge to ground at the nearest grounded point. Current flowing in the ground wire will, of course, cause current to flow in the transmission line by electromagnetic induction. This will, however, be small compared with the current directly induced in the line.

"Electromagnetic induction may be of importance in certain special cases. For instance, a magazine protected by a complete cage would be free from electrostatic induction, but heavy lightning currents flowing in a lightning rod could produce voltage in the interior of the cage by electromagnetic induction."

*N. E. L. A. Proceedings, 1921, Vol. 2.

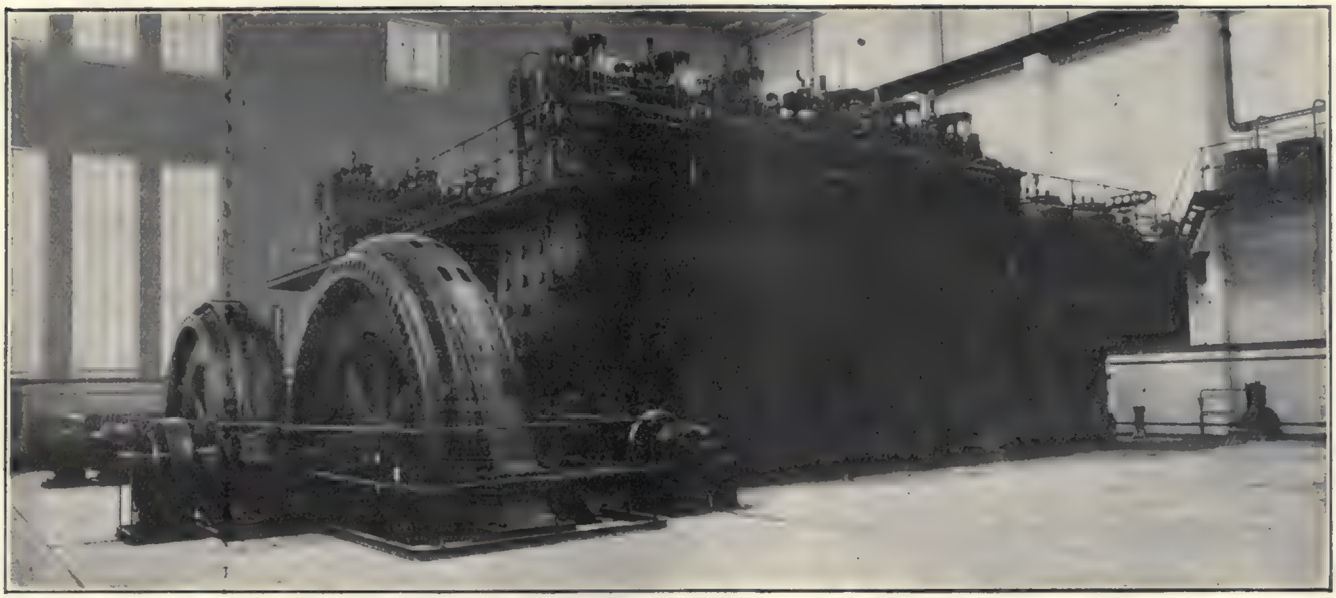


FIG. 1—TWO 3,000-HP. TWO-CYCLE DIESELS IN BREMEN ELECTRIC PLANT

Possibilities of Diesel Engines for Central-Station Service

This Equipment Can Be Built in Large Sizes, Despite Assumption to the Contrary—Erroneous Conception Prevails as to Its Costs and Limitations—Analyses of Cost of 5,000-Kw. and 20,000-Kw. Stations

By E. B. POLLISTER
Busch-Sulzer Brothers-Diesel Engine Company

THE rapidly changing art of energy production has revived the interest in possible alterations of many pieces of equipment and schemes of development that had been considered as fixed and stationary. The object of all efforts in this direction is to produce electricity more cheaply whatever the type of equipment used.

The use of high-pressure steam and of mercury-vapor boilers and other radical departures have caused Mr. Pollister to write this article on the Diesel engine, with the idea that central-station engineers and executives should carefully consider this type of prime mover in the larger sizes that can be built on the basis of years of actual experience with smaller units.—*Editors.*

FRANKLY speaking, central-station engineers and executives have been conservatively slow in using the Diesel engine and have not sufficiently investigated its possibility as a prime mover in the central-station industry. They have been inclined to assume without much investigation that the admittedly superior thermal economy of a Diesel engine is offset by a higher initial cost, a higher maintenance cost, a shorter life, and a more expensive, because more skilled, operating force. They have, besides, too quickly decided that its use is properly limited to small units under 1,000 b.hp. in very small stations.

These assumptions about the Diesel are incorrect, and its possibilities should receive thorough and careful consideration. In the first place the Diesel engine has a thermal efficiency such that 30 to 35 per cent of the heat units in the fuel are converted into mechanical energy. Moreover, if the available heat in the exhaust gases and cooling water is fully utilized in waste-heat boilers or exhaust-gas turbines, an over-all Diesel plant thermal efficiency of 80 per cent may be obtained.

This is an outstanding figure to contemplate in comparison with the possible thermal efficiencies of any steam or mercury-vapor plant, and yet the inherent engineering difficulties and mechanical complexities associated with its attainment are less than those encountered in any other energy-conversion system. It seems remarkable that such an economical thermal agency has been left quiescent by central-station engineers during the recent period of searching the highways and byways of the world for equipment capable of being developed into more efficient thermal mechanisms.

It may be that this has resulted from the assumption that Diesel engines can be built in small sizes only or in small quantities. As an actual fact, however, in Europe one manufacturer, as an example, has built 750,000 hp. in Diesel engines since 1903 in sizes up to 4,000 b.hp. and including 39-b.hp. to 1,500-b.hp. units and has suc-

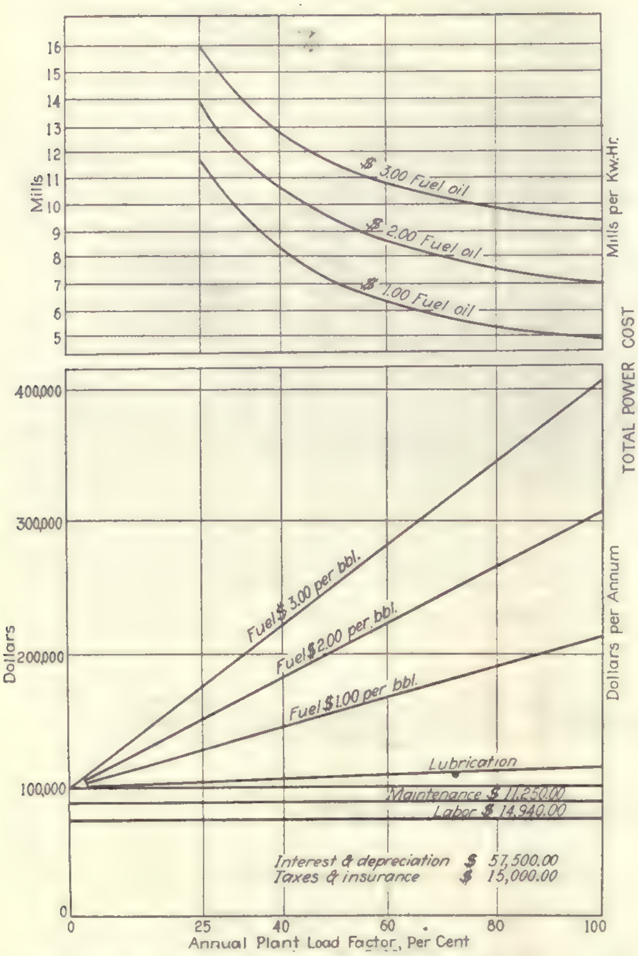


FIG. 2—COST OF DIESEL-ENGINE POWER FOR 5,000-KW. PLANT

cessfully constructed a 2,000-hp. experimental cylinder to demonstrate the practicability of eight-cylinder, 10,000-kw. units. Yet the total stationary Diesel capacity in the United States in central-station service will not aggregate more than 500,000 b.hp.

There is no reason whatever to state didactically that Diesel-engine units are limited to small sizes. There is no engineering reason why 4,000-kw. and 6,000-kw. units cannot be produced in this country at present, and there is little difficulty in visualizing units of 10,000 kw. and 15,000 kw. as a future development. And why shouldn't 4,000-kw. or 6,000-kw. Diesel-engine units be used in the central-station industry, even with the development of superpower systems?

A 20,000-kw. Diesel plant will use only 0.75 sq.ft. of floor space per kilowatt installed, or a room about 168 ft. x 94 ft., having a height of 46 ft., including crane clearances. It will cost complete about $150 per kilowatt installed and will contain five 4,000-kw. units. If it operates at a 50 per cent load factor, the fixed charges on the initial cost will not exceed 1 mill per kilowatt-hour. The life of the engine will be at least twenty-five years, the depreciation rate being only about 4 per cent and the maintenance 1½ per cent.

Oil-Burning Stations Should Consider Diesels

The United States Department of the Interior reports an annual consumption of fuel oil in the production of electricity of 13,197,216 barrels for the year 1922. Of this amount about 12,000,000 barrels was used in steam boilers in generating stations in all parts of the country. Rhode Island, Kansas, California, Texas and Florida are states that use large amounts of fuel oil under steam boilers. Operating records of the largest stations show a consumption of 1.2 lb. per kilowatt-hour. At an assumed cost of $1.50 per barrel and a fuel consumption ratio of one to two, the saving which could be effected by burning this oil in Diesel engines would mount to $9,000,000 per year.

Where fuel oil competes with coal for boiler fuel, both conservation and economy show that Diesel engines have great possibilities.

Where coal is of poor quality or high in price, or where load conditions, such as standby service, are unfavorable to the economical operation of steam plants, the reduction in the cost of fuel through the use of Diesels is at once apparent. In the issue of June 2, 1923, the ELECTRICAL WORLD published a table showing the operating economies and production expenses of forty-five coal-burning stations, from which a list of twelve plants, with capacity ranging from 10,000 kw. to 25,000 kw. and with relatively high fuel costs, have been selected to show what the reduction in fuel cost would be if Diesels were used.

On the basis of two-dollar fuel oil averaging only 10.6 kw.-hr. per gallon, Diesel engines with an equivalent fuel cost of 4.5 mills would generate the total output of these twelve stations for one year with a fuel bill $1,433,304 less than the cost of the coal actually used. These twelve plants cover wide ranges in fuel cost, fuel quality, load factors and type of equipment, and it is not claimed that Diesel engines should replace the steam equipment in all of the plants. But the Diesel engine should be carefully considered for all of them, and not only with reference to its high fuel economy.

The cost of Diesel power, like that of steam power, will vary with the cost of fuel, requiring from 2 mills to 6 mills per kilowatt-hour with oil costing respectively $1 and $3 per barrel. The comparative cost of coal and oil, therefore, is a very important factor in the selection of the type of prime mover, but there are other factors which may warrant the use of Diesels even where the cost of fuel oil is high in comparison with the cost of coal.

Computing Fixed Charges Correctly

Because of its higher initial cost the Diesel has been too generally condemned without a hearing—guilty of high fixed charges. And yet, in comparison with steam

TABLE I—COST OF PLANT, 5,000-KW. DIESEL CENTRAL STATION

	Total	Per Kw.
Real Estate—Lot 175 ft. x 200 ft.	$2,000	$0.40
Building—Brick, 112 ft. x 60 ft. x 24 ft. including 5-ton cranes and 7,500 bbl. concrete fuel-oil storage	65,000	13.00
Foundations—For engines and generators, 1,400 cu.yd., at $15	21,000	4.20
Diesel Engines—Five, each rated at 1,000 kw.; total weight, including standard auxiliary equipment, about 840 tons; f.o.b. factory	550,000	10.00
Generators—Five, each rated at 1,000 kw., three-phase, 60-cycle, 2,300 volts, including direct-connected exciters, weight about 90 tons, f.o.b. factory	50,000	10.00
Freight—On 930 tons, at, say, 75 cents per 100 lb. (engines and generators)	14,000	2.80
Piping—70 ft. of 12-in. exhaust piping per engine; small oil and water piping to connect engines to oil tanks and water supply	8,000	1.60
Cooling-Water Equipment—Including tower, motor-driven pumps and piping	10,000	2.00
Erection of Machinery—Including superintendence, expert and common labor	10,000	2.00
Switchboard—Eight panels, including station wiring, installed	10,000	2.00
Miscellaneous Items and Contingencies	10,000	2.00
Total	$750,000	$150.00

turbines of any size, the obsolescence factor in depreciation is almost nil and the depreciation rate very low. No appreciable improvement in Diesel fuel economy has been made in the last twenty-five years, and the future economy lies in the direction of utilizing accessory equipment, such as waste-heat boilers, rather than in the engine itself.

A high-grade Diesel, when properly maintained, will last indefinitely. The very nature of its construction and the materials used prohibit physical depreciation, and only proper maintenance is required to secure and keep its initial test bed economy. Diesels were first built on a commercial scale in this country about 1904, and records of these early designs show that:

1. Nine out of a total of eleven Diesels rated larger than 100 b.hp. built in 1904 are in service today. Of these four are operated by the Texas Power & Light Company.
2. In central stations today there are five Diesels operating in their twentieth year or longer, fifteen Diesels operating in their nineteenth year, twenty-six in their eighteenth, forty-two in their seventeenth, forty-seven in their sixteenth and fifty-one in their fifteenth year or longer.
3. Of the Diesel horsepower sold to central stations from 1903 to 1910 inclusive, 93 per cent is still in service, giving approximately the same economy as the Diesel built today.

From the evidence submitted it can be stated conservatively that the useful life of a Diesel engine is at least twenty-five years.

ESTIMATED COST OF 5,000-KW. DIESEL PLANT

A 5,000-kw. Diesel-engine generating station may be installed today at a cost of approximately $150 per kilowatt, a total investment of $750,000 (Table I). On the basis of a twenty-five-year life the depreciation is

TABLE II—OPERATING COSTS, 5,000-KW. DIESEL CENTRAL STATION

Total Fixed Expense per Annum:		
Interest and depreciation	$57,300.00	
Taxes and insurance, 2 per cent	15,000.00	
		$72,300.00
Labor:		
One chief engineer	$3,600.00	
Three assistant engineers, at $175	6,300.00	
Three operating engineers, at $140	5,040.00	
		14,940.00
Maintenance, 1½ per cent		11,250.00
Total fixed expense per annum		$98,490.00
Variable Expense:	Cents	
Lubrication—1 gal. per 2,000 kw.-hr., at 65 cents per gallon—per kw.-hr.	0.0325	
Fuel—10.7 kw.-hr. per gallon; 450 kw.-hr. per barrel, at $2 per barrel—per kw.-hr.	0.444	
At 80 per cent load factor—Annual output 35,040,000 kw.-hr.:		
Fixed expense		$98,490.00
Lubrication		11,400.00
Fuel, at $2 per bbl.		155,730.00
Total cost with fuel at $2		$265,620.00
(Total cost per kw.-hr., 0.758 cent)		
At 60 per cent load factor—Annual output 26,280,000 kw.-hr.:		
Fixed expense		$98,490.00
Lubrication		8,550.00
Fuel, at $2 per bbl.		116,800.00
Total power cost with fuel at $2		$223,840.00
(Total cost per kw.-hr., 0.852 cent)		
At 40 per cent load factor—Annual output 17,520,000 kw.-hr.:		
Fixed expense		$98,490.00
Lubrication		5,700.00
Fuel, at $2 per bbl.		77,865.00
Total power cost with fuel at $2		$182,055.00
(Total cost per kw.-hr., 1.040 cents)		

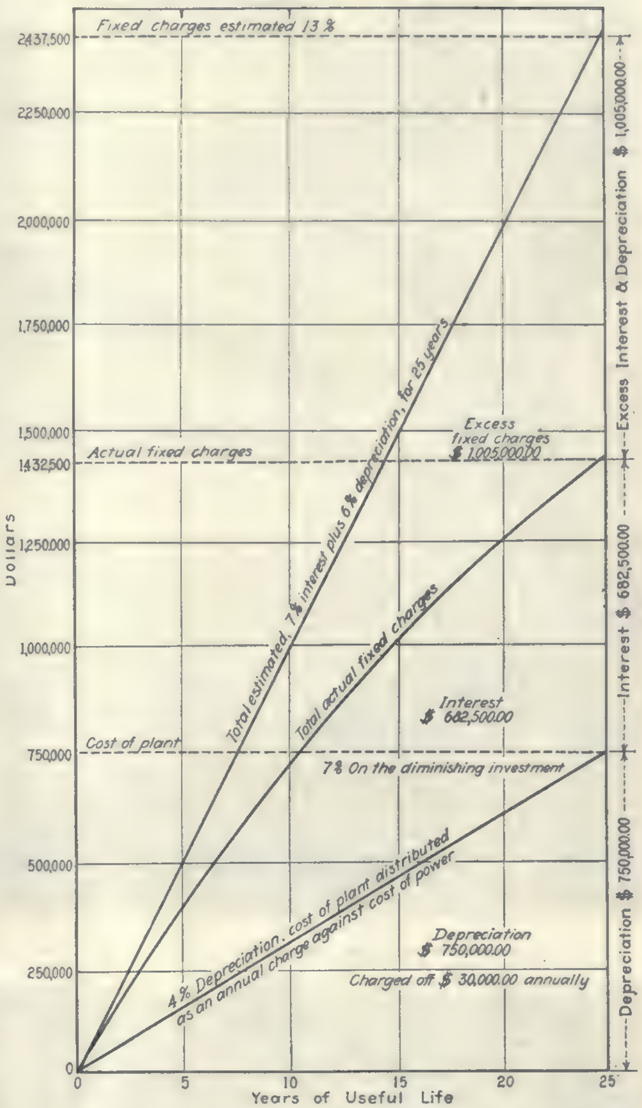


FIG. 3—EXCESS FIXED CHARGES OF $1,000,000 OFTEN ESTIMATED ON A DIESEL PLANT COSTING $750,000

$30,000 per year corrected for interest charges determined by the formula:

$$\text{Average interest on investment} = \frac{\text{interest rate (years} + 1) \div 2}{\text{years}}$$

This on a 7 per cent interest rate gives:

$$\text{Rate} = \frac{0.07\ (25 + 1) \div 2}{25} = 3.64 \text{ per cent,}$$

and the annual interest charge is 3.64 per cent of $750,000 = $27,300. The total annual charge for interest and depreciation is $30,000 + $27,300, which amounts to $1,432,500 in twenty-five years. This sum, representing twice the original investment, is used in giving service and is a proper charge against the cost of power.

MUST CONSIDER FUEL ECONOMY

A preliminary estimate of the cost of Diesel power which loads a seven-hundred-and-fifty-thousand-dollar plant with an excess of $1,000,000 of fixed charges (Fig. 3) may lead to the installation of less economical prime movers unless it is known that the excess million dollars, which might be added to net earnings, would be paid out for fuel during ensuing years. Table II shows the total estimated cost for the 5,000-kw. station, and

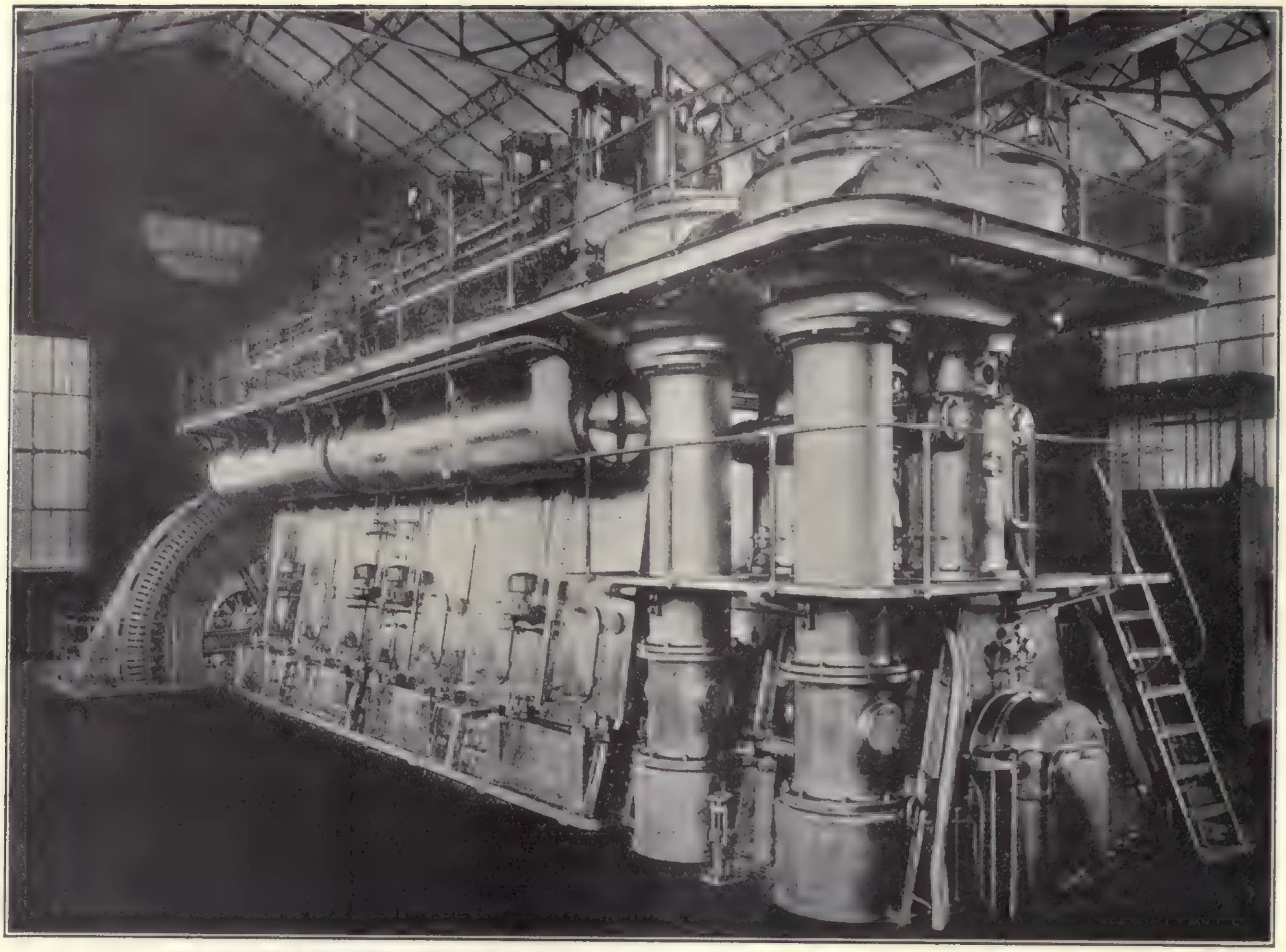
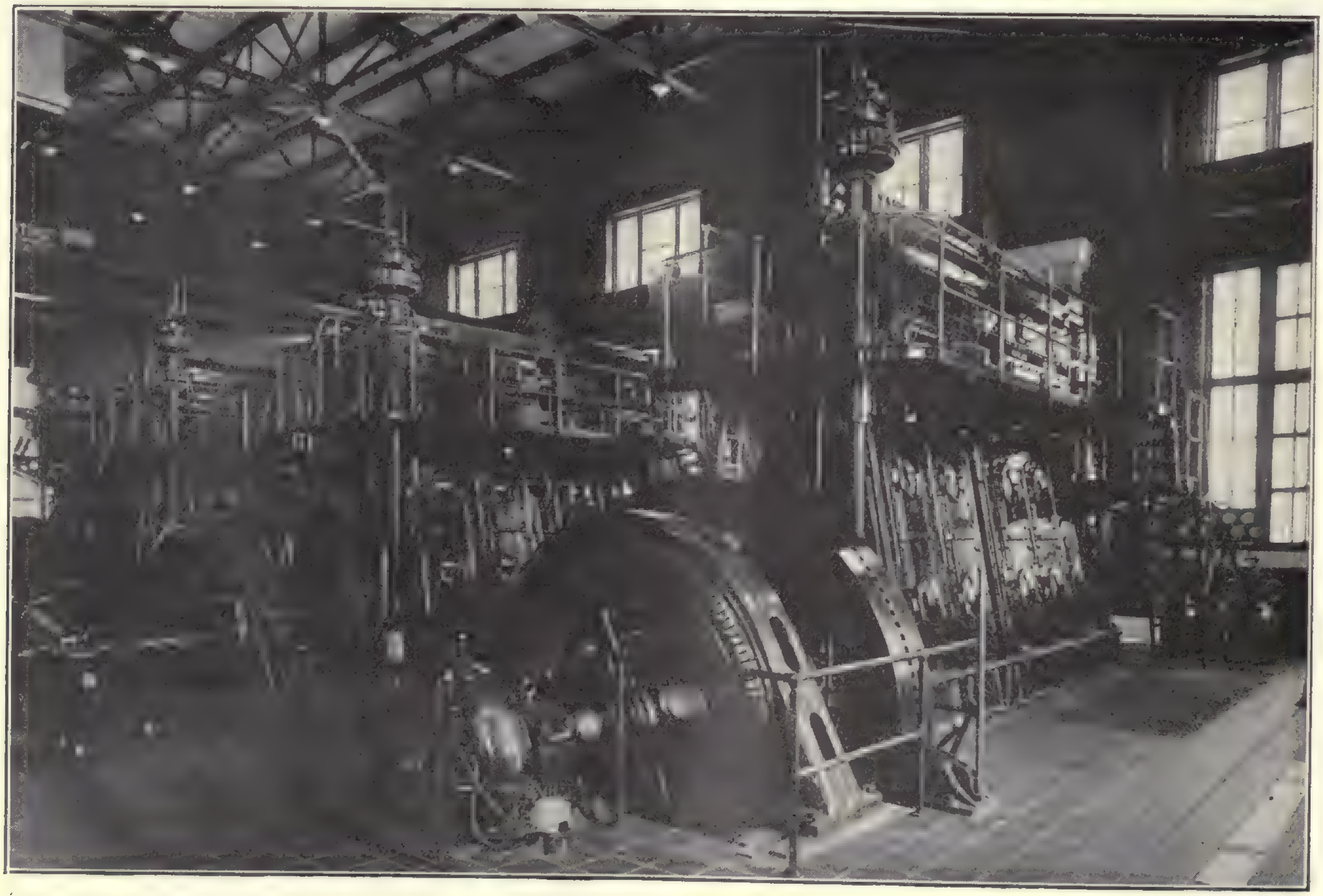


FIG. 4 (ABOVE)—A 4,000-B.HP. DIESEL UNIT. FIG. 5 (BELOW)—INTERIOR OF A THREE-UNIT DIESEL STATION



curves (Fig. 2) show operating costs for load factors from 25 per cent to 100 per cent with fuel costs at \$1, \$2 and \$3 per barrel. An output of 450 kw.-hr. per barrel of fuel is based on a unit load factor of 70 per cent, and at full load over 500 kw.-hr. will be produced per barrel of 18,500 B.t.u., the oil weighing 7½ lb. per gallon. An important item is the fact that this economy will be constant throughout the life of the engines.

A 20,000-kw. Diesel station, consisting of five 4,000-kw. units, can be built on a lot 175 ft. x 200 ft. The four walls of the single building required would inclose a room 168 ft. long, 94 ft. wide and 46 ft. high. This lot will be sufficiently large to store sixty days' fuel supply in underground tanks.

Cooling water is a small item, since only 8 gal. of cooling water in circulation is required per brake-horsepower at 75 deg. F. inlet temperature, in order to dissipate about 3,000 B.t.u.s per brake-horsepower-hour. A single monolithic concrete block supports the five units, and each unit requires about 110 ft. of 22-in. exhaust piping, air ducts and oil and water piping of small size between the engine and oil tanks and water-cooling system.

The Diesel engine is simple in operation as it is placed in motion by compressed air, receives initial ignition from the heat of the cylinder, and compression is positive. An idea of its simplicity may be gained by stripping an automobile engine of its carburetor and ignition system and substituting fuel oil for explosive gasoline.

Only a failure of oil, air or cooling water will stop the operation of the unit, and automatic safety governors permit full load to be thrown on or off suddenly, with a return to normal speed in less than fifteen seconds. The duty of the operator consists chiefly in observing the lubrication system, the cooling-water temperature and the exhaust. The economy of the engine is self-controlled by the machine itself.

The Diesel plant, in common with plants of other types, requires high-grade mechanical work in its maintenance, but the payroll is small as only thirteen men are required in a five-unit, 20,000-kw. plant. These men would be a chief, three assistants in charge of shift, three operating engineers and six oilers.

A great advantage of the Diesel plant is that it can be located at the center of distribution. This saves distribution losses, reduces size of plant required, saves cost of transmission and transforming equipment and may serve to relieve the load on existing installations by placing the Diesels at the load centers to operate at about 90 per cent load continuously, floating on the system, carrying local loads and feeding excess into the main system.

As the difference in rate of fuel consumption and cost per horsepower is about the same in all sizes of Diesel engines, the use of from three to eight duplicate units is not objectionable. The flexibility and the simplicity of the plant in operation are improved by the use of duplicate units, which may be installed gradually as the load increases. As an advance guard to high-tension systems and as a developer of new territories the Diesel plant has proved very successful. In this type of service economy is obtained, and the unit becomes very valuable for auxiliary and standby service on the interconnected system that ultimately serves the territory.

The future of the large Diesel engine in America is largely in the hands of central-station engineers and executives. Until they demand it manufacturers will be slow to undertake the expensive development required to produce the very large units. The engine should be seriously considered for the reasons given as a very promising possibility for new stations. For many existing stations the installation of a Diesel engine of from 1,000 kw. to 4,000 kw. should offer many operating advantages and economies. It is hoped that this article will cause more serious consideration to be given to the possibilities of the Diesel engine as a very important unit for central-station use.

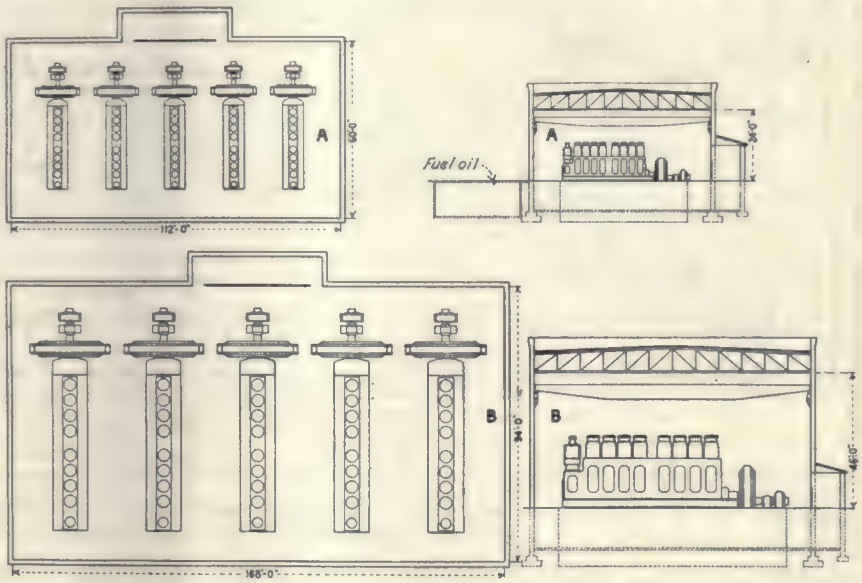


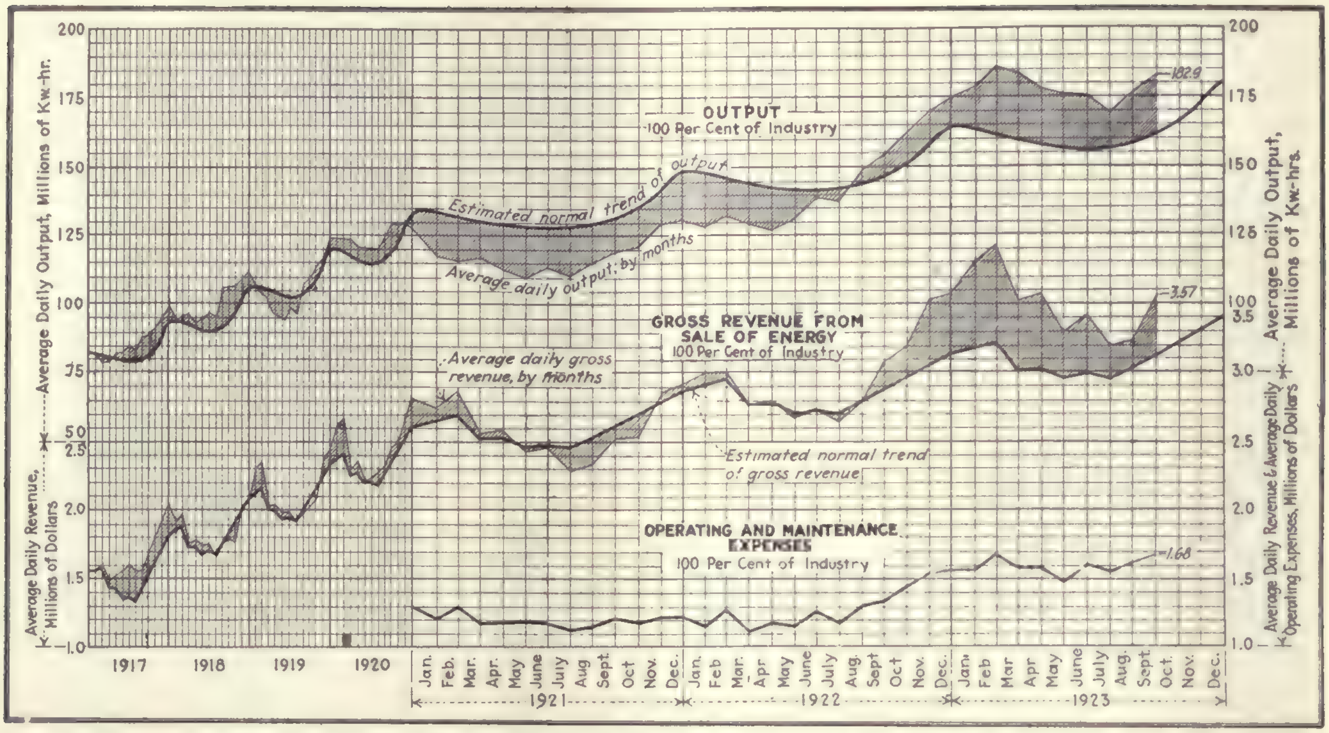
FIG. 6—COMPARATIVE FLOOR SPACE AND BUILDING REQUIREMENTS FOR 5,000-KVA. AND 20,000-KVA. DIESEL CENTRAL-STATION PLANT

Nine Months' Output Shows Gain of 23.7 per Cent Over 1922

September Output of Central Stations 12.9 per Cent Above Normal—Large Increase in Gross Revenue Over August

REPORTS received by the ELECTRICAL WORLD for the first nine months of the present year from central generating and distributing companies representing 75 per cent of the installed generator rating of the country indicate that the energy sold by the electric light and power industry during this period totaled 48,704,000,000 kw.-hr., a gain of 23.7 per cent over the energy sold during the first nine months of 1922. It must be remembered that this output figure includes energy purchased for resale, and is therefore in excess of the actual amount of energy generated. The monthly percentage gain in output has been decreasing since the beginning of the year. In January it was 28.0 per cent over that in January, 1922, while in September this gain over the previous year had dwindled to 15.8 per cent.

The South Central States report the largest percentage increase for the first nine months over a similar period for 1922 with 30.5 per cent, followed by the New



THE CENTRAL-STATION OUTPUT DURING SEPTEMBER WAS 12.9 PER CENT ABOVE NORMAL AND THE GROSS REVENUE WAS 14.1 PER CENT ABOVE NORMAL

England States with 28.4 per cent, Atlantic States with 26.6 per cent, North Central States with 22.3 per cent and the Mountain and Pacific States with 20.6 per cent.

The reports on revenue from the sale of energy for the first nine months of the year are also most interesting. The gross revenue of the industry for this period totaled $956,100,000, as against $809,150,000 for the first nine months of 1922, or a gain of 18.2 per cent. The record figure for revenue for the nine-month period was that reported during January, showing a total of $117,400,000 for the month.

Reports for the month of September indicate that the average daily output totaled 182,910,000 kw.-hr., which is considerably higher than that reported for August. A study of the accompanying diagram indicates that the central-station output for September was about 12.9 per cent above what would have been the seasonal energy requirements if the energy had been normal. The average daily revenue from the sale of energy during September was $3,570,000, a large increase over the revenue reported for August. This is 14.1 per cent above what would have been the revenue if growth in the industry had been normal.

TABLE I—CENTRAL-STATION RETURNS FOR THREE MONTHS

Mos.	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting) 1923 Thousands	1922 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting) 1923 Thousands	1922 Thousands	Per Cent Increase
July....	76	3,992,518	3,305,235	20.8	70	$69,569	$58,877	18.2
Aug...	76	4,176,284	3,557,250	17.4	70	70,381	60,999	15.4
Sept...	75	4,115,526	3,555,408	15.8	69	73,912	65,480	12.9

Mos.	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies Reporting) 1923 Thousands of Dollars	1922 Thousands of Dollars	Per Cent Increase	Operating Ratio: Steam Plants 1923	Steam Plants 1922	Hydro Plants 1923	Hydro Plants 1922	Combined Systems of Steam and Hydro 1923	Combined Systems of Steam and Hydro 1922
July....	59	28,381	24,148	17.5	52.0	55.3	28.0	27.9	45.0	46.1
Aug...	59	29,819	26,040	14.5	53.1	55.8	29.1	29.2	49.3	49.3
Sept...	59	29,736	27,034	9.9	51.1	55.2	31.4	22.4	53.5	52.6

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A THREE-MONTH PERIOD

Month	New England States: Percentage of Installed Ratings Represented	1923 Thousands	1922 Thousands	Per Cent Increase	Atlantic States: Percentage of Installed Ratings Represented	1923 Thousands	1922 Thousands	Per Cent Increase	North Central States: Percentage of Installed Ratings Represented	1923 Thousands	1922 Thousands	Per Cent Increase	South Central States: Percentage of Installed Ratings Represented	1923 Thousands	1922 Thousands	Per Cent Increase	Pacific and Mountain States: Percentage of Installed Ratings Represented	1923 Thousands	1922 Thousands	Per Cent Increase
KW-HR. OUTPUT:																				
July......	73	289,828	226,028	28.2	76	1,469,301	1,168,106	25.8	73	1,220,628	1,045,528	16.8	57	195,989	158,765	23.5	89	816,772	706,808	15.5
Aug.....	73	308,117	255,493	20.6	77	1,527,480	1,269,734	20.4	73	1,277,669	1,108,287	15.3	57	207,638	172,516	20.4	89	855,380	751,220	13.9
Sept.....	74	298,401	253,763	17.6	76	1,505,305	1,291,822	16.5	73	1,274,564	1,105,579	15.3	57	219,295	185,909	17.9	88	817,961	718,335	13.9
REVENUE:																				
July......	73	$6,887	$5,740	20.0	71	$26,500	$22,269	19.0	62	$20,043	$16,831	19.0	56	$4,519	$3,668	23.2	89	$11,620	$10,369	12.0
Aug.....	73	7,031	5,984	17.5	71	26,264	22,505	16.7	62	20,482	17,961	14.0	56	4,679	4,011	16.6	89	11,925	10,538	13.1
Sept.....	74	7,043	6,348	10.9	71	28,075	24,931	12.6	62	21,508	18,869	14.0	56	5,036	4,364	15.4	88	12,250	10,968	11.7
OPERATING EXPENSES:																				
July......	44	$2,555	$1,763	45.0	58	$10,657	$8,699	22.5	52	$8,877	$8,029	10.5	56	$2,341	$2,027	15.5	87	$3,951	$3,630	8.8
Aug.....	44	2,660	1,997	33.2	59	11,032	9,285	18.8	52	9,489	8,963	5.9	56	2,366	2,086	13.4	88	4,272	3,709	15.2
Sept.....	45	2,483	2,031	22.3	58	11,097	9,726	14.1	51	9,391	9,045	3.8	56	2,389	2,247	6.3	90	4,376	3,985	9.8

Analysis of Interconnection Tie Line*

Study of Elements Involved in the Purchase of Energy Over One Tie Line by a Small Steam Station

MANY interconnecting lines are first built for the purpose of purchasing energy from another system. When any company is making a study of the problem of purchasing energy, it is necessary to take into consideration a number of essential factors shown in Table I. This table shows in some detail a study of the comparison between actual costs in the enlarged steam plant of a local company, called "Company A," and the actual cost (without profit to the delivering company) of purchased energy over a tie line from an adjacent larger company. This study is based on costs only, and the profit to the delivering company would be a part of and derived from the savings of "Company A."

These figures do not represent any actual system, but it is thought that the values in general are approximately correct. "Company A," which is making this study, has a steam generating plant capable of carrying 10,000 kw., with a peak load of 6,000 kw. At a distance of 29 miles is another plant of very large capacity which has sufficient installed capacity to carry additional loads of 10,000 kw. or 15,000 kw. without requiring the building of other plants. As is shown in the tabulation, it is much cheaper to pay carrying charges and energy charges on additional capacity in a large plant, plus carrying charges on the transmission line, than it is to install and operate the necessary equipment in the smaller generating plant. This is one of the incidental things brought out in Table I, as the table is primarily for the purpose of showing the proper method of analysis.

*Abstract from report of transmission lines committee, E. P. Peck chairman, presented at convention of Empire State Gas & Electric Association, Lake Placid, N. Y., Oct. 8-9, 1923.

TABLE II—COMPARISON OF COSTS BETWEEN (1) NEW STEAM PLANT AND (2) PURCHASED ENERGY BASED ON 132,000-VOLT OPERATION

	Year B		Year C	
Investment or Capital Costs	Steam	Purchased	Steam	Purchased
Present investment station A	$800,000	$800,000	$800,000	$800,000
Total investment station A	1,700,000	800,000	2,300,000	800,000
Investment in station B to be used for station A	....	600,000	....	1,080,000
Substation investment, 132 kv.	....	368,000	....	404,000
Line, 29 miles, at $19,000 mile, 132 kv.	....	551,000	....	551,000
Total capital cost	$2,500,000	$3,119,000	$3,100,000	$3,635,000
Fixed Charges and Annual Operating Cost				
Station A fixed charge, at 14.5 per cent	$246,000	$116,000	$333,000	$116,000
Station B demand charge, 14 per cent on part used for station A.	....	84,000	....	151,000
Fixed charges on tie line and switch equipment at 14.5 per cent	....	133,255	....	138,475
Station B energy charge, at 0.8 cent per kw.-hr.	....	320,000	....	440,000
Operating cost station A: (1) (2)				
Year A 1.35	....	....	....	....
Year B 1.30 1.77	650,000	177,000	....	....
Year C 1.25 1.43	....	....	937,500	286,000
Total fixed and operating costs	$896,000	$830,255	$1,270,500	$1,131,475
Total saving in fixed operating costs by interconnection	....	$65,745	....	$139,025
Saving in initial investment to station A	....	19,000	....	545,000
Costs per kw.-hr., cents	1.79	1.66	1.69	1.51
Saving per kw.-hr., cents	....	0.13	....	.18

All of the other advantages of interconnection are not shown in this table. It is well in any particular study to consider very carefully the additional points of diversity in loads, combination of hydro-electric and steam plant operation and increased insurance against long-time interruptions.

It will be seen that the first section of this table sets up the present and prospective load conditions; the second section the investment and capital costs in the present system and in the proposed interconnection, and the third section the fixed charges and annual operating costs subdivided as is required for clear analysis. The conclusions are very interesting. At the end of year C, which may be four, six or ten years, the interconnection would save an investment of $1,052,000 to

TABLE I—COMPARISON OF COSTS BETWEEN (1) NEW STEAM PLANT AND (2) PURCHASED ENERGY OVER TIE LINES BASED ON 66,000-VOLT OPERATION

	Year A		Year B		Year C	
Physical Conditions	Steam (1)	Purchased (2)	Steam (1)	Purchased (2)	Steam (1)	Purchased (2)
Peak load, kilowatt-hours one hour	6,000	....	10,000	10,000	15,000	15,000
Maximum available generating capacity, station A	10,000	....	10,000	10,000	10,000	10,000
Additional capacity—steam or purchased	0	0	5,000	5,000	10,000	10,000
Capacity of tie line, station A to station B	....	....	....	10,000	0	10,000
Effective capacity with largest unit or one tie line down	5,000	....	10,000	10,000	15,000	15,000
Demand to be purchased from station B	....	....	....	5,000	....	9,000
Firm energy to be purchased from station B, kw.-hr., year (in thousands)	....	....	....	40,000	....	55,000
Firm energy generated in station A	30,000	....	50,000	10,000	75,000	20,000
Total kw.-hr. per year (in thousands); annual load factor 57 per cent	30,000	....	50,000	50,000	75,000	75,000
Investment or Capital Costs						
Present investment in station A	$800,000	....	$800,000	$800,000	$800,000	$800,000
Total investment station A	800,000	....	1,700,000	800,000	2,300,000	800,000
Investment station A, per kw. installed	[illegible]	....	*180	....	*180	....
Investment station B, per kw. installed	....	....	....	120	....	120
Investment in station B to be used for station A	....	....	....	600,000	....	1,080,000
Substation investment	....	....	....	100,000	....	100,000
Line, 29 miles, at $12,000 per mile, 66,000 volts	....	....	....	348,000	....	348,000
Fixed Charges and Annual Operating Cost						
Station A fixed charge, at 14.5 per cent	$116,000	....	$246,000	$116,000	$333,000	$116,000
Station B demand charge at 14 per cent on part used for station A	....	....	....	84,000	....	151,000
Fixed charges on tie line and switch equipment, 14.5 per cent	....	....	....	65,000	....	65,000
Station B energy charged at 8 cents per kw.-hr.	....	....	....	320,000	....	440,000
Operating cost station A (1) (2)						
Year A 1.35	405,000	....	....	....	....	....
Year B 1.30 1.77	....	....	650,000	177,000	....	....
Year C 1.25 1.43	....	....	....	....	937,500	286,000
Total cost	$521,000	....	$896,000	$762,000	$1,270,500	$1,058,000
Total savings in fixed and operating costs by interconnection	....	....	....	$134,000	....	$212,500
Saving in initial investment to station A	....	....	....	452,000	....	1,052,000
Cost per kw.-hr., cents	1.74	....	1.79	1.52	1.69	1.42
Saving per kw.-hr., cents	....	....	....	.27	....	.28

* Investment per additional kilowatt of capacity.

"Station A" and would make a saving in fixed and operating costs of $212,500. The saving in kilowatt-hour cost would be 0.28 cent per kilowatt-hour.

"Station A," the home company, and "station B," the delivering company, may, in any given study, represent single plants or entire systems.

This tabulation is based on the simplest possible case in order to make it clear, and it does not show all of the possibilities which may be obtained in more complicated situations. However, even in this case a very substantial saving is shown by "Company A" in total investment and in operating costs.

A small company was used for the illustration in Table I, because it is generally harder to show economies in a case with light loads than it is if heavy loads are involved. On account of the small amount of power under consideration, the transmission line was taken for operation at 66,000 volts. If lines and substations had been considered for 132,000 volts, the savings would have been reduced. There is still some saving, however, as is shown in Table II, which covers the same general situation with costs figured for 132,000-volt construction.

High-Voltage Trunk Lines Tapped for Local Service

THREE-PHASE trunk lines carrying voltages of 100 kv. or more frequently pass small settlements and farms that would like to benefit by electric service. Often the high cost of a transformer installation to meet the small demand of these consumers, amounting to only a few kilowatts, makes this either technically difficult or economically impossible. A transformer of 5-kva. capacity suitable for giving such service and built for a voltage ratio of 110,000 to 110 would require physical dimensions not materially different from those of a 500-kva. transformer, and as a result the cost of the small transformer per kilovolt-ampere would be enormous. Another use for small power is the night illumination of transmission lines at highways, rivers, railways, etc. For these cases an unusual and apparently very economical system has been developed

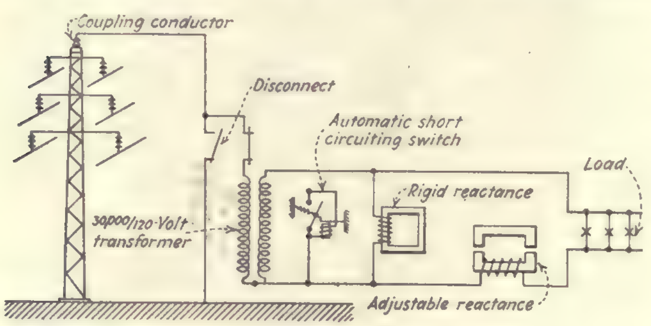


FIG. 1—SMALL COMMUNITIES MAY BE SERVED POWER BY THIS COUPLING ARRANGEMENT

and successfully tried out in Germany, according to R. Deuser in the August-September issue of *Siemens Zeitschrift*.

It is well known that an electric field rotates around every energized three-phase transmission line. If a conductor is introduced into this field parallel to the line, it will assume a voltage against ground. If this conductor is connected through resistance to ground, a current will flow through the resistance, returning from ground by means of the capacity of the line. The induced voltage will depend upon the operating voltage of the power line and the relative arrangement of the power lines and the "coupling conductor," as it is called. The voltage in the coupling conductor will drop if current in phase with the power line is taken from it and will rise if reactive current is taken from it. By a combination of phase current and reactive current in a certain relative proportion the useful voltage may be kept constant. The useful energy available increases with the length of the coupling wire.

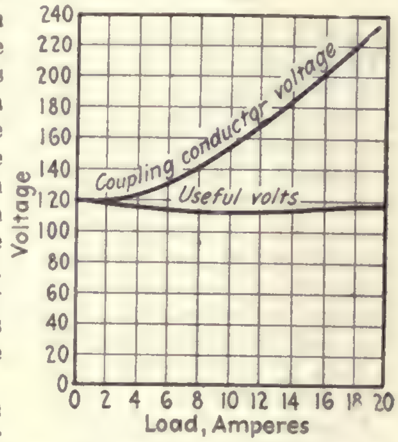


FIG. 2—VOLTAGE CHARACTERISTICS OF COUPLED CIRCUIT

In co-operation with a large power company practical tests were made with this arrangement on a suitable stretch of a 100,000-volt line near Berlin. The ground wire was used as the coupling conductor by insulating it from the steel towers for a distance of about 1½ miles. The arrangement of coupling wires and transmission cables is shown at the left in Fig. 1. The useful current (120 volts) is obtained from the secondary of a small single-phase, 30,000/120-volt transformer. The arrangement of rigid and adjustable reactances, etc., as shown in Fig. 1, is used to keep the secondary of 120 volts constant. How well this has been achieved is shown on the curves of Fig. 2. For the arrangement shown a useful energy of about 1 kw. has been obtained per 0.6 mile of coupling conductor and a highest voltage of 30 kv. in the conductor.

Arizona Reports Large Central-Station Growth

The United States Census Bureau has just issued the following data on the central stations in the state of Arizona:

	1922	1917	Per Cent* of Increase 1917–1922
Number of establishments	31	29	.....
Commercial	27	25	.....
Municipal	4	4	.....
Income	$3,974,000	$2,141,000	85.5
Electric service	$3,917,000	$2,103,000	87.6
All other	$57,000	$38,000	—50.0
Total expenses, including salaries and wages	$3,170,000	$1,752,000	80.9
Number of persons employed	608	436	39.4
Salaries and wages	$861,000	$451,000	90.9
Total horsepower of prime movers	71,922	38,662	86.0
Steam engines and turbines:			
Number	29	28	.....
Horsepower	22,029	23,870	—7.7
Internal-combustion engines:			
Number	28	15	.....
Horsepower	11,862	3,592	230.2
Waterwheels and turbines:			
Number	23	4	.....
Horsepower	38,031	11,200	239.6
Kilowatt capacity of dynamos	48,765	26,972	80.8
Output of stations, kw.-hr.	147,370,000	65,732,000	124.2
Number of consumers' meters in service	48,231	24,303	98.5
Number of customers	38,134	24,320	56.8

* A minus sign (—) denotes decrease; percentages not shown where base is less than 100.

Forty Lighting Intensities in One Street

Experimental Installation at Cleveland for Studying Lighting Principles Varies from 100 Cp. to 3,000 Cp.

STREET lighting is not keeping pace with the increasingly rigid requirements imposed by the rapid growth of cities in the United States and the addition of hundreds of thousands of motor cars every year on the already congested streets. Furthermore, before it will be possible to convince city and central-station officials generally that the lighting problems of their particular cities can be solved through the application of sound engineering principles there must first exist among engineers themselves a reasonable degree of unanimity of opinion on the fundamental principles of the art. It has been generally felt that the difference of opinion on the part of engineers is primarily due to the incompleteness of fundamental data on the visibility of objects under various systems of street lighting. Investigations by various individuals and organizations have contributed substantially to this knowledge; but, even with the information resulting from these tests, there are still many important factors which have not as yet been definitely evaluated.

With the hope of contributing to the basic facts of the science, the engineering department of the National Lamp Works, Cleveland, Ohio, in co-operation with the Cleveland Electric Illuminating Company and the Municipal Department of Light and Heat, has installed a full-scale experimental set-up (Fig. 1) for investigating and demonstrating the principles underlying thoroughfare and residential district lighting. The installation covers a 2,000-ft. section of a typical Cleveland street, East 152d Street. It consists of some forty separate lamp circuits—virtually forty streets in one—and each circuit illustrates a definite principle of correct illumination. Lamps ranging from 100 cp. (1,000 lumens) to 3,000 cp. (30,000 lumens) in size, with spacings from 75 ft. to 900 ft., are mounted at heights from 11 ft. to 26 ft. The location of units ranges, by four successive steps, from 2 ft. back of the curb line to the center of the street, bracket arms being used.

This installation affords by far the most comprehensive demonstration of street-lighting principles and effects ever installed. It is the only place in the world where comparison of a wide variety of lighting effects upon the street can be made instantly. It is planned to conduct a number of investigations on this street under the various lighting effects for a wide variety of conditions, with the view of properly evaluating the different factors involved and obtaining definite information regarding the particular characteristics of each system.

FIG. 2—ORNAMENTAL STREET-LIGHTING EQUIPMENT AT NELA PARK

This equipment affords a means of comparing various types of posts and fixtures during the day or night.

This installation will also serve another distinct purpose, apart from its research function. The selection of a suitable street-lighting system by a town or city has always been rendered somewhat difficult on account of the lack of an opportunity to view a number of different street-lighting systems at one time and to compare their characteristics with respect to the specific requirements of that town or city. With this demonstration available at Cleveland, city officials, city engineers, civic organizations and central-station officials now have an opportunity to view at one time the various standard types of street-lighting systems that are available in order to compare their individual characteristics of appearance and light distribution.

In addition to the 152d Street demonstration there

FIG. 1—LIGHTING INSTALLATION, EAST 152D STREET

With all the systems turned on, this street has approximately five times as much illumination as any other street in the world. The magnitude of the intensity can be gaged from the way the cracks in the roadway show up.

also is an exhibition of ornamental street-lighting equipment at Nela Park (Fig. 2). This comprehensive exhibition is made possible through the co-operation of the principal post and fixture manufacturers of the country. One of its most valuable features is the intimate comparison it affords of the most up-to-date ornamental equipment available at the present time. It gives the observer a definite idea of the day and night appearance of any one unit as compared with the other modern types. Each unit can be turned on and off individually so that its appearance when lighted, as well as its particular characteristics of light diffusion and distribution, may be observed without interference from neighboring units.

To every engineer who is interested in street lighting in any of its phases, and to all municipal, civic and central-station officials desiring to study right upon the street the various kinds of systems and types of equipment available, a cordial invitation is extended to view both of these exhibitions. Arrangements to do so at any time may be made by writing to the engineering department, National Lamp Works, Cleveland, Ohio.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Engineers and Manufacturers

To the Editors of the ELECTRICAL WORLD:

On page 939 of the ELECTRICAL WORLD for Nov. 3 there appears an article by H. W. Young which should not be allowed to stand unchallenged. Mr. Young's idea is that apparatus design and development should be left entirely to the manufacturers, who sometimes, when they are in particularly good spirits, would generously allow some engineers to make suggestions, using their own judgment in deciding whether or not the suggestions should be considered. What do engineers know about high-tension apparatus, anyhow? When they need a new substation all they should do is to tell Mr. Young about it and, like good boys, wait and see what he gives them, and then merely "O.K." the bill for their clients to pay. Engineers should not "play with toys" for fear that they might break them.

Where would the industry be today if engineers had stopped playing with toys, say, twenty years ago? Would manufacturers have developed 50,000-kw. turbines if they had not been forced to do it by demands of engineers? They would not, because they can make more profit if they sell ten 5,000-kw. units instead of one 50,000-kw. unit. Neither would they have developed any 30,000-kva. transformers, since there is more money in selling thirty 1,000-kva. units. All this is so obvious that it is hardly necessary to dwell on it. There is more money in standard stuff which is already developed and tried out, and naturally some small manufacturers who have not the facilities for developing new devices would be happy to stop the wheels of progress and not go to higher voltages, larger units, better switches, better insulators, etc. It costs manufacturers a great deal of money to develop new things, so why not try to sell the old stuff?

A study through the history of the electrical industry will prove that nearly all new developments are better than the old ones, and that nearly all new developments were suggested not by manufacturers but by engineers who were "playing with toys" and who forced them upon the manufacturers because of the operator's demand for ever better apparatus.

May the day never come when the engineers stop "playing with toys," for this would mean the end of progress! Engineers must and will continue playing with toys, and new toys must and will be developed all the time, and those manufacturers who refuse to play with them will sooner or later have to stay out of the game altogether.

M. M. SAMUELS.

New York.

Australasia Backward in Things Electrical, but Change Is Coming

To the Editors of the ELECTRICAL WORLD:

I have noticed with interest reference in an American periodical to the new policies which are being adopted by Australian electric supply authorities and consequent improvement in the prospects before electrical traders.

The Melbourne City Council, which supplies the city and a portion of the suburbs with energy, has recently adopted a tariff under which users of 72 kw.-hr. per month can have the whole of their electricity on a flat rate of 1¾d. per unit. This is much the cheapest electrical energy that has been sold in Australia. This authority recently bought £1,000 worth of electric cooking apparatus and now has an expert testing samples from a large number of British, American, Canadian and Australian manufacturers. After the conclusion of these tests steps will be taken by the Council to push the sale of the type which it considers most suitable for local conditions.

The Victorian State Electricity Commission, which will ultimately control all electric supply in this state, is also keenly interested in electrical household helps, and when its large generating station at Yallourn is completed next year will be obliged to "boost" the domestic load in order to sell its output.

In Tasmania the Hydro-Electric Department has surplus energy at present and is developing both city and country districts rapidly. Energy in that state is cheap, and electric cooking and other household devices are finding increased sale.

In New South Wales the Sydney City Council, one of the largest central-station proprietors in Australia, is considering the idea of spending £4,000 a year for three years on advertising electricity, on condition that traders find £6,000 a year for the same period.

This is a small beginning, but it is a beginning, and Australia is almost a virgin field for the electrical trader. Generally speaking, the electrical installation in the Australian home today averages about one lighting point per room, and in 99 per cent of the cases there is no other outlet. Most persons use electric flatirons, taking energy from a lamp socket.

In New Zealand things are worse at present than in Australia. Supply is mostly in the hands of power boards, shortage of plant is common almost everywhere, and in several of the leading cities the use of radiators, for instance, is banned altogether or during peak-load hours.

Soon all this will be changed, and both in Australia and New Zealand a great trade will be done in electrical appliances. People here will buy freely when they feel the want of electrical help at home, and they are being educated today as never before.

W. DAVEY,

Managing Editor "Australasian Electrical Times."

Melbourne, Australia.

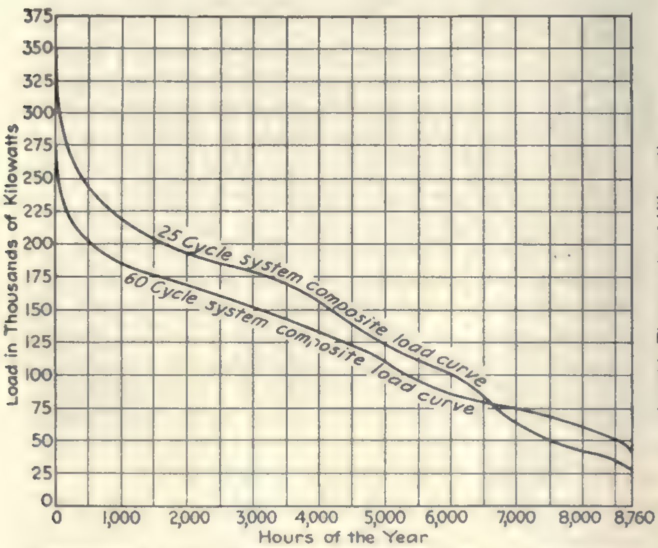
Construction of Composite Load Curves

Representative Days Chosen in Order to Lessen Labor of Calculation —Method of Procedure Outlined in Detail

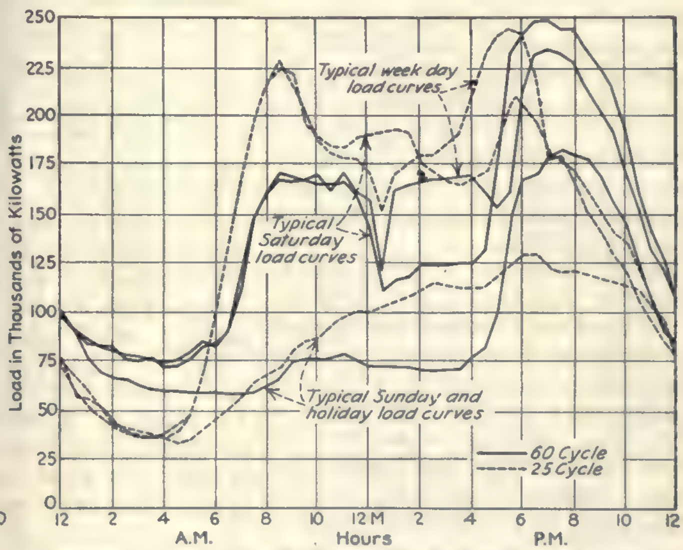
BY STANTON S. BAILEY

Distribution Division, Commonwealth Edison Company, Chicago

IN ORDER to have a basis for planning the installation of new and more economical generating units, the engineers of the Commonwealth Edison Company thought it would be desirable to construct a composite load curve. This curve has the kilowatt load upon the system for its ordinate and the hours throughout the whole year as its abscissa. Thus every point on the curve represents a certain load on the system for a definite number of hours during the year. The area under the curve represents the total number of kilowatt-hours generated. These curves aid in the decision whether it will be cheaper to carry the peak loads on the old and uneconomical units or whether it will be more economical to install new and more efficient units. Thus arises the old question of fixed charges versus savings in operating costs. When the savings in operating costs equal the fixed charges on the new investment, then is the time to install new units.



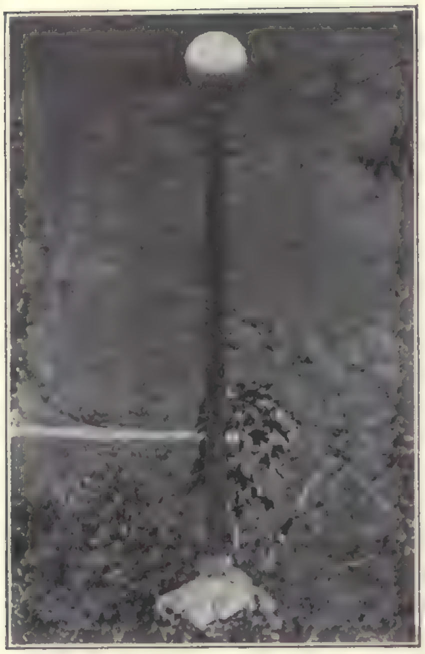
COMPOSITE LOAD CURVES GIVING THE HOURS OF ENERGY DEMAND DURING A ONE-YEAR PERIOD

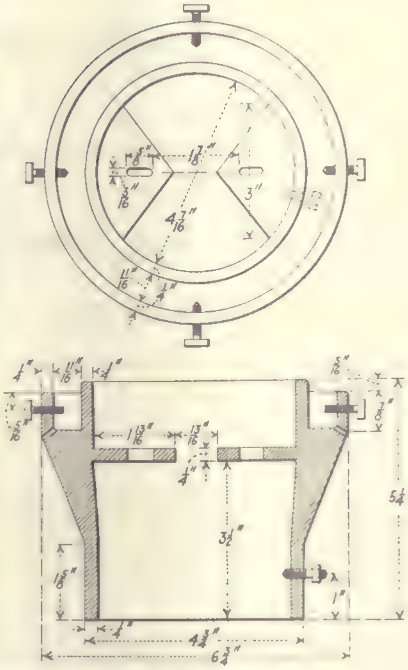


TYPICAL LOAD CURVES OF THE COMMONWEALTH EDISON COMPANY'S 25-CYCLE AND 60-CYCLE SYSTEMS

In the construction of these curves—there being one for the 60-cycle and one for the 25-cycle system—the procedure was as follows: Taking the log table of the daily average loads covering the year 1922, certain days were picked out. The reason for choosing these particular days was that they seemed to be representative of certain groups of days. Another reason for choosing representative days was to save time and much useless routine labor. The percentage of error introduced by this method of choice is negligible. For example, all the Sundays of the year were divided into thirteen groups of four each, and one Sunday was taken as representing each group. The same thing was done with the Saturdays. Each holiday was taken separately. Corresponding with each group of Saturdays and Sundays there was another group of nineteen or twenty weekdays, depending on whether or not a holiday occurred in that group, out of which one representative day was chosen. In order to get the maximum and minimum values of the curve, the days of the weeks in which the maximum and minimum loads occurred were taken separately, while the weeks immediately preceding and following the maximum and minimum were each taken as a group of four or five days. This again depended upon the occurrence of a holiday. In this way a list of sixty representative days was obtained covering the entire year. Seven of these composite days each represented twenty days, four others typified nineteen days, four more represented five, twenty-eight others stood for four days and the remaining seventeen each represented one day. Since the accuracy of the composite load curve depended upon the deliberate choice of these representative days, they were chosen with extreme care.

Next the daily system load curves for these sixty representative days were studied. From them a tabulation of the kilowatt load for every half hour was made giving a total of 2,880 readings, divided into the groups as explained above. Readings were made only to the nearest 5,000 kw. as this was thought ac-





SIMPLE LIGHTING UNIT FOR PLANTS AND SUBSTATIONS

curate enough for the purpose. The maximum and minimum points in this tabulation were next found and a list of readings in 5,000 steps between these points was made. Then the number of times each reading occurred in each group was found. When the whole list was completed, the proper constants were applied so that the total hours' use of each load could be computed. The constant used for each group was half the number of days represented by each daily curve in the group because half-hourly readings were used in making the tabulation. For example, each load reading represents the average load upon the system for some definite half-hour period. Therefore, if a particular reading occurs ten times in a group representing twenty days, that means that this average load is on the system for ten half hours or five total hours per day, making a total of one hundred hours for this load in that particular group. This gave a table showing the load in 5,000-kw. steps and the hours' use of each load during the year.

When these tabulations were plotted the composite load curves shown were obtained. Besides being used as mentioned above, the curves have been found useful in checking rough calculations on the cost of producing energy, there being known the number of hours of operation and the operating costs for each generating unit on the system; in estimating energy cost for coming years, and in determining load factors.

Old Boiler Tubes Used for Lighting Posts

BY FREDERICK KRUG
Superintendent of Hydro-Electric Plants, Porto Rico Railway, Light & Power Company, Bayamon, Porto, Rico

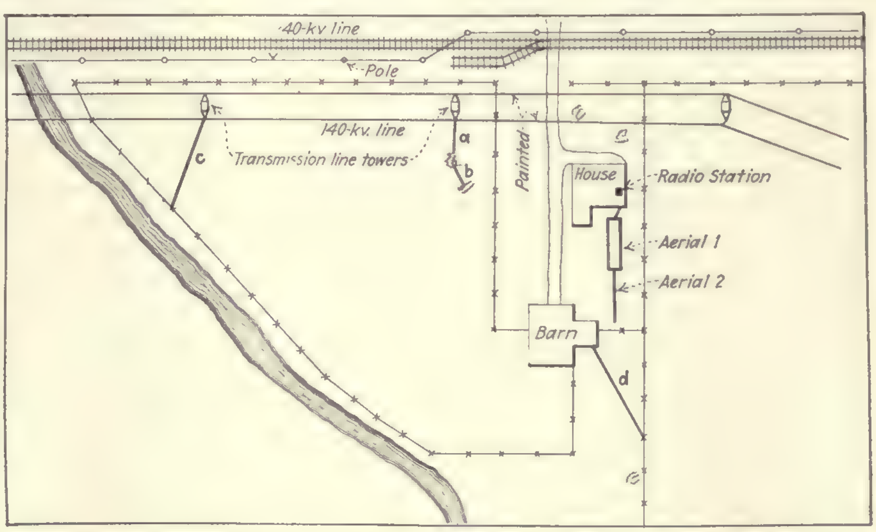
A VERY simple yet decorative lighting post made up from old boiler tubes is used around all the plants and substations of the Porto Rico Railway, Light & Power Company. This company annually discards from its steam plant many 4-in. boiler tubes which, while no longer of value in a boiler, are useful for a variety of other purposes. A great many have been used for ornamental light posts, and for this purpose castings were made up as shown in the drawing. The castings were designed to fit the standard 6-in. x 12-in. "Alba" opal globe.

Some of these posts were wired with underground cable, but in most cases a small stone and concrete base was built around them to give added stability and the wires were carried on iron brackets, as shown in the accompanying illustration.

Inductive Troubles Between Transmission Circuits and Radio Sets

CASES of inductive troubles between transmission and distribution lines and radio receiving sets are presenting a somewhat acute problem. One that occurred recently on the system of the Consumers' Power Company in Michigan indicates some of the problems that central-station operators must face as the number of radio receiving sets increases. The owner of the receiving set lives close to one of the 140-kv. and 40-kv. transmission lines of the company. The situation is shown in the accompanying illustration. The owner had started in March, 1922, with a regenerative set and detector and, having no trouble, in spite of the close proximity of the high-voltage line, added a two-step amplifier and loud speaker. The man evidently knew what he might encounter in the way of inductive troubles as is evidenced by the care he took in locating his antenna and by the trial with relatively simple equipment before going ahead with the complete installation.

In October, 1922, it was found



CORONA FROM TRANSMISSION LINE SERIOUSLY AFFECTED TWO-STEP RADIO AMPLIFIER

Location of transmission circuits, radio receiving antenna and test set-ups used in the investigation. Antennas Nos. 1 and 2 are the ones originally installed and on which the trouble occurred. *a*, *b*, *c* and *d* are the set-ups. That at *d* is about 400 ft. away from the transmission line and practically eliminated the disturbance.

necessary by the company to change the conductors on the 140-kv. circuit, and a new wire consisting of seven strands of No. 8 A. W. G. copper was substituted for the old one, which consisted of six strands of No. 6 copper with a hemp center. The outside diameter of both the old and the new conductor is 0.39 in. Trouble with the radio set commenced at once and was found to be due to corona discharges from the new conductor. Static discharges between the strands of the new conductors could be seen from the ground. The owner of the set suggested that an insulating paint would be of some help. This was put on the latter part of November and apparently had some effect in reducing the inductive disturbance. The various test set-ups made in the investigation are shown in the illustration. It was found in these tests that while reception of distant radiophone stations was possible there was enough disturbance to be very annoying in tuning and listening to these stations. In installing the new wire it, of course, received some bruises that left sharp points and encouraged static discharges. As the conductor weathered there seemed to be a lessening of the trouble and painting assisted still further.

As a final remedy it was suggested that antenna No. 1 be removed to a distance of 500 ft. from the transmission line and that the lead-in wire to the set be carried underground with an insulated conductor. This would put the antenna out of range of the static discharges as shown by the tests, and the insulated conductor underground would provide sufficient shielding for the lead-in wire. It was also suggested that the receiving set be placed in a box shielded by sheet copper with the shield grounded and that the owner of the receiving set install a separate ground in place of using the lightning-rod ground as he was doing when the case was investigated.

Underground Cable Record System Valuable

BY F. L. ROHRBACH
Engineer Underground System Washington Water Power Company, Spokane, Wash.

THE underground cable and subway system of the Washington Water Power Company is laid out in a diagrammatic manner on a large board on the wall of the station, as in Fig. 1, which shows at a glance what cables pass through each manhole and what duct space is available in any subway. The streets of the business section of Spokane are shown by heavy black lines, and in the middle of each block a shipping tag showing a cross-section of the subway in that block is hung on a hook. An enlarged section of the board with the four tags in each direction from the street intersection is shown in Fig. 2. By a system of symbols and numbers these tags give all necessary information about each cable.

With this system, if the dispatcher is notified of a fire in a certain manhole, he consults the board and can readily see what cables are involved. The scheme is also very useful in routing cables.

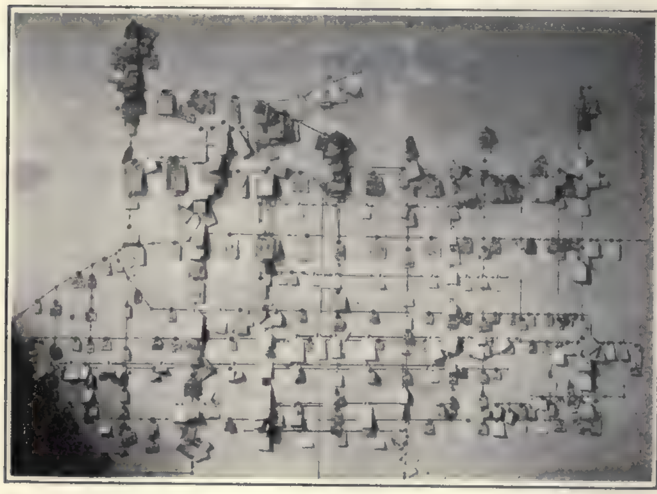


FIG. 1—AVAILABLE DUCT SPACE CAN EASILY BE LOCATED WITH THIS TYPE OF GRAPHICAL RECORD

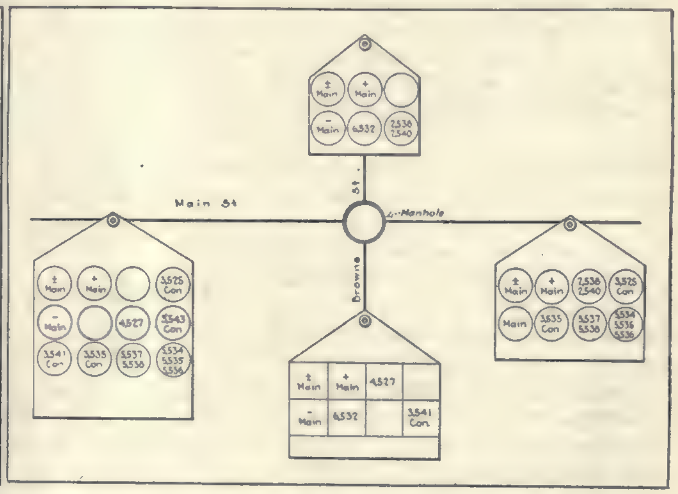


FIG. 2—NUMBERS ON TAGS INDICATE VOLTAGE, FEEDER NUMBER AND ANNEXATION

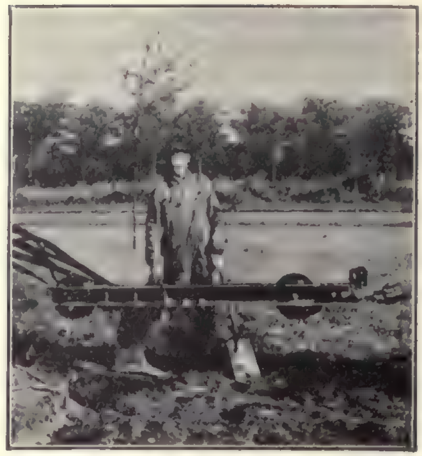
☐ tile duct ; O fiber duct ; last two figures (as 01, 23, 41, etc.) indicate feeder number; next figure to left (1, 2, 3, etc.) indicates station from which the cable feeds; remaining figures to the left (2, 3, 13, etc.) indicate the voltage of the cable; "con" means concentric cable. Example: "3541-con" means concentric cable, feeder No. 41 from station 5 operating at 300 volts. Two or more numbers in a duct symbol indicate that a multi-conductor cable is being used in the specified duct.

Laying Cable Economically by Special Plow

BY J. W. SYLVESTER
Superintendent Alternating-Current and Arc Underground Lines, Philadelphia Electric Company

A SPECIAL plow built for installing parkway cable in the grass plots between curb and sidewalks in residential streets and on private property has been very successfully used by the Philadelphia Electric Company. This company has installed 28 miles of cable by this method on the Roosevelt Boulevard in Philadelphia and has used it in a number of suburban towns for incandescent street-lighting purposes. Long underground services on private property have been installed with perfect success. In all of these installations the ordinary lead-covered cable has been used, it being found unnecessary to resort to steel-armored cable. The company fully believes that this method has been justified because of the exceedingly low cost of maintenance of this type of installation.

In laying cable by this method a hole about 18 in. deep by 2 ft. square is dug at the point where the cable plow is to begin its work. The cable is attached to the rear end of the torpedo-shaped prong which forms the lower end of the plowshare, about 18 in. in front of which is a harrow disk which serves to cut the sod in front of the plowshare. The plow is drawn along the surface of the ground by means of a cast-steel running rope attached to a gasoline-driven winch, which is secured to

CABLE-LAYING PLOW USED SUCCESSFULLY BY THE PHILADELPHIA ELECTRIC COMPANY

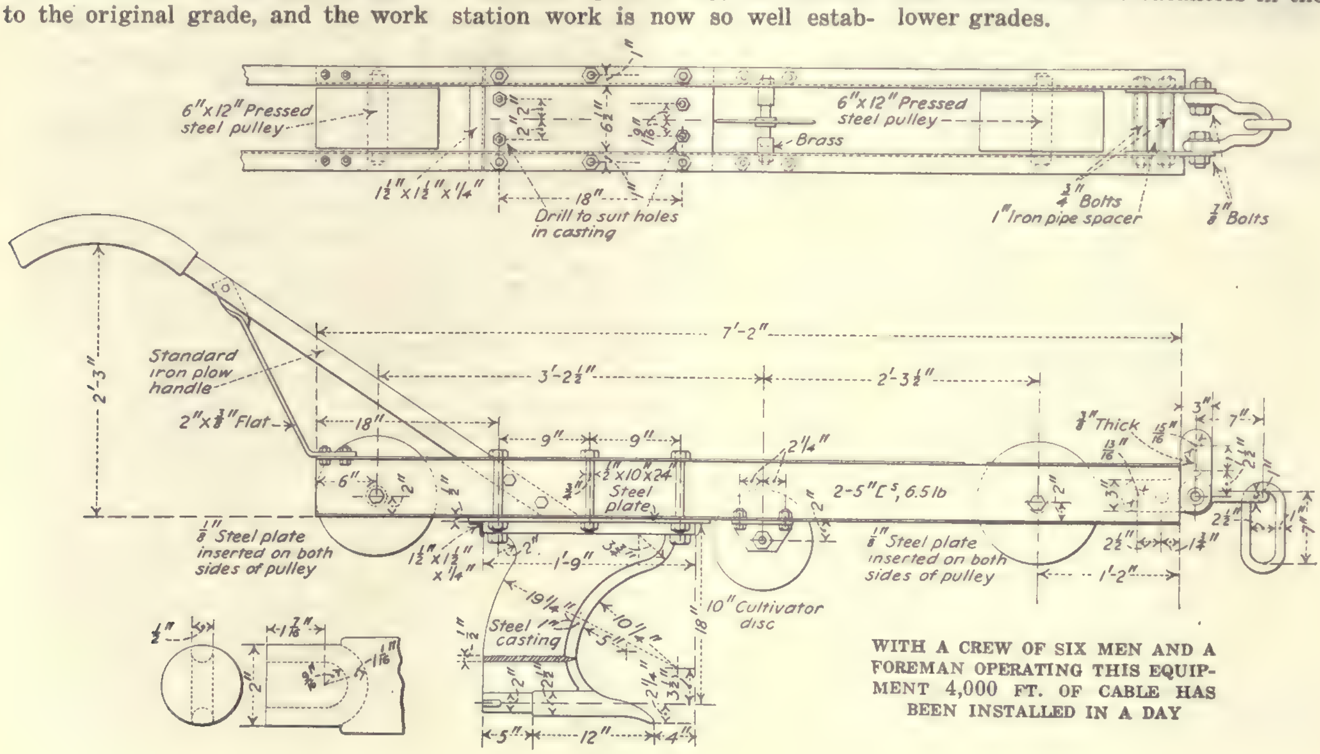
the ground at a point in the distance to which the cable plow is drawn. This distance is usually not over 600 ft., although cable has been pulled in this manner a distance of 800 ft. The longer distance is not, however, recommended. As the plow is drawn toward the winch it drags the cable through the ground, the cable being fed to the plow through the hole in the ground mentioned above.

The usual size of a crew on this work is six men and a foreman, and as high as 4,000 ft. has been installed in a day with such a crew and this equipment. Unless the plowshare encounters large stones in its progress through the ground, the only evidence of it seen on the surface will be a small, slightly raised seam in the sod about ½ in. wide. By means of a tamper this is readily restored to the original grade, and the work is so neatly done that unless one were looking for it, it would be imperceptible. Of course, if the plow meets with stones, it usually results in the tearing up of the sod, but this can be readily remedied.

At the time this plow was designed tractors had not come into economical use, but the writer feels that in place of a cumbersome gasoline-driven winch a tractor could be used which would be very much more satisfactory. He has no doubt that with a tractor the 4,000 ft. per day could be readily increased.

Distribution and Safety

THE first step in attaining proper attitude toward safety and other established rules is a permanent working force. Formerly systems were built up hurriedly, but central-station work is now so well established that nearly every operating company can maintain a more or less permanent working force in the outside plant department. This can be accomplished by making inspections of the system and planning necessary but deferred maintenance work in advance so that it can be done during the off-peak periods in construction work. In this way the force can be kept busy and the expense of training new men or of using men not familiar with the established methods or standards can be avoided. A premium should be placed on length of service. This can be in one of many forms, rate of pay, disability and death benefits, pension systems, etc. The line force should be built up from the bottom and as far as possible all vacancies should be filled by promotion and the new men hired to fill the vacancies in the lower grades.



WITH A CREW OF SIX MEN AND A FOREMAN OPERATING THIS EQUIPMENT 4,000 FT. OF CABLE HAS BEEN INSTALLED IN A DAY

Small High-Voltage Units Must Be Avoided

BY W. S. MOODY
Engineer Transformer Department, General Electric Company, Schenectady, N. Y.

THERE is a common misconception that when high voltages capable of transmitting power economically over 250 to 500 miles are used every hamlet along the route can have electric power. The cost of transforming at such high voltages is far too great to make it commercially feasible to supply small customers unless there are enough

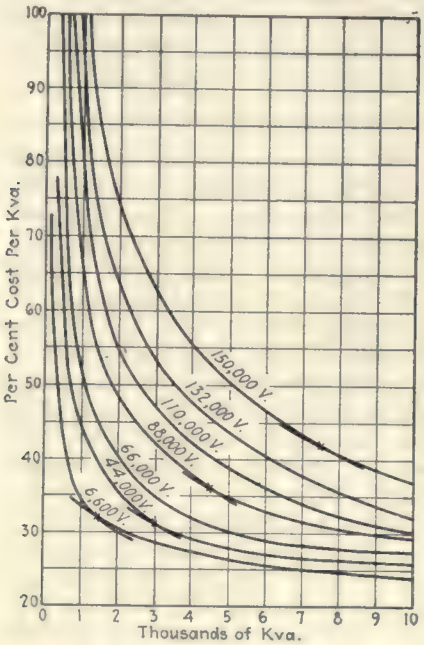


FIG. 1—RELATIVE COSTS PER KVA. OF TRANSFORMERS OF VARIOUS VOLTAGES

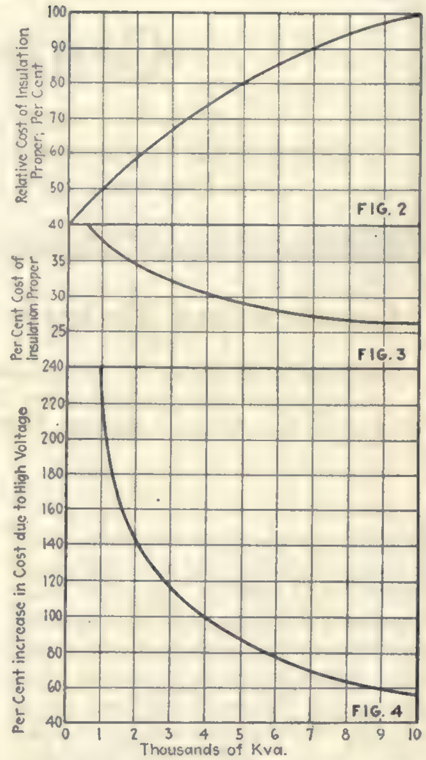
of them situated so that they can be collected into a unit of service at a much more moderate voltage.

Often the demand is so scattered as to require three successive transformations before the individual user is reached. The relative cost per kilovolt-ampere of self-cooled transformers of different sizes designed for different voltages is shown in Fig. 1. The portion of the curve where the cost per kilovolt-ampere takes a rapid upward turn indicates the minimum size below which it is not usually economical to go, and it will be noted that the higher the voltage the larger is the size at which this occurs. Thus, if, for comparison, we take the points where the curves have a 30-deg. slope upward, we find that this occurs at 1,500 kva. on the 6,600-volt line, 3,000 kva. on the 44,000-volt line, 4,500 kva. on the 88,000-volt line, and 7,500 kva. on the 154,000-volt line.

Small units must therefore be avoided, not only because all manufactured devices cost more per unit capacity as the size of the device becomes smaller, but because the economic lower kilovolt-ampere limit in high voltages is much higher than at low voltages, on account of the fact that the vital and expensive part of a high-voltage transformer—namely, its insulation—is for a given voltage almost constant in cost regardless of size.

The relative cost of the insulation proper of 150,000-volt transformers is shown in Fig. 2, and it is interesting to note that the cost of the insulation proper of a small transformer is as much as 40 per cent of that of a 10,000-kva. transformer. Fig. 3 gives the cost of insulation proper in percentage of total cost of the transformer. Although these curves alone would be sufficient argument in themselves, there is a further fact to be considered, namely, that the insulation proper is only one part of the high cost entailed by high voltages, and that the excess cost due to larger size of tank, core, coils, clamps and oil necessitated by the larger clearances demanded for such insulation is also chargeable against the cost of high voltage.

Since in power-size transformers the lowest cost is at 6,600 volts, we will take the cost of the 6,600-volt self-cooled line as a basis and express the excess cost of 150,000 volts in various kva. sizes in Fig. 4 in percentage of the cost of the corresponding 6,600-volt unit. It is interesting to note that 150,000 volts costs about 54 per cent more at 10,000 kva., but about 220 per cent more at 1,000 kva., and prohibitively higher a smaller capacities.



FIGS. 2-4—RELATIVE INSULATION COST AND EXCESS COST OF 150,000-VOLT TRANSFORMERS

Fig. 2—Relative cost of the insulation proper of 150,000-volt transformers in per cent of that of a 10,000-kva. unit.
Fig. 3—Cost of insulation proper of 150,000-volt transformer in per cent of total cost of transformer.
Fig. 4—Excess cost of 150,000-volt transformers above those of 6,600-volt transformers in per cent of the cost of the latter.

Aside from the advantage in cost in favor of larger sizes, there is also an unusual advantage in efficiency in favor of the larger sizes as shown by Fig. 5.

Minimum sizes used on any voltage should therefore be well beyond the zone where the cost per kva. increases rapidly. Transformers for the highest operating voltages such as 220,000 volts should preferably be above 10,000 kva. per phase.

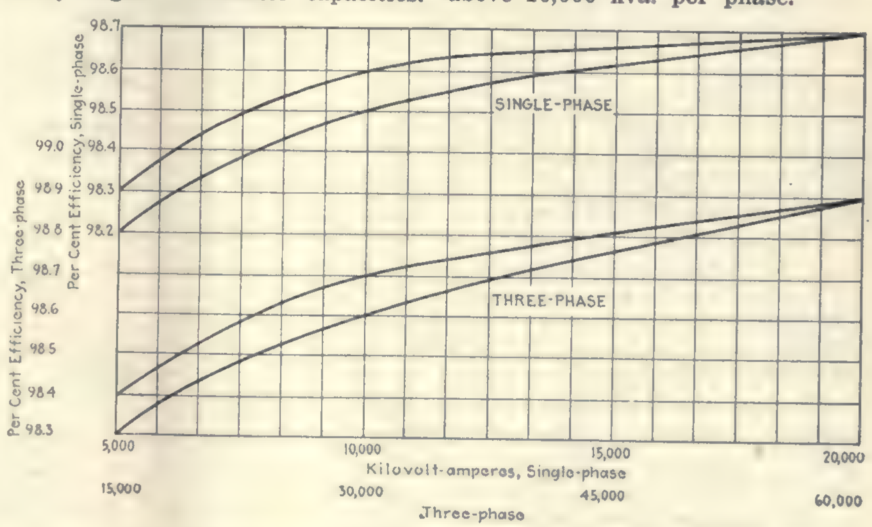


FIG. 5—EFFICIENCIES OF SINGLE-PHASE AND THREE-PHASE TRANSFORMERS AT A POTENTIAL OF 220,000 VOLTS

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Connecting Meters Within Eight Hours

Systematic Routine in Scheduling Orders Minimizes Delays—Applications Signed After Meter Installation—Electric Service Left Connected

By J. H. Thomas
Chief Clerk Central Illinois Light Company, Peoria, Ill.

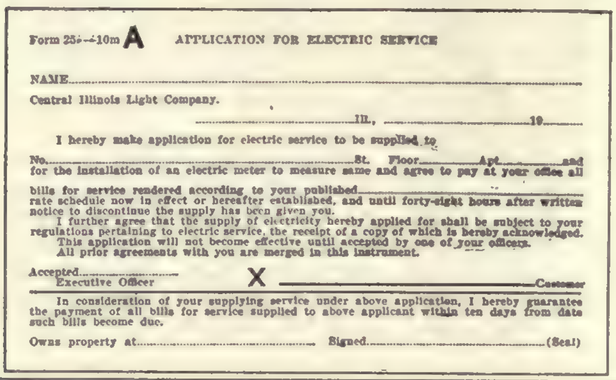
IN HANDLING more than 2,500 gas and electric service orders per month the Central Illinois Light Company has reduced the average time for setting meters to less than eight hours. This, of course, considers only the working time where a meter installation alone is necessary. Where line extensions must be built more time is necessary. This company serves 22,000 electric and 19,500 gas customers in Peoria, and a carefully worked out routine is followed to facilitate quick action in connecting meters.

Orders to connect service are taken by the order department from customers in person or by telephone. In either case the application "A," together with form "B," is completed and passed to the credit department, which is adjacent to the order department and operates as a division of it. When the credit has been approved—that is, if the application is for "old work" where the service is already installed—the order is placed in a "ready file." Telephone orders on "old work" follow the same routine, and if credit is approved, the application is mailed to the customer for signature, together with a letter signed by the secretary of the company. If a deposit is necessary the manager of the credit department writes the customer to that effect, but in either event the order is not delayed since it is placed in the "ready file."

New Construction Procedure

On orders requiring new extensions the applications are held in the order department pending completion of inspection by the municipal inspection department. Each day, however, the construction department reviews these new orders so that its work may be planned in accordance with them. Upon receipt of a certificate of inspection from the municipal inspector the "new work" orders are placed in "ready file."

At 11 a.m. and 4 p.m. each day all service orders are removed from the "ready file" and are typewritten in duplicate on form "C," which is similar for electric and gas service. These forms and a register copy are obtained in one operation. After


Form 25--10m A APPLICATION FOR ELECTRIC SERVICE

NAME........

Central Illinois Light Company.

........Ill., ...19....

I hereby make application for electric service to be supplied to

No.........St. Floor.......Apt.......and for the installation of an electric meter to measure same and agree to pay at your office all bills for service rendered according to your published........ rate schedule now in effect or hereafter established, and until forty-eight hours after written notice to discontinue the supply has been given you.

I further agree that the supply of electricity hereby applied for shall be subject to your regulations pertaining to electric service, the receipt of a copy of which is hereby acknowledged.

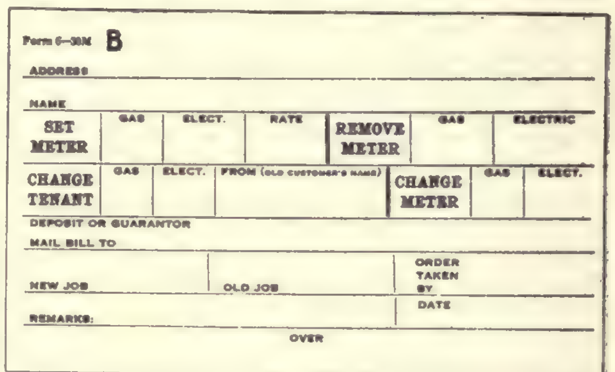
This application will not become effective until accepted by one of your officers.

All prior agreements with you are merged in this instrument.

Accepted........ Executive Officer X ....Customer

In consideration of your supplying service under above application, I hereby guarantee the payment of all bills for service supplied to above applicant within ten days from date such bills become due.

Owns property at........ Signed........(Seal)


Form 6—30M B

ADDRESS

NAME

SET METER	GAS	ELECT.	RATE	REMOVE METER	GAS	ELECTRIC

CHANGE TENANT	GAS	ELECT.	FROM (OLD CUSTOMER'S NAME)	CHANGE METER	GAS	ELECT.

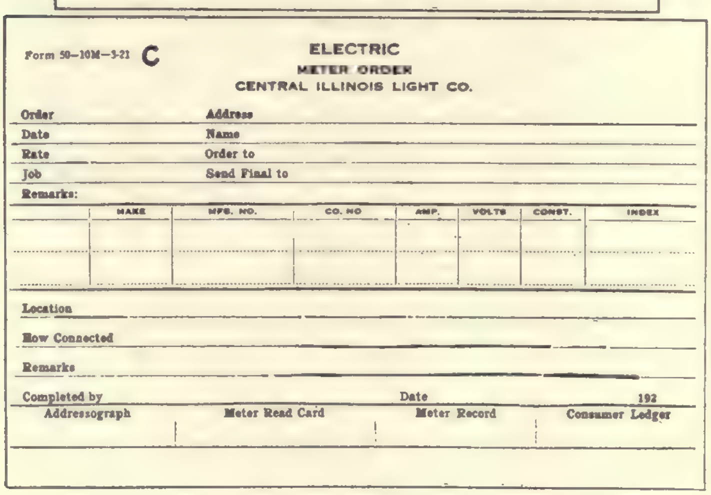
DEPOSIT OR GUARANTOR

MAIL BILL TO

NEW JOB | OLD JOB | ORDER TAKEN BY

REMARKS: | DATE

OVER


Form 50—10M—3-21 C

ELECTRIC
METER ORDER
CENTRAL ILLINOIS LIGHT CO.

Order | Address
Date | Name
Rate | Order to
Job | Send Final to
Remarks:

	MAKE	MFG. NO.	CO. NO	AMP.	VOLTS	CONST.	INDEX

Location
How Connected
Remarks
Completed by | Date | 192

Addressograph | Meter Read Card | Meter Record | Consumer Ledger


D

Form 147—2M

Service Discontinued

FOR
RECONNECTION
CALL 4-3340
Ask for ORDER DEPARTMENT

CENTRAL ILLINOIS LIGHT CO.
Office 316 S. Jefferson Ave. Peoria, Illinois

A—Service application blank. B—Meter set or connect service order. C—New construction order. D—Tag on entrance switch informs new customer how service can be restored.

FORMS USED BY CENTRAL ILLINOIS LIGHT COMPANY IN HANDLING SERVICE ORDERS

SERVICE CONNECTIONS—JUNE, 1923

Class	Number of Orders	Average Time per Order, Hours	Minutes
Unlocks, gas and electric	439	1	22
Install meter, gas, old job	146	7	43
Install meter, electric, old job	72	7	59
Install meter, gas, new job	98	18	32
Install meter, electric, new job	174	25	56

typing, the orders are turned over to the "lock-unlock" clerk, who checks each set order against a file of the meters which are locked and also against the customer's ledgers for the meter number, etc. The lock and unlock orders are held in the commercial office and the remaining orders which require the installation of meters or "new work" are sent to the respective departments for completion. Thus the larger part of the orders taken by the order department in the morning are ready for the workmen by 1 p.m. A summary of work for the month of June, 1923, is given in the accompanying table, which shows the average elapsed time for all connections. Obviously it takes less time merely to unlock meters than install them and it requires still longer time where construction is necessary.

Electric installation meter orders are handled by the electric distribution department. Orders on old work are checked against a card file to insure that the correct kind and size of meter is used. On new work the meter setters are advised each day where new services are being run, and they endeavor to route their work so as to follow the new orders as closely as possible.

ELECTRIC SERVICE LEFT CONNECTED

For several years this company has been using the plan of leaving the meters installed when a customer discontinues the use of service. However, this practice is restricted to residences, offices and smaller stores only. When meters are locked a red card is attached to both the electric and gas meters explaining how service may be obtained. Where this service is of both kinds the gas meter only is locked. The main electric switch is opened, however, and the red card "D" placed upon the panel. When the customer telephones to have the service connected he is instructed to close the main switch to obtain immediate electric service and is told the approximate time that the "meter-set man" will call to unlock the gas service. It has been found that one man with a car is able to handle electric and gas "locks," "unlocks" and "change tenant readings" by covering the city twice daily. He telephones to the office at 10 a.m. and 3 p.m., and any "rush" orders to unlock meters are given him at that time. He works out of the commercial office direct, rather than from either the gas or the electrical distribution department.

Courteous Letter Asking Customer to Sign Service Application

Dear Mr. ....

In compliance with your telephone request, we are connecting your premises at the above address for service and, as promised, are inclosing for your signature our regular application contract form. Please sign on the line marked "customer" and return to us in the inclosed envelope at your earliest convenience.

We are glad to have you as a customer at this new address and want you to know that we appreciate the opportunity of continuing our service, which we hope will prove satisfactory in every way. It is our aim not only to furnish an uninterrupted and dependable supply of gas and electricity, but also to serve you individually and personally through the several departments of our organization on all occasions.

We realize that mistakes may happen, that our service may not always be all we aim to make it. If so, we shall appreciate your telling us in what respect we have failed that we may have opportunity to correct our shortcomings. Our telephone number is 4-3340.

As indicated in the time of connections, there is particular advantage in quick service to the customer when the meters are allowed to remain installed. The man who handles the "unlocks" has found that the customers appreciate service, since hardly a day goes by that he does not receive favorable comment from some customer in regard to the prompt service given.

Aside from the gain in revenue due to the earlier use of service, there is also the advantage of a considerable saving over setting and removing meters with every change of customer and the necessary meter tests resulting therefrom. There is no question that this prompt connection of service is appreciated by the customer, and if in his initial contact with the company he receives immediate and courteous service, the company may be sure that public good will is being built upon a firm foundation.

Putting Appliance Operating Costs on Envelopes

TO HELP customers in checking their bill variations to a degree as different appliances are added to their installations, the United Electric Light Company, Springfield, Mass., has recently placed a tabulation of average hourly operating costs of such devices on the backs of its envelopes. This information, which is shown in the accompanying table, answers many inquiries which arise in the customer's mind as to the probable operating expense of appliances not in the service of an individual customer.

TABULATION PRINTED ON BACKS OF ENVELOPES

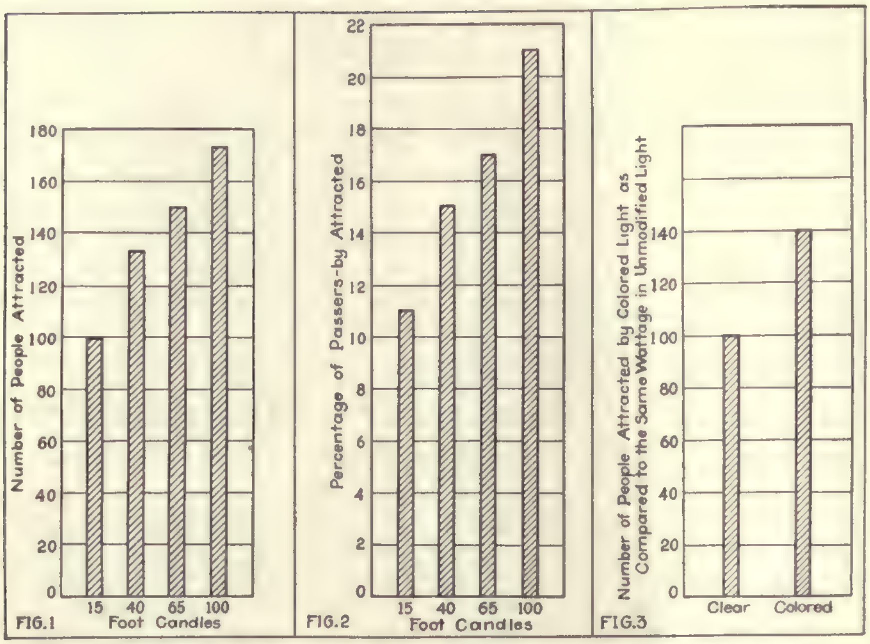
Average cost per hour for operating the following electric appliances:

	Cents		Cents
Flatiron	5	Heating pad	½
Toaster	4½	"Hedlite" heater	6
Vacuum cleaner	1½	Fan	¾
Washing machine	2	Percolator	4½
Curling iron	½	Chafing dish	5½
Grill	5½	Ironing machine	2
Sewing machine	1		

Effectiveness of High-Level Window Illumination

HIGH-LEVEL illumination and color effects will materially increase the number of passersby who pause to view displays, said A. L. Powell, lighting service department, Edison Lamp Works, General Electric Company, at the recent Swampscott convention of the New England Division of the N. E. L. A. This is indicated by the accompanying chart, which is based on observations in 106 individual test runs in two widely separated representative cities.

Central-station lighting solicitors are making capital out of the qualitative information shown, which indicates increased interest on the



PULLING POWER OF WINDOWS INCREASES WITH LIGHTING INTENSITY

Fig. 1—Thirty-three per cent more passersby stopped to look at this window when the intensity was increased from 15 ft.-candles to 40 ft.-candles, while 50 per cent more stopped when the intensity was raised to 65 ft.-candles, and 73 per cent when raised to 100 ft.-candles.

Fig. 2—With an intensity of 15 ft.-candles, 11 per cent of the total number of passersby were attracted; with an intensity of 40 ft.-candles 15 per cent stopped; up to 100 ft.-candles, 21 per cent stopped.

Fig. 3—With a high intensity it was found that by using color caps with no increase in wattage 40 per cent more passersby stopped to examine the display.

part of the public as intensities and color displays are heightened. Broadly speaking, Mr. Powell said, there are two general types of standardized reflectors, one suited to high, narrow windows and the other to low, deep windows. The installation of these reflectors with 100-watt lamps on 12-in. to 20-in. centers, depending on the intensity of illumination in the neighborhood, will meet average conditions in an excellent manner.

What Other Companies Are Doing

Ashland, Wis.—Through the efforts of W. J. Hodgkins, vice-president of the Lake Superior District Power Company here, the land around the local power house of the company will become one of the "show places" of the city. A landscape gardener has been engaged to take charge of the work of turning the unsightly grounds surrounding the plant into a small park. This work is estimated to cost about $3,000 when completed.

Logansport, Ind.—With the completion of the plant of the Northern Indiana Power Company, four days have been designated as visiting days for the public. On these days a committee of employees will serve as guides to any one who desires to visit and inspect the plant.

Boston, Mass.—Appliance sales by utilities operated by Charles H. Tenney & Company are now running about 40 per cent ahead of last year's figures.

Montreal, Canada.—The second customer-ownership campaign of the Southern Canada Power Company was even a greater success than its first one, conducted in 1922. The campaign opened Oct. 27 and was scheduled to run for ten days with 4,000 shares to be sold. At noon on Oct. 30 the company found it necessary to halt the campaign, 5,485 shares having been disposed of, or a 40 per cent oversubscription with two and a half days' work. In 1922 a total of 2,358 shares was sold to 932 shareholders in four days. The 5,485 shares sold this year went to 1,668 shareholders. The sales were made by employees of the company, 240 of them participating. They made 10,261 calls during the campaign. An unusual feature of the campaign was the fact that of the 1,668 persons who purchased securities more than 1,300 were new subscribers, so that the company now has more than 3,000 of its 15,000 customers financially interested.

All Service Departments Combined in Impressive Building

BEHIND the scenes in modern central-station service lie many activities unimagined by the general public. The utility customer knows of the existence of a generating station and the necessity for a distribution system appeals to him, but few customers visualize the ceaseless work which must be done in order that men and materials shall be concentrated at particular points on the system at stated times; that supplies shall be purchased and stored in readiness for immediate delivery at any hour of day or night, and that facilities for testing apparatus and material and for keeping accurate and complete accounts of service transactions shall be organized and maintained.

These problems have been solved by the Narragansett Lighting Company of Providence, R. I., in its new Melrose service station shown above. Erected this year after an exhaustive study of previously built installations of the kind, this plant represents an investment for better service of upward of $750,000.

The Melrose service station combines offices for operating and engineering executives with extensive stockkeeping facilities, quarters for the transportation department, laboratory, meter storage and testing departments, light and heavy stockrooms, customer records and employee recreation facilities.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Hydro-Electric Development and Steam Equipment

Review of the Fuel Situation in Canada.—A discussion of the Dominion Fuel Board, report which deals with the recurring hard-coal shortages in Canada and which contains suggestions for the more general employment of bituminous coal and other fuels, principally of Canadian origin. This three-and-one-half-page article considers the various uses of fuel in Canada, comparison of fuels and the aspects of future supply. — *Canadian Engineer*, Oct. 16, 1923.

Condensing Plant for 20,000-kw. Turbine at Shanghai.—This surface condensing plant is of the Hick-Breguet type and is designed to condense 239,000 lb. of exhaust steam per hour and maintain a vacuum of 28 in. at the exhaust inlet to the condenser, with a barometric pressure of 30 in. and when supplied with circulating water at 80 deg. F. The amount of circulating water required is 2,400,000 gal. per hour, the cooling surface being 40,000 sq.ft. As the condensing water contains a considerable amount of fine mud in suspension, special attention has been given to the avoidance of reduction in vacuum due to the deposit of such foreign material on the inside of the tubes.—*Engineering (England)*, Oct. 19, 1923.

Upper Falls Development of the Washington Water Power Company.—L. J. POSPISIL.—The author describes a recent hydro-electric development in the center of a city, this plant having a single vertical-shaft generator and delivering its output to the buses of an existing distribution substation 350 ft. distant, the excitation and load control of the new generator being from the substation. The principal features of the development are the auxiliary devices to assure reliable operation of a remotely controlled unit and provision for an automatic shutdown of the unit in case of serious trouble; also the automatic bypassing of a large portion of the water used by the wheel if the load is greatly reduced.—*Journal of A. I. E. E.*, November, 1923.

Generation, Control, Switching and Protection

Field Excitation Switch.—E. POIRSON.—The high inductivity of the generator field requires a special construction of the switch which opens this field to divert the unavoidable overvoltage from the pole windings. Usually a double knife switch is used, the auxiliary knives opening an instant after the main blades separate, closing the field upon a fixed external resistance. The results obtained are, however, not always fully satisfactory. Three new methods are suggested to improve such a switch. The first is the use of a double-pole twin switch, with resistances in series with the field and between the twin knives. The resistances are in normal operation short-circuited by the longer blades. When opening, the long blades separate first, cutting the resistances in the circuit for an instant, whereupon the shorter blades open the weakened field. The second suggestion is that the protective resistance be placed as additional steps at the end of the field-regulating resistance, turning the handle always to the very last position before opening the simple main field switch. The last and most recommended solution prescribes a suitably dimensioned condenser across the field through which the overvoltage is discharged. Formulas are given for the calculation of the size of the condenser needed. — *Revue Générale de l'Electricité*, Oct. 6, 1923.

Features of Importance in Circuit-Breaker Design.—E. K. READ.—In the design of a circuit breaker there are several factors that must be carefully considered. It is not enough that the apparatus be able to carry the greatest current at the rated voltage and interrupt a given current whenever called upon to do so. The size and weight of the apparatus must be considered because they affect the design of the switch house. The cost of erection and preparation for service must also be considered as the purchaser is primarily interested in completely installed costs.—*Electric Journal*, November, 1923.

Transmission, Substation and Distribution

Cables and Accessories for Agricultural Purposes.—ELVIO SOLERI.—The portable cables which connect the main transmission line to the different portable motors working in the fields are of a great importance and extensively used in electro-agriculture. These special cables differ from the other ones mainly by an external mechanical protection which has an influence upon the mechanical and electrical characteristics of the cables themselves. Considering first what is the maximum length and the highest permissible voltage of the cables, the author shows how experiments were made and what the results were as concerned insulation, durability, flexibility, handling, current capacity, weight, losses, safety, cost and upkeep of many different types of cables. As accessories the author considers the joints between cables and between cable and permanent line, switches, etc.—*Elettrotecnica*, Sept. 25, 1923.

Design of Transmission-Tower Lines.—W. DREYER.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. fall convention, Oct. 20, 1923, page 799.—*Journal of A. I. E. E.*, November, 1923.

Shunt Operation of Rotary Converters.—R. J. SAULSBURY.—In the early part of 1923 the Pittsburgh Railways System adopted shunt operation for 60-cycle converters, and during the first six months the time of power outages was reduced to less than half that occurring with compound operation. Since the change flashovers have become almost entirely eliminated.—*Electric Railway Journal*, Nov. 10, 1923.

Units, Measurements and Instruments

Design Constants and Measuring Units.—L. E. WIDMARK.—This paper presents a generalization of a method described in a previous paper by the author ("An Arrangement of the Circle Diagram," *Journal of the A. I. E. E.*, September, 1922). The author suggests an interdependence between measuring units and the design constants of a machine and, employing this method, proceeds to outline the direct "unit parabola diagram" for direct-current machine, the "unit circle" arrangement of the Behrend circle diagram and the "C. S. U." (cross-section unit) reference system where length dimensions take the place of ordinary electric units in recording the electrical data of a machine.—*Journal of A. I. E. E.*, November, 1923.

Cathode-Ray Oscillograph.—D. A. KEYS.—The cathode-ray oscillograph and its application to the exact measurement of explosive pressures, potential changes in vacuum tubes and high-tension magnetos are discussed. After a description of the apparatus a few experiments are described which indicate some of the various applications and possibilities of the methods developed. With this oscillograph it is possible to measure changes in pressure or potentials which occur in 0.00001 second or less. New avenues of research are consequently opened for investigation which should result in practical results of economic and commercial value.—*Journal of Franklin Institute*, November, 1923.

Illumination

Visibility of Radiant Energy.—K. S. GIBSON and E. P. T. TYNDALL.—In cooperation with the Nela Research Laboratories a new determination of the visibility of radiant energy has been made by the step-by-step method, an equality-of-brightness method with little or no hue difference in the two parts of the photometric field. Energy values were based upon radiometric and spectrophotometric measurements made at the bureau, checked by an independent color temperature measurement at the Nela Research Labora-

tories. Luminosity values were obtained with a Brace spectrophotometer. Detailed comparisons are made between the individual and average results of this investigation and those of previous investigations. A revision of the I. E. S. mean curve is proposed which results in better agreement with the average experimental visibility data and still gives the same wave-length center of gravity for light of a color temperature of 2,077 deg. K. as is given by Ives' physical photometer solution. —*Scientific Paper No. 475 of the Bureau of Standards.*

Motors and Control

Mine-Hoist Control Equipment for Large Installations.—H. W. CHADBOURNE.—Advantages of the Ilgner-Ward Leonard system, high-efficiency hoisting apparatus, automatic control features and the auxiliary hoisting motors are among the more important features discussed in this article.—*Coal Age*, Nov. 1, 1923.

First All-Electric Steel Plant in Brazil.—N. A. V. PAULSSON.—The first all-electric steel plant in Brazil was recently placed in operation. This installation utilizes 5,000 kva. in the iron and steel plant, but a 12,000-kva. power station is being built so that extensions

ELECTRICAL EQUIPMENT FOR BRAZILIAN STEEL PLANT

	Rating, Kva.
Two Swedish type furnaces, one stand-by	3,000
Two 6-ton bessemer converters (blowing engine for one)	700
One 6-ton Ludlum steel furnace	1,500
One 16-in. rolling mill	500
One 10-in. rolling mill	500
Miscellaneous 220-volt power for motors, cranes, shops and lighting	400
Total	6,600

may be made later. A general description is given of the ore supply, electric pig-iron furnace, iron smelting, steel making, rolling mill and various other electrical features. The equipment now installed with the rating of each is given in the accompanying table.—*Bulletin of the Pan-American Union*, November, 1923.

Electrical Equipment of Sand and Gravel Dredges.—J. E. BORLAND.—Two dredges of the ladder or bucket type that have been in successful operation for more than a year and that are completely electrified are described.—*Electrical Journal*, November, 1923.

Heat Applications and Material Handling

Automatic Conveying in Material Handling.—L. S. LOVE.—Vertical units and various types of horizontal conveyors that are in intensive use at the National Cash Register works are described. Control equipment and motor drive are considered.—*Iron Age*, Oct. 25, 1923

Factors Entering Into the Selection of Motors for Mine Hoists.—F. W. CRAMER and A. A. MACDONALD.—Frequently in the selection of a hoist the first cost has a direct bearing on the buying of equipment. The cost of power often influences the style and type of drive purchased. In a mine completely electrified the authors believe that a 1,000-hp. hoist motor has no appreciable affect on the demands when central-station power is purchased. Complete electrification means greater production and lowest cost of coal per ton mined. The straight induction motor, water rheostat control and the Ward Leonard motor-generator system are the typical hoist drives. The induction motor represents the lowest investment cost, but the starting demands are high. With the second system the demand peak is reduced about 15 per cent, while with the motor-generator set the demand peak is cut to one-half or one-third that of the induction motor, but the cost of the equipment is about two and one-half times as great. As the energy consumed per ton of coal by the induction motor is always the same for the same installation, this system is more efficient when the output of the mine is cut down by slumps, car shortage, etc. With the motor-generator set the energy consumed is variable, depending on the rate of use.—*Proceedings of Association of Iron and Steel Electrical Engineers*, October, 1923.

Electric Lift Trucks for Material Handling.—M. W. POTTS.—The author discusses some of the problems of material handling and shows how they are being solved. In particular he treats of lifting trucks, under which come the tiering, crane, dump body, furnace charging, ram, paper and special load-carrying trucks. There is very little standardization between the various types of trucks on the market for one particular duty. The main difference is in the hoisting mechanism and the location of the elevating motor drive and control.—*Industrial Management*, October, 1923.

Electrophysics, Electrochemistry and Batteries

Electricity in Flames.—H. A. WILSON.—A concise review is given of the present state of the knowledge of the subject, followed by a bibliography. The paper includes early observations, conductivity of salt vapors in flames, ionic mobilities, flames in a magnetic field, charge carried by the ions of salt vapors at high temperatures, conductivity of flames for rapidly alternating currents and thermodynamical theory of ionization at high temperatures.—*Paper presented before the American Electrochemical Society at Dayton, Ohio*, Sept. 27-29, 1923.

Positive Ion Currents in the Positive Column of the Mercury Arc.—I. LANGMUIR.—Negatively charged electrodes in the path of a mercury arc take up a current which is bound to be independent of the impressed voltage. The author, starting with this phenomenon, arrives at a theory which not only explains this fact but also gives a new conception of the nature of the mercury arc.—*General Electric Review*, November, 1923.

Traction

Savings from Paulista Electrification Estimated.—S. B. FORTENBAUGH.—The costs of electric and steam operation over a period of five years are analyzed on this important main-line railway in Brazil. Electrification is expected to save as high as 65 per cent of the total operating cost, of which fuel is a major factor. — *Electric Railway Journal*, Nov. 3, 1923.

Electrification of Foreign Railways.—S. PARKER SMITH.—In the third article of this series on railway electrification the author deals with the developments which are taking place in Scandinavia. In this country the problem is intimately bound up in the utilization of the water-power resources. The coal fields of Sweden are of small extent and their products not suitable for locomotive use, so that in addition to a purely economic consideration in the use of water power for electrification there is the allied consideration of economic independence of imported coal. A discussion of the various methods of electrification in use is given.—*Beama (England)*, November, 1923

Miscellaneous

Electric Irrigation Plant at Los Almadenes, Spain. — H. DESBARRES. — The fertility of the regions of Murcie and Alicante on the west coast of Spain depends largely upon profuse artificial irrigation, made possible by an elaborate canal system which dates back to Moorish times. To supplant the decentralized and extremely inefficient ancient irrigation wheels in this section, a modern electric pumping system has recently been put in service. The entire territory of about 40,000 hectares requires more than 7,000 liters of water per second, which calls for a pumping energy of over 6,000 hp. A hydro-electric power station was erected at Los Almadenes, on the River Segura, operating under a head of 47 m. Three horizontal-shaft Francis-type turbines of 4,200 hp. and 500 r.p.m. drive 3,500-kva., 5,000-volt, 50-cycle, three-phase generators, the voltage of which is stepped up to 65,000 by a bank of three 3,700-kva. single-phase transformers. The transmission line, of a total length of 137 km., is supported on steel towers, spaced on the average 100 m. apart, equipped with American pin-type insulators. A Petersen grounding coil is placed at the Y-point of the 65,000-volt bus system. Six substations are distributed along the irrigation canals, reducing the transmission voltage to 5,000 for the operation of induction motors, driving direct-coupled centrifugal pumps. Depending on delivery and head, two types of pumps are used, namely, 220-hp. sets for 1,700 liters per second and 6.8 m. elevation, and 650 hp. for 1,500 liters per second and 25 m. elevation. The pumps are horizontal-shaft Sulzer types, running at 585 r.pm. and 740 r.p.m. respectively.—*Revue Générale de l'Electricité*, Sept. 29, 1923.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Topics at the Capital

Surveying Muscle Shoals Power Market—Tri-State Treaty—Niagara and Barge Canal

A SURVEY of the power market in the region tributary to Muscle Shoals is being made by the federal government. The Department of Commerce, the Ordnance Department and the Federal Power Commission are participating. Apparently this information is being gathered to enable the government to calculate the value of a lease, should it be decided to handle the Muscle Shoals proposition on such a basis. A bill is to be introduced early in the new Congress to provide that the leasing of power at Muscle Shoals must be conducted under the provisions of the water-power act. A number of government officials have accepted the invitation of Col. Hugh Cooper to visit Muscle Shoals as members of the party which will examine the project in the week of Dec. 10.

The Secretary of War has suggested the advisability of permitting representatives of the Corps of Engineers and of the Federal Power Commission to participate in the early discussions of the proposed treaty between New York, New Jersey and Pennsylvania as to the utilization of the resources of the Delaware River. Since any compact into which these states might enter affects matters within the jurisdiction of those agencies, Secretary Weeks believes it would be well to have the general commission acquainted with the exact jurisdiction of the federal government in connection with the utilization of the Delaware River.

Dispute Over Barge Canal Water

Measurement of the water passing through the New York State Barge Canal is to be undertaken to determine whether or not water in excess of the amount needed for navigation is being diverted from the Niagara River. The work will be done by the measuring commission recently appointed to represent the United States and Canada, of which the American member is Major P. S. Reinicke, the district engineer in charge at Buffalo for the Corps of Engineers. W. M. Stewart represents Canada.

It is contended by representatives of the federal government that no water is being diverted through the canal over and above the requirements for navigation, although in issuing a license to the Niagara Falls Power Company it was assumed that 500 cu.ft. per second of treaty water was going through the canal. Certain interests in Lockport and Medina have laid claim to the right to use this 500 second-feet of treaty water and have applied to the Federal Power Commission for a license to cover its use. Those interests hold a revocable state permit which recites their right to have this amount of treaty water transported through the canal as far as Lockport.

If it is found that no treaty water is being transported through the canal, it is assumed that the Federal Power Commission will license the 500 second-feet for diversion at the Falls. Even in that event it is understood that the Niagara Falls Power Company is willing to remunerate the holder of the state license for any equity which he may possess.

Ottawa Official Talks of Increasing Niagara Diversion

A dispatch from Ottawa quotes the Canadian Minister of the Interior, Charles Stewart, as saying that if power requirements continue to increase at their present rate it will compel a reconsideration on the part of the four parties to the power treaty—the United States, New York State, Canada and Ontario—of the diversion limitations provided in that pact.

"There is no serious concern felt here," said Mr. Stewart, "but our experts are now engaged in making measurements on both sides of the Niagara River to determine the amount of water now being used for power purposes, and it is inevitable that if the present situation becomes aggravated for any considerable period the treaty limitations will have to be reconsidered."

Stock-Selling Campaign in Colorado Far Past Mark

Henry L. Doherty & Company report that during a ten-day customer ownership campaign just ended which was conducted by the Public Service Company of Colorado 5,545 new stockholders purchased 16,593 shares of stock. This was an average purchase by each new shareholder of 2.99 shares of stock. The success of the campaign, the quota for which was 10,000 shares of 7 per cent preferred stock, was, the Doherty organization says, the result of co-operation and effort on the part of the 1,500 employees of the company, which serves the cities of Denver and Boulder and a large number of smaller towns and villages in Colorado.

Missouri Merger Complete

Commission Authorizes a Newly Organized Company to Acquire Ten Others

EXPANSION of the McKinley-Studebaker utility properties along lines already indicated in these columns has reached another stage through the authorization by the Missouri Public Service Commission of the acquisition of ten operating public utility companies in the central part of Missouri by the newly organized Missouri Power & Light Company of Mexico (formerly the Missouri Utilities Company), whose common stock is owned by the North American Light & Power Company, which is closely associated with the Illinois Power & Light Corporation in the ownership and management of public utility properties in Illinois, Missouri, Iowa, Kansas, Nebraska and Oklahoma.

Public utility service in twenty-four Missouri towns is affected by the deal. These include Mexico, Jefferson City, Boonville and Moberly. Besides the Missouri Utilities Company those absorbed are the North Missouri Light & Power Company, Jefferson City Bridge & Transit Company, Jefferson City Light, Heat & Power Company, Boonville Light, Heat & Power Company, Citizens' Electric Company, Huntsville Light & Power Company, Adair County Light, Power & Ice Company, La Plata Light, Heat & Ice Company and the Moberly Light & Power Company.

Officials of the North American Light & Power Company at Chicago say that arrangements have been made with Chicago and New York bankers to finance the reorganization.

Another purchase just announced by the Illinois Power & Light Corporation is that of the Monmouth (Ill.) Public Service Company.

Denied that Control of Kansas City Company Has Passed

Purchase by the Illinois Power & Light Corporation of the Armour common stock holdings in the Kansas City Power Securities Corporation, which owns all the capital stock of the Kansas City Power & Light Company, is confirmed. This, however, does not carry with it control of the company, according to Joseph F. Porter, president of the Kansas City company and of the Kansas City Power Securities Corporation, who says that Mr. Armour's stock was only about 26 per cent of the total.

Changes in Wisconsin Code

Many of Interest to Engineers and Operators Undergo Consideration at Milwaukee

PREPARATORY to printing a second edition of the Wisconsin Safety Code, supplies of which are now exhausted, the advisory committee of the Railroad Commission of Wisconsin, with C. B. Hayden as chairman, held a meeting in Milwaukee on Nov. 22 at which various proposed changes in the code were brought up for consideration. As pointed out by Mr. Hayden before the meeting started, it is the desire of the committee to consider only minor changes in the code or others of greater importance which are made imperative by changed conditions. He expressed the opinion that radical changes not made necessary so far by experience should be postponed to a later time so that they can have adequate consideration.

It developed in the discussion, however, that some of the proposed changes, even though in fair compliance with the National Safety Code, differed radically from the present Wisconsin State Electrical Code, and these subjects have been referred to sub-committees for further consideration with the hope that some agreement can be reached in time to include them in the new code. If this agreement is not reached, it is quite likely that the changes will be postponed.

OTHER CHANGES PROPOSED

Less than 25 per cent of the proposed changes could be gone into in the one-day session, and another committee meeting, possibly about Dec. 12, will have to be held if all of the proposed changes are to be considered. Of the changes considered, those which aroused the greatest discussion and difference of opinion were the ones affecting who should provide ground for services to power apparatus, whether ground wires should be run in metal conduit or not, the clearance between wires and buildings, and what electrical apparatus should be allowed inside motion-picture booths. Other proposed changes which may arouse discussion concern the identification of terminals, the question whether conductors larger than No. 8 A. W. G. should be identified, the desirability of requiring disconnecting switches for all motor starters, the proximity of control apparatus to the apparatus controlled, a limitation on the connecting of motors direct to lines without starters, the desirability of intrducing exception to requirements for fuses or circuit breakers in industrial plants when changes are made in conductor size under certain conditions, the advisability of requiring switches on the load side of cartridge and plug fuses above a certain size, the proposal of dead-front panelboards for lighting distribution centers, and the prohibition of combustible shades on all electric light bulbs regardless of type and wattage.

All interests are very well represented on the advisory committee, and even after new recommendations or proposed changes are made the whole subject of revision of the code will be thrown open to a public meeting before action is taken.

Brooklyn Edison Buys Electric End of Flatbush Gas

Negotiations are under way whereby the Brooklyn (N. Y.) Edison Company will take over the electric distribution system and franchises of the Flatbush Gas Company, and application will soon be made to the New York Public Service Commission for authority for the transfer. The Flatbush Gas Company is owned by the Brooklyn Union Gas Company, and the sale price is $4,500.000. This was announced on Monday by William A. Prendergast, chairman of the Public Service Commission.

The Flatbush company serves consumers in the Flatbush section of Brooklyn, and, according to Mr. Prendergast, the transfer of the electric service to the Brooklyn Edison Company will result in a saving of approximately $250,000 a year to consumers of electric light and power in that section. "If approved," Mr. Prendergast said, "this sale would mean that all the electric lighting business in Brooklyn would be done by the Brooklyn Edison Company, which will avoid the duplication now necessary." He said the change would reduce the base price for electricity now paid by 35,000 users in Flatbush to 8 cents a kilowatt-hour. Small consumers now pay 10 cents a kilowatt-hour.

International Power Scheme Under Way

Plans for the development of export power business between the Province of Quebec and the New England States are said to be approaching maturity. The interests controlled by E. A. Robert, president of the Montreal Tramways Company, are reported behind the plan, which will involve the transmission of about 60,000 hp. across the border.

The plan would result in the disappearance of the Montreal Tramways & Power Company, holding company for the Montreal Tramways, and the formation of a new company, embracing the Quebec-New England Hydro-Electric Corporation and the Canadian Light & Power Company, as well as control of the Montreal Tramways.

The project is said to include the development of 40,000 hp. at Carillon, near Montreal, where the group controls a valuable power site, as well as at Rivière du Loup, 70 miles from Montreal, where 21,000 hp. will be available. Contracts obtained in New England for power will, it is said, form the basis of financing the enterprise. An export license for ten to twenty years has been requested from the authorities at Ottawa.

Electric Accident Policies

A. I. E. E. Discussion at Hartford on Insurance Covering Electric Hazards to Machinery

BEFORE a largely attended meeting of the Connecticut Section of the American Institute of Electrical Engineers held at Hartford on Nov. 22 W. R. C. Corson, vice-president Hartford Steam Boiler Inspection & Insurance Company, outlined the recent development of electrical accident insurance in this country and emphasized the need of further experience in order to determine satisfactory rates for power-plant and electric installations.

In a general discussion which followed the author's historical survey it was brought out that about sixteen companies are now writing engineering insurance in America, about half of these also writing electrical insurance. It is roughly estimated that the total volume of electrical insurance in the United States is about eight million dollars. The past year's experience shows that premiums will have to be increased unless losses can be reduced by inspection and by the co-operation of plant owners and operators. One large company reported that one electrical machine out of thirteen insured was up for a claim of some sort last year, compared with one electrical machine in ten insured in England and one boiler in 250 insured in that country. The first year's insurance against engineering breakage is apt to be disastrous in total claims involved as compared with later periods.

The importance of more closely defining "fire" in the insurance of electrical machinery against loss was brought out in the discussion. There have been disagreements between casualty and fire insurance companies as to mutual liability for damages in turbo-generator burn-outs, for example. In one case it cost $8,000 to rewind a 30,000-kw. generating unit, the winding of which had been damaged by internal overheating, resulting in the destruction of insulation. This was accompanied by smoke, but the fire insurance interests argued against sharing in the damages on the ground that the accident was not a fire in the accepted sense. The courts held otherwise, and all the insurance interests shared the loss.

STANDARDIZING INSPECTIONS

A. D. Colvin general manager Hartford Electric Light Company, pointed out the opportunities for standardizing inspections covering the same plant. In a typical case two inspectors went over the same plant and the reports and recommendations differed radically. Each list of points presented had merit, but there was not the concurrence of view that would have been expected. Much depends, the speaker said, upon the use made of insured machinery, some equipment held chiefly for reserve service deserving a different rating in regard to premiums from the more modern apparatus.

H. W. Derry, power engineer Hartford Electric Light Company, pointed out that the attention of all purchasers of motors is drawn to the value of breakdown insurance, and as a result the insurance taken out in many cases has helped materially in weeding out operating troubles. It was brought out that where a process involving large values in product or critical treatment is dependent upon a single small motor, the provision of an extra motor represents a highly satisfactory insurance against interruptions of production.

Joseph Sachs, electrical engineer, Johns Pratt Company, Hartford, touched upon the interdependence of electrical equipment and circuits and the importance of defining the limits of coverage in insuring against accidents.

Transatlantic Radio Makes a New Stride

For the first time in the history of radio, transatlantic broadcasting on a liberal scale was carried out last Sunday, when piano music rendered in England and exclamations of greeting from Liverpool, Manchester, Glasgow, Cardiff and other British cities were distinctly heard in the Atlantic Coast States. Every broadcasting station in the United States by prearrangement became silent at 10 o'clock, Eastern standard time, equivalent to 3 a.m. in London, while radio receiving apparatus the country over began listening for England.

Had there not been interference from San Antonio and Chicago the results, it is held, would have been even more successful. As it was eight official British stations and one independent attempted successfully for thirty minutes to establish group communication. A darkened ocean, chosen as more favorable than daylight, and air that for at least part of the time was hushed from coast to coast aided the accomplishment.

Calls on Maine to Abandon Water-Power Policy

A call to the people of Maine to take action to end the present impasse regarding the non-exportation of power from the state and to encourage hydro-electric development for interconnection purposes was sounded by Clarence C. Stetson of Bangor, Me., on Nov. 22, in an address before the Bangor Chamber of Commerce. Mr. Stetson served during the past two years as secretary of the Colorado River Commission and was recently an assistant of Secretary of Commerce Hoover. Declaring that the present is a critical period for Maine in view of the prospective development of superpower in neighboring Atlantic Coast states, the speaker emphasized the economic benefits to the state and its people which would result from the exportation of surplus hydro-electric and steam-plant energy. He termed the retention on the statute books of the law forbidding the transmission beyond the confines of the state of hydro-electric energy on the plea that Maine will require all the power for her own uses and that industries will thus be forced to go there a "most striking instance of sectionalism and individualism."

The speaker pointed out that existing power developments are small and relatively uneconomical compared with those which might be developed to conform to superpower and interconnection requirements, with exportation of surplus power. There is today in Maine, he said, 500,000 installed horsepower and about 700,000 hp. awaiting development. Assuming an increase of 125,000 hp. to be needed by Maine up to 1932, there would still be a surplus of 575,000 hp. which could be marketed. Maine, said Mr. Stetson, cannot afford to remain isolated from superpower development. Capital will not seek investment in her water power on the needed scale until a definite and constructive policy is established by the state. Development and exportation of power, he declared, would mean $100,000,000 of new wealth distributed chiefly among the citizens of Maine, $1,500,000 in new taxes annually distributed in Maine and $12,000,000 in new revenue annually in circulation.

November Yield Advances to 6.49 per Cent

NEW bond, note and stock issues of electric light and power companies offered during the month of November amounted to $56,672,000, a total representing a decrease of more than seven million dollars under the preceding month's total and an increase of more than six million dollars over the total of November, 1922. The rate of return yielded the investor advanced considerably, from 6.25 in October to 6.49, the second highest average yield of the year. The larger offerings of the month included an issue of $10,300,000 in gold bonds of the Penn Central Light & Power Company offered at 98 and yielding 6.15 and a ten-million-dollar issue of Northern States Power Company gold notes offered at 98½ and yielding 6.70. Long-term securities prevailed.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN NOVEMBER

Name of Company	Amount of Issue	Period, Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Penn Public Service Corp.	$2,500,000	24	First and refunding mortgage gold bonds, series C	Construction	6	98½	6.13
Electric Bond & Share Co. (N. Y.)	2,400,000		Cumulative preferred stock	General corporate purposes	6	97½	6.15
Nevada-California Electric Corp. (Cal.)	1,000,000	27	First lien gold bonds, series B	Construction	6	94	6.45
Bartlesville Gas & Electric Co. (Okla.)	246,000	24	First mortgage sinking-fund gold bonds	New capital	6	93.96	6.50
Mississippi Power & Light Co.	1,200,000	20	First and refunding mortgage sinking-fund gold bonds, series A	Additions, refunding and other corporate purposes	6½	94¾	7
Illinois Power & Light Corp.	5,000,000	30	First and refunding mortgage gold bonds, series A	Additions	6	98½	6.10
Tennessee Electric Power Co.	1,000,000	10	Debenture bonds	Additions and to increase working capital	6½	96	7.05
Ohio River Edison Co.	3,000,000		Cumulative guaranteed preferred stock	Additions	7	93½	7.50
Pennsylvania Water & Power Co.	2,000,000	30	First refunding mortgage gold bonds, series A	Construction and other corporate purposes	5½	95¾	5.80
Penn Central Light & Power Co.	10,300,000	30	First and refunding mortgage gold bonds	Refunding and additions	6	98	6.15
Pennsylvania-Ohio Electric Co. (Ohio)	250,000	15	First mortgage and collateral trust sinking fund gold bonds, series B		6½	100	6.50
Ohio Public Service Co.	2,400,000	30	First mortgage and refunding gold bonds, series C	Construction	6	94½	6.40
Utica Gas & Electric Co. (N. Y.)	500,000	..	Cumulative preferred stock	Additions	7	102	6.86
Sioux City Gas & Electric Co. (Iowa)	300,000	..	Preferred stock	Additions	7	100	7
Northern States Power Co. (Minn.)	10,000,000	10	Convertible gold notes	Refunding and to reimburse for expenditures	6½	98½	6.70
West Penn Co.	4,000,000		Cumulative preferred stock	Additions and other corporate purposes	7	89¾	7.80
Minnesota Power & Light Co.	8,300,000	27	First and refunding mortgage gold bonds	Construction	6	97¾	6.15
Kansas Power Co.	500,000	10	Sinking-fund gold debenture bonds		7	99½	7.05
Indiana Service Corp.	500,000	27	First and refunding mortgage bonds, series A	Additions	5	86½	6
Indiana Power Co.	450,000		Cumulative participating preferred stock	Additions	7	90	7.78
Appalachian Power Co. (W. Va.)	826,000	18	First mortgage bonds	Reimburse for addition to property	5	90½	5.85
Total	$56,672,000						

Central Stations Spending Half Billion

Large Power Houses and Extensions Now Under Way Will Have Rating of 4,595,675 Kva.—Sixty-four of These Installations Are Steam and Fifty-two Hydro

THE tabulation below gives the chief electric power stations and extensions now under way in the United States. The figures, though not exact in every case, are believed to be a reasonably close approximation. A total expenditure of $536,708,750 is indicated. Although a few large municipal and industrial developments are included in this total, innumerable small installations are not recorded, and it is evident that the amount now being spent by the electric light and power companies of the United States to increase their output is much over half a billion dollars. Sixty-four of the plants included in the table are steam and fifty-two are hydro-electric, the steam plants having a total rating of 3,052,850 kva. and the hydro-electric plants of 2,057,100 hp., equivalent to 1,542,825 kva.

The biggest steam installation under way is that of the Philadelphia Electric Company (270,000 hp.). The 250,000-kva. installation of the Public Service Electric Company at Kearny, N. J., is another large individual steam installation, and the Commonwealth Edison Company is installing a total of 227,000 kva. in two of its Chicago stations. The Detroit Edison Company, with 150,000 kva., is fourth. The largest hydro-electric installation is that of the Niagara Falls Power Company (210,000 hp.). Three other hydro-electric plants reach the 100,000-hp. mark.

As would be expected, the Middle Western States take the first place in kva. of steam installations, with the Northern Atlantic Coast States next, while the Pacific and Mountain States lead in water power. The total for the Southern States, however, is also high, showing that construction activity prevails in every section of the country.

Cincinnati Company Seeking Site for Big Plant

Within the next thirty days a decision will be reached by the Union Gas & Electric Company of Cincinnati as to the location of an electric generating plant, to cost between $12,000,000 and $15,000,000. This statement was made last week by President W. W. Freeman of the company. This generating station, which will be erected

Power Stations and Extensions Now Under Way

(As recorded in the "Electrical World" Up to Dec. 1, 1923)

STEAM STATIONS

Company	Plant	Initial Kva.	Ultimate Kva.	Date of Operation
Abilene (Kan.) Gas & Electric Co.	Abilene	3,700		1923
Adirondack Power & Light Corporation (N. Y.)	Amsterdam	*30,000		1924
Brooklyn Edison Co. (N. Y.)	Hudson Avenue	62,500		1924
Central Power Co. (Neb.)	Grand Island	3,750		1923
Cleveland Electric Illuminating Co.	Lake Shore	*70,000		1923
Commonwealth Edison Co.	Calumet	*67,000		1923
Commonwealth Edison Co.	Crawford Avenue	160,000	600,000	1924
Connecticut Light & Power Co.	Devon	75,000	150,000	1923
Consolidated Light, Heat & Power Co. (W. Va.)	Kenova	15,000		1924
Consumers' Power Co. (Mich.)	Zilwaukee	50,000	10,000	1923
Danville (Ill.) St. Ry. & Lt. Co.	Danville	7,500		1924
Denver Gas & Electric Light Co.	Boulder	90,000	90,000	1923
Detroit Edison Co.	Trenton Channel	150,000		1924
Detroit Municipal Plant	Detroit	80,000		1925
Duquesne Light Co. (Pa.)	Colfax	*70,000		1924
East Penn. Electric Co. (Pa.)	Pine Grove	50,000	300,000	1923
East St. Louis Light & Power Co.	Cahokia	60,000	240,000	1923
Edison Elec. Ill. Co. of Boston	Weymouth	62,000	300,000	1923
Empire District Electric Co (Kan.)	Riverton	20,000		1923
Fort Dodge Gas & Elec. Co. (Iowa)	Fort Dodge	15,000		1923
Houston Ltg. & Pwr. Co. (Tex.)	Deepwater	40,000	160,000	1924
Illinois Electric Power Co.	Peoria	53,300	133,000	1925
Illinois Power & Light Co.	Venice	*20,000		1924
Indiana Electric Corp.	Wabash	40,000	100,000	1924
Indiana General Service Co.	Marion	*10,000		1923
Indiana & Michigan Electric Co.	South Bend	60,000	300,000	1925
Iowa Railway & Light Co.	Cedar Rapids	10,000		1923
Kansas Gas & Electric Co.	Service City	60,000		1924
Kentucky Utilities Co.	Pineville	30,000		1924
Louisville Gas & Electric Co.	Louisville	*20,000		1923
Metropolitan Edison Co. (Pa.)	Middletown	30,000	200,000	1924
Middle West Power Co. (Ill.)	Grand Tower	25,000	100,000	1924
Montaup Electric Co. (Mass.)	Fall River	30,000	150,000	1924
New York Edison Co.	Waterside	*30,000		1923
Northern States Power Co.	High Bridge	80,000	120,000	1924
Northern States Power Co.	Riverside	*30,000	90,000	1926
Northern States Power Co.	Sioux Falls	*10,000		1924
Northern States Power Co.	Fargo	*4,000		1923
Ohio Power Co.	Philo	60,000	300,000	1924
Oklahoma Gas & Electric Co.	Harrah	15,000		1924
Oklahoma General Power Co.	Muskogee	*10,000		1923
Penn. Central Power Co. (Pa.)	Saxton	25,000	80,000	1924
Pennsylvania-Ohio Edison Co.	Toronto	66,000	240,000	1924
Philadelphia Electric Co.	Delaware	*60,000		1923
Philadelphia Electric Co.	Delaware River	270,000	600,000	1926
Public Service Co. of Northern Ill.	Joliet	*30,000		1923
Public Service Co. of Northern Ill.	Waukegan	25,000	250,000	1923
Public Service Electric Co. (N. J.)	Jersey City	25,000		1923
Public Service Electric Co. (N. J.)	Kearny	250,000	500,000	1925
Public Service Electric Co. (N. J.)	Essex	*99,900		1924
Sand Springs (Okla.) Pwr. & Lt. Co.	Sand Springs	*12,000		1923
Sioux City Gas & Elec. Co. (Iowa)	Sioux City	20,000		1924
Southern Colorado Power Co.	Pueblo	*7,500		1923
Southern Power Co.	Mount Holly	40,000		1924
Southern Power Co.	Eno	20,000		1924
Tennessee Electric Power Co.	Nashville	*12,500		1923
Tennessee Electric Power Co.	Hales Bar	40,000		1924
Topeka Edison Co. (Kan.)	Topeka	15,000		1924
Tri-City Railway & Light Co. (Ill.)	Moline	*26,000		1924
Union Gas & Electric Co. (Ohio)	Cincinnati	*30,000		1926
Union Lt., Ht. & Pwr. Co. (N. D.)	Fargo	4,000		1924
United Elec. Lt. & Pwr. Co. (N. Y.)	Hell Gate	*70,000		1923
United Light & Railways Co.	Davenport	26,000	150,000	1924
West Penn Power Co.	Springdale	*70,000		1924
Total kva.		3,052,850		

HYDRO-ELECTRIC STATIONS

Company	Plant	Initial Hp.	Ultimate Hp.	Date of Operation
Alabama Power Co.	Coosa River	120,000	120,000	1923
Alabama Power Co.	Mitchell Dam	75,000	120,000	1923
Alabama Power Co.	Tallapoosa	86,000	132,000	1925
Arkansas Light & Power Co.	Ouachita	15,000	120,000	1924
Blue Ridge Power Co. (N. C.)	Turner Shoals	10,000		1924
Dixie Power Co.	White River	50,000	160,000	1926
Eastern Iowa Power Co.	Pinhook	1,800		1923
Empire District Electric Co. (Kan.)	Table Rock	60,000		1925
Farmington River Hydro. Corp. (Conn.)	New Boston	7,600		1925
Feather River Power Co. (Cal.)	Bean Creek	62,000	202,000	1925
Georgia Railway & Power Co.	Mathis	15,000		1924
Georgia Railway & Power Co.	Tugaloo	60,000		1924
Georgia Railway & Power Co.	Bull Shine	*5,000		1925
Georgia Railway & Power Co.	Leeds	6,000		1925
Georgia Railway & Power Co.	Burton	6,000		1926
Georgia Railway & Power Co.	Tugaloo and Tallulah	30,000		1926
Great Western Power Co.	Caribou	30,000	180,000	1924
Idaho Power Co.	Snake River	*20,000		1923
Indiana Hydro-Electric Co.	Norway	2,500	9,000	1923
International Paper Co. (N. Y.)	Sherman Island	30,000		1923
Kentucky Hydro-Electric Co.	Dix River	25,000		1924
Lake Superior District Power Co.	Flambeau	16,000		1925
Los Angeles Municipal Plant	San Francisquito	*16,000		1924
Louisville Electric Co.	Falls of Ohio	75,000		1926
Minnesota Light & Power Co.	Jim Falls	16,000		1923
Modesto-Turlock Irr. Dist. (Cal.)	Don Pedro	15,000		1923
Montana Power Co.	Mystic Falls	15,000		1924
New England Power Co.	Davis Bridge	40,000		1923
Niagara Falls Power Co.	Niagara	*210,000		1923–4
Northern States Power Co.	High Bridge	80,000	106,000	1925
Northern States Power Co.	St. Croix Falls	*9,000		
Pacific Gas & Electric Co.	Pit No. 3	90,000		1925
Pacific Power & Light Co.	Hood	8,700		1923
Pacific Power & Light Co.	Deschutes	40,000	40,000	1926
Pennsylvania Power & Light	Hawley	50,000		1925
Pennsylvania Public Service Corp.	Clarion River	25,000	260,000	1923
Pennsylvania Water & Power Co.	Holtwood	*40,000		1924
Portland Railway & Light Co.	Oak Grove	25,000	100,000	1924
Portland Railway & Light Co.	Clackamas River	35,000	105,000	1924
Roosevelt Dam Project	Salt River	*7,000		
San Francisco Municipal Plant	Hetch Hetchy	100,000	100,000	1924
Seattle Municipal Plant	Skagit	40,000	70,000	1923
Sierras Power Co.	Leevening Creek	*14,000		1923
Southern California Edison Co.	Big Creek No. 3	108,000	210,000	1923
Southern Power Co.	Mount Holly	80,000		1923
Southern Power Co.	Great Falls	60,000		1923
Southern Power Co.	Catawba	50,000		1924
Southern Sierras Power Co.	Mill Creek	3,000		1924
Tennessee Electric Power Co.	Great Falls	22,200		1924
Utah Power & Light Co.	Bear River	18,800		1924
Washington Water & Power Co.	Oroville	*2,500		1923
Western States Gas & Elec. (Cal.)	Eldorado	27,000	100,000	1924
Total hp.		2,057,100		

TOTAL RATINGS AND ESTIMATED COST OF POWER HOUSES AND EXTENSIONS UNDER WAY

Steam (64 installations), 3,052,850 kva., at $100 per kva.	$305,285,000
Hydro-electric (52 installations), 1,542,825 kva., at $150 per kva.	231,423,750
Total estimated cost of stations and extensions under way	$536,708,750

* Extensions.

near Cincinnati at some point where advantage of the company's coal properties may be taken, will be the main source of the electrical energy with which the company is to supply Cincinnati, Hamilton, Middletown and northern Kentucky cities, deriving their light and power from the present plants of the Columbia Gas & Electric Company and Union Gas & Electric Company.

If the plant is placed in close proximity to the coal mines the coal from these mines is to be burned at their mouths instead of shipping it by barge and trainload to the present plants of the company. The proposed superpower plant, it is said, will take the place of the plants now in operation in Cincinnati and elsewhere, though these are to be retained as standby stations in case of accident to the trunk transmission lines. Mr. Freeman says that one of the company's several optional sites will be selected within thirty days, or before the end of the year.

Southeast, Too, for Pleasing the Public

This Theme Provides the Keynote for the Tampa Convention—Recommendations for Fruitful Publicity—Technical, Commercial and Accounting Sessions

ADVOCACY of improved relations between the central-station industry and the public, which has characterized so many recent National Electric Light Association gatherings, proved also to be the outstanding feature of the general sessions of the eleventh annual convention of its Southeastern Geographic Division, held at the Hillsboro Hotel, Tampa Fla., on Nov. 19 to 22.

Second only to the necessity for cordial relations between the utility companies and the public came the subject of co-operation between the various branches of the industry. This phase was particularly emphasized by F. M. Feiker, operating vice-president of the Society for Electrical Development, and L. W. Davis, general manager of the Association of Electragists International.

Reporting on the public relations committee work in the past year, P. S. Arkwright, chairman, brought out the fact that nearly every company heard from in the Southeast is active in new business and good-will advertising and that most of the advertising appropriations are going into newspaper display with a scattering here and there of billboard and motion-picture advertising, direct-by-mail advertising being utilized by the majority of companies to supplement their newspaper space. It was the opinion of the committee that newspaper advertising is bringing the best results, billboards falling into second place, motion-picture advertising coming third and direct-by-mail advertising last of all.

EIGHT RECOMMENDATIONS

The report outlined in detail the activities of the section during the past year and closed with definite recommendations to the incoming administration, the outstanding recommendations being (1) that all utility companies increase their advertising appropriations; (2) that wherever it is possible to do so public utilities organize and maintain a department of public relations; (3) that newspapers be considered the most desirable medium of advertising; (4) that the work of the women's committee on public information be encouraged in every possible way; (5) that co-operation between the individual companies and the state committees on public utility information be encouraged and that steps be taken to organize state committees in all states in the Southeastern Division; (6) that steps be taken to encourage closer co-operation between manufacturers and jobbers and central stations; (7) that public speaking and safety work be encouraged in every way possible; (8) that more attention be paid to the relations between employees and the public, and that the employees be kept fully informed as to the problems of the company through talks by department heads, employees' meetings or company publications.

Miss Elizabeth Lee, division chairman of the women's committee, voiced an encouraging note when she said that virtually all of the women employees of the various companies were interested and only wished for an opportunity to enter actively into public relations work.

The work of the state committees on public information was sketched by Ross Murphey of the Tennessee committee, who submitted a detailed report of the activities of information bureaus now functioning in the Southeast. H. T. Sands, chairman of the National Public Relations Section, spoke on "Public Relations—What? Why?"

George F. Oxley discussed the publicity plans of the national association, calling attention to good results obtained and urging member companies to keep actively behind their publicity and public relations work. An outline of the association activities in general was given by M. H. Aylesworth, managing director, who held that central-station companies should make every effort to encourage the use of electricity on farms and in rural districts, even though this service might for the time being have to be given at a loss.

TAXATION AND THE INDUSTRY

Adequate and just tax laws and their relation to the central-station industry, both directly and indirectly, was the subject of an address by A. J. Maxwell of the North Carolina Corporation Commission and the North Carolina Tax Commission. Mr. Maxwell stated that it was only through just and adequate tax legislation that the Southeastern States could hope to become the center of great industrial development and that the public must not cripple the industry and prevent its expansion through a short-sighted policy of overtaxing this most important branch of modern business life.

Safety work was ably handled by Charles B. Scott, chairman of the national safety committee, and W. R. Loyd, Southeastern division chairman.

The interconnecting power systems of the Southeast were described in detail in a paper by H. M. Atkinson, chairman of the board of directors of the Georgia Railway & Power Company, in which he outlined concisely the wonderful asset that the present interconnection of the large Southeastern companies has been to that section. Instance after instance was adduced where shutdowns of industrial plants were averted by the ability of the power companies to obtain the necessary supply of energy from sections in which there was a surplus. Mr. Atkinson stressed also the additional economy in the operation of these power companies that inevitably resulted from interconnection.

Speaking from the viewpoint of the public, R. Hudson Burr, Chairman of the Florida Utilities Commission, said that courtesy and tact on the part of employees constitute the most valuable asset of the industry today. He emphasized the need and sound policy of the regulation of all utilities, asserting that only through such regulation by state bodies could justice be done both to the public and to the utilities.

THE SECTION MEETINGS

Commercial Section activities proved to be of unusual interest. In a paper by I. H. Morehead entitled "The Electric Range as a Revenue Builder" monthly energy consumption and other operating conditions were outlined, and J. S. Sutherland's report for the Appliance Bureau, outlining the methods of appliance sales work in the smaller communities of the Southeast, attracted considerable attention.

Samuel A. Chase of the Westinghouse Electric & Manufacturing Company spoke on "Selling the Electrical Idea to the Public."

Among the other subjects covered at the commercial meetings were "Training Salesmen," by M. L. Pierce of the Hoover Suction Sweeper Company, the report of the Power Sales Bureau by H. B. Whiteman, and "Industrial Heating," by P. E. Shacklett.

No little interest was aroused by the Technical Section papers on "Carrier-Current Telephony for Power Systems," by C. C. Jackson of the Westinghouse Electric & Manufacturing Company; "Lightning-Arrester Grounds," by H. M. Towne of the General Electric Company; "Carrier Systems from the Standpoint of Co-ordination," by H. S. Osburn of the American Telephone &

Telegraph Company; "Our Neighbors on the Highway," by K. L. Wilkinson of the American Telephone & Telegraph Company, and "Demand Meters," by W. A. Gentry of the Westinghouse Electric & Manufacturing Company. The latter paper brought out an active discussion.

The Accounting Section's meetings were devoted largely to reports of the budget committee, the committee on classification of accounts and other committees, with a round-table discussion on the various reports.

Following the business sessions, the following officers were elected to serve for the ensuing year: President—T. W. Martin, Alabama Power Company; first vice-president, R. L. Lindsey, Durham (N. C.) Public Service Company; second vice-president, H. C. Foss, Savannah Electric & Power Company, Savannah, Ga.; third vice-president, Howard Hall, Western Electric Company, Atlanta.

The members of the new executive committee will be Charles A. Collier of Atlanta, F. V. Underwood of Birmingham, E. H. Ginn of Atlanta, P. A. Tillery of Raleigh, B. C. Edgar of Chattanooga, Henry Coles of Atlanta, S. M. Cooper of Charleston, A. W. Houston of Palatka, Fla., and W. R. Sammons of Knoxville, Tenn.

Empire State Engineers Meet

Distribution Systems, Joint Line Construction, Underground Network Systems, Overhead Ground Wire, Interconnection and Parallel Operation Discussed

A WELL-BALANCED program presenting vital engineering and operating problems marked the annual fall meeting of the Electric Section of the Empire State Gas and Electric Association, held in Schenectady Nov. 21 and 22. C. H. Ruffner, vice-president and general manager of the Adirondack Power & Light Corporation, after welcoming the association to Schenectady, emphasized the point that the engineers who do the actual technical and engineering work of the central-station industry should aid the public relations committee in meeting the public and informing them what the industry is and what it means to them. These same men should also try to develop an interest in all the departments of the individual company with which they are connected so that, having this broader knowledge, they will not criticise unfairly other departments.

E. P. Peck then explained the plan by which his company, the Utica Gas & Electric, accomplishes this end by means of weekly and semi-weekly conferences of officials of all departments. In these conferences the work that has been done is reviewed and future plans are laid and co-ordinated.

OVERHEAD DISTRIBUTION

In discussing the essentials of a modern overhead distribution system H. W. Watt, electrical engineer of the Westchester (N.Y.) Lighting Company, declared that a properly built system requires correct design followed by careful construction with good material. Correct design is possible only after a study of the conditions and an application of the best engineering theory and practice. Careful construction requires trained men under intelligent supervision, and good material can best be obtained from reliable manufacturers working under suitable specifications. When laying out a system consideration should be given to the load, its distribution throughout the given area, the load factor, the operating characteristics and the probable growth or change. A definite scheme of procedure should be laid down for a period of ten to fifteen years ahead, with as accurate as possible a predetermination of the extensions and modifications of the system and the year in which these will become operative.

In the discussion following this paper E. P. Peck said that distribution transformers should be built without tops. In regard to automatic substations he thought that there was a very great opportunity for their application to modern systems. This could be done by placing small automatic substations close together with short feeders and operated by supervisory control from the load dispatcher's office.

The suggestion of using a differently colored insulator for the neutral of the four-wire, three-phase system brought forth an animated discussion as to whether this was the best method. C. A. Bacon of the Adirondack Power & Light Corporation favored this plan, while others considered as a better method the running of two phase wires on one side of the pole and the other phase wire and neutral on the other side with neutral toward the pole.

R. A. Paine, Jr., distribution engineer of the Brooklyn Edison Company, said that with pole-type regulators a lot of trouble had been encountered with faulty motors. Mr. Watt thought that this was usually caused by overloading and inadequate inspection and also said that the pole-type regulator should be used only as a temporary method of raising the voltage of part of a line, to be replaced later by an adequate circuit controlled from the substation. The use of this regulator at the end of a rural line was advocated by Mr. Peck when the rural line was part of an urban circuit. This type of circuit occurs when rural customers are first obtained and there is not sufficient load to warrant a new circuit throughout.

An excellent report on the cost of joint-line construction in rural districts was delivered by J. C. Robbins, Albany Southern Railroad Company, and A. W. Underhill, Niagara, Lockport & Ontario Power Company, both members of the rural transmission committee. The paper gave costs on 4,600-volt joint lines and costs on 6,600-volt and 11,000-volt lines under various conditions and types of construction, together with costs on transformer installations. An abstract of this report with the cost tables will appear in a subsequent issue of the ELECTRICAL WORLD.

F. W. Crone, director of the New York State Committee on Public Utility Information, described clearly the work and the purposes of this committee.

C. T. Sinclair of the United Electric Light & Power Company presented a paper giving the features of distribution and transmission systems, particularly of the underground network, of the above company. Practically all of the underground work is at either 7,800 volts or 13,200 volts. After discussing the system layout, relative load density, duct systems and transformer installations he described a method of fault localization. This is accomplished by means of a single-line diagram of a complete circuit, upon which are placed all of the points at which the circuit may be cut apart to determine in what part of the circuit the short circuit has occurred. The use of secondary automatic network switches for clearing short circuits has been found very satisfactory.

OVERHEAD GROUND WIRE

To determine the prevailing practice and attitude of operating companies toward the use of an overhead ground wire, the transmission line committee, C. A. Bacon chairman, sent out questionnaires to twenty-nine companies in New York State, receiving answers from twenty. Analysis of the answers showed that 37 per cent were in favor of the ground wire, 42 per cent unfavorable, 16 per cent favored it on steel but not on wooden poles, and 5 per cent were uncertain. Nine per cent considered the individual pole lightning rod as effective as an overhead ground wire, 48 per cent did not consider this to be the case and the remainder expressed no opinion.

E. P. Peck asserted that while the ground wire on wooden poles gives electrostatic protection, the burning effect is very serious unless the ground wire is well insulated. He was much against the use of the ground wire on wooden-pole lines but thought that on steel-pole lines it had many advantages. Sydney Alling of the Rochester Gas & Electric Corporation said that on wooden-pole lines with steel arms and ground wire very good operation is obtained.

A valuable paper on high-voltage impregnated-cable specifications, inspections and tests was presented by L. A. Zima of the Brooklyn Edison Company. He described extensive tests made on cables supplied by five manu-

facturers for a voltage of 33,000. Four of these cables tested satisfactorily, while the fifth did not.

WATER-POWER SURVEY

The water-power committee, the chairman of which is F. J. Howes of the Rochester Gas & Electric Corporation, plans to make a survey of seven or eight streams with the aid of the combined companies in central and western New York. Stream-flow data are already available in this area. This data will be plotted with the purpose of ascertaining the diversity between the various streams. Following this the committee plans to make a quantitative survey of this territory, giving the results in dollars and cents.

The New York State interconnection report, presented in its commercial aspects at the Lake Placid convention, was again brought forward by E. P. Peck, chairman, this time in its technical aspects. A general résumé of this report was published, with a map showing transmission systems at 11,000 volts and above in New York, New Jersey, the New England States, Pennsylvania and part of Ohio, in the ELECTRICAL WORLD for Nov. 17. The original report is being published by the association and will be ready in a few days.

W. M. Carpenter, engineer of the Empire State Gas & Electric Association, expressed the opinion that the various state groups working on interconnections in a way similar to that adopted by the Empire State association should be directed and co-ordinated by an N. E. L. A. committee to assure standardization. If this is not done, it is very possible that states in close proximity will eventually have standards varying so widely that interconnection between them will be hampered to a great extent.

Methods of phasing generators and transformers before their operation in parallel with other apparatus were discussed by A. C. Jordan, chairman of the operating committee. As numerous accidents due to improper phasing have been reported, it was the object of the committee to outline a standard method of procedure. Specific instructions with adequate diagrams give the methods of phasing out for generators and tie lines, transformers and stub-end power lines.

H. W. Watt of the Westchester Lighting Company was made chairman of the Electric Section and K. V. Farmer of the Syracuse Lighting Company was made vice-chairman.

Unfinished Georgia Station Helps Out in Drought

During the recent drought in the Southern States half a dozen engineers gathered about one of the huge waterwheels at the half-finished Tugaloo power station of the Georgia Railway & Power Company and threw the generating energy of one unit that had been rushed to completion into the transmission system of the company in aid of its successful effort to keep the industries of Atlanta and other Georgia cities in operation. The plan worked, and 22,000 hp. was added to the company's capacity. As fast as the other units of the new station are completed they will be thrown into the system one by one, and the Tugaloo plant will be unique in that it will be a plant running in full operation some months before it is complete in all details.

A 110,000-volt line was carried from Tugaloo 2½ miles and connected temporarily with the main line at Tallulah Falls. A temporary switch was put in use.

Post Office Continues Work for Better Lighting

Twenty-five Post Office lease inspectors now in Washington from all sections of the country have each been equipped with portable foot-candle meters for measuring illumination, it has been announced by First Assistant Postmaster-General John H. Bartlett, under whose bureau the work is being done. The inspectors in their travels over their districts will study the intensity of the illumination in both new and old buildings and, following their reports, the Post Office Department will take action to bring the lighting of the various offices up to the standard previously established. (See ELECTRICAL WORLD, Feb. 24, page 470.)

Through the use of the instrument the amount of illumination lost because of the aging of the lamp, that lost in passing through the shade or globe, that due to the dirt accumulations, as well as that absorbed by the walls and furniture in the rooms, are accounted for, and an actual measurement of the light at the place where the work is done is obtained. Tests quickly show any change in intensity due to any of these sources.

The equipment of inspectors with the meter is a part of the Post Office Department's policy of providing adequate lighting in all post office buildings so as to assure a maximum of efficiency from employees and at the same time conserve their eyes. For post office work a minimum of 8 ft.-candles to 10 ft.-candles has been established on the basis of studies made by the United States Public Health Service. This standard is to be obtained by general rather than local illumination and will be furnished by a relatively small number of large units installed over the entire working area.

Street-Lighting Tables for 1924

FOLLOWING its practice for thirty-five consecutive years, the ELECTRICAL WORLD has prepared tables showing the proper time for lighting and extinguishing street lamps. The tables for 1924 are now ready, and a copy of them will be sent free to any subscriber upon request to ELECTRICAL WORLD, Tenth Avenue and Thirty-sixth Street, New York. For more than one copy a charge of 25 cents each is made to cover a portion of the postage, printing and compilation costs.

Features of Coming Power Show in New York

Among the salient features of the second national exposition of power and mechanical engineering, to be held at the Grand Central Palace, New York, on Dec. 3-8, concurrently with the annual meetings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers, will be a complete showing of the latest devices used in measuring the flow, temperature and pressure of fluids and gases. Flow meters for steam, water, air and gas will be shown. In this group one manufacturer will demonstrate the effect of pipe fittings on fluid flow by circulating water at various rates through a section of glass pipe. In another exhibit water pumped through a Venturi meter will be measured by three instruments, two recording and one an indicating manometer, and in addition a special planimeter for obtaining total quantities through the meter from the flow charts will be displayed. One manufacturer will exhibit a V-notch weir meter which records, indicates and integrates the flow of water at a rate of 50,000 lb. of water per hour.

Fuel-oil burners complete with controls and pumps will be displayed by several companies. One exhibitor will show a burner in action spraying water in a glass case. A boiler setting will also be displayed illustrating the method of bricking and connecting the burner and installing the air register. Pulverized-fuel equipment may also be seen and will be of great interest to those who have kept in touch with the recent successful installations that have given high economies and steady performance.

There will also be exhibits of power-transmission devices, including ball and roller bearings for all types of service, self-oiling bearings, accurately cut gears, clutches of all kinds, right-angle transmission and leather and steel transmission belting.

Every manufacturer of refractory material has been bending his efforts to a solution of the problem of producing an economical firebrick for this severe service, and the exhibits will display the results of their efforts. High-temperature insulation in brick block, powder and cement form, air-cooled blocks, clinker-proof blocks and other forms of refractory designed to reduce furnace maintenance, increase furnace efficiency and reduce labor costs will be displayed.

Appraises Coal Reports

George Otis Smith Points Out Their Value and Indicates Where They Fall Short

ADMITTING that only in part are the recommendations contained in the United States Coal Commission's twenty-odd reports broadly or analytically stated, George Otis Smith, director of the Geological Survey and a member of the Coal Commission, said at the annual meeting of the Academy of Political Science in New York on Tuesday, Nov. 20:

"It is none too generous praise to term the commission's reports, made public as yet only in a form primarily for the use of the press, a veritable mine of valuable information, but candor compels the added comment that to prepare the product of this mine for general consumption some sort of a breaker must be provided—it is not enough to dig up raw, crude facts; they must be sized and separated from associated matter of less value.

Absence of Clean-Cut Program

"The year and more in which the coal problem has had the center of the stage," Mr. Smith continued, "has not sufficed to bring to it the full understanding that is desirable and indeed essential. The continued play of the spotlight has brought out many details, but all the fact finding has not discovered any simple cure-all. This explains the absence of a clean-cut program as the final pronouncement of the Coal Commission; instead, the commission addresses recommendations of remedial action not only to the Congress but to state legislatures and municipal officials, to the Interstate Commerce Commission and to railroad executives, to coal operators and to mine workers, and finally to the great body of coal consumers, large and small. The finding is one of divided responsibility for things as they are and therefore of distributed obligation to make things different.

"With both hard and soft coal, the immediate cause of exorbitant prices has been the demand from buyers at times when the supply has been inadequate. The consumer himself can do much, as the commission recommends, to smooth out the ups and downs of demand, by purchasing coal on annual contract and by providing for storage. To encourage the off-season delivery and storage of bituminous coal, the Coal Commission recommends that the Interstate Commerce Commission allow the commercial ability to sell coal the year round to be the controlling influence in the distribution of railroad cars in months of transportation shortage. Economy in the use of transportation by the encouragement of river movement of coal and by the discouragement of long rail hauls is also recommended. Unfair competition by means of unwarranted freight differentials has favored waste of transportation service, both in making improved waterways ineffective and in promoting the premature opening of mines to serve old markets already well supplied from nearer fields. Thus mine capacity has outstripped railroad capacity.

"Irregularity of seasonal demand and unnatural widening of marketing territory, however, are not the only causes of overdevelopment. The opening of too many mines has been a direct result of the uncertainty of continuous operation due to the uncertainty of labor supply. The periodic and anticipated strikes encouraged a higher peak capacity within the organized territory, and as the strikes increased in severity the coal shortage promoted the opening of more mines in the non-union fields."

Dictionary of Specifications in Preparation

Work has been started at the Bureau of Standards, Director Burgess announces, on the compilation of material for a dictionary or handbook of specifications for supplies purchased by federal, state and municipal governments and public institutions. This work grew out of a meeting held in May, 1923, of state purchasing agents from all over the country, at which the co-operation of the various states was assured.

Subsequently a conference was held of various national organizations interested in the preparation and unification of purchase specifications and in their use from the point of view of both the producer and the consumer. This conference was called for the purpose of organizing an advisory committee to co-operate with the Department of Commerce and the national conference of state purchasing agents in the work of formulating purchase standards, specifications and tests. Although no meeting of this advisory committee has yet been held, the various organizations represented are co-operating actively in the actual work of compiling the material for the dictionary, and a great deal of information has been supplied.

Correspondence conducted with the officers of trade associations and the purchasing agents of a large number of municipalities and public institutions has established the fact that all the individuals and groups for which the dictionary of specifications is being prepared will welcome its appearance enthusiastically and co-operate actively in the preparation.

A collection is now being made of all available specifications prepared by the various departments and independent establishments of the federal government and those used by state and municipal governments, public institutions and the important national trade associations and technical societies. These specifications are being thoroughly card-indexed and classified. Care is being taken to pick out those specifications which are most urgently needed, and due consideration is being given to the attitude of purchasers and consumers toward the existing and the proposed specifications.

Brief News Notes

Substantial Increase in Earnings of Electrical Department of New Orleans Utility.—The annual report of the New Orleans Public Service, Inc., for the year ended Sept. 30, 1923, recently made public, discloses an increase in electric revenue of $434,663 for 17,454,672 additional kilowatt-hours. There were increases in operating expenses for the gas and electrical units, however, which reduced the total earnings of the Public Service, Inc., by $128,041.

Record Installation of Electric Meters in New York State.—Two hundred and thirty thousand new electric meters were installed by the electric utility companies of the Empire State in the first nine months of the present year, according to a survey made by the New York State Committee on Public Utility Information. This marks a new record in extension of service and exceeds by 20 per cent the 190,000 meters installed during the first nine months of 1922.

Unique Street-Lighting Standards to Be Used in Kansas City.—In a new residence subdivision, called the Indian Village, recently opened in Kansas City, Mo., at Fifty-eighth Street and Wornau Road, the street-lighting standards will be in the form of totem poles. These unique posts were designed by Arthur Frederick Adams, a Kansas City architect and are a combination of totem pole and Aztec Indian obelisk. There will be sixty-eight of them, made of terra cotta, each one 18 ft. high.

Maquoketa, Iowa, Installs Municipal Lighting System.—The Iowa Electric Company's street-lighting service at Maquoketa has ended, the company's efforts to enjoin the city from operating its own plant having failed. The city lighting system consists of 120 lamps of 250 cp. Fifty more lamps in the outlying districts will be added in a few weeks. This does not include the boulevard lamps, which the city has lighted for two years. The Iowa Electric street system consisted of 138 lights of 80 cp.

Perfection of Electric Device for Stopping Motors from Distance Not Confirmed.—Reports that French and German electrical engineers have perfected a device by which motors on automobiles, and perhaps airplanes, can be stopped from a distance have been investigated by army radio and engineering experts and found to be exaggerated. The investigations were made at places where reports said the devices had been successfully demonstrated in France and Germany, but as yet nothing has been discovered by the army experts to indicate that the device has been found practicable.

Five-Thousand-Dollar Prize for Storage-Battery Locomotive.—The Department of Mines of Great Britain has offered a prize of £1,000 for the best design of a storage-battery locomotive suited for use in the deep mines of the British Isles. It is recognized that American competitors for this prize will have a distinct advantage owing to the higher state of development of storage-battery locomotive manufacture in this country. The contest will be open until April 1, 1924. Details may be had from the secretary of the Storage Battery Locomotive Competition, Department of Mines, London, S.W. 1.

Florida Soon to Have Utility Information Bureau.—On Nov. 21 about forty representatives of utility companies operating in Florida met at the Hillsboro Hotel, Tampa, to discuss the formation of a Utility Information Bureau for that state. A pre-organization committee appointed to prepare the plans consists of A. W. Houston, Southern Utilities Company, Palatka, Fla.; D. A. Cheney, Orlando Public Service Company; T. J. Hanlon, Jr., Tampa Electric Company; B. M. Latham, St. Petersburg Lighting Company, and H. H. Hyman, Miami Electric Light & Power Company.

Reduction of Missouri Power Rates.—The Empire District Electric Company, which supplies electrical energy to Joplin, Webb City, Carterville, Carthage and other places in southwestern Missouri, has been ordered by the Missouri Public Service Commission to put a reduced schedule of power rates into effect on Dec. 1 that will effect a saving of $120,000 a year to consumers. The new schedule eliminates a surcharge of 6.18 mills per horsepower-hour and the readiness-to-serve and consumption charges are reduced. Lighting rates are not affected, as the company did not increase those rates during the war period.

Drought in Wisconsin.—Drought has interfered with the production of hydro-electric power by the many water-power plants in Wisconsin. Two of the largest, situated on the Wisconsin River at Kilbourn and Prairie du Sac, which furnish 10 per cent of the total power requirements of the Milwaukee Electric Railway & Light Company and its subsidiaries, have both been unable to supply the maximum amount of electricity specified in contracts. At Portage the Wisconsin River is more than a foot below normal, while other streams are also very low, and central-station companies have had to depend on their steam or oil-burning plants and to call on interconnected companies to make up the deficiency.

Southern Power Company Rate Hearing. — The petition of the Southern Power Company for an increase in rates of approximately 10 per cent came up for hearing before the Corporation Commission of North Carolina last week. About thirty textile mills and other industries and two or three towns which buy power at wholesale are opposing the increase. The power company's contention is that the present rates do not afford a reasonable return on its investment and that under these circumstances it cannot get capital for expansion. The only witness heard by the commission was W. S. Lee, vice-president and general manager of the power company. The opponents of the increase did not desire to present evidence but asked that the commission make a thorough inquiry into the business of the company. Each side will have fifteen days after receipt of the transcript to file briefs.

Municipal and Central-Station Rivalry at Richmond, Ind. — The municipal board of works of Richmond, Ind., has declined to enter into a contract with the Terre Haute, Indianapolis & Eastern Traction Company which would permit the latter to build and operate a high-voltage electric line through the city of Richmond. The traction company had agreed that it would not sell electrical energy in Richmond or Wayne Township if permitted to maintain the feed line through the city, but the opinion prevailed that the company was becoming a direct competitor with the city in the power business in which both are engaged. The company may appeal to the Public Service Commission.

Area Charge Proposed in Indiana.—The Northern Indiana Gas & Electric Company, which in a conference with the Indiana Public Service Commission agreed to a reduction in electric rates in Lafayette estimated at about $30,000 or $35,000 a year, has proposed a new basis for its rates in that city. Instead of charging 10 cents a kilowatt-hour for the first 25 kw.-hr., ranging down to 7 cents a kilowatt-hour, with a monthly minimum of $1, the company proposes an area charge of 40 cents a month for the first 500 sq.ft. of floor area and 5 cents for each additional 100 sq.ft. plus an energy charge of 6 cents a kilowatt-hour, with $1 monthly minimum and with 1 cent a kilowatt-hour deduction for prompt payment. A new basis for commercial charges also is proposed. The company seeks to put the new schedule in effect Dec. 1.

Puget Sound Company to Spend a Million Dollars.—Expenditure of $1,000,000 in new hydro-electric power development by the Puget Sound Power & Light Company of Seattle in the immediate future is announced by A. W. Leonard, president, who recently returned from an extended Eastern trip. "Whether the contemplated development will take the form of enlarging one of our ten present hydro-electric plants or the installation of an entirely new project," said Mr. Leonard, "will be decided in the near future. It depends upon a comprehensive survey we are making of the power needs of the entire district. Whichever decision we reach will mean material additional use of Washington's water-power resources. The entire new unit which we may decide on represents an investment of $5,000,000 to $6,000,000."

Associations and Societies

New York Electrical Credit Association.—The twenty-eighth annual meeting and dinner of this association will be held on Wednesday, Dec. 12, at the Building Trades Club, 34 West Thirty-third Street, at 6 p.m.

American Physical Society.—At the one hundred and twenty-third regular meeting of the American Physical Society, held at the University of Chicago on Nov. 30 and to continue Dec. 1, Dr. Niels Bohr was scheduled for an address on "The Quantum Theory of Atoms with Several Electrons." Many other papers related to electrophysics were to be presented. The annual meeting of the society is to be held at the University of Cincinnati on Dec. 27-29.

Lighting Fixture Associations Dine.—At a joint dinner in New York on Nov. 21 of the Association of Lighting Fixture Manufacturers and the New York division of the National Council of Lighting Fixture Manufacturers, presided over by Herman Plaut, chairman of the national body, there were addresses by Edward L. Cox, Robert Biddle, Fred R. Farmer, Charles H. Hofrichter and Bernard Blitzer. Chairman Plaut cited the fact that within the past year thirty-four hotels, representing an investment of $54,000,000, and eighty-eight apartments, representing $120,000,000, have been erected in New York City, yet less than 1 per cent of this total investment was spent for lighting fixtures. Mr. Blitzer estimated the total sales of lighting fixtures for the past year at between $225,000,000 and $250,000,000.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

American Society of Mechanical Engineers—New York City, Dec. 3-6. C. W. Rice, 29 West 39th St., New York.

National Association of Railway and Utilities Commissioners—Hotel Urmey, Miami, Fla., Dec. 4-7. J. B. Walker, New York Transit Commission, New York City.

Accounting National Section, N. E. L. A.—Hotel Muehlenbach, Kansas City, Dec. 10-11.

American Physical Society—University of Cincinnati, Cincinnati, Dec. 27-29. H. W. Webb, Columbia University, New York City.

American Engineering Council (F. A. E. S.)—Washington, Jan. 10-11. L. W. Wallace, 26 Jackson Place, Washington.

Wisconsin State Association of Electrical Contractors and Dealers—Pfister Hotel, Milwaukee, Jan. 17-19. H. M. Northrup, 23 Erie Street, Milwaukee.

Western Association of Electrical Inspectors—Hotel Fontenelle, Omaha, Jan. 29-31. W. S. Boyd, 175 West Jackson Blvd., Chicago.

American Institute of Electrical Engineers—Midwinter convention, Philadelphia, Feb. 4-8. F. L. Hutchinson, 33 West 39th St., New York.

Commission Rulings

Depreciation of Overheads. — The theory of not depreciating any overheads, said the Michigan Utilities Commission in a case affecting the Detroit United Railway, is only defensible upon the hypothesis that the property is to be continuously maintained in operating condition from operating revenues and that no capital contributions are to be made thereto; but probably those overheads allocable to property whose maintenance is constantly chargeable as an operating expense, paid from operating revenues and not charged to capital account, ought not to be depreciated as a matter of accounting practice in public utility operation.

Importance to the Public of Sound Financing of Utilities.—Dwelling on the common interests of public utility companies and the customers they serve, the Illinois Commerce Commission, in a finding affecting the Chicago Telephone Company, went on to say: "The valuation of the company should be such that capital seeking investment will flow in sufficient amount into the securities of the company that it may make, without any considerable effort, necessary investments to insure public service. Again, its securities should be maintained at or near par in order that an undue burden should not be thrown upon the operating department of the utility in order to amortize any undue costs of selling securities or of securities sold at much less than par. In this regard the financial structure of a company is a matter of grave import in that the financial structure should be so devised that the securities of the company may have the widest possible market and its structure so simple that any person having funds to invest might find the securities of the ordinary utility available for such investment. Some courts have said that the value is to be fixed as of the date of the inquiry. This may be true as a strictly legal proposition, but in considering all of the economic laws governing the perpetuity of a company in service, a fair value must be so fixed as will, within reasonable conditions in the future, furnish a safe and reliable valuation both for the flotation of securities, for the security of capital invested and for furnishing a field for the investment of new finances in the future development of the company. In this regard not only must the commission be governed by considerations of a value and rate not subject to the criticisms of confiscation, but it must also consider trend of prices, original cost, reproduction cost and all other considerations which may in any manner assist the commission in fixing a value which, in the fluctuation of prices and cost reasonably to be expected in the immediate future, will carry the company through on a safe, sound and economic financial basis."

Outside Utility Company Cannot Intervene to Upset Sale of Municipal Plant.—In sustaining the sale of the municipal electric plant of Cambridge City to Robert S. Ashe and denying to the Interstate Public Service Company, another bidder, the right to intervene, the Indiana Public Service Commission said that a public utility company which has bid for a municipal plant offered for sale, but which is not a resident of the municipality or a taxpayer thereof and which has no vested right in the town or interest in the result of a proceeding for the confirmation of the sale, is not entitled to intervene on the ground that errors or irregularities entered into proceedings leading to the sale to another bidder of the property which the utility company sought.

Recent Court Decisions

New York Law on No-Par-Value Stock Issues by Utilities.—The Supreme Court of the State of New York has declared, in People vs. Liberty Light & Power Company, that under the stock corporation law and the Public Service Commission law of the state a light and power corporation may issue stock of no par value in exchange for all the outstanding stock of par value, without authority from the Public Service Commission, and still not incur a penalty under the Public Service Commission law. (210 N. Y. S. 302.)*

Owner of Dam May Not Capriciously Release Water to Injury of Ice Harvester.—Taft vs. Bridgeton Worsted Company was a suit for damages for injury to an ice crop because of the release of water stored for the operation of a mill plant. The Supreme Judicial Court of Massachusetts, upsetting in part a verdict for the plaintiffs, decreed that since the plaintiffs had only a license from the owner of the artificial pond to take ice, for which no consideration was given, they could not sue for damage to the ice, the damage to their revocable license not being recognized as injury to their property. The court, however, asserted that one who had by easement acquired the right to build a dam, thus overflowing another's land, could not through mere caprice draw off the water at a time when he knew that it would inevitably cause serious damage to the owner of the land by destruction of ice, if the right to take the ice could be exercised without legal injury to the owner of the dam. (141 N. E. 119.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Decisions Must Be Based on Facts Established, Not on Independent Knowledge Acquired. — The Supreme Court of Oklahoma has overruled a finding of the Oklahoma Corporation Commission against which the Oklahoma Natural Gas Company took action, on the ground that the rights of the parties depend upon facts established at the hearing, and not upon some independent knowledge of the commission acquired after the hearing. "There being no evidence to the effect that the price of gas at the mouth of the well had declined," said the court, "but the evidence all being to the effect that at the time of the hearing the company was compelled to pay 10 cents per 1,000 cu.ft. therefor, we must disregard this finding of the commission. A finding without evidence to support it is arbitrary and baseless."

Damages for Flowage.—In Fritz vs. Southern Wisconsin Power Company, a suit for damages to farmland resulting from flooding caused by the erection of a power dam, the Supreme Court of Wisconsin reversed a judgment for the plaintiff, holding erroneous an instruction permitting assessment of damages to land in the amount of the damage to the part subjected to flowage, with its added value as part of the whole, plus the damage to the rest. The court disagreed with the method of appraisal, especially in view of the fact that large damages were assessed. The owner, the court held, was entitled only to the amount by which the value of the entire property was lessened. Land used for a ferry landing, across a river from land subjected to flowage by the building of the dam, was held to be improperly considered as part of the owner's farm in determining his damages. (195 N. W. 321.)

Whether Height of a Dam Was Raised and Whether It Caused Flowage Are for Jury.—In Pajak vs. Chicopee Manufacturing Corporation and two other suits the petitioners alleged that the respondent maintained a dam across the Chicopee River for the purpose of operating a mill, and that by reason of the maintenance of flashboards and the heightening of the dam itself respondent had caused the water to run to a greater height than theretofore and to overflow petitioners' lands, to their loss and damage. The Supreme Judicial Court of Massachusetts has refused to overrule verdicts for the plaintiffs, holding that on all the evidence the jury could find that the flashboards had been raised and that the flowage of the land in 1918, 1919 and 1920 was caused, not by excessive rainfall, but by the backwater from the river, and that there was a causal connection between the raising of the flashboards and the flooding of the land. There was more than a mere scintilla of evidence in support of the petitioners' contention and, however probable the evidence of the respondent might appear, the decision of the jury could not be overruled. (141 N. E. 112.)

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

George Slater has succeeded E. E. Hanks as engineer of power station of the Minnesota Electric Light & Power Company, Bemidji, Minn.

J. S. Johnston, formerly division manager of the Brooke Electric Company, has been transferred to the security sales department of the West Penn system.

Dr. Robert A. Millikan of the California Institute of Technology, recently awarded the Nobel Prize for physics, has been awarded the Hughes medal by the Royal Society of London in recognition of his determination of the electronic charge and other physical constants.

L. W. Robert, industrial engineer of Atlanta, was presented with a gold watch and chain by the members of the Georgia Electrical Association at its semi-annual meeting at the East Lake Country Club in Atlanta on Nov. 7, as a token of appreciation for his services as the first president of the organization and his subsequent work in its behalf.

Guy S. Nunemaker, formerly general superintendent of the Tennessee Power Company at Chattanooga, Tenn., and recently general manager of the Cumberland Power Company, has been appointed general manager of the Southern Cities Utilities Company's holdings in Tennessee and Alabama, with offices at Chattanooga. This company operates in about thirty cities in Tennessee and Alabama.

L. A. Osborne, president of the Westinghouse International Company, has been decorated by the Japanese Emperor with the Third Order of the Rising Sun, according to a cable just received from Japan. Mr. Osborne received the Fourth Order on a previous visit. General Guy E. Tripp, chairman of the Westinghouse Board, was decorated with the Second Order of the Sacred Treasure (the highest Japanese civilian decoration) on his arrival in Japan, as reported in the ELECTRICAL WORLD of Nov. 2. General Tripp and Mr. Osborne are now on their way to Shanghai, and they will return to the United States by way of India and Europe.

David R. Cooper, formerly connected with the Fargo Engineering Company of Jackson, Mich., has recently opened offices in Syracuse, N. Y., as a consulting hydraulic engineer. While associated with the Fargo company Mr. Cooper had charge of design of the hydro-electric plant at Jim Falls, Wis., and he previously served as engineer in the hydraulic division of Stone & Webster, Inc. His earlier connections include the position of designing engineer with the New England Power Company, assistant chief engineer with the Salmon River Power Company, chief engineer at Minetto, N. Y., of hydro-electric development, engineer-secretary of the New York State Water Supply Commission, hydraulic designer of the Electric Bond & Share Company and assistant engineer-designer of the New York City Board of Water Supply.

Sir Philip Dawson, British Electric Railway Pioneer

Sir Philip Dawson, member of Parliament and partner in the firm of Kincaid, Waller, Manville & Dawson, consulting electrical engineers, London, has built or been connected with most of the big electric traction installations in Great Britain, the Dominions and South America. He was a pioneer in British railway electrification, and during his association with the electrical industry he has been called in by many railway companies and public and private interests to advise on large traction and electric power schemes. For five years before the war he gave a post-graduate course of lectures on railway electrification at the Imperial College of Science and Technology, South Kensington, which he has continued since 1919. Sir Philip has served as a member of the Board of Trade water-power resources committee, to which he devoted much time. The Belgian government, too, availed itself of his services when it appointed him vice-president of the royal commission organized during the war to report on the advisability of electrifying the Belgian State Railways. Sir Philip has been the recipient of various medals awarded for papers of distinguished merit read before engineering societies, and he is also the author of the first standard works on electric railways.

SIR PHILIP DAWSON

H. T. Shaffer is now chief engineer of the Dunbar (Pa.) Electric Company, succeeding Clark White.

William Shannon, formerly connected with Stone & Webster's Seattle office, has been transferred to the San Francisco office of the company.

T. F. Malone has been made superintendent of water-power plants of the Adirondack Power & Light Corporation, Amsterdam, N. Y.

E. E. Helm, manager of the industrial bureau of the Akron Chamber of Commerce for the past two years, has been appointed district manager at Detroit of the Bridgeport Brass Company.

E. T. Anderson has assumed the duties of electrical engineer for the Water and Electric Light Commission, Lansing, Mich. Mr. Anderson was formerly electrical engineer with the firm of Smith, Hinchman & Grylls of Detroit and was in direct charge of the electrical work of the new municipal plant for that city.

H. L. Unland, for thirteen years engineer with the General Electric Company, eleven years of which were spent in the power and mining department, leaves that company on Dec. 1 to become electrical engineer with the Victor Talking Machine Company at Camden, N. J. After being graduated from the Engineering College of the University of Nebraska Mr. Unland entered the General Electric test. He was in charge of the water-rate test and later became connected with the power and mining engineering department on power and transmission station applications. He has specialized in electric welding and is the author of many articles on this subject.

Obituary

Edward Lloyd Cooley, in charge of small-motor contracts for the Boston office of the General Electric Company, died suddenly at his office on Nov. 22. He was born in 1859 and entered the company's service in 1900, later becoming district manager of the small-motor department with headquarters at the Lynn works.

Victor E. Raggio, for more than a quarter of a century prominent in electrical circles in the Southwest, died recently in Dallas, Tex., after a long illness. At the time of his death Mr. Raggio was commercial engineer in the power division of the Dallas Power & Light Company, a position he had held for several years after returning to business activities following a period spent in retirement on his ranch at Fort McKavett, Tex., where he went in search of health. Mr. Raggio was successively Texas representative of the Western Electric Supply Company and manager of the General Electric Company's branch in Dallas. He was widely known in the electrical trade of the Southwest and in business circles throughout Texas. Mr. Raggio was fifty-eight years of age.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Service Stations as Good-Will Builders

How an Adequate Service Department Helps the Sales Department, Speeds Repairs and Aids the Purchaser

BY "OBSERVER"

CLOSE contact between manufacturers of electrical appliances and their customers is one of the most vital factors in building and maintaining good will on the part of purchasers. Successful national manufacturing of electric ranges, irons, toasters, water heaters and other appliances, light or heavy, must be done on a mass-production basis under present conditions of industrial development. This means that weaknesses in design or construction are multiplied through duplication of products unless they are caught and taken care of almost immediately after the device gets into service. A sensitive contact with the retail market is the answer, and this can be obtained through the local service station with the co-operation of the jobber if both these institutions are "on their toes."

An adequate service station must perforce be organized and run upon modern business principles. A typical station meeting the needs of a group of Eastern states contains an attractive office for the regional sales manager, his assistants and clerical staff; a well-lighted and commodious display room and a carefully systematized stockroom, with repair facilities for the lighter troubles arising in the use of the products of this house. This establishment does not undertake jobbing, although it is necessary to wholesale a small amount of stock during holiday periods to meet eleventh-hour demands for equipment and units and also to accommodate members of the local "electrical family" in the territory. In this particular case sales of appliances are handled through this office and station to a few large electric utility holding corporations or operating syndicates, with a close contact between the manufacturing company's representative and the utility purchasing agents and sales managers that speeds up the service and greatly facilitates "ironing out" troubles which occasionally arise in the field.

Upon the prompt handling of repairs depends in no small degree the good will of the regional trade. Hence special care has been taken to classify all repair and replacement jobs according to the day each is to be finished, and compartments are provided, one for each weekday, to hold equipment due to be repaired within a stated short time limit. In this way it is usually possible to give a twenty-four-hour service, and the cut-down of lost time resulting from the use of electricity from central-station mains is much appreciated by the utilities. The repair staff is not permitted to leave the office on Saturdays until the bins for Friday and preceding days are cleared.

AN EXHIBIT OF "THE LINE"

This work involves the maintenance of about 25,000 parts for use on the premises or for sending out into the field on receipt of requests for such items, but with modern adjustable shelving and flexible compartments it is possible to handle this stock with a minimum of difficulty. The value of the heating elements carried as spares, however, is large enough in the mass to require a careful accounting of stock, and access to it by unauthorized persons is not favored.

A well-arranged exhibit of the major devices manufactured adds to the usefulness of the service station, and this includes a standard display case, which can be purchased for retail use if desired and which has provision for the "knock-down" exhibition of disassembled parts of typical equipment such as flatirons and toasters. These displays are well illuminated, easy of inspection by the visitor, and they save much time and eliminate many chances of error in ordering spare units or duplicate parts. The purchaser merely has to point to the part which he needs in order to obtain it—a decided contrast to the usual method of making a personally conducted or solitary trip through a catalog in order to find a particular item which may be designated as the manufacturers "Style No. 456,998, type B-3, unit," with all the possibilities of misquoting the catalog or picking out the wrong number and having to send back the part because it does not fit, with consequent loss of time and money by all concerned.

The mere concentration of devices in a sales office, of course, amounts to little without an alert personnel, interested in following up every service lead obtainable. Precautions against loss of material shipped in for replacement or repairs pay well. In the establishment in mind above a special compartment is reserved for devices mailed in to the station without explanatory letter or other adequate tagging. Since these are few in number, they are quickly identified when the user or his agent makes himself known; no time is lost in hunting these strays, and better service is rendered. The final success of a service station rests upon the men and women who work therein and upon the field personnel who utilize such a regional headquarters as a divisional staff office through which field experience clears to the manufacturing plant itself and where needs arising today can be met by tomorrow at the latest.

Importance of Timely Information on Credits

ROOM exists for much improvement in mercantile agency reports as regards timeliness, according to H. D. Clark, Van Brunt Porcelain Company, Columbus, Ohio, who spoke before a recent meeting of the National Electrical Credit Association. From many business concerns

today, according to his experience, the credit man is able to get only reports dating from six months to two years prior to the request. Many irregularities can occur during such a period, and such old reports are of no value as bases upon which to accord credit.

"Every concern transacting business on a credit basis," said Mr. Clark, "is, in buying, obligated to those who extend credit to it. The credit seeker should realize the necessity of being in position to furnish real up-to-date information based entirely on solid facts and the individual, firm or corporation which does not maintain records that will enable it to furnish proper information in regard to its condition, brought up to within thirty days of date of the demand for such information, is placing itself in a position that would justify its being looked upon as a doubtful credit customer. Such a condition gives reason to wonder, if the records do not receive proper attention, what kind of attention an account would receive. Therefore, just as we say that we can always tell a workman by the tools he uses, indicating that if the tools are not adequately adapted to his craft or are poorly kept he is not an efficient workman, the same inference can be drawn concerning any business house with incomplete or out-of-date records.

"Another important feature in the compiling of a mercantile report is the fact that few of them are verified by city, county or other legal records. Much information of real value is obtained by the use of such investigations. No mercantile report can be too complete, and those extending credit, irrespective of to whom, should not stand subject to criticism in their endeavor to obtain full details. There are many concerns today which, in addition to mercantile reports, employ attorneys to investigate such legal records as it is believed contain information of transactions by the applicant for credit or between him and others.

"In the desire for credit information one must be willing to give as well as to receive, and credit men are organized, not for the purpose of malice, but to help one another toward a betterment of conditions."

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

CENTRAL station purchases of line construction material for the purpose of pushing outside construction work to completion before the coming of the first winter storms was a feature of the market this week, both in New England and the northern states of the Middle West. Aside from this the main interest of both the wholesaler and the retailer has centered on the holiday market which is steadily increasing in its activity. Orders for the full line of Christmas gift appliances, portable lamps and many of the larger household devices are pouring in. Deliveries are prompt and in the main prices are firm.

New England jobbers are buying other lines in small quantities, but the general feeling is that business is good. Electrical manufacturers are busy. In the New York section general business fell off a bit, but this was not considered important inasmuch as the dealer is intent on holiday trade. Good crops in the Southeast have stimulated building which is beginning to react in the electrical market on the demand for wiring material. Steady buying of radio and appliance lines continues in Chicago and there is a lively expectation there that there will be an increase in the price of rigid iron conduit and wire. Construction material and high-tension equipment holds steady. On the Coast Christmas selling seems to be running well ahead of previous years. Telephone and power extensions are active and creating a steady demand for wiring material. The building movement continues unabated, showing that general business is in a very satisfactory condition.

Motors at Record Production; Market Awaits Applications

ACCORDING to statements made by several leading motor manufacturers within the past few days, the motor-manufacturing plants, taken as a whole, are as busy as at any time during their history, even at the 1920 peak. It is pointed out that this condition has not been generally apparent because of the custom of measuring production in terms of dollars' value of either production or sales rather than in terms of total horsepower rating or total number of units produced. The variation in the intrinsic value of the dollar, used as a measure of production, has thus hidden the fact that the continued electrification of manufacturing establishments goes ahead without abatement.

One prominent motor manufacturer says that a more or less definite level of total motor production in the United States has been reached owing to the fact that the available business in horsepower with present knowledge of motor applications is more or less definitely fixed and that the job is to manufacture motors for this more or less definitely known utilization market. He adds that only the opening up of new applications is awaited to see further demands made upon motor manufacturers to produce greater quanties. Another manufacturer says he sees as one reason of present activity a more intelligent development of the foreign market, which is waiting and ready to absorb large quantities of American-made motors as fast as American motor manufacturers can establish the correct sort of foreign representation or, preferably, place their own representatives in foreign fields.

Portable Lamp Factories Rushed with Orders

PORTABLE-LAMP manufacturers appear to be turning out their product in a sort of whirlwind finish of the year's work, the demand in representative sales offices exceeding that of last year by 50 per cent or more and mounting up to a record surpassing all previous experience. There is little opportunity to build up factory stocks under these conditions, and the feeling is very strong that the coming year will be a prosperous one in this branch of the industry.

Last week a representative of the ELECTRICAL WORLD visited a leading portable-lamp manufacturing center in Connecticut and was informed that while factory stocks of raw materials are rather low, no difficulty is being experienced in obtaining shipments of brass from adjacent mills in ample quantities to keep up with current demand. The supply of glass, recently short and disquieting, has now improved very decidedly. Enough business is now on the books of one leading manufacturer of portables to keep the plant running full time for the next six months.

Insulator Makers Increasing Capacity; Demand Continues

DELIVERIES of porcelain insulators, both pin and suspension type, have changed only slightly as compared with conditions as they existed early this summer, and promises of a definite shipping date are still often the main consideration in selling this equipment. Delivery dates for insulators manufactured in the Chicago territory run from two to six months.

In spite of this bugbear of slow deliveries, however, the demand does not seem to slacken materially. With so much line construction during the past summer in many different parts of the country, sales of porcelain insulators have increased over 1922 by 20 to 25 per cent. Many of the power companies are going into higher-voltage distribution systems, which require longer strings of

suspension insulators, and this also tends to increase the time of delivery. The problem now before porcelain manufacturers is how to educate their buyers to anticipate as closely as possible their immediate needs and place orders accordingly. Unless some scheme is so worked out they fail to see just how they will be able to make their delivery schedules meet the rapidly increasing demand.

Little difficulty is experienced in obtaining the raw materials since the foreign shipments containing the basic clay commodities are arriving on frequent schedule, rather, there is not not enough manufacturing capacity to meet the rapid increases in demand for this equipment. From a manufacturing standpoint labor has ceased to be such a problem as it was in early spring and summer. In other words, the labor market is becoming saturated so that employers are in a better position to pick and choose their men than they were formerly. Prices on insulators are expected to remain firm as long as the basic commodities, including raw materials and labor, are offset against the excellent demand now felt, according to authorities in the field.

Radio Sales Reported 100 per Cent Above 1922 Figures

THE American people have invested \$115.000.000 in radio sets and equipment this year and will probably double this amount in 1924, just as 1923 has seen the doubling of last year's sales. This remarkable statement was made by David Sarnoff, vice-president and general manager of the Radio Corporation of America, during the recent meeting of the Electrical Supply Jobbers' Association at Buffalo. Mr. Sarnoff said that within two or three years the radio industry will probably bulk larger in point of sales than the entire phonograph industry, which is now selling \$400,000,000 worth of products annually.

To cite one instance of the extent to which radio is growing, the volume of the vacuum tubes now being sold reaches in value 20 per cent of the entire sales of incandescent lamps and from 25 to 33 per cent of the total volume of all merchandise handled by the electrical jobbers of the country is radio equipment

Already there are two million radio sets in use, including both the home-made and factory-built equipment, and it is estimated that there is today an audience of seven million people "listening in" and enjoying the entertainment and information that is being broadcast through the air.

Mr. Sarnoff predicts a superpower broadcasting service which will comprise perhaps three superpower stations —perhaps one in the East, one in the North Central section and one in the Northwest, with sending apparatus powerful enough to operate loud speakers in any part of the United States. The problem of increasing the power of present station outputs from 500 watts to 100 kw. and 200 kw. will not be difficult to solve, according to Mr. Sarnoff, since already 20-kw. tubes are being built the size of quart milk bottles and ten such tubes, of course, could constitute a 200-kw. station.

Wiring Device Makers Busy—Heavy Duty Switches Strong

INQUIRY into the status of wiring-device production shows a large volume of business at the factories now being handled, with exceptionally good sales of heavy-duty switches for electric range and other heating service. It would probably be fair to class present production as normal on lines of sockets and switches for household service, the total orders being filled running in representative cases slightly above pre-war values. Leading manufacturers report that wholesale buying is still on a hand-to-mouth basis and that factory stocks tend to run higher than they should. Deliveries are easy, except that heavy-duty material is out of factory stock in some lines. Foreign sales are not very impressive except in the heavy-duty line, which is being exported to England in large quantities at present.

Within the factories wages appear to be at the peak and labor well employed. One large establishment is running overtime three evenings a week at present filling accumulated orders. The year's increased demand for electric cooking equipment has been reflected in this field. It is said on good authority that margins of profit are narrow in the common lines of wiring-device manufacture and that a much greater volume of business than formerly has to be handled in order to attain satisfactory figures. Raw materials are plentiful and easily obtainable.

Collections are giving little trouble and prices appear to be firm without much fluctuation for the time being. Modern methods of manufacture are improving internal conditions in some of the wiring-device plants, and the value of this year's output in a representative case will run as high as \$5,000 per employee. If the expansion of the building industry continues during the coming year, the outlook will be favorable for the wiring-device branch of the industry.

October Electrical Exports Gained \$912,120

TOTAL exports of electrical machinery, apparatus and appurtenances for October were \$6,035,410, an increase of \$912,120 over October, 1922, when the total amounted to \$5,123,290. In September, 1923, total electrical exports amounted to \$5,925,529. The accompanying figures are supplied by the Bureau of Foreign and Domestic Commerce.

ELECTRICAL EXPORTS FOR OCTOBER, 1923, COMPARED WITH CORRESPONDING MONTH A YEAR AGO

	Value October 1922	Value October 1923
Turbines	26,770	31,172
Generators:		
Direct-current:		
Under 500 kw.	33,600	71,078
500 kw. and over	132,272	41,406
Alternating-current:		
Under 2,000 kva.	19,780	5,295
2,000 kva. and over	165,390	111,980
Accessories and parts for generators	44,661	166,755
Self-contained lighting outfits	32,265	56,719
Batteries:		
Primary	82,586	99,654
Storage	165,044	196,342
Power transformers	84,191	199,987
Other transformers	33,552	63,003
Rectifiers, condensers, double-current and motor generators, dynamotors, synchronous and other converters	55,377	57,801
Switchboard panels, except telephone	252,621	78,185
Switches and circuit breakers over 10 amp	119,424	185,345
Fuses and fuse blocks	19,652	38,129
Watt-hour and other measuring instruments	53,003	39,579
Volt, watt, and ampere meters and other recording, indicating and testing apparatus	66,691	96,700
Lightning arresters, choke coils, reactors and other protective devices	35,535	47,233
Motors under 1 hp	83,791	117,505
Stationary motors, 1 to 200 hp	156,018	334,899
Stationary motors, over 200 hp	24,794	86,740
Railway motors	112,158	11,500
Electric locomotives:		
Railway	10,000	
Mining and industrial	19,779	18,126
Other motors	6,685	12,750
Rheostats, controllers and other starting and controlling equipment	62,246	131,963
Accessories and parts for motors	63,874	173,001
Electric appliances:		
Electric fans	45,575	62,201
Electric lamps:		
Incandescent carbon-filament	2,893	3,968
Incandescent, metal filament	138,022	118,053
Other electric lamps	23,980	19,723
Flashlights	31,896	36,479
Searchlights and projectors	89,196	19,839
Motor-driven household devices	83,928	41,707
Domestic heating and cooking appliances	76,789	88,915
Industrial electric furnaces and ovens	46,279	12,019
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	64,862	56,257
Radio and wireless apparatus	564,803	270,061
Telegraph apparatus	38,887	19,205
Magneto telephones	(2)	45,855
Other telephones	433,016	23,739
Magneto switchboards	(2)	25,402
Other telephone switchboards	(2)	37,154
Railway signals, switches and attachments	28,733	84,898
Bells, buzzers, annunciators, and alarms	6,760	8,011
Spark plugs, magnetos, and other ignition apparatus	88,373	124,975
Insulating material	80,542	123,978
Metal conduit, outlet and switch boxes	14,662	42,190
Sockets, receptacles and lighting switches	75,449	93,424
Other wiring supplies and fixtures	143,968	160,648
Other electrical apparatus not elsewhere specified	436,276	894,031
Globes and shades for lighting fixtures	40,089	51,775
Electrical glassware except for lighting	15,976	13,238
Electrical porcelain	72,606	215,842
Electrical carbons, carbon brushes, electrodes	93,330	226.697
Insulated wire and cable (iron and steel)	31,327	50,324
Other manufacturers of aluminum	93,874	110,563
Copper:		
Bare wire	128,613	267,178
Insulated wire and cables	170,827	274,214
Total	\$5,123,290	\$6,035,410

Porcelain, Wire and Conduit Mark Time in New York

PRICE uncertainties in the markets for porcelain, wire, conduit and some wiring devices are said to have caused a falling off in buying by the jobbers during last week in the New York territory. This hesitancy in purchasing from the manufacturer is not considered especially serious at this time because of the small volumes being consumed by the contractor-dealers, who now are devoting most of their efforts to a splendid appliance market.

During the week only fair orders were placed by the industrial and central-station companies of this territory. Material required to make installations and repairs before heavy winter weather arrives is in principal demand, and no further requirements are expected to be in evidence until after the first of the year. A feature of the market is the spurt in sales of new and second-hand motors for the garment trades.

Retail Trade on Coast Making Record; Construction Booming

GENERAL business conditions in the Far West are satisfactory with an encouraging volume of retail and wholesale trade. The electrical retail business is averaging better than the 11 per cent over last year which the department stores on the Coast are showing. This is largely because of increased radio business, but also due to hollow-ware sales, which have been growing, and to improved merchandising of the larger household appliances. Last year saw the general abandonment of "blind" door-to-door selling, and 1923 seems to mark the practical passing of the doorway canvassers. This has naturally had a good influence on store trade. Pre-holiday buying is holding up well, and the month of December is expected to show a very heavy volume of Christmas buying. The holiday shopping started somewhat earlier this year than usual, the retailers report.

The building boom which began over a year ago has continued so consistently that it has become a normal condition with no sign of let-up. All this has made a fine market for the electrical industry. A large number of new apartment houses have been equipped with electric ranges, which has developed a heavy increase in range sales.

There have been continued slight drops in some lines, especially conduit, wire and certain schedule materials, but it is believed the market will shortly stiffen. Competition in steel products is especially keen. Single switch boxes have just dropped to about $8.50 per 100 in lots of 100, and mill carload shipments of rigid iron conduit have decreased approximately 5 per cent in price. Copper, on the contrary, is steadily advancing, having risen about 1¼ cents per pound over the low mark of a month ago. Local stocks of all lines are good and, while rather high, are healthier than a year ago.

Telephone and power extensions in the Puget Sound district and the interior valley oil country report many extensions which have developed demand for wire, fixtures and other equipment. Reports show that agricultural crops were not only bumper in size, but, because abnormally late, were marketed with practically no loss. Collections are satisfactory.

Firm Prices and Diversified Demand Prevail in New England

ELECTRICAL trade conditions in the New England territory manifest increasing strength, with prompt deliveries and firm prices, barring a weakness of about 5 per cent in pole-line hardware, and a diversified demand. Outside construction by central-station companies is being pushed hard to complete as much work as possible before heavy winter weather sets in. Weatherproof wire is in active demand and prices are stiffening as the cost of cotton trends upward. A slight reaction in the price of copper had little effect on last week's wire market. Central-station expansion continues in both private and municipal utilities.

Jobbers are buying on a hand-to-mouth basis, but the volume of trade is so large that turnovers are quite satisfactory and manufacturers in many lines are unable to build up much in the way of stocks. Apparatus factories in New England are very busy, and so are lamp manufacturers. Normal outputs of wiring devices are reported from Connecticut; House wiring is a bit quieter, but appliance sales are growing by leaps and bounds. Kitchen-lighting units are moving fast in Massachusetts and lower Connecticut, and at Hartford a campaign for the sale of store-lighting units has made a flying start. Motor sales are fairly active in smaller sizes. In the textile field conditions continue spotty with marked curtailment and some pressure to bring about lower labor costs is apparent.

Southeastern Market Strong; Jobbers' Business Satisfactory

EXCELLENT weather conditions throughout the Southeast are tending to hold up general business activities, and electrical jobbers in Atlanta report their business during the past week as entirely satisfactory. The continued drought in the Carolinas and Georgia, while not so serious as it was thirty days ago, is still proving very expensive and embarrassing to the larger power companies, although no general shutdown is anticipated, owing to the ability to obtain steam power over interconnecting lines. The steel industry in the Birmingham section continues to hold up fairly well, with a possible improvement in the past thirty days, although some of the smaller mills are still shut down.

Alabama jobbers and central-station companies report electrical merchandising as on a splendid basis throughout the entire state, the smaller towns of from 500 to 5,000 population being exceptionally good. The outlook for a record holiday business in this state is very bright.

In Florida the citrus crop promises to be one of the best on record, and the tourist traffic, which is of great importance to that state, is already heavier than that of prior years. These facts have resulted in a spirit of optimism, which is reflected by a heavy building program of both residential and commercial types. The development of new residential subdivisions is causing a heavy demand for "white-way" lighting fixtures, glassware, parkway cable and wire, one of the heaviest of these orders on record having been recently placed by real-estate firms in Miami. The building program is, of course, taking large quantities of electrical construction material.

Radio and Christmas Buying Are Features of Chicago Market

BUSINESS in the Chicago electrical trade seems about the same as last week. There has been an unusual demand for radio products, which might have been brought about by the radio show held recently at the Coliseum. Christmas buying is in full sway and appliance sales are best, with toasters, percolators and floor lamps selling in excellent volume.

Wire, which has been expected to advance at any moment, remains steady, although large orders have been booked for deliveries in the first quarter of 1924. Conduit sales have fallen off somewhat, and prices are firm. Several months ago, when the eight-hour day was put into effect at the steel mills, producers of conduit expected to be forced to advance their prices. Orders were accepted only for delivery at the price prevailing at date of shipment. This situation changed a while back, and the electrical trade was not

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.0354	$0.0354	$0.0304
Cold finished shafting, per lb.	0.0465	0.0465	0.039
Brass rods, per lb.	0.1475	0.1525	0.17
Solder (half and half), per lb.	0.31	0.295	0.275
Cotton waste, per lb.	.10 to .13	.10 to .13	.09 to .11½
Washers, cast iron (½-in.), per 100 lb.	6.50	6.50	6.00
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.38	3.38	3.02
Machine oil, per gal.	0.297	0.297	0.33
Belting, leather, medium, off list	30-10%	30-10%	30-10%
Machine bolts, up to 1-in. x 30-in., off list	40-10%	40-10%	40%

asked to assume the extra cost of production. It now seems that the expected added cost is to be passed on to the ultimate consumer. Just when is a matter of guesswork, but, with the increased demand for conduit at this moment, it would seem that the producers would judge this an opportune time.

With the cotton market at its high mark, tape manufacturers using cotton and varnishes maintain that there will be higher prices for these commodities at the first of the year. A concerted effort is being made by cotton growers to stabilize and uphold the price of cotton through banding together into an association, and it seems as if they may be succeeding. Construction material and high-tension equipment sales have been steady for this period of the year.

The Metal Market

A DECIDED lull in demand for copper appeared during the week. This was not unexpected in view of the large sales made during the first half of the month, and some authorities now estimate that the actual transactions thus far in the current month have involved as much as 250,000,000 lb. If these estimates are correct, a new high record for recent years on sales has been made. Many of the leading selling agents have disposed of all the copper they cared to for the current month, a fact which has been shown by their attitude in the market during the past week.

NEW YORK METAL MARKET PRICES

	Nov. 21, 1923 Cents per Pound	Nov. 27, 1923 Cents per Pound
Copper, electrolytic...	13.00	12.62½
Lead, Am. S. & R. price	6.85	6.85
Antimony...........	9.50	9.25
Nickel, ingot.....	27.00 to 32.00	27.00 to 32.00
Zinc, spot...........	6.40 to 6.45	6.25
Tin, Straits..........	43.00	43.00
Aluminum, 98 to 99 per cent..........	26.00 to 27.00	26.00 to 27.00

The official contract price of lead as established by the American Smelting & Refining Company continues at 6.85 cents per pound, New York City. At this level it is possible to obtain lead for late December and January shipment. Prompt lead is scarce and can be obtained only by paying a premium. As high as 7 cents, New York, has been paid for spot lead in large quantities.

The slab zinc market has sagged, and prices have declined to 6.25 cents per pound, East St. Louis, for both prompt and forward metal. Sales have been fair, and the market seems to have been influenced by the drop in copper prices and the easier position of the stock market. Producers think that production is too high, especially in view of the improbability of any immediate export business.

Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Wagner Electric Cuts Transformer Prices 8 per Cent

On Nov. 15 the Wagner Electric Corporation announced a reduction of 8 per cent in transformer prices. This price reduction applies to self-cooled transformers for both 25 cycles and 60 cycles, in sizes up to and including 500 kva., having a primary voltage rating of 46,000 or less. This reduction was made at this time as an incentive to customers contemplating the purchase of transformers in the near future to order now.

Department Stores Exhibit Their Electric Trucks by Parading

During the past month two New York City department stores, Gimbel Brothers, Manhattan, and Abraham & Straus, Inc., Brooklyn, have conducted electric truck parades in their respective communities to impress the public with the size of the trucking fleets necessary to deliver purchases. In each case the increasing number of electric trucks which are being employed for frequent-stop delivery work was made manifest.

Each electric truck in the service of Abraham & Straus is operated on a daily route of at least 35 miles when the batteries are charged every other day. This route mileage is much greater, of course, when batteries are charged daily. A total mileage of 69 on a single charge has been obtained in one instance.

"Amrad" Corporation Obtains Illinois License

The American Radio & Research Corporation, manufacturer of radio supplies and also of fractional-horsepower motors at Medford Hillside, Mass., has taken out papers authorizing it to transact business in Illinois. The capital stock is $500,000, of which $56,962 is to be employed in Illinois. William R. Watson, 203 South Dearborn Street, Chicago, is Illinois representative.

Edison Appliance Company Enlarges New England Office

The Edison Electric Appliance Company, Inc., with headquarters in Chicago, has increased its New England headquarters and service station space by about 33 per cent, including improved facilities for the display of light and heavy appliances, a re-arrangement of the stockroom layout, and better accommodations for the clerical and sales staff. These offices are at 99 Bedford Street, Boston, C. P. Myrick being New England manager.

Mr. Myrick is taking an active part in the co-operative campaign of the baking industry and manufacturing and central-station interests to promote the use of electric toast and the sale of toasters in this connection through electrical retailers. Mr. Myrick states that the current year bids fair to create a record in the sale of heavy-duty ranges and bakery equipment.

Chain Belt Establishes Direct Branches on Pacific Coast

The Chain Belt Company, Milwaukee, manufacturer of "Rex" chain, transmission machinery and conveying equipment, formerly represented on the Pacific Coast by the Meese & Gottfried Company, San Francisco, has established direct factory branches and warehouses in Portland and Seattle. Arrangements have also been made with the Washington Machinery Depot, Tacoma, Wash., to carry stocks. Other quantities of the firm's products will be placed in important centers throughout the Pacific Northwest for the prompt handling of local requirements.

The Northwest territory, headquarters in Portland, will be in charge of Allen C. Sullivan, formerly connected with the Allis-Chalmers Manufacturing Company, Milwaukee. Don B. Catton, formerly with Meese & Gottfried and later engaged in the machinery supply business on his own account, will be the special sales representative for the Portland office. The Seattle and British Columbia territory will be handled by William F. Nichols out of the Seattle office. Mr. Nichols for the past eleven years has also been connected with the Meese & Gottfried Company. The Portland office of the Chain Belt Company is at 67 First Street, Portland, and the Seattle office at 1040 Sixth Avenue, Seattle. Large stocks are maintained at both places.

Trojan Washer Distributor Organized to Serve Chicago District

The Trojan Washing Machine Company has been organized to serve as distributor for the Trojan washing machine in the Chicago district. Offices are at 7730 Cottage Grove Avenue, and the officers are: John S. Haines, president; Charles W. Watterson, vice-president; William Campbell, secretary.

This location also serves as the headquarters for other branch stores at Gary and Hammond, Ind., and Glenellyn, Ill. Mr. Haines was formerly with the American Finance Company, Indianapolis, and with the Standard Washing Machine Company, the predecessor of the Standard Domestic Appliance Company of Chicago, with which Mr. Watterson was formerly connected. Mr. Campbell is also sales manager of the Hogan, Spencer &

Whitley Company of Erie, Pa., which manufactures the Trojan washing machine.

Nulite Exploit Patent for Repairing Lamps

The Nulite System, Inc., 823 Land Title Building, Philadelphia, has been incorporated under the Delaware laws, with capital stock of $2,500,000, to exploit the Wilkins patent for repairing incandescent lamps. Present plans provide for opening a plant in Philadelphia, commencing Feb. 1, which will have a capacity for repairing 20,000 bulbs per day.

Radio Corporations Extensions in China Will Cost $13,000,000

The Radio Corporation of America, Woolworth Building, New York City, through its affiliated organization, the Federal Telegraph Company of California, San Francisco, is perfecting plans for a group of radio stations in China to cost $13,000,000 and to be completed in twenty-four months. The central plant in Shanghai will be of 1,000,000-watt capacity, with seven steel towers, each 1,000 ft. high, and power plant. Other stations will be at Pekin, Canton and Habin. R. P. Schwerin, president of the Federal company, will be in charge.

Philadelphia Division of Sturtevant Moves to Larger Quarters

On Nov. 19 the Philadelphia division of the B. F. Sturtevant Company, whose headquarters are in Boston, moved to a modern daylight building with a Pennsylvania railroad siding at Thorne and Copewood Streets, Camden, N. J. In this new location the company will maintain a modern shop for manufacturing all kinds of sheet-metal work required for the complete installation of fan systems, including heating, ventilating, drying, exhaust and conveying work. Guards for machines, pulleys and gears will also be produced and a large stock of standard equipment, such as pressure blowers, turbo undergrate blowers, blast gates, etc., will be carried. Capacity will be increased fourfold at this division.

Rawson Collier Opens Atlanta Office for Dwight P. Robinson

Dwight P. Robinson & Company, Inc., New York City, have opened an Atlanta office in the Healey Building, with W. Rawson Collier in charge. Mr. Collier was for many years with the Georgia Railway & Power Company and joined the Dwight P. Robinson forces several months ago, going to them from the Poughkeepsie Gas & Electric Company. He is a graduate of the Massachusetts Institute of Technology and has been prominently identified with the work of the National Electric Light Association, the American Institute of Electrical Engineers, the American Gas Association and the Illuminating Engineering Society.

The opening of the Atlanta office gives the company a total of eight branches. Other branches are at Chicago, Pittsburgh, Youngstown, Philadelphia, Montreal, Los Angeles and Rio de Janeiro.

Among the company's recent activities in the South are the new wet-process cement plant of the Lehigh Portland Cement Company at Birmingham, Ala.; extensions to the steel plant of the American Rolling Mill Company at Ashland, Ky.; extensions to the power generation and distribution systems of the New Orleans Public Service Inc., and the design and construction of the fifth sulphur mining plant which the firm has built for the Freeport Sulphur Company at Hoskins Mound, Tex.

Combination of Westinghouse and Japanese Interests Announced

Reports of an arrangement consummated between Westinghouse and Japanese electrical interests has been confirmed by cables received by the Westinghouse Electric International Company at New York City from General Guy E. Tripp, chairman of the Westinghouse board, and L. A. Osborne, president of the Westinghouse International Company, who are now in the Orient.

"The new company is known as the Mitsubishi Denki Kabushiki Kaisha, or, in English, the Mitsubishi Electric Manufacturing Company," states E. D. Kilburn, vice-president and general manager of the Westinghouse International Company. "I assume that the reported capitalization, 15,000,000 yen or $7,500,000, is correct, although word on this point has not been received.

"The Westinghouse company has for many years been engaged in promoting the use of electricity in Japan, and its efforts have met with so favorable a reception that Japanese electrical development compares favorably with that in the United States. This includes railroad electrification, the use of water power, the installation of large steam generating plants and the formation of superpower systems.

"As a consequence of this rapid development, electrical apparatus has become one of Japan's largest imports, and since Japan's principal exports, silk, copper and objects of art, cannot be expanded to a corresponding degree, the Japanese began to feel that there was danger of a continuing unfavorable balance of trade. Hence it seemed wise to Japanese interests to begin the manufacture of electrical machinery and supplies in their own country. In pursuance of this policy, the important Mitsubishi interests, which are engaged in banking, shipbuilding and steel making, approached the Westinghouse company with a proposal for a co-operative agreement whereby the company was to supply technical skill and experience to a Japanese manufacturing company.

"The Mitsubishi Electric Manufacturing Company is the outcome of these negotiations. The Japanese profit by the arrangement through the employment it will give to Japanese workmen and the improvement in their foreign trade situation while the Westinghouse company profits by receiving a continuous revenue for services and royalties in lieu of exports that it was certain to lose within a comparatively few years. The United States profits because if the Westinghouse company had not accepted this proposal, it is possible that a German firm would have been considered by the Mitsubishi organization.

"A third party to this agreement is Takata & Company, the well-known Japanese importers, with offices at 30 Church Street, New York City. This concern, which is the Japanese agent of the Westinghouse company, will play a large part as distributor for the Mitsubishi Electric Manufacturing Company and will also continue to import such Westinghouse products as will be supplied from America."

The Scovill Manufacturing Company, Waterbury, Conn., is reported to be planning to transfer its vacuum cleaner manufacturing department to the plant of the Hamilton-Beach Manufacturing Company, Racine, Wis., which was recently sold to the Scovill interests. The transfer, it is stated, will not involve enlargement of the Racine works.

The Maytag Company, North Fourth Avenue, Newton, Iowa, manufacturer of electric washing machines, agricultural implements, etc., is considering preliminary plans for an addition to cost $200,000. The larger part of the structure will be equipped as a foundry for aluminum casting production.

The Noyes Electrical Supply Corporation, recently organized in New York City with a capital stock of $50,000, announces that it will soon start the manufacture of a general line of household appliances.

Maydwell & Hartzell, Inc., San Francisco, representing electrical manufacturers on the West Coast, on Nov. 10 consolidated offices and warehouse in their new building at 158 Eleventh Street.

The Westinghouse Electric & Manufacturing Company last week received a contract from the Public Service Electric Company of New Jersey for station equipment to the value of $400,000.

The Handon Boiler Corporation, New York City, has been organized to act as manufacturers' agent in the distribution of boilers, tanks, etc. The present address is in care of J. A. McNamara, 165 Broadway, New York City.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Prague, Czechoslovakia (No. 8,236), for electrical equipment and novelties for automobiles.

Purchase is desired in Singapore, Straits Settlements (No. 8,235), for automobile accessories, including electrical equipment, lamps, etc.

An agency is desired in Bradford, England (No. 8,313), for electric accessories for automobiles, flashlights and parts, lighting accessories and domestic electrical appliances.

An agency is desired in Birmingham, England (No. 8,272), for electrical engineering supplies.

Purchase is desired in Prince Rupert, Canada (No. 8,215), for large figures, toys and machines for electrical window display.

Purchase and agency is desired in Aleppo, Syria (No. 8,241), for ice-manufacturing machines.

Purchase is desired in Rio de Janeiro, Brazil (No. 8,246), for refrigerating machinery.

Purchase and agency is desired in Milan, Italy (No. 8,239), for electrolytic copper in bars and cakes.

Purchase is desired in Glasgow, Scotland (No. 8,270), for wire heating element.

TENDERS FOR EQUIPMENT FOR ELECTRIC PLANT AT DELHI, INDIA.—Tenders will be received by the Public Works Department, Delhi, India, until Jan 21, 1924, for equipment for electric plant, including turbo-alternator set, condensing plant, cranes, economizer, switchboards, converters, boiler-house equipment, steel chimney, pipework, substation equipment, feeder cables and accessories. Specifications may be obtained from the chief controller of stores, engineering section, Indian Stores Department, Delhi.

TENDERS FOR COAL UNLOADING AND CONVEYING PLANT FOR SYDNEY, AUSTRALIA.—Tenders will be received by the City Council, Sydney, Australia, until Jan. 7 for a coal unloading and conveying plant.

New Apparatus and Publications

BATTERY CARRIER.—A battery carrier, "Acco," designed for use by service stations, radio "fans" and car owners, has been placed on the market by the American Chain Company, Bridgeport, Conn.

COMMERCIAL LIGHTING UNIT.—The Moran & Hastings Manufacturing Company, 16 West Washington Street, Chicago, has developed a new commercial lighting unit, known as the "Othello."

ELECTRIC RANGE UNITS.—The Edwin L. Wiegand Company, 422 First Avenue, Pittsburgh, has brought out a line of "Chromalox" range units for converting coal, gas and other types of ranges into electric ranges.

CABLE CONNECTOR.—The Pollack Conduit Company, 467 Greenwich Street, New York City, has developed a cable connector, "All-In-One," to fit any No. 14-2 armored cable.

VAPOR-PROOF LANTERN.—The Crouse-Hinds Company, Syracuse, N. Y., has brought out a portable vapor-proof lantern, known as type "VSB," for use wherever combustible vapor, gas or dust is present.

TRANSFORMERS.—Bulletin No. 2,028, entitled "Quantity Production Pittsburgh Distributing Transformers," issued by the Pittsburgh Transformer Company, Pittsburgh, describes the method of construction of the "Pittsburgh" transformers.

ELECTRICAL MEASURING INSTRUMENTS.—The Brown Instrument Company Philadelphia, is distributing bulletin No. 105, covering its salinity meters, equipment for the measurement of electrolytic conductivity, surface condenser leakage and evaporator priming. Bulletin No. 100 covers its electrical instruments for ion concentration measurements.

CAR DUMPER.—The Wellman-Seaver-Morgan Company, Cleveland, is distributing bulletin No. 78, which describes and illustrates its "W-S-M" revolving car dumper.

CONDULETS, COVERS AND WIRING DEVICES.—The Crouse-Hinds Company, Syracuse, N. Y., is distributing a folder covering its flanged obrotund condulets, covers, and wiring devices.

FLEXIBLE COUPLING.—The De Laval Steam Turbine Company, Trenton, N. J., has issued a pamphlet describing the "De Laval" flexible coupling for turbines or motors geared or directly coupled to pumps, generators, etc.

INSULATORS, CLAMPS, ETC.—"Suspension Insulators, Clamps and Attachments" is the title of Bulletin No. 2, Catalog No. 25, issued by the Locke Insulator Corporation, Victor, N. Y., covering the "Locke" suspension insulators, attachments, etc.

New Incorporations

THE PRESTON COUNTY LIGHT & POWER COMPANY, Morgantown, W. Va., has been incorporated with a capital stock of $50,000 by H. C. Greer, A. W. Hawley, D. W. Saffel and others, of Morgantown.

THE CORTEZ (COL.) LIGHT, POWER & MILLING COMPANY has been incorporated with a capital stock of $50,000 by J. J. Downey, R. J. Bryce, J. W. Bozeman and A. W. Cowling.

THE LAURENS ROAD LIGHT & POWER COMPANY, Greenville, S. C., has been incorporated by W. P. Conyers, president, and James M. Richardson, secretary.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

FALL RIVER, MASS.—The Lawrence Plywood Company, recently formed, plans to construct a power house at its proposed new woodworking plant on site to be selected in Maine, to cost about $175,000.

WORCESTER, MASS.—The Boston & Maine Railroad Company plans to erect a power house on Millbrook Street, to cost about $65,000.

ROCKY HILL, CONN.—The Belamose Silk Corporation, 983 Main Street, Hartford, plans to erect a power house at its proposed local mill, to cost about $400,000. McClintock & Craig, 33 Lyman Street, Springfield, Mass., are engineers.

Middle Atlantic States

FREDONIA, N. Y.—The installation of electrically driven pumps in connection with proposed extensions to the waterworks, to cost about $200,000, is under consideration.

OAKFIELD, N. Y.—Electric power equipment will be installed in the new plant addition to be erected by the United States Gypsum Company, to cost about $85,000.

PALMYRA, N. Y.—Bids will be received by R. K. Fuller, Commissioner of Canals and Waterways, Capitol, Albany, until Dec. 18 for construction of power station and incidental work at Lock No. 29, Palmyra.

SALEM, N. Y.—The Salem Light, Heat & Power Company is considering plans for the construction of a new hydro-electric power plant, to cost about $100,000.

SYRACUSE, N. Y.—The City Council has authorized the extension of the ornamental lighting system through West Onondaga and Gifford Streets.

CLIFTON, N. J.—Bids will be received by the Passaic Valley Sewerage Commissioners, 24 Branford Place, Newark, until Dec. 4 for three electrically-operated centrifugal pumps, each with capacity of 6,500,000 gal.; one gasoline-driven electric generating set, switchboard, automatic control and auxiliary apparatus, for the Yantacaw pumping station.

HOLLAND, N. J.—The New Jersey Power Corporation has construction under way on a local electric plant on the Delaware River. A transmission line will be built from Gettysburg, Pa., to Dover, N. J.

ORANGE, N. J.—The Public Service Electric Company has purchased property at Oakwood Avenue and Prince Street as a site for a substation.

ERIE, PA.—The installation of a high-tension conduit system on Twelfth Street, to cost about $25,000, is under consideration. F. G. Lynch is city engineer.

GROVE CITY, PA.—Plans have been approved for new municipal power station near the city waterworks, the removal of the present plant on Main Street to this location and the installation of additional machinery. Contracts have been let for engines and generators. Awards for auxiliary machinery will soon be made.

McCALL'S FERRY, PA.—The Pennsylvania Water & Power Company plans to construct an additional unit at its local hydro-electric plant, to increase the capacity about 40,000 kw. A transmission line will be erected to York, 23 miles, and to Coatesville, 30 miles.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company contemplates the construction of a new carbarn and shops.

READING, PA.—The Thomas Jackson & Son Company plans to rebuild its power house and cordage mill, recently destroyed by fire, with loss of about $500,000.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company is considering a site on the waterfront for a new generating plant unit, to cost about $3,000,000.

OAKLAND, MD.—Plans have been prepared by Charles B. Hawley, consulting engineer of the Youghiogheny River Power Company and the Youghiogheny Water & Electric Company, for a hydro-electric development on the Youghiogheny River. The first development will be located where Deep Creek flows into the Youghiogheny, between Oakland and Friendsville. The plans call for a development of 100,000 hp., to cost about $35,000,000. The power will be distributed throughout western Pennsylvania.

CHARLESTON, W. VA.—The West Virginia Water & Electric Company is planning extensions to its transmission system in different parts of the county.

CHARLESTON, W. VA.—Bids will be received by the State Board of Control, Charleston, until Dec. 28 for construction complete of the Governor's mansion, including electric wiring, conduit system, intercommunicating telephone system, vacuum cleaner, heating system, etc. Walter F Martens is architect.

HUNTINGTON, W. VA.—Bids will be received by the United States Engineer Office until Dec. 19 for one Diesel engine and electric generator.

LOGAN, W. VA.—Steps have been taken by the Logan Chamber of Commerce for the installation of ornamental lamps on Stratton and Main Streets.

MORGANTOWN, W. VA.—The Preston County Light & Power Company, recently organized, contemplates building a power plant, to cost about $100,000. H. C. Greer is director.

TWIN BRANCH, W. VA.—The Fordson Coal Company, a subsidiary of the Ford Motor Company, Highland Park, Mich., plans to install electric power equipment and other machinery on its local coal properties.

NORFOLK, VA.—Plans are under consideration by the Ice Delivery Company for the construction of five ice and refrigerating plants in different sections of the city, with storage and distributing facilities, to cost about $250,000.

WASHINGTON, D. C.—Bids will be received by the chief signal officer, United States Army, until Dec. 3 for thirty-five transformers, 158 resistances and four coils. (Circular C.P. 15891-9.)

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Dec. 18 for five electric grinders for the South Brooklyn Navy Yard and ten electric grinders for the Mare Island Navy Yard; also, for three electric drills for the South Brooklyn yard and eight electric drills for the Hampton Roads (Va.) yard. (Schedule 1608.)

North Central States

CADILLAC, MICH.—Bids are being received by the Consumers' Power Company, Jackson, for construction of dam and power house on the Manistee River, near Cadillac. E. M. Burd is engineer.

DETROIT, MICH.—The Cadillac Motor Company, Clark Avenue, plans to install electric power equipment at its new plant additions, comprising six buildings, to cost about $2,000,000.

EAST LANSING, MICH.—Work has started on construction of the new power plant at the Michigan Agricultural College.

RIVER ROUGE, MICH.—The Peerless Portland Cement Company, Union City, plans to construct a power house at its pro-

posed local cement mill, to cost about $3,500,000.

HAMILTON, OHIO.—An ordinance has been passed by the City Council authorizing the sale of the municipal electric plant to the Union Gas & Electric Company, Cincinnati. Under the terms of the contract the company will furnish power to the city for a period of twenty-five years. The construction of the proposed new plant, for which $650,000 in bonds had been issued will be abandoned.

LORAIN, OHIO.—Plans are being prepared by the Ohio Public Service Company for the erection of a high-tension line from Lorain to Mansfield, and also for a line to Ashland.

YOUNGSTOWN, OHIO.—Electric power equipment will be installed by the Truscon Steel Company at its proposed plant additions, to cost about $400,000.

MADISONVILLE, KY.—Plans are under consideration by the Kentucky Utilities Company, Louisville, and the Central Illinois Public Service Company, Springfield, Ill., for extending their transmission lines, connection to be made at Morganfield.

PAINTSVILLE, KY. — Extensions are contemplated to the waterworks, including the installation of electrically operating pumping machinery, to cost about $50,000.

LAFAYETTE, IND.—The board of directors of Purdue University has awarded a general contract to A. E. Kemmer, Lafayette, for the erection of a power plant and electrical building at the institution, to cost $100,000 and $105,000, respectively, including machinery, for which awards will be made at an early date. A project for the construction of a high power transmission laboratory at the institution will be held in temporary abeyance.

CHANDLERVILLE, ILL.—The Central Illinois Public Service Company has acquired the local municipal electric plant, with twenty-five-year lighting franchise. A transmission line will be erected from Virginia, about 12 miles, and a local substation installed, at a cost of about $30,000 Service at the municipal plant will be discontinued.

BRUCE, WIS.—The Byllesby Engineering & Management Corporation, 208 South La Salle Street, Chicago, has purchased the water power rights of the Chippewa River Power & Fiber Company, between Bruce and Radisson.

ELKHORN, WIS.—Preparations are being made by the Wisconsin Butter & Cheese Company to install an electric generator and a 50-hp. steam engine to generate electricity for light and power for its plant.

LUCK, WIS.—An agreement has been made whereby the electric systems of the Luck (Wis.) Light & Power Company and the Frederic (Wis.) Light & Power Company will be interconnected. The transmission line of the Luck company, which connects Cumberland and Luck, will be extended a distance of 20 miles and will furnish electricity in Frederic and Lewis.

TOMAHAWK, WIS. — The Tomahawk Kraft Paper Company will install electric power equipment in connection with plant additions to cost about $100,000.

DULUTH, MINN.—The Minnesota Power & Light Company has issued $8,300,000 in bonds, part of the proceeds to be used for extensions and improvements.

CEDAR RAPIDS, IOWA. — The Iowa Railway & Light Company contemplates building an addition to its power house and installing new machinery.

CEDAR RAPIDS, IOWA.—Plans are being considered by the Southern Iowa Public Utilities Company for extensions and improvements to its system.

COUNCIL BLUFFS, IOWA.—The Citizens' Gas & Electric Company contemplates extensions and improvements to its system, to cost about $250,000.

DAVENPORT, IOWA.—A site has been acquired on the Mississippi River, above Davenport by the United Light & Railways Company on which it proposes to build a power plant which will ultimately cost about $12,000,000. The initial unit will cost $2,500,000. Electricity will be transmitted to Davenport, Rock Island, Moline and East Moline.

MUSCATINE, IOWA. — The Muscatine Lighting Company has applied for permission to rebuild its distribution in Wilton.

SHENANDOAH, IOWA.—At an election held recently the proposal to issue $175,000 in bonds for a municipal electric plant was defeated.

SIOUX CITY, IOWA.—The Sioux City Gas & Electric Company plans to build a new generating plant to cost about $3,000,000. The transmission system will be extended in Northwestern Iowa and Eastern Nebraska.

WASHINGTON, IOWA.—The date for receiving bids for improvements to waterworks has been extended from Dec. 6 to Dec. 14. The works consists of brick building, electrically driven pumps, piping and equipment and a 200,000-gal. elevated tank, etc. Arthur L. Mullergren, Gates Building, Kansas City, Mo., is consulting engineer.

KANSAS CITY, MO.—The Illinois Power & Light Corporation has secured a controlling interest in the Kansas City Power & Light Company and contemplates extensions in the transmission system, etc.

FREMONT, NEB.—Work will soon commence on the installation of a municipal electric plant, to cost about $100,000, for which bonds have been voted.

FULLERTON, NEB.—The Nebraska Gas & Electric Company contemplates raising the voltage on its Fullerton-Central City transmission line (20 miles) from 16,500 to 33,000.

KANSAS CITY, KAN.—Electric power equipment will be installed in the proposed local plant to be erected by the Pittsburg Marble Works, Pittsburg, Kan., to cost about $100,000.

Southern States

HENDERSON, N. C.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system on Garnett Street from Horner to Young Street.

LAURINBURG, N. C.—Bids will be received by the Mayor and Board of Town Commissioners until Dec. 18 for waterworks improvements, including pumping station, filter house and filter tubs, auxiliary station, storage basin, water tank and tower, 3½ miles of 6,600-volt transmission line, motor-driven centrifugal pumps and accessories, filter-plant equipment, etc. The Gilbert C. White Company, Durham, is engineer.

RALEIGH, N. C.—Plans are being prepared for a new power plant of about 1,000 hp. capacity for the North Carolina State College of Agriculture and Engineering. The plant will also be equipped as a testing station for students at the institution. J. E. Sirrine & Comany, Greenville, S. C., are engineers.

WILMINGTON, N. C.—The Wilmington Wood Products Company plans to install electric power equipment at its proposed plant in the Love Grove district, to cost about $85,000.

AIKEN, S. C.—Plans are under consideration for the installation of an ornamental lighting system on Park and Hayne Avenues. E. C. Lowe is interested in the project.

SAVANNAH, GA.—Plans are under consideration to establish a municipal electric plant, with transmission system, to cost about $1,500,000. Lawrence Manning is engineer.

MOSS BLUFF, FLA.—Plans have been completed by J. D. Young, Leesburg, for the construction of an electric plant and transmission line, for which contracts have been awarded. The company contemplates installing an addition unit of 500 hp. later. Victor G. Johnson is construction engineer.

ST. PETERSBURG, FLA.—Bids, it is understood, will be opened by the West Central Association, 11 Fifth Street, North, in about thirty days for the installation of an ornamental lighting system, covering about 7 miles.

CHATTANOOGA, TENN. — Work will soon begin by the Cumberland Telephone & Telegraph Company on the construction of a conduit on East and West Seventh Street, to replace its overhead wires. Extensions and improvements, involving an expenditure of $174,000, during the coming year are contemplated by the company.

MOBILE, ALA.—Bids will be received by the Supervising Architect, Treasury Department, Washington, D. C., until Dec. 17 for conduits, wiring and lighting fixtures for the local marine hospital.

PINE BLUFFS, ARK. — The Arkansas Light & Power Company has been granted permission to construct a hydro-electric plant on Little Red River in Clebourne County.

VAN BUREN, ARK.—The waterworks station now being built will be equipped with electrically operated pumps. Electricity will be furnished by the Fort Smith (Ark.) Light & Traction Company.

GIBSLAND, LA.—A special election will be held Dec. 4 to vote on the proposal to issue $60,000, in bonds, part of the proceeds to be used for the installation of a street-lighting system. E. T. Archer & Company, New England Building, Kansas City, Mo., are engineers.

OAK GROVE, LA.—Plans are being considered by the City Council for the installation of a municipal electric plant and waterworks system.

CANTON, OKLA.—The installation of electrically operated pumping machinery at the proposed municipal waterworks is under consideration. V. V. Long & Company, Colcord Building, Oklahoma City, are engineers.

CORSICANA, TEX. — Plans are under way by the Texas Power & Light Company, Dallas, to erect a high-tension transmission line from Corisicana to Tyler, to cost about $300,000.

DALLAS, TEX. — The Theater Electric Light Company, recently organized, has leased property at 208 North Akard Street, where it will establish an electric light and power plant for service to theaters in this section. L. G. Bissinger is secretary and treasurer.

GILMER, TEX.—The American Public Service Corporation has acquired the plant of the Gilmer Ice & Electric Company, and plans to erect a transmission line from Longview to furnish service at Big Sandy, Alba, Winnsboro and vincity.

ROTAN, TEX.—The Universal Gypsum Company, Fort Dodge, Iowa, plans to erect a power house at its proposed local plant, to cost about $250,000. C. T. Murphy is engineer in charge.

SAN ANGELO, TEX.—C. C. Holder plans to operate a local light and power plant for commercial service. A distributing system will be installed.

SEYMOUR, TEX. — The Wichita Falls (Tex.) Electric Company has acquired the plant of the Seymour Light & Ice Company and plans to erect a high-tension transmission line from Wichita Falls to Seymour to furnish electricity here. It is proposed to supply electricity to towns along the proposed line and also to extend the line to towns beyond Seymour.

WILLS POINT, TEX.—The Texas Power & Light Company, Dallas, has acquired the property of the Wills Point Electric Company, and plans to erect a high-tension transmission line from Terrill to Wills Point for local service.

Pacific and Mountain States

BELLINGHAM, WASH.—An ordinance has been passed authorizing a fund of $500,000 for the construction or purchase of a municipal electric plant and system.

CHEHALIS, WASH. — A franchise has been granted the North Coast Power Company to extend its transmission line Coal Creek to the Swayne property.

PORT ANGELES, WASH.—The Washington Pulp & Paper Corporation will install electric power equipment in its proposed new sulphite mill, to cost about $500,000, with other plant extensions and betterments.

SEATTLE, WASH. — The Puget Sound Light & Power Company has tentative plans under consideration for the construction of a new generating plant, to cost about $4,000,000. Extensions and improvements are also contemplated in its system to cost about $1,000,000.

TACOMA, WASH.—Application has been filed with the State Hydraulic Engineer, by Charles C. Garland and associates of Tacoma for permission to build a large hydro-electric plant on the Toutle River in Pierce County, to cost about $5,000,000.

VANCOUVER, WASH. — The Mackall-Paine Veneer Company contemplates the construction of a power house at its mill, to cost about $75,000.

WENATCHEE, WASH.—The Washington Coast Utilities Company is planning extensions and improvements to its system in Wenatchee during the coming year, to cost about $40,000. Plans are being prepared by the company for proposed new work, to cost about $100,000 additional.

WINLOCK, WASH. — The Independent Electric Company has been granted a franchise to erect a transmission line on the old Lewis County Road.

DIAMOND SPRINGS, CAL.—The California Door Company contemplates rebuilding its power house and mill, recently destroyed by fire with loss of about $150,000.

EL DORADO, CAL.—The Western States Gas & Electric Company, San Francisco, plans to install additional units at its local hydro-electric power plant, now in course of erection. The first unit will have a capacity of 27,000 hp.

LIVERMORE, CAL. — Bids will be received at the office of the United States Veterans' Bureau, Room No. 791, Arlington Building, Washington, D. C., until Dec. 22, for construction complete of infirmary, including administration, mess and kitchen building, recreation building, nurses' quarters, attendants' quarters, garage, storehouse, boiler house and laundry, occupa-

tional-therapy building, ambulance cottages, officers' quarters, including mechanical equipment and outside service lines. Separate proposals will be received for central heating plant, including boiler plant, and heating equipment for all buildings, electrical equipment, elevators, refrigerating plant, stack, pumping, water supply, etc.

NEWPORT BEACH, CAL.—Bids will be received by the city trustees until Dec. 3 for the installation of an ornamental lighting system on Thirty-sixth Street and Finley Avenue. Paul E. Kressly, H. W. Hellman Building, Los Angeles, is city engineer.

SALINAS, CAL.—The Coast Valleys Gas & Electric Company, recently acquired by H. M. Byllesby & Company, Chicago, Ill., contemplates extensions and improvements to its system.

SAN BERNARDINO, CAL.—Bids will be received by the City Council until Dec. 3 for the installation of an ornamental lighting ssytem on E Street from Fifth Street to Highland Avenue.

SAN FRANCISCO, CAL.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Dec. 18 for one motor-generator set and six transformers for the Mare Island Navy Yard. (Schedule 1629.)

SAN FRANCISCO, CAL.—Bids are being received by Bliss & Faville, Balboa Building, architects, for the construction of administration building, six cottages, laundry and power house on a site bounded by Twenty-eighth and Thirtieth Avenues, Vicente and Wawona Streets, for the San Francisco Protestant Orphan Asylum. The cost is estimated at $350,000.

SANTA MONICA, CAL.—Plans for extension of the Santa Monica Boulevard, include the installation of ornamental lamps.

EVANSTON, WYO.—The County Commissioners have granted the Utah Power & Light Company, Salt Lake City, a franchise to erect transmission lines in Uinta County. The company is negotiating for the purchase of the property and franchises of the Evanston Electric Light Company.

Canada

VANCOUVER, B. C.—The City Council is considering making application to the Minister of Lands for an option on the Cheakamus power site.

WINKLER MAN.—Application has been made to the Manitoba Hydro-Electric System to extend the transmission line from Morden to Winkler, a distance of 8 miles.

WINDSOR, ONT.—The Michigan Central Railway Company has contracted with the Windsor Hydro-Electric Commission for electricity (1,300 hp.) to serve the ice plant being erected in its Windsor yards.

CHICOUTIMI, QUE. — The Donnacona (Que) Paper Company contemplates building a hydro-electric plant near here.

MONTREAL, QUE.—The Ottawa River Power Company, Ltd., has awarded a general contract for construction of a dam and power house at Calumet Island Falls, near Bryson, Que. William Kennedy & Sons, Ltd., Montreal, and Dr. L. A. Herdt are engineers. William Kennedy, Jr., will purchase the hydraulic machinery and Dr. L. A. Herdt will buy the electrical machinery.

MONTREAL, QUE.—Plans, it is understood, are being considered by a group of financial men associated with the Montreal Tramways Company for a hydro-electric development on the Rivière du Loup, near St. Paulin, in the County of Maskinonge, about 70 miles northeast of Montreal. The plans include a dam and power house with an initial output of 21,000 hp. to be increased by later extensions.

THREE RIVERS, QUE.—Plans are being prepared by the North Shore Power Company for the construction of a hydro-electric plant and mill on the River Batiscan, to develop 5,000 hp. J. C. Smith, Montreal, is engineer.

Miscellaneous

HONOLULU, HAWAII.—Extensions and improvements involving an expenditure of about $1,250,000 are contemplated by the Hawaiian Electric Company, Ltd. The work will include increasing the output of the plant to 35,000 kw., the installation of a new 12,500-kw. steam turbo-generator unit, two 826-hp. boilers, fuel-oil-heaters, etc. The company has entered into a contract with the Honolulu Rapid Transit Company to furnish electricity to operate the car lines and will erect a 11,000-volt feeder lines to the power station of the transit company. Extensions to its lines in the sugarcane plantation and other industrial districts on the island of Oahu are to be made. A new substation will be erected at Waikiki.

Electrical Patents

Announced by U. S. Patent Office

(Issued Nov. 6, 1923)

1,473,417. RADIO RECEIVING APPARATUS; F. G. Beetem, Philadelphia, Pa. App. filed June 16, 1920. Control for tube filaments.

1,473,433. CARRIER-WAVE TRANSMISSION SYSTEM; A. W. Kishpaugh, East Orange, N. J. App. filed May 3, 1921. Remote control of high-frequency oscillations.

1,473,485. SOUND-PRODUCING MECHANISM; F. B. Little, Chicago, Ill. App. filed Oct. 20, 1921. Mechanism for suspending and operating tubular chimes.

1,473,504. RAIL CLAMP; R. E. Neely, Terre Haute, Ind. App. filed Dec. 23, 1922. Securing trolley wire insulators to supporting beams in mines.

1,473,567. TROLLEY LOCK; W. M. Lauer, Glenns Falls, N. Y. App. filed May 15, 1923. For retaining trolley wheel in proper relation to wire.

1,473,585. IGNITION DEVICE FOR AUTOMOBILES; H. R. Patterson, Toledo, Ohio. App. filed July 9, 1917. Condenser arrangement for ignition circuit.

1,473,586. ELECTRIC POWER PLANT; H. R. Patterson, Toledo, Ohio. App. filed Sept. 10 1919. Engine-driven storage-battery-charging set.

(Issued Nov. 13, 1923)

15,722 (reissue). SYSTEM FOR PRODUCING MODULATED WAVES; R. A. Heising, Millburn, N. J. App. filed Dec. 27, 1918. Radio-telephone transmitting system.

15,724 (reissue). METER; R. F. Schuchardt, Chicago, Ill. App. filed July 5, 1919. Measures kilowatts, kilovolt-amperes, maximum demand and power factor.

1,473,618. CARD-PUNCHING MACHINE; J. H. Gault, Philadelphia, Pa. App. filed June 9, 1920. Magnetically operated punches.

1,473,645. ELECTRIC HEAT DEVICE; T. C. Russell, Chicago, Ill. App. filed Sept. 18, 1922. Cooking unit.

1,473,671. TELEPHONE-EXCHANGE SYSTEM; J. Davidson, Jr., Trenton, N. J. App. filed Dec. 18, 1920. Machine-switching equipment controlled over toll lines.

1,473,674. MEANS FOR AND METHOD OF MODULATION; L. Espenschied, Queens, N. Y. App. filed Dec. 16, 1920. Transmission by carrier current.

1,473,682. REPEATER APPARATUS FOR CARRIER SYSTEMS; H. S. Osborne, New York, N. Y. App. filed July 24, 1919. Means for amplifying high-frequency carrier oscillations without disturbing low-frequency repeater.

1,473,719. RADIOTELEGRAPHY; R. R. Beal, Palo Alto, Cal. App. filed Feb. 19, 1920. System of single-wave radio signaling.

1,473,784. PROCESS OF ELECTRIC SMELTING AND FURNACE FOR SAME; J. C. Dow, Great Falls, Mont. App. filed July 6, 1920.

1,473,807. RECTIFIER; E. W. Breisch, Edgewood, Pa. App. filed Nov. 5, 1920. Means for smoothing out pulsations when single-phase source is employed.

1,473,809. TROLLEY BASE; L. F. Burnham, Fairport, N. Y. App. filed May 14, 1921. Two poles mounted on same base move independently of each other.

1,473,812. OUTLET-BOX CONSTRUCTION; N. T. Clements, Superior, Wis. App. filed May 12, 1920. Method of inserting armored cables.

1,473,856. SWITCH TERMINAL; H. D. James, Edgewood Park, Pa. App. filed April 9, 1919. Controller for heavy-starting-current motors.

1,473,862. THREE-PHASE REACTANCE COIL; A. Nyman, Wilkinsburg, Pa. App. filed June 19, 1918. Method of bracing coils.

1,473,865 to 1,473,867. ELECTRIC HEATER; S. I. Phelps, Rockford, Ill. App. filed Feb. 18, 1922. Electric cooking range.

1,473,881. NON-INDUCTIVE INTERFERENCE SYSTEM; C. F. Scott, New Haven, Conn. App. filed Dec. 2, 1918. Method of interrupting short-circuit current in single-phase railway to prevent induced voltage in nearby wires.

1,473,882. PICTURE TRANSMISSION; A. Sinding-Larsen, Vestre Aker, Norway. App. filed Sept. 16, 1919. Photo-electric cells with alkali metal cathode.

1,473,883. ELECTROLYTIC CONDENSER; J. Slepian, Wilkinsburg, Pa. App. filed Dec. 17, 1919.

1,473,900. ELECTRIC LIGHTING SYSTEM; J. B. Bushnell, Berkeley, Cal. App. filed Dec. 1, 1920. For automobile lights directly connected to generator.

1,473,915. RHEOSTAT; L. C. Martin, Providence, R. I. App. filed June 10, 1922. Spiral-wound wire with connector that makes contact by means of spiral groove over wire.

1,473,921. HIGH-FREQUENCY SIGNALING SYSTEM; J. Bethenod, Paris, France. App. filed May 6, 1922. Synchronizing connection for high-frequency alternators.

1,473,959. CIRCUIT-OPENING DEVICE; T. F. Johnson, Jr., Atlanta, Ga. App. filed Aug. 16, 1919. Automatic skeet switches.

1,473,960. THROW-OFF OR CIRCUIT-BREAKING SWITCH FOR SKEET HEADS; T. F. Johnson, Jr., Atlanta, Ga. App. filed May 13, 1920. For high-tension transmission lines.

1,473,977. HAIR-WAVING APPARATUS; O. Schaumberg, Pittsburgh, Pa. App. filed Dec. 5, 1921.

1,474,008. MACHINE-SWITCHING TELEPHONE-EXCHANGE SYSTEM; R. Stokely, Floral Park, N. Y. App. filed Dec. 8, 1920. Arrangement to take care of toll calls to and from full automatic offices.

1,474,014. ELECTRIC BELL; R. B. Benjamin, Chicago, Ill. App. filed March 1, 1919. All hammer-actuating mechanism inclosed in sealed casing.

1,474,015. LAMP SOCKET; R. B. Benjamin, Chicago, Ill. App. filed Dec. 12, 1919. For locomotive headlights.

1,474,037. ALTERNATING-CURRENT MOTOR; H. W. Jeannin, Toledo, Ohio. App. filed March 18, 1919. Repulsion-induction type.

1,474,038. TELEPHONE REPEATER CIRCUITS; E. D. Johnson, East Orange, N. J. App. filed Jan. 4, 1918. Repeater automatically connected in correct direction by voice current.

1,474,053. TELEPHONE METER; E. H. Martin, Los Angeles, Cal. App. filed Sept. 25, 1920. For measuring time receiver is in service.

1,474,060. RHEOSTAT; A. E. Waller, Bronxville, N. Y. App. filed Dec. 31, 1920. For electroplating processes capable of carrying heavy currents.

1,474,094. SWITCH DRUM FOR STARTING AND CONTROLLING ELECTROMOTORS; L. Schön, Essen, Germany. App. filed Sept. 26, 1922. Ratchet arrangement to prevent damaging contact when shut off.

1,474,100. AUXILIARY MOUTHPIECE FOR TELEPHONES; O. W. Aagaard, Chicago, Ill. App. filed Jan. 19, 1922. Flexible mouthpiece to conform with each individual mouth.

1,474,104. ELECTRIC WATER HEATER; W. E. Burgess, New Orleans, La. App. filed June 15, 1922. Placed directly in water-pipe line.

1,474,151. ELECTRODE FOR ION CONCENTRATION EFFECTS; E. A. Keeler, Norristown, Pa. App. filed Nov. 30, 1921. For measuring ion concentration.

1,474,152. INDUCTION COIL; A. A. Kent, Ardmore, Pa. App. filed Jan. 8, 1921. For internal-combustion engines.

1,474,153. MEANS FOR DETACHABLY CONNECTING AN OPERATING MEMBER TO A POWER-DRIVEN SHAFT; B. W. Klein, Mount Vernon, N. Y. App. filed Oct. 16, 1922. Connecting polishing brush to flexible shaft of shoe-polishing machine.

1,474,169. AUTOMATIC WATER FILTER FOR STORAGE BATTERIES; J. D. Sartakoff, Forest Hills, and W. V. Forrest, Brooklyn, N. Y. App. filed Nov. 5, 1920. Electrolyte automatically maintained at predetermined point.

1,474,172. ELECTRIC MEASURING INSTRUMENT; W. M. Scott, Cleveland, Ohio. App. filed Dec. 10, 1919. Ammeter for automobile.

1,474,186. SANITARY ATTACHMENT FOR TELEPHONE TRANSMITTERS AND THE LIKE; C. P. Abbott, Allston, Mass. App. filed June 19, 1922.

1,474,199. UNIVERSAL POINT AND CARRIER FOR WELDERS; F. P. McBerty, Warren, Ohio. App. filed June 30, 1921. Facilitates welding at any angle.

1,474,241. TROLLEY SHEAVE; J. J. Crapper, Brooklyn, N. Y. App. filed March 29, 1923. Guard for preventing displacement of trolley wire.

1,474,242. ACOUSTIC RECEIVING APPARATUS; C. A. Culver, Beloit, Wis. App. filed Oct. 28, 1919. Transmuting electrical impulses into audible sounds.

1,474,256. INSULATOR; W. T. Goddar, Victor, N. Y. App. filed March 14, 1917. Method of insulating coiled inductances.

1,474,293. THERMIONIC VALVE; F. Reynolds, Walkerville-on-Tyne, England. App. filed Nov. 10, 1921. Method of supporting electrodes.

1,474,304. ELECTRIC TABLE LAMP WITH BRAKE-CONTROLLED SUPPORTING ARMS FOR INCANDESCENT LAMPS; G. Weber, Egelsbach, Germany. App. filed Dec. 29, 1921.

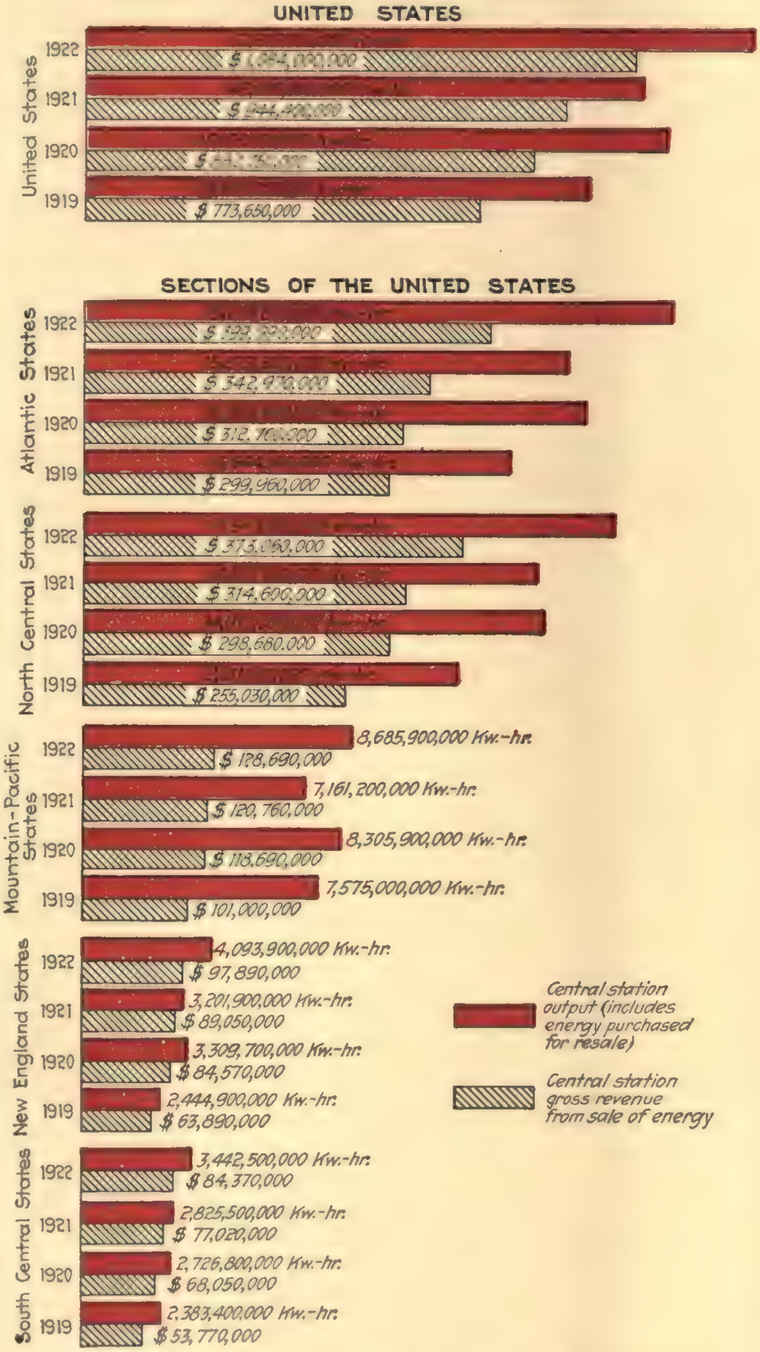
1,474,312. ELECTRIC CONTROL MECHANISM; C. W. Wyman, Claremont, N. H. App. filed Sept. 5, 1919. Motor starter.

1,474,313. STORAGE BATTERY; J. M. Allen, St. Louis, Mo. App. filed Nov. 29, 1920. Positive plates connected in pairs to prevent buckling.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

No Section of the Country Has Ever Reported a Decrease in Annual Gross Revenue



Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

The Relation of Revenue to Output

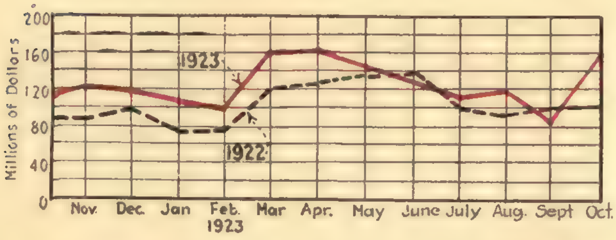
IN STUDYING the relation which exists between central-station revenue and output in various sections of the country it is necessary to have a clear view of lighting and power conditions as they exist in those sections, as well as the economic conditions entering into the generation of the energy. Because a system in one section of the country reports an output double that of a system in another section it does not follow that the revenue of the first system is double or even equal that of the second system.

Out on the Pacific Coast, and in a large portion of the Mountain States, load conditions are such that the electric public utilities enjoy high yearly load factors which make for low rates. Coupled with this is the fact that in these two sections almost 87 per cent of the energy is generated in favorably located hydro plants. About 80 per cent of this hydro-electric energy is consumed by high-load-factor power users and only 20 per cent is used by low-load-factor but high-revenue lighting customers. Mass production of energy is, therefore, prevalent.

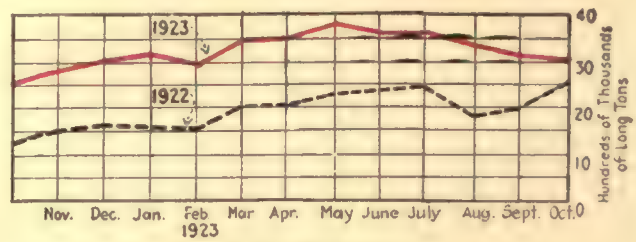
On the other hand, controlling conditions in the North Central States result not only in a large output of energy but also in a comparatively high revenue. The utilities there do not operate on such high yearly load factors, and, besides, almost 83 per cent of the energy used in that section is produced in steam-electric plants, which, with their higher cost of operation, call for comparatively higher rates for energy. In that section, also, about 32 per cent of the energy is consumed by low-load-factor, high-revenue lighting customers and 68 per cent by high-load-factor, low-revenue power customers. All these conditions result in comparatively high revenue for the systems in the North Central States.

In the last analysis, however, there is little difference between the relation of net revenue to the investment of central-station systems in the various sections of the country, the regulatory authorities basing rates upon conditions as they exist in the various systems.

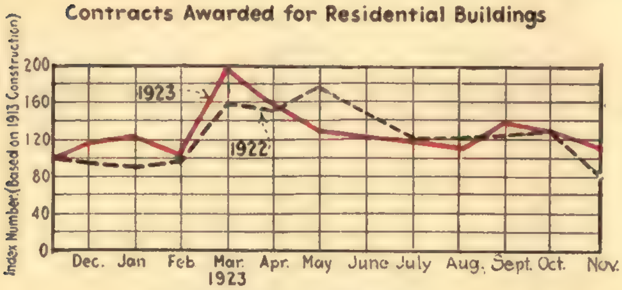
How the Primary Industries Are Trending



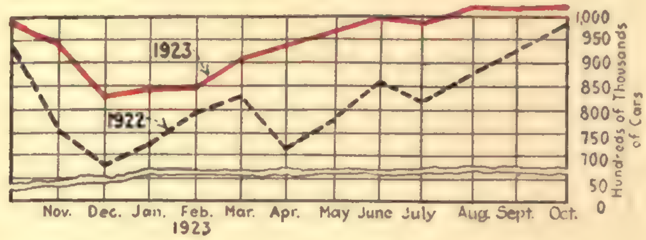
Contracts Awarded for Residential Buildings



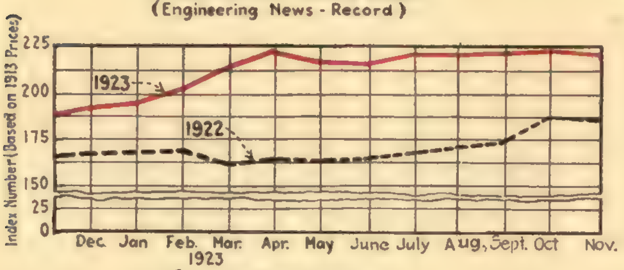
Pig-Iron Production



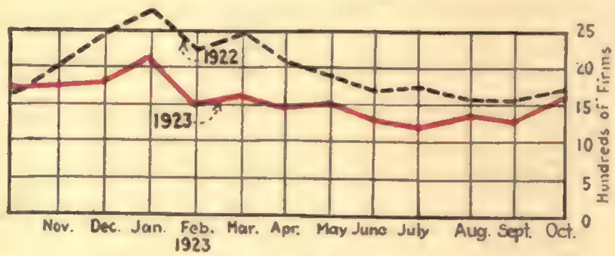
Construction Volume Index
(Engineering News-Record)



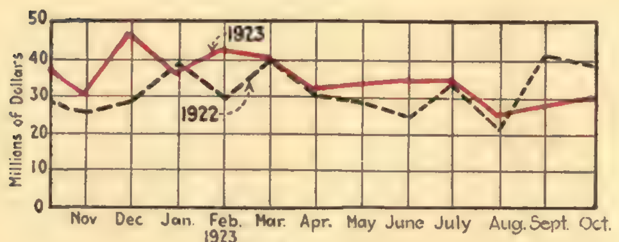
Total Average Weekly Freight-Car Loadings



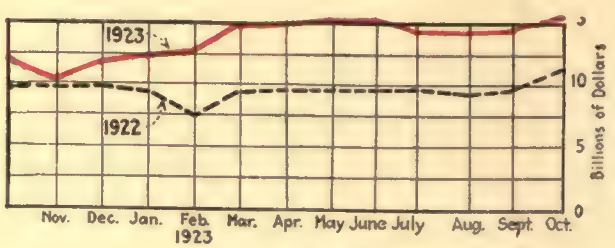
Construction Cost Index
(Engineering News-Record)



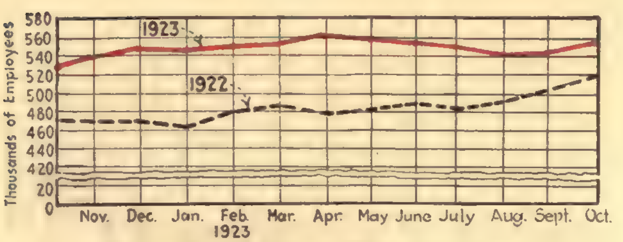
Business Failures



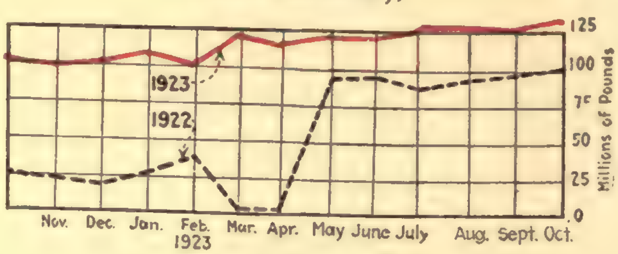
Fire Losses



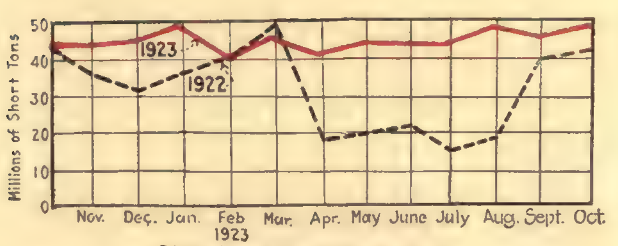
Bank Clearings
(Outside of New York City)



Employees in Factories of New York State



Copper Production



Bituminous Coal Production

Optimistic Outlook for 1924

The question, "What has 1924 in store for business?" is a most important one just at this time among manufacturers and distributors. The Harvard University Committee on Economic Research sums up the situation as follows: "We forecast improvement in business during the first half of next year, with generally firm and rising commodity prices, expanding operations and activity, and a normal manufacturing output."

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The consolidation of Electrical World, Electrical Engineer and American Electrician

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Put Our Own Story on the Radio

A REAL opportunity that is being almost entirely ignored lies within reach of electrical men. This opportunity is to broadcast the message of electricity to the two million homes that today are operating radio receiving sets. It is estimated that there is now an unseen audience of several million people who are listening to the radio with considerable regularity. Broadcasting programs are steadily becoming more interesting and more worth while. The popularity of short educational talks is growing. The variety of subjects which are being so presented is expanding all the time. Radio has become one of the accepted mediums for the dissemination of information and knowledge. And yet few electrical men have given it any serious thought.

PUBLIC relations is a live topic with central-station executives today. They are constantly on the alert to discover occasions when the story of electricity may be told to the people. There is no enterprising general manager in the industry who would not jump at the chance of appearing before any large gathering of his consumers and prospective customers to interpret the place of the modern utility in the community. But here nightly waits an audience vaster by far than any single edifice will hold, ready, listening for the words that come so mysteriously into the homes of those who compose it.

Electrical engineers have long wanted more people to know more about what they as a class have contributed to society and to industry. Engineering topics, particularly electrical engineering topics, are especially acceptable to radio audiences. They look to the engineer for authoritative statements as to what can be done and what cannot be done electrically; and engineers owe it to themselves and to their industry to satisfy, in simple yet convincing terms, these thousands of listeners. They are eager to learn more about the many things that electrical engineers can, if they will, tell them.

It is time that some organized effort was made to put the story of electricity into "the air." There is a wonderful romance in it that is susceptible to expression in almost endless variety. The story of electricity in industry, in the home, on the farm may be pictured to the popular mind; the story of the generating station, the vision of superpower, the story of the lamp, tales of great electrical men—all these offer appealing themes for radio broadcasting. Some one must take the initiative and get it started.

THREE things will be needed. Electrical men — central-station executives, electrical engineers, manufacturers, jobbers—all must be interested in their personal opportunity to contribute to this great educational program. Next, to some, material must be made available to assist them in preparing their talks—ideas, information, advice, to make it easy for them to do a creditable, useful job. For there are "tricks of the trade" in radio broadcasting to give the best results. Then, finally, some one must arrange the booking with the broadcasting stations so that demand as well as supply shall be assured. And not only will the story of electricity be told, but the very fact of this message being broadcasted will provide an additional service of valuable publicity. For the fact that the general manager of the lighting company or some engineer of prominence is to talk on the radio is news in the community. The bigger the man the wider this news will carry.

THE job is to get such a program started. It is primarily a local problem. No national or central "booking agency" can run the various programs. The local broadcasting station is the place to start, and local electrical men and local leagues should get behind the definite local programs. There is a place, however, for national service by the Society for Electrical Development in this connection. Already it is collecting radio speeches by electrical men, and it can well afford in its efforts to spread the electrical gospel to set up some definite mechanism within its organization to encourage local action—to help see that every listed broadcasting station gives a place to the electrical story. It can also do much by distributing sample addresses and otherwise helping to prepare material for broadcasting.

Reuben James Russell

An electrical manufacturer of single-phase motors who has devoted himself to the cause of standardization and through leadership in association work has achieved much for the electrical industry.

ALMOST every man whose natural ability has won him recognition in any industry and established him in a position of leadership will be found to have had some one strong, direct purpose in his work, some ideal which has inspired him to unusual effort and unusual achievement and attracted to him the attention and the confidence of his fellows. This is signally true in the case of R. J. Russell, president of the Century Electric Company of St. Louis. Early in his career he became convinced of the vital importance of maintaining definite standards in manufacturing production and of strictly adhering to them. In his administration of the Century Electric Company he has proved the practical success of such a policy. In his long service as a leader in the activities of the Electric Power Club he has done his utmost to insure the adoption of this economic principle by the other electrical apparatus manufacturers of America and with noteworthy success.

Mr. Russell was born in Detroit in 1872 and in 1891 entered the employ of the Detroit Electrical Works, manufacturers of electric railway apparatus and general electrical and telephone equipment. Four years later he moved to Cleveland and with the Walker Electric Company devoted himself to the manufacture of electric and cable railway machinery, contributing materially to the progress made in the development of the larger railway apparatus. In 1900 he joined the Wagner Electric & Manufacturing Company, opening its Atlanta office and then being transferred to its general offices in St. Louis, where he remained until 1903, when the Century Electric Company was organized and he became one of its executive officers.

For twelve consecutive years Mr. Russell has been a member of the board of governors of the Electric Power Club, and he has served two terms as its president. He has also been a member of the executive committee of the Electrical Manufacturers' Council. In both these organizations he has persistently endeavored to influence manufacturers to eliminate all non-essential sizes and types and also to anticipate public regulation rather than pursue a policy of yielding only upon public demand.

Mr. Russell believes that American manufacturers should seek a world market, and he has been active in foreign sales. He has steadfastly favored an absolutely open price policy, that prices of all electrical products should be given out to anybody without reservation. These broad principles have had no small influence on American practice during his long activity.

Editorial Comment

Electrical World, December 8, 1923
Volume 82 Number 23

The Stability of Electric Light Securities

DAILY newspapers record the fact that twenty-four country banks closed within six days in the Minneapolis territory, and at least one bank has been reported in the doubtful or uncertain class for every one reported closed. Of the twenty-four closed, one was a national bank and twenty-three were state organizations. Now, by the public, banks are looked upon as the perfection of security, and yet what a contrast they present to electric light and power companies. During the last decade not one strictly electric light and power company has defaulted in its securities, a record unapproached in the entire public utility field; whereas the investment market is strewn with the wrecks of water, gas, telephone, railroad and railway companies innumerable. Moreover, the quality of electric service has been greatly improved during the decade and its actual cost lessened, notwithstanding increased costs of everything going to make up that service. That does not hold for other utility service, and it is a record of which all engaged in the business should be proud. It shows close co-operation and eternal vigilance on the part of the executive, operating and sales branches, and it is only natural that such excellence should be reflected in securities as well.

"We of the South"

NO ONE who visits the new South and gets an impression of the industrial growth of the states below the Mason and Dixon line and east of the Mississippi can fail to receive renewed impressions of the virility and definiteness of purpose of that development. To an electrical man particularly this expansion has special significance, since the future of this well-started development is intimately linked with the electrical industry. It is perhaps not too much to say that what slave power was to the old South from an economic point of view hydro-electric power is to this new country.

The achievements in this undeveloped territory are noticeable not alone for specific engineering accomplishment nor in the actual statistics of growth, but in the "will to do" which is everywhere expressed by industrial and electrical men. The South is leading in certain specific engineering accomplishments, such as the practical working out of an effective tie-in between power plants and the actual accomplishment of the superpower idea. From an engineering viewpoint, moreover, certain of the hydro-electric developments are epoch-making. The figures for actual growth of industries in North Carolina, Alabama and Georgia also are tangible evidences of the new order. But greater than all these is the long-sighted industrial statesmanship which is being exhibited by electrical men and by the utility commissioners and which may well be emulated in every state. One who attended the recent meeting of the Southeastern Section of the National Electric Light Association at Tampa and heard the speeches by Commissioner Maxwell of North Carolina and Commissioner Burr of Florida recognized that he was listening to state regulation expressed in terms of fundamental economic needs. These speeches, together with the plans expressed there by leaders of the industry for definite industrial betterment programs and the application of electricity to the development of agriculture, were not only specific in their recommendations but had that quality of looking ahead for the industry which spells true progress.

Applications of electricity in the fields of industrial heating, industrial power, the electric truck, were discussed at this meeting in terms of actual accomplishment. One of the outstanding features of the new industrial development is the extension of the use of electricity on the farm. A practical start has been made in this at the Alabama Polytechnic Institute with the co-operation of the Alabama Power Company, in which the application of electricity is being analyzed, not alone from the viewpoint of furnishing electricity to the farmer, but in the spirit of helping the farmer find diversified applications for power which will reduce his costs of operation, under the guidance of a farm expert and agricultural engineer.

The South has many problems in this new development. Costs of transmission are relatively more important than primary generating costs. Industrial communities in the South are pearls on long strings, and one gets an impression of distances between cities which parallel the conditions in the Far Western States. The South needs capital to meet the growing demands for power. It is looking for ideas from the North on intensive commercial development, but the impression lingers that these problems are, in homely illustration, the problems of clothing a rapidly growing youth. Electrical development represents the essential trousers, which must be kept long enough. No one from outside its own area can visit the new South without being conscious of wanting to say, "We of the South," and not "You of the South," in helping its electrical industry reach its ultimate destiny.

The Engineer as a Public Servant

MANY times in the past few years has a high light been thrown on the engineer and his opportunity, his obligation, to be of service in a public way aside from his purely technical work. While much of this agitation—and it has been constructive agitation—has had its source in the consciousness of the engineer himself, yet some of it has also emanated from others who see in the engineer some one whose capabilities should be utilized for the general social good.

The subject was again called forcibly to attention

this week in the presidential address at the annual meeting of the American Society of Mechanical Engineers. As was the case with President D. S. Kimball last year, so this year President J. L. Harrington finds this subject the most important one to place before the members of the society. Two points were made this year: that it is up to the engineer to solve the industrial problem —to keep the native American in industry; and that the engineer must make himself a definite factor in political development, now retarded by the hordes of lawyers with their precedents.

These fields are strange to the technical engineer. His own work in the development of engineering industries has thus far completely engrossed him. Now, having brought them to such a stage that they affect and are a part of the lives of every one, he finds that he must orient himself in order best to understand the next work of applying his methods to the solution of the more general problems of the day, problems largely a result of engineering accomplishment.

But the engineer is meeting the challenge to his ability. He realizes that he has a duty to his fellows in the way of public service as well as technical service, and he is starting to perform. And the opportunity for the electrical engineer today transcends that of any other. It is he who has the advantage of most intimately serving by labor-saving accomplishments. It is to the electrical engineer that the country looks for greater development of natural resources. He has made living easier. He has connected every one by electrical communication. His is the most human of the various engineering services. It is for these reasons that the electrical engineer has a special opportunity—he has a good will already created—to have a useful influence with his fellowmen in public service, and the opportunity must not be allowed to pass.

Teach Political Responsibility in the Colleges

ENGINEERS are generally sound in their citizenship but inactive in assuming any political responsibility. They are trained to have a sense of responsibility, of thorough performance and of discipline in their professional environment, but, in general, they exercise too lightly and too carelessly the political leadership their knowledge entitles them to assume.

They are inclined to laugh at the political fallacies of most reformers and not to serve as true leaders in opening the gates to larger fields of national prosperity and well being. The rank and file are like the average college student who successfully carries on his studies but takes no part in the extra-curriculum activities.

In the opinion of many, the most fruitful field of endeavor lies in attempting to educate the thousands of young engineers in the colleges. Without detriment to their technical proficiency, these young men could be taught to appreciate their personal responsibility of participating in national affairs. But the leaders of industry must give impetus and direction to this type of education. They only have the data, the perspective and the fresh contact with affairs whereby the young engineers can be taught to be conscious of their obligations to the nation. Splendid possibilities are afforded the national engineering associations to make this a definite and constructive part of their program of activity, and it is encouraging to note that the educators are cordially receptive to any plans that may be proposed to accomplish such desirable results.

Higher Voltage the Only Answer to the Distribution Problem

THE growth in load densities, the extension of electrical systems and the increased investment in copper involved in these changes have resulted in very detailed studies of distribution systems for metropolitan areas. To the old debate about the relative merits of direct current and alternating current, two-phase, three-phase and three-phase four-wire, have been added debates about the most economical voltage or voltages to use in view of the ultimate growth in system loads.

While charts of relative copper economics and theoretical studies of high-voltage system economics have been available for years, little has been done to determine upon any modification to adopt as a type of system to build. There are so many variables in the equation that it is almost impossible to obtain an exact solution even under the pressure of commercial necessity. Legal limitations, safety limitations, cable and equipment limitations, indefinite estimates of future requirements and a lack of real engineering and economic data are handicaps that face each property in a different aspect.

In the past few years the pressure for better "economic engineering" in electrical distribution has caused many two-phase systems to change to three-phase and many three-phase three-wire systems to change to three-phase four-wire. But, apparently, these changes are merely stop gaps in the development that must occur if the investment in distribution circuits is to be reduced and service reliability increased.

Two outlets are recognized as available for bettering the situation—raising the voltage and multiplying the phases—and of the two only the first seems to offer any concrete hope. It is apparent that 115 volts and 230 volts will remain standard for service voltages, although it may be that the future will see the elimination of the 115-volt secondaries. Studies show that 2,300-volt primary distribution is uneconomical, while even the 4,000-volt, four-wire system, though it helps some, is not the answer. Above these voltages systems are being tried out at 6,600, 11,000, 13,200, 22,000, 66,000 and 132,000 volts for the main primary lines. Which is the most economical and best to use in this wide range of voltages is as yet undetermined, and the decision is very materially affected by the specific system considered. From an engineering standpoint, as regards the development of equipment, there are no limitations to the use of the highest voltage on overhead systems, and only the unreliability of high-voltage underground cables prevents the same condition in the underground system. But, aside from the technical aspects, there are economic, social and legal phases which give great trouble to those studying the problem. Costs can pretty well be figured, and on this basis the higher voltage would be decided upon, even though each 66,000-volt, 30,000-kva. substation of the outdoor type involves an expenditure of more than $800,000 when any number of feeders are to be supplied. But the cost of rights-of-way, lines and equipment is difficult to determine exactly when only a seer can vision the possibility of these voltages being permitted on city streets in overhead-line installations. Not even the utility executives agree as to the feasibility of these voltages on overhead systems in populous districts, and much comment is caused by the daring of one company in using 13,000-volt overhead distribution in outlying areas of a large city.

Custom, habit and the type of development undergone by distribution systems work against the adoption of higher distribution voltages even when careful analysis shows that these lines when properly installed are safe, economical and reliable. And yet the financial pressure is getting increasingly stronger and the demands for service increasingly greater, so that a decision about the distribution systems must soon be made, even though every bit of evidence indicates that only the use of very high voltages will adequately solve the economic and engineering problem.

Study, trial and education which begins at home are methods to use to get the answer, but every lead seems to end at the initial theorem, that distribution of electrical energy must occur at voltages very much higher than those used at present on any property. To this may be added as a corollary that any property that takes a half-way step in raising its distribution voltage is wasting good money.

Resistance of Ground Returns

ENGINEERS are accustomed to think of the electrical resistance of earth paths as being of widely varying magnitude dependent upon local conditions. This idea is entirely natural in view of numerous tests which have been made of the voltage necessary to pass current through the earth between electrodes of varying degrees of size and separation. The values of resistance so obtained, while variable, are usually quite high, indicating that as a portion of a circuit for the transmission of energy the earth can have but little value. On the other hand, the troubles which have arisen from electrolysis in structures near the track return of electric railroad systems show that the earth currents may have considerable value. In these cases, however, neighboring underground metallic systems are largely contributory, and even these conspicuous cases of earth return do not necessarily indicate low values of earth resistance.

The value of the resistivity of the earth over long distances is a question of some importance in connection with a mutual impedance between power, telegraph and telephone lines. This mutual impedance obviously has an important bearing on the question of inductive interference. In these cases, however, the length of the ground return is very much greater than has been usual in the power field and in measurements such as those referred to above; moreover, the values of current are very much smaller. An interesting theoretical analysis of the values of mutual resistance and inductance between long circuits grounded to the earth has been made by George A. Campbell and published in the October number of the *Bell System Technical Journal*. This study has been made in the assumption of a constant value for the resistivity of the earth, and it concerns itself with different values of the elevation of the lines and the distances between conductors. The theoretical analysis has been checked by a series of experiments on a number of lines of different lengths, and the results of observation are in general agreement with the theoretical analysis and indicate a value of the resistivity of the earth approximately constant at 0.5 megohm per centimeter cube. It is apparent from these results that, if taken over a considerable length of line, it may be assumed that the earth has a constant value of resistivity. The investigation referred to confines itself to the direct-current case, and due account of penetration into the surface of the earth is taken. A study of the alternating case is promised, with particular reference to the screening effect of the earth in limiting the current to layers near the surface.

The "Danger of Over-lighting"

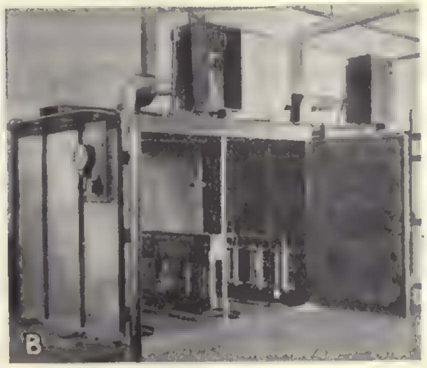
IN MANY respects the aim of human progress is either to improve upon or to become independent of nature. The harnessing of electricity has aided mankind in its efforts to realize this aim. Indoors, electric lighting is often a great improvement over natural lighting, but when one thinks of the sun as a light source and of the intensity of the illumination which it constantly provides over one-half the earth's surface, the accomplishments of mankind in this field seem feeble indeed.

There is such a general misconception of the relative intensities of natural and artificial light that the overwhelming intensity of sunlight compared with ordinary manufactured lighting intensities cannot be overemphasized. One often hears the expression "Too much light" in connection with an artificial lighting installation when, of course, "Too much glare" would probably describe the condition accurately.

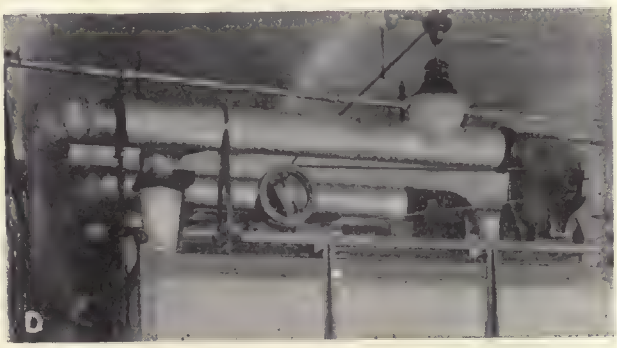
On a clear June day at noon outdoors the earth is illuminated to an intensity of 10,000 foot-candles. The candlepower of the sun is so great that all the artificial light made by mankind dwindles to an insignificant spark by comparison. This candlepower as determined by the foot-candles at the earth's surface, from the sun at its known distance, is about 25×10^{26}. Actually it is much greater owing to the absorption of the earth's and the sun's atmospheres. No adequate conception of this luminous intensity can be obtained from the bare figure. Possibly it would help to put it in terms of the earth's population of about two billion beings. If all the inhabitants of the earth were gathered into one group and if to each person there were given a billion lamps of a billion candlepower each, there would be an aggregate light source which would compete with the sun in luminous intensity. Looked at from another angle, if the present rate of manufacture of light sources were increased a billion times, it would still require a hundred million years to accumulate enough lamps for their combined candlepower to compete with that of the sun.

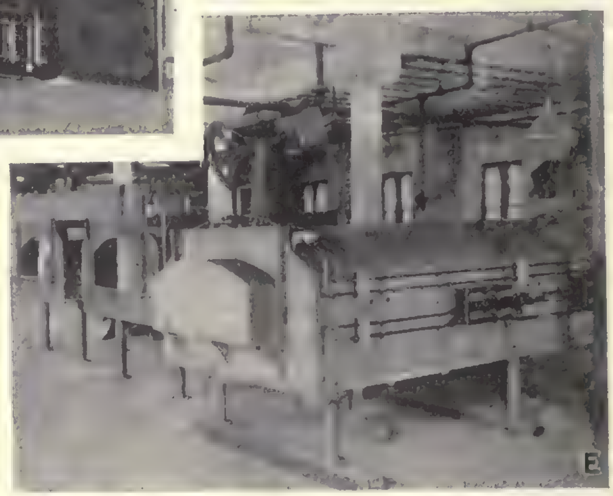
But let the great distance of the sun be eliminated from the computations and consider illuminating the earth from a reasonable earthly distance by means of lamps contained in perfect reflectors. Suppose the population of the earth to be distributed uniformly over its surface. Each person would occupy about a 500-foot square. If present-day 1,000-watt lamps were used and all the light were reflected toward the earth, each 500-foot square would require more than one million such lamps. In other words, each person on the average would have to manufacture one million 1,000-watt lamps every thousand hours or every forty days, or 25,000 lamps each day. These same people would also have to mine the coal and do all the incidental things that the central-station company does to supply the electrical energy to operate the lamps.

It may seem foolish to compile such figures. But at least they may startle us into a realization that there is no danger of overlighting this earth by the feeble facilities of mankind at the present time. Such danger dwindles to less than a suspicion of a ghost of a reality.



Electric Heat Reduces Labor Cost and Eliminates Waste





IN INDUSTRY electricity has rapidly forged to the front because of its adaptability to manufacturing requirements. In handling materials, heat applications, processes and other phases of activity electrical energy can be applied economically and at the same time efficiently.

In the automobile industry electric ovens and conveyors handle many large parts very efficiently, as is indicated in A and C. For japanning and enameling there is available a truck type furnace (B) or continuous conveyor types (F) which enamel or japan many small parts. Ventilation is readily applied by using motor-driven fans (D), and for heat-treating tools and other work requiring higher temperatures furnaces of the type shown in (E) have found a widespread use.

Line and Substation Costs*

Comparison of Costs of 66-Kv., 110-Kv. and 132-Kv. Lines and Substations—Recommended Construction of Substations and Lines—Detailed Unit Costs and Discussion of Overhead Costs

THE work of preparing cost estimates of transmission lines and substations for operation at 66 kv., 110 kv. and 132 kv. involved the compilation of unit prices as of May 1, 1923, the study of costs of right-of-way and other variables depending upon line location, and the determination of the design and type of construction to be used in lines and substations. The result, while it is an estimate, affords a basis for working out specific cost problems and serves to give illustrative figures for checking up specific studies made by others. A summary of costs is shown in Table I.

TABLE I—SUMMARY OF COSTS OF LINES AND SUBSTATIONS

Voltage	Cost of Line per Mile	Cost of 6,000-Kva. Tap Substation	Cost of 15,000-Kva. Sectionalizing Substation
66,000	$18,031	$103,662	$184,253
110,000	18,559	140,145	242,773
132,000	20,362	179,346	299,506

The construction covered is typical of that to be employed in connecting moderately large power centers in a reliable manner. It is not implied that other forms of construction may not be employed to advantage in particular cases. For example, the use of flexible steel or wooden transmission structures may be very well justified under certain conditions. In the time at its disposal the sub-committee was unable to make estimates covering all the possible combinations of materials, but estimates have been so itemized that the difference in cost caused by changes in the type of construction can be readily calculated.

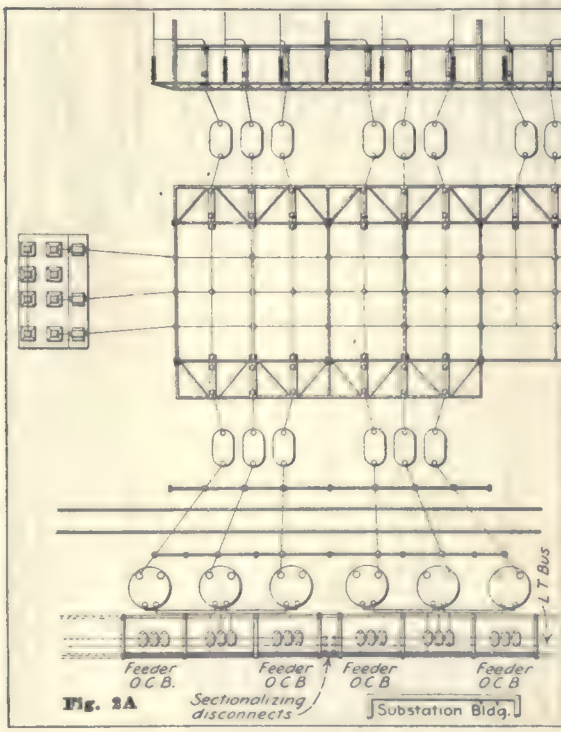
*Abstract from report of transmission lines committee, presented before convention of Empire State Gas and Electric Association, Lake Placid, N. Y., Oct. 8-9, 1923.

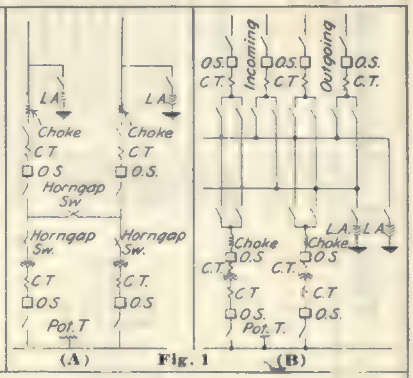
The prices of materials used are those at which the various items could be purchased on May 1, 1923. Unit costs have been given, where practicable, so that the estimates can be brought up to date at any time. Labor costs are the average of the estimates and actual costs of a number of companies which have recently carried on similar construction in New York and neighboring states.

TRANSMISSION LINE COSTS

Right-of-Way.—It was assumed that for permanent construction the cost of a strip of land, purchased outright, would be but little greater than that for tower easements. The 100-ft. strip included in the estimate provides space for additional construction in the future.

Structures.—For the estimates four-legged steel towers carrying two circuits were selected as line supports at all voltages. The same structures are used for the 66-kv. and the 110-kv. line, as it was considered that in any construction of this sort designed to operate at 66 kv. at present the clearances should be large enough to allow the voltage to be raised to 110 kv. Conductor spacing for 66 kv. and 110 kv. is 10 ft. vertical, 20 ft. horizontal, with middle conductor offset 2 ft. on each side of tower. For 132 kv. the spacing is 13 ft. verti-





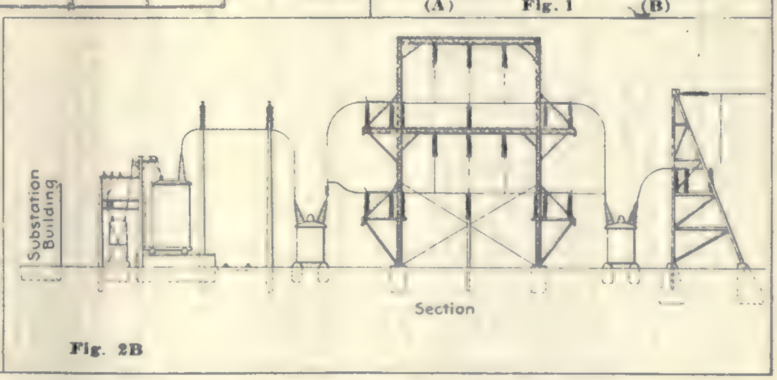


FIG. 1—SINGLE-LINE DIAGRAMS OF SUBSTATIONS: (A) TAP SUBSTATION; (B) SECTIONALIZING SUBSTATION.
FIG. 2—(A) PLAN OF 110,000-VOLT SECTIONALIZING SUBSTATION; (B) SECTION OF 110,000-VOLT SECTIONALIZING SUBSTATION

Table II—Estimate of Cost of Three-Phase, Double-Circuit 30-Mile Line

66 KV.*

Material	
Right-of-Way:	
100 ft. strip, purchased outright, at $3,000 per mile	$90,000
Supports: (galvanized-steel towers, 8 per mile)	
190 suspension towers, 7,250 lb., at $0.065	89,500
32 semi-dead-end towers, 10,375 lb., at $0.065	21,590
18 dead-end towers, 12,700 lb. at $0.065	14,860
18 10-ft. extensions for suspension towers, 1,170 lb. at $0.065	1,370
9 20-ft. extensions for suspension towers, 2,180 lb., at $0.065	1,275
5 10-ft. extensions for semi-dead-end towers, 1,760 lb., at $0.065	572
3 20 ft. extensions for semi-dead-end towers, 3,050 lb., at $0.065	595
3 10-ft. extensions for dead-end towers, 2,250 lb., at $0.065	439
2 20-ft. extensions for dead-end towers, 3,900 lb., at $0.065	507
Concrete Footings (for dead-end towers):	
396 yd. at $20 per yd.	7,920
Conductor:	
No. 4/0 hard-drawn stranded copper, 185.4 miles, 3,488 lb. per mile, at $0.1925	124,500
As an alternative:	
336,400-circ.mil A.C.S.R., 185.4 miles, 2,788 lb. per mile, at $0.2175	112,500
Ground Wire:	
7/16-in. galvanized high-strength steel-strand, 30.9 miles at $152.70	4,720
Insulators:	
5 per string on suspension towers = 5,700, at $2.30	13,110
7 per string on semi-dead-end towers = 2,688, at $3.00	8,064
7 per string on dead-end towers = 1,512, at $3.00	4,536
Line Hardware:	
1,140 suspension clamps with arcing horns, at $1.16	1,322
384 semi-dead-end clamps with arcing horns, at $3.34	1,283
216 dead-end clamps with arcing horns, at $2.34	506
1,740 hooks, at $0.25	435
1,140 upper arcing horns, at $0.40	456
600 upper arcing horns, at $0.34	204
Freight:	
$200 per mile of line	6,000
Labor	
Clearing Right-of-Way:	
$250 per mile	$7,500
Excavation and Backfill:	
2,252 yd. earth (20 per cent wet excavation), at $3.75 per cu.yd.	8,450
563 yd. rock, at $10.60 per cu.yd.	5,965
Note: Rock excavation is assumed to be 20 per cent of total excavation.	
Tower Erection:	
240 towers, at $95	$22,800
Stringing Conductors and Installing Insulators:	
185.4 miles, at $80	14,830
Stringing Ground Wire:	
30.9 miles, at $50	1,545
Distributing Material:	
30 miles, at $350	10,500
Engineering and Supervision:	
30 miles, at $250	7,500
Contingency—10 per cent	47,285
	$520,139
Interest During Construction:	
50 per cent of total for one year, at 8 per cent	20,800
	$540,939
Total cost per mile	18,031

110 KV.

Material	
Right-of-Way:	
100 ft. strip, purchased outright, at $3,000 per mile	$90,000
Supports (galvanized-steel towers, 8 per mile):	
190 suspension towers, 7,250 lb., at $0.065	89,500
32 semi dead-end towers, 10,375 lb., at $0.065	21,590
18 dead-end towers, 12,700 lb., at $0.065	14,860
18 10-ft. extensions for suspension towers, 1,170 lb., at $0.065	1,370
9 20-ft. extensions for suspension towers, 2,180 lb., at $0.065	1,275
5 10-ft. extensions for semi-dead-end towers, 1,760 lb., at $0.065	572
3 20-ft. extensions for semi-dead-end towers, 3,050 lb., at $0.065	595
3 10-ft. extensions for dead-end towers, 2,250 lb., at $0.065	439
2 20-ft. extensions for dead-end towers, 3,900 lb., at $0.065	507
Concrete Footings (for dead-end towers):	
396 yd. at $20 per yd.	7,920
Conductor:	
No. 4/0 hard-drawn stranded copper, 185.4 miles, 3,488 lb. per mile at $0.1925	124,500
As an alternative:	
336,400-circ.mil A.C.S.R., 185.4 miles at 2,788 lb. per mile, at $0.2175	112,500
Ground Wire:	
7/16-in. galvanized high-strength steel-strand, 30.9 miles, at $152.70	4,720
Insulators:	
8 per string on suspension towers = 9,120, at $2.30	20,990
10 per string on semi-dead-end towers = 3,840, at $3.00	11,520
10 per string on dead-end towers = 2,160, at $3.00	6,480
Line Hardware:	
1,140 suspension clamps with arcing horns, at $1.16	1,322
384 semi-dead-end clamps with arcing horns, at $3.34	1,283
216 dead-end clamps with arcing horns, at $2.34	506
1,740 hooks, at $0.25	435
1,140 upper arcing horns, at $0.40	456
600 upper arcing horns, at $0.34	204
Freight:	
$200 per mile of line	6,000
Labor	
Clearing Right-of-Way:	
$250 per mile	$7,500
Excavation and Backfill:	
2,252 yd. earth (20 per cent wet excavation), at $3.75 per cu.yd.	8,450
563 yd. rock, at $10.60 per cu.yd.	5,965
Note: Rock excavation is assumed to be 20 per cent of total excavation.	
Tower Erection:	
240 towers, at $95	22,800
Stringing Conductors and Installing Insulators:	
185.4 miles, at $83	15,380
Stringing Ground Wire:	
30.9 miles, at $50	1,545
Distributing Material:	
30 miles, at $350	10,500
Engineering and Supervision:	
30 miles, at $250	7,500
Contingency—10 per cent	48,668
	$535,352
Interest During Construction:	
50 per cent of total for one year, at 8 per cent	21,414
	$556,766
Total cost per mile	18,559

132 KV.

Material	
Right-of-Way:	
100 ft. strip, purchased outright, at $3,000 per mile	$90,000
Supports (galvanized-steel towers, 8 per mile):	
190 suspension towers, 9,000 lb., at $0.065	111,200
32 semi-dead-end towers, 12,800 lb., at $0.065	26,620
18 dead-end towers, 15,160 lb., at $0.065	17,740
18 10-ft. extensions for suspension towers, 1,450 lb., at $0.065	1,697
9 20-ft. extensions for suspension towers, 2,710 lb., at $0.065	1,585
5 10-ft. extensions for semi-dead-end towers, 2,180 lb., at $0.065	708
3 20-ft. extensions for semi-dead-end towers, 3,760 lb., at $0.065	733
3 10-ft. extensions for dead-end towers, 2,690 lb., at $0.065	524
2 20-ft. extensions for dead-end towers, 4,660 lb., at $0.065	606
Concrete Footings (for dead-end towers):	
492 yd., at $20 per yd.	9,840
Conductor:	
No. 4/0 hard-drawn stranded copper, 185.4 miles, 3,488 lb. per mile, at $0.1925	124,500
As an alternative:	
336,400-circ.mil A.C.S.R., 185.4 miles, 2,788 lb. per mile, at $0.2175	112,500
Ground Wire:	
7/16-in. galvanized high-strength steel-strand, 30.9 miles at $152.70	4,720
Insulators:	
9 per string on suspension towers = 10,260, at $2.30	23,600
11 per string on semi-dead-end towers = 4,224, at $3.00	12,680
11 per string on dead-end towers = 2,376, at $3.00	7,130
Line Hardware:	
1,140 suspension clamps with arcing horns, at $1.16	1,322
384 semi-dead-end clamps with arcing horns, at $3.34	1,283
216 dead-end clamps with arcing horns, at $2.34	506
1,740 hooks, at $0.25	455
1,140 upper arcing horns, at $0.40	456
600 upper arcing horns, at $0.34	204
Freight:	
$250 per mile of line	7,500
Labor	
Clearing Right-of-Way:	
$250 per mile	7,500
Excavation and Backfill:	
2,768 yd. earth (20 per cent wet excavation), at $3.75 per cu.yd.	10,370
692 yd. rock, at $10.60 per cu.yd.	7,330
Note: Rock excavation is assumed to be 20 per cent of total excavation.	
Tower Erection:	
240 towers, at $110	26,400
Stringing Conductors and Installing Insulators:	
185.4 miles, at $85	15,750
Stringing Ground Wire:	
30.9 miles, at $50	1,545
Distributing Material:	
30 miles, at $400	12,000
Engineering and Supervision:	
30 miles, at $250	7,500
Contingency—10 per cent	53,398
	$587,382
Interest During Construction:	
50 per cent of total for one year, at 8 per cent	23,495
	$610,877
Total cost per mile	20,362

* Conductors spaced for operation at 110 kv.

Table III—Detailed Costs of Tap Substations

66 Kv.

Land and Structure

	Land, 1½ acres, at $1,500	$2,250
	Structural steel, 49,130 lb., at $0.055	2,702
	Rails, 13,330 lb., at $0.03	400
	Concrete in place, 340 yd., at $16	5,440
	Copper for low-tension bus, 975 lb., at $0.195	190
	1½-in. galvanized-iron pipe for high-tension bus, 660 ft. at $0.19	125
	Fencing, erected, 550 ft., at $2.50	1,375
	Switchboard building, 25 ft. x 25 ft. x 17 ft. at $0.40	4,250
	Conduit for control wiring	440
	Transformer transfer car	525
	Miscellaneous material	1,200
	Total	$18,897

Equipment

	For installation outdoors:	
7	1,000-kva., 66,000/11,000-volt transformers*	$32,725
2	400-amp., 66,000-volt oil circuit breakers, rupturing capacity 1,000,000 kva.†	
7	300-amp., 66,000-volt TPST gang-operated disconnecting switches	
2	66,000-volt oxide-film lightning arresters	
6	200-amp. suspension-type choke coils	
38	66,000-volt bus supports	
2	400-amp., 15,000-volt oil circuit breakers, rupturing capacity 400,000 kva.	
9	300-amp., 15,000-volt SPST disconnecting switches	32,669
6	300-amp., 11,000-volt current transformers	
2	11,000-volt potential transformers	
3	11,000-volt, fused disconnecting switches	
72	11,000-volt bus supports	
	For installation indoors:	
2	incoming line panels	
1	direct-current battery panel	
1	storage battery	
1	battery-charging set	
3	5-kva., 11,000/110-220-volt station service transformers	
	Freight on equipment and structural material	900
	Total	66,294

Labor

	Erection and wiring	$3,500
	Cartage and rigging	2,200
	Engineering and supervision	1,500
	Total	$7,200
	Contingency—10 per cent	9,239
	Interest During Construction:	
	50 per cent of total for 6 months, at 8 per cent	2,032
	Grand total	$103,662
*7	1,667-kva., 66,000/11,000-volt transformers	$43,225
7	2,500-kva., 66,000/11,000-volt transformers	53,900
7	3,333-kva., 66,000/11,000-volt transformers	65,100
7	5,000-kva., 66,000/11,000-volt transformers	86,450

† To substitute oil circuit breakers having rupturing capacity of 500,000 kva. for those listed, deduct $4,170 from price of switchboard equipment.

110 Kv.

Land and Structure

	(For itemized estimate see under "66 Kv.")	$18,897

Equipment

	For installation outdoors:	
7	1,000-kva., 110,000/11,000-volt transformers*	$46,375
2	400-amp., 110,000-volt oil circuit breakers, rupturing capacity 500,000 kva.†	
7	300-amp., 110,000-volt TPST gang-operated disconnecting switches	
2	110,000-volt oxide-film lightning arresters	
6	200-amp. suspension-type choke coils	
38	110,000-volt bus supports	
2	400-amp., 15,000-volt oil circuit breakers, rupturing capacity 400,000 kva.	
9	300-amp., 15,000-volt SPST disconnecting switches	
6	300-amp., 11,000-volt current transformers	50,635
2	11,000-volt potential transformers	
3	11,000-volt fused disconnecting switches	
72	11,000-volt bus supports	
	For installation indoors:	
2	incoming line panels	
1	direct-current battery panel	
1	storage battery	
1	Battery-charging set	
3	5-kva., 11,000/110-220-volt station service transformers	
	Freight on equipment and structural material	1,100
	Total	$98,110

Labor

	Erection and wiring	$3,800
	Cartage and rigging	2,500
	Engineering and supervision	1,600
	Total	$7,900
	Contingency—10 per cent	12,490
	Interest During Construction:	
	50 per cent of total for six months, at 8 per cent	2,748
	Grand total	$140,145
*7	1,667-kva., 110,000/11,000-volt transformers	$57,925
7	2,500-kva., 110,000/11,000-volt transformers	71,295
7	3,333-kva., 110,000/11,000-volt transformers	85,050
7	5,000-kva., 110,000/11,000-volt transformers	108,850

† To substitute breakers having larger rupturing capacity make additions as follows to price of switchboard equipment: Rupturing capacity 750,000 kva. add $4,263; rupturing capacity 1,000,000 kva., add $7,015.

132 Kv.

Land and Structure

	Land, 1½ acres, at $1,500	$2,250
	Structural steel, 53,430 lb., at $0.055	2,940
	Rails, 14,250 lb., at $0.03	428
	Concrete in place, 340 yd., at $16	5,440
	Copper for low-tension bus, 975 lb., at $0.195	190
	1½-in. galvanized-iron pipe for high-tension bus, 750-ft., at $0.19	142
	Fencing, erected, 575 ft. @ $2.50	1,438
	Switchboard building, 25 ft. x 25 ft. x 17 ft., at $0.40	4,250
	Conduit for control wiring	450
	Transformer transfer car	525
	Miscellaneous material	1,200
	Total	$19,253

Equipment

	For installation outdoors:	
7	1,000-kva., 132,000/11,000-volt transformers*	$60,025
2	400-amp., 13,200-volt oil circuit breakers, rupturing capacity 560,000 kva.†	
7	300-amp., 13,200-volt TPST gang-operated disconnecting switches	
2	132,000-volt oxide-film lightning arresters	
6	200-amp. choke coils	
38	132,000-volt bus supports	
2	400-amp., 15,000-volt oil circuit breakers, rupturing capacity 400,000 kva.	
9	300-amp., 15,000-volt SPST disconnecting switches	
6	300-amp. current transformers	70,717
2	11,000-volt potential transformers	
3	11,000-volt fused disconnecting switches	
72	11,000-volt bus supports	
	For installation indoors:	
2	incoming line and transformer panels	
1	battery panel	
1	storage battery	
1	battery-charging set	
3	5-kva., 11,000/110-220-volt station service transformers	
	Freight on equipment and structural material	1,250
	Total	$131,992

Labor

	Erection and wiring	$4,100
	Cartage and rigging	2,800
	Engineering and supervision	1,700
	Total	$8,600
	Contingency—10 per cent	15,985
	Interest During Construction:	
	50 per cent of total for six months, at 8 per cent	3,516
	Grand total	$179,346
*7	1,667-kva., 132,000/11,000-volt transformers	$69,510
7	2,500-kva., 132,000/11,000-volt transformers	84,175
7	3,333-kva., 132,000/11,000-volt transformers	98,000
7	5,000-kva., 132,000/11,000-volt transformers	122,255

† To substitute oil circuit breakers having rupturing capacity of 842,000-kva. for those listed, add $4,200 to price of switchboard equipment. To substitute oil circuit breakers having rupturing capacity of 1,500,000 kva. for those listed, add $6,082 to price of switchboard equipment.

Table IV—Detailed Costs of Sectionalizing Substation

66 KV.

Land and Structure

	Land, 2 acres, at $1,500	$3,000
	Structural steel, 112,580 lb., at $0.055	6,192
	Rails, 13,330 lb., at $0.03	400
	Concrete in place, 477 yd., at $16	7,632
	Copper for low-tension bus, 975 lb., at $0.195	190
	1½-in. galvanized pipe for high-tension bus, 2,200 ft., at $0.19	418
	Fencing, erected, 750 ft., at $2.50	1,875
	Switchboard building, 30 ft. x 30 ft. x 17 ft., at $0.40	6,120
	Conduit for control wiring	800
	Transformer transfer car	525
	Miscellaneous material	2,000
	Total	$29,152

Equipment

	For installation outdoors:	
7	2,500-kva., 66,000/11,000-volt transformers*	$53,900
6	400-amp., 66,000-volt oil circuit breakers, rupturing capacity 1,000,000 kva.†	
16	300-amp., 66,000-volt TPST gang-operated disconnecting switches	
2	66,000-volt oxide-film lightning arresters	
112	66,000-volt bus supports	
6	200-amp. suspension choke coils	
2	400-amp., 15,000-volt oil circuit breakers, rupturing capacity 400,000 kva	
9	600-amp., 15,000-volt SPST disconnecting switches	
6	500-amp., 11,000-volt current transformers	69,988
2	11,000-volt potential transformers	
3	11,000-volt fused disconnecting switches	
72	11,000-volt bus-supports	
	For installation indoors:	
2	incoming line panels	
2	transformer panels	
1	battery panel	
1	storage panel	
1	battery-charging set	
3	5-kva., 11,000/110-220-volt station service transformers	
	Freight on equipment and structural material	1,900
	Total	$125,788

Labor

Erection and wiring	$5,000
Cartage and rigging	2,500
Engineering and supervision	1,800
Total	$9,300
Contingency—10 per cent	16,400
Interest During Construction:	
50 per cent of total for six months, at 8 per cent	3,613
Grand total	$184,253

*7 3,333-kva., 66,000/11,000-volt transformers ... $65,100
7 5,000-kva., 66,000/11,000-volt transformers ... 86,450

† To substitute oil circuit breakers having a rupturing capacity of 500,000 kva. for those listed, deduct $12,110 from price of switchboard equipment.

110 KV.

Land and Structure

(For itemized estimate see under "66 Kv."	$29,152

Equipment

	For installation outdoors:	
7	2,500-kva., 110,000/11,000-volt transformers*	$71,295
6	400-amp., 110,000-volt oil circuit breakers, rupturing capacity 500,000 kva.†	
16	300-amp., 110,000-volt TPST gang-operated disconnecting switches	
2	110,000-volt oxide-film lightning arresters	
112	110,000-volt bus supports	
6	200-amp. suspension choke coils	
2	400-amp., 15,000-volt oil circuit breakers, rupturing capacity 400,000 kva	
9	600-amp., 15,000-volt SPST disconnecting switches	
6	500-amp., 11,000-volt current transformers	103,676
2	11,000-volt potential transformers	
3	11,000-volt fused disconnecting switches	
72	11,000-volt bus supports	
	For installation indoors:	
2	incoming line panels	
2	transformer panels	
1	battery panel	
1	storage battery	
1	battery-charging set	
3	5-kva., 11,000/110-220-volt station service, transformers	
	Freight on equipment and structural material	2,300
	Total	$177,271

Labor

Erection and wiring	$5,300
Cartage and rigging	2,800
Engineering and supervision	1,850
Total	$9,950
Contingency—10 per cent	21,640
Interest During Construction:	
50 per cent of total for six months, at 8 per cent	4,760
Grand total	$242,773

*7 3,333-kva. 110,000/11,000-volt transformers ... $85,050
7 5,000-kva. 110,000/11,000-volt transformers ... 108,850

† To substitute breakers having larger rupturing capacity make additions as follows to price of switchboard equipment: Rupturing capacity 750,000 kva., add $11,823; rupturing capacity 1,000,000 kva., add $19,615.

132 KV.

Land and Structure

	Land, 2 acres, at $1,500	$3,000
	Structural steel, 127,025 lb., at $0.55	6,986
	Rails, 14,250 lb., at $0.03	428
	Concrete in place, 477 yd., at $16	7,632
	Copper for low-tension bus, 975 lb., at $0.195	190
	1½-in. galvanized pipe for high-tension bus, 2,500-ft., at $0.19	475
	Fencing, erected, 830 ft., at $2.50	2,075
	Switchboard building, 30 ft. x 30 ft. x 17 ft., at $0.40	6,120
	Conduit for control wiring	825
	Transformer transfer car	525
	Miscellaneous material	2,000
	Total	$30,256

Equipment

	For installation outdoors:	
7	2,500-kva., 132,000/11,000-volt transformers*	$84,175
6	400-amp., 132,000-volt oil circuit breakers, rupturing capacity 560,000 kva.†	
16	300-amp., 132,000-volt TPST gang-operated disconnecting switches	
2	132,000-volt oxide-film lightning arresters	
112	132,000-volt bus supports	
6	200-amp. suspension choke coils	
2	400-amp., 15,000-volt oil circuit breakers, rupturing capacity 400,000 kva	
9	600-amp., 15,000-volt SPST disconnecting switches	
6	500-amp., 11,000-volt current transformers	138,958
2	11,000-volt potential transformers	
3	11,000-volt fused disconnecting switches	
72	11,000-volt bus supports	
	For installation indoors:	
2	incoming line panels	
2	transformer panels	
1	battery panel	
1	storage battery	
1	battery-charging set	
3	5-kva., 11,000/110-220-volt station service transformers	
	Freight on equipment and structural material	$2,700
	Total	$225,833

Labor

Erection and wiring	$5,800
Cartage and rigging	3,100
Engineering and supervision	1,950
Total	$10,850
Contingency—10 per cent	26,694
Interest During Construction:	
50 per cent of total for six months, at 8 per cent	5,873
Grand total	$299,506

*7 3,333-kva., 132,000/11,000-volt transformers ... $98,000
7 5,000-kva., 132,000/11,000-volt transformers ... 122,255

† To substitute oil circuit breakers having rupturing capacity of 842,000 kva. for those listed, add $12,600 to price of switchboard equipment. To substitute oil circuit breakers having rupturing capacity of 1,500,000 kva. for those listed, add $17,202 to price of switchboard equipment.

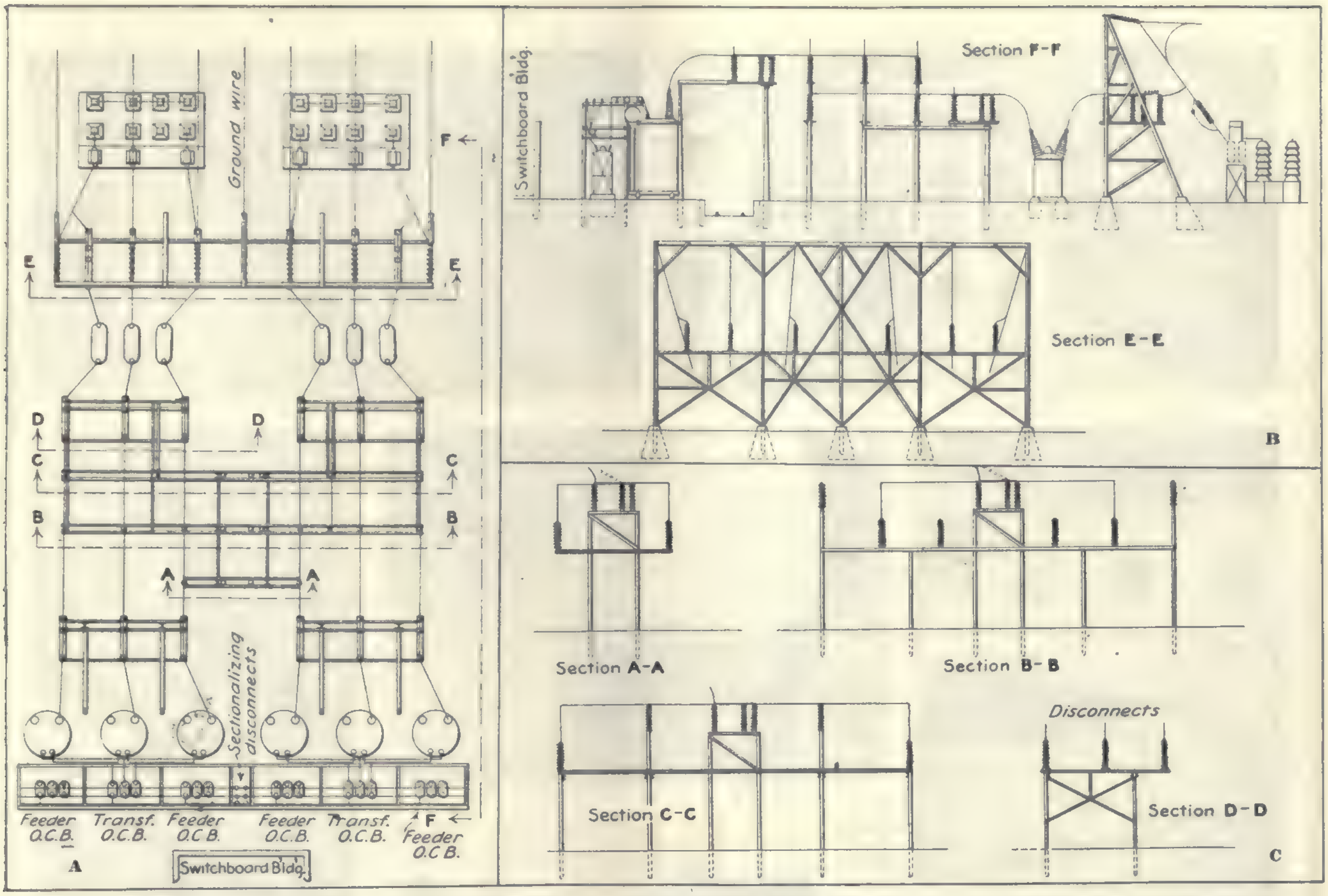


FIG. 3—(A) PLAN OF 110,000-VOLT TAP SUBSTATION; (B) SECTION OF 110,000-VOLT TAP SUBSTATION; (C) DETAILS OF 110,000-VOLT TAP SUBSTATION

cal, 20 ft. horizontal, with middle conductor offset 3 ft. outward on each side of tower. The minimum clearance to earth is 25 ft. The maximum cable loading is 8 lb. per square foot wind pressure on the projected area of the conductor, when the latter is covered with ½-in. thickness of ice.

Ground Wire.—A ground wire was included to insure positive grounding of all structures, to insure positive relaying and for lightning protection.

Insulators.—Insulators were used as follows:

Line Voltage	Number of Units in Suspension	Number of Units at Dead Ends
66,000	5	7
110,000	8	10
132,000	9	11

Standard 10-in. units are used on suspension towers. To avoid the use of yokes high-strength units are used at semi-dead-end and dead-end structures.

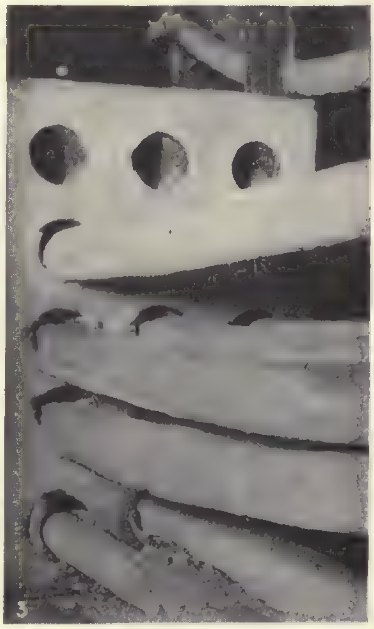
Conductors.—The line costs are based on a conductor size of No. 4/0 copper or equivalent in steel-core aluminum. This size was fixed after a consideration of practice on most of the large transmission systems of this country as being in line with the requirements of interconnecting transmission lines. No. 4/0 conductors provide sufficient conductivity for the interchange anticipated, but excessive corona loss is to be expected if larger conductors are not used, at elevations above sea level, with 132,000-volt transmission.

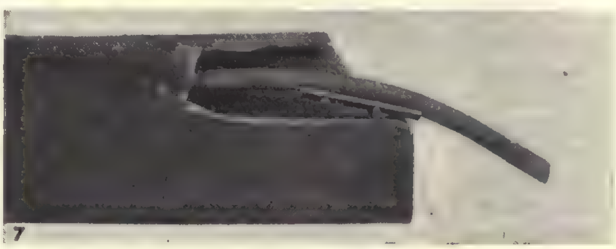
Telephone Facilities.—No telephone line is included in the estimate. For the purpose of load dispatching the transmission line itself may be used for telephoning by means of carrier-current telephony. Line patrolmen's telephone stations may be connected to the lines of the telephone company at convenient points.

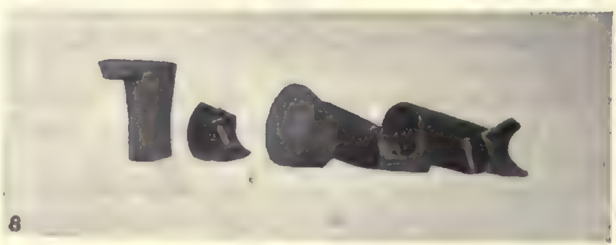
Two types of substations are covered by the estimates—first, a tap substation to be installed solely for the purpose of taking power from the lines; second, a sectionalizing substation to be installed at points where the transmission circuits are to be sectionalized. The accompanying illustrations show the equipment and its arrangement. The estimates given cover the cost of the substations equipped with various probable sizes of transformers and oil circuit breakers. The low-tension bus voltage is 11,000 in all cases. No equipment on outgoing low-tension feeders is included in the estimates. All substation equipment is for 60-cycle service.

Substation transformers are all single-phase self-cooled units equipped with ratio adjusters. All transformer banks are star-connected on the high-tension side and delta-connected on the low-tension side. Substations are arranged for operation with the high-tension neutral grounded, but insulation is provided for the neutral bus in case a ground resistance is used or non-grounded operation desired.

The complete membership of the transmission lines committee which compiled the report consisted of E. P. Peck, chairman; C. A. Bacon, O. H. Bundy, S. Piek, W. C. Fisher, William Nesbit, H. M. Brinckerhoff, C. A. Davis, H. Goodwin, Jr., John L. Harper, R. A. Paine, Jr., W. C. Pearce, H. G. Davis, Sydney Alling, H. L. Kneisley, H. R. Cox, T. S. Worcester. Sydney Alling and Messrs. Kneisley, Cox, Worcester and Piek formed the sub-committee which compiled the data on line and substation costs.







Why Good Duct Construction Is Needed

Fig. 1—Old-style duct construction. Too many ducts are used. They are too close together. Wood or lead cushions are used, and asbestos paper is used for fire protection.

Fig. 2—Later type of duct construction. Note the wider duct spacing.

Fig. 3—Ducts not sufficiently separated. Concrete fire protection is used and lead cushions. The protection cannot be extended into the ducts.

Fig. 4—Measuring the extent of the expansion and contraction of a cable. This is readily done by using a graphic meter with a line attached to the meter pointer and the cable.

Fig. 5—Lead cushion forced out of duct and damaged lead sheath.

Fig. 6—Types of shields used that can be forced out of ducts. Note wear on the lead shields.

Fig. 7—Great care must be used with shields to get a correct angle between cable and shield.

Fig. 8—Roller-support duct end devices, showing removable form for concreting. The smaller type is used where ducts are closely spaced.

Fig. 9—Usual construction of duct ends using larger roller supports. The roller is removable; no lubricant is required; fire protection can be extended into the duct opening without rubbing.

Fig. 10—Large duct-end roller-support device installed in duct-end model.

Maintenance of Cables in Manholes

Discussion of Fire Protection Methods and Duct-End Protection—Tests on Fire Protection Applications—Description of Duct-End Protective Device

By F. L. ROHRBACH
Engineer of Underground System, Washington Water Power Company

DURING the last two or three years more attention than formerly has been given to the operation and maintenance of cables in manholes. In most cases the manholes and conduit lines have been designed and built by one department and the cables installed and operated by another. As a result cables are usually installed to fit the duct line instead of the duct line being built for the proper operation of cables.

In the past manholes have usually been too small and the conduit lines have contained too many ducts. These two conditions have made it all the harder to install and operate cables properly. The best practice at present is to build manholes at least 6 ft. square, preferably with rounded corners, and to install not more than fourteen or sixteen ducts in a run. With manholes and duct lines installed properly there are still two very important things to be observed, fire protection of cables and duct-ending at the manhole.

Fire Protection of Cables

Special protection by brick or transite board is sometimes used, but it is not applicable to all cables and the cost is very high. For cables in general some form of concrete or asbestos is used. Both the cost and the degree of protection vary according to the method of application. Methods in common use are:

1. Concrete with $\frac{1}{4}$-in. rope.
2. Concrete with metal lath (do not use on single conduit or with alternating current).
3. Asbestos tape and waterglass.
4. Asbestos paper and waterglass.
5. Asbestos paper and steel tape (do not use on single conduit or with alternating current).

The methods of installing and using these applications may be outlined as follows:

1. Paint the lead sheath with waterglass. Soak the rope in water and coil it around the cable, leaving $\frac{1}{4}$ in. space between turns. Then apply concrete (one part cement, two parts sand) from $\frac{7}{16}$ in. to $\frac{9}{16}$ in. over the sheath.

2. Paint the lead sheath with waterglass. Cut the metal lath in strips and form it around the cable, fastening it with wire. Then apply concrete from $\frac{5}{16}$ in. to $\frac{9}{16}$ in. over the sheath.

3. Use asbestos tape 2 in. wide and $\frac{1}{16}$ in. thick. Soak it in waterglass and then wrap it around the cable, lapping one-half, after which give it one or more coats of waterglass.

4. Use asbestos paper (22 lb. per 100 sq.ft.) about $\frac{1}{16}$ in. thick and cut in strips 2 in. wide. Wrap the first layer of paper in one direction and then paint it with waterglass. Wrap the second layer in the opposite direction and paint it with one or more coats of waterglass.

5. Use two layers of asbestos paper as in paragraph 4 and then wrap with one layer of galvanized tape (No. 28 gage) cut $\frac{3}{4}$ in. wide.

TABLE I—COMPARISON OF COSTS PER LINEAR FOOT OF 1,000,000-CIRC.MIL CABLE

(Based on protecting two cables in a manhole and then moving equipment to the next manhole)

Type	Material, Cents	Labor, at 50 Cents per Hour, Cents	Total, Cents	Remarks
1	6	12	18	....
2	10	10	20	....
3	31	4	35	....
4	4	8	12	Two layers
4	8	12	20	Four layers
4	12	16	28	Six layers
5	8	14	22	....

Unit costs: Rope, 1 cent per linear foot; cement, \$3.75 barrel; sand, \$2 per yard; metal lath, 5 cents per square foot; roll of asbestos paper, weight 100 lb., \$10; galvanized iron, No. 28 gage, 30 in. x 96 in. \$1.10; woven asbestos tape, 6 cents per foot.

Costs and Tests

Samples of the types given were made up by protecting 12-in. lengths of 1,000,000-circ.mil cable having $\frac{5}{32}$-in. lead sheath. The stranded copper and insulation were then removed so that the first indication of sheath failure could be noted by looking lengthwise through the lead sheath. The comparative costs are given in Table I.

Tests were made by heating the samples over a cableman's gasoline furnace, a metal strip being placed so as to distribute the heat. The results of the tests are given in Table II.

TABLE II—TESTS OF SAMPLE CABLES

Type	First Indication of Sheath Melting, Min.	Sec.	Remarks
1	6	20	$\frac{3}{16}$-in. rope, $\frac{9}{16}$-in. concrete over lead
2	3	40	Metal lath, $\frac{5}{16}$-in. concrete over lead
3	1	35	$\frac{1}{16}$-in. asbestos tape, two layers
3	1	10	$\frac{1}{16}$-in. asbestos tape, two layers
4	1	45	$\frac{1}{32}$-in. asbestos paper, two layers
4	2	30	$\frac{1}{32}$-in. asbestos paper, three layers
4	3	30	$\frac{1}{32}$-in. asbestos paper, four layers
4	5	45	$\frac{1}{32}$-in. asbestos paper, six layers
5	1	40	$\frac{1}{32}$-in. asbestos paper, two layers and 1 steel tape

The time noted was the elapsed time for sufficient heat to pass through the protection and melt a spot through the lead sheath.

In case of a manhole fire lasting for some time there is no question in my opinion that concrete protection is by far the best. I have had several experiences where the asbestos tape or paper has been reduced to ashes, thus allowing the insulation proper of the cable to be destroyed. On the other hand, concrete, no matter how hot, will retain its shape and thus protect the cable insulation by preventing air getting to it in sufficient quantity to aid combustion.

The one objection to concrete is that it is seriously damaged by the expansion and contraction which occurs

in all cables owing to the heating and cooling of the conductor caused by the varying load. Most of the damage can be prevented by installing the cable with the proper bends and taking especial care that it is free to move on the brackets. Reverse curves or sharp bends should be avoided. Where the protection at a particular place is frequently damaged, it can be helped, when repaired, by using a layer of garden hose or other suitable material under the concrete. This soft material will take the force of the expansion and prevent damage.

Duct-End Construction in Manholes

Probably more serious cable breakdowns occur at the manhole duct end than at any other place on the system. These burn-outs are caused by several conditions—the cables are closer together, expansion and contraction of cables cause very serious wear of the sheath on the duct edge, and fire protection usually stops from 1 in. to 3 in. from the duct entrance.

The oldest duct lines were built mainly of multiple-tile duct and no attempt was made to separate the ducts at their ends. After some time, when fiber ducts and single-tile ducts were introduced, more attention was given to the question of spreading out the ducts at their entrance into the manhole. Later on the idea of belling the duct mouth was introduced, so that at the present time provision is made for separating the cables and for carrying the fire protection into the duct end.

Apparently very little has been done to avoid the wear on the sheath at the duct edge, except to install cushions of wood, leather, metal or lead. In many instances these cushions are worn through or are pushed out into the manhole and the lead sheath must then take the wear. There is no question that the majority of burn-outs in the manhole could be avoided by preventing this filing effect at the duct edge. Belling the duct mouth helps, but this alone will not prevent the damage. When the extent of the movement of cables and the weight that must be supported at this point are appreciated, it is evident that damage can be avoided only by the proper support of the cable.

Cables are sometimes cemented at the duct mouth to restrain them, thus preventing wear on the sheath. This is objectionable because the conductor might move independently of the sheath and because all ventilation at the duct mouth is stopped.

If an average length of cable installed between two manholes is considered, it will be found that the cable at the center of the line remains at rest under all changes of load. From the center point and going toward the mouth of each manhole the movement increases, and it is greatest at the duct end. There is more or less wear along the full length of the duct, but as the cable is supported at virtually every point, the damage is slight as compared with that at the duct edge where the cable must form an angle. This means that the duct edge supports at least from 2 ft. to 3 ft. of cable in addition to the weight of the fire protection.

The Washington Water Power Company, Spokane, Wash., has adopted a duct-ending device,* the installation and details of which are clearly shown in the pictures on page 1164. Many experiments were made, movements of cables were measured, wear and displacement of different types of cushions were noted, and several kinds of movable supports were tried out.

The installation of this device solves several problems. First, it gives a spreading duct line; second, it allows the fire protection to be carried into the duct mouth and also prevents it from rubbing on the duct; third, most important of all, it prevents wear on the lead sheath, thereby cutting down the expense of inspection and removing the breakdown hazard at this point.

October Activities 6.6 per Cent Above Normal

INDEX figures upon which the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" is based indicate that activities in many of the industries of the country were further curtailed during October. All the main industries which influence activity in the electrical industry reported de-

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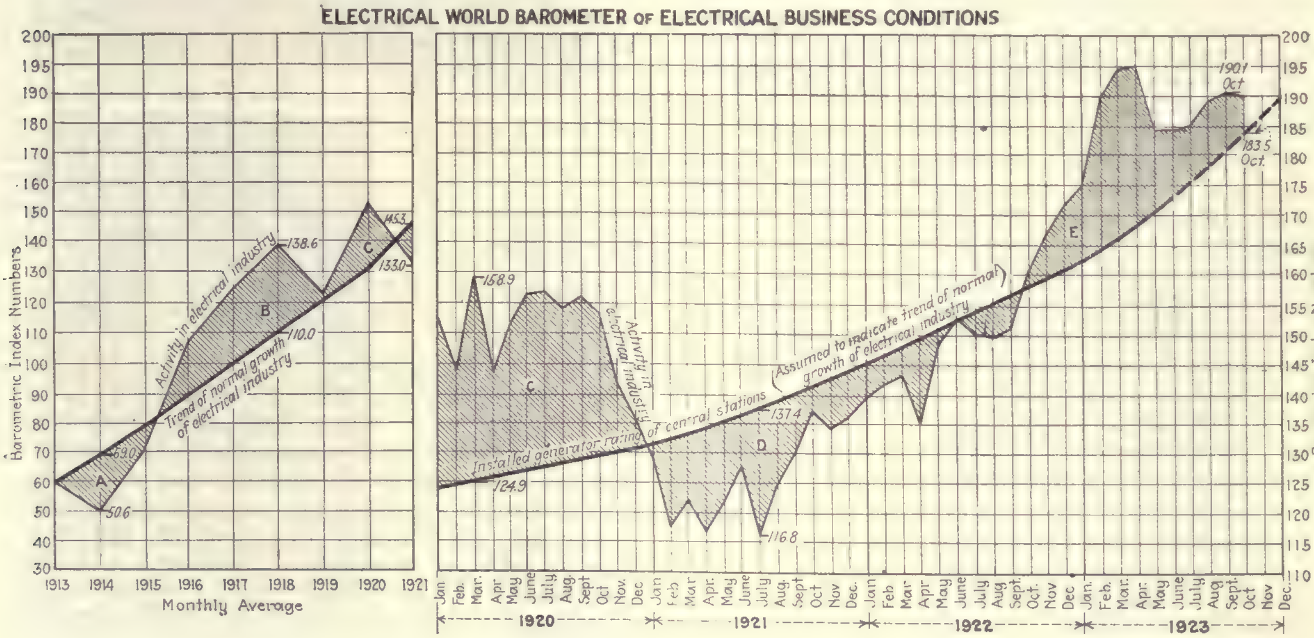
ELECTRICAL WORLD BAROMETER OF ELECTRICAL BUSINESS CONDITIONS



creased activity during October as compared with September—that is, when referred to their respective normal growths.

The data upon which the "ELECTRICAL WORLD Barometer" is based indicate a decrease of 0.6 point on the scale as compared with September activities. During this interval the industry has grown 2.7 points, leaving a net decrease in activities of 3.3 points on the barometer scale as compared with September. The electrical industry as a whole was operating in October at 6.6 points or per cent above what would have been the point of seasonal demand if growth in the industry had been normal. In September it was operating at 9.9 and in August at 11.3 points or per cent above the point of normal demand.

The Outlook for Utilities

President Walter H. Johnson of the N. E. L. A. Presents Facts and Figures of Vital Interest to Electric Service Companies

AN ADDRESS full of facts and figures regarding the growth of the public utility industry, definitely planned special expenditures for the coming year, capitalization, extent of customer ownership, the problems of rural service and transcontinental superpower lines was presented by Walter H. Johnson, president of the National Electric Light Association, at the convention of the Great Lakes Geographic Division in French Lick recently.

Mr. Johnson, admitting the imperative necessity for the industry to expand, said that none the less it is a mistake to let it grow too fast. The expenditures must be kept proportional to the income or to the definitely estimated increase in income. This year it is conservatively estimated that the energy output of central-station companies will reach 55,000,000,000 kw.-hr., or an increase of 15 per cent over 1922. In other words, there has been a greater increase in the last six years than in the previous twenty-five years. Sixty-five per cent of this amount will be generated from steam plants and 35 per cent from hydro-electric plants.

FINANCIAL PROBLEM ONE OF THE GREATEST

The financial problem is one of the greatest confronting the industry, Mr. Johnson declared. Projects costing $602,142,000 are actually known to be under construction and will be completed during the current year. It is estimated that the amount actually expended during 1923 will reach at least $650,000,000. This will bring the total investment in the electric light and power industry to $5,750,000,000. Despite this fact, the reduced rates which are being put into effect by many companies will permit them to increase their gross earnings only $70,000,000. To dissipate the misapprehension that utilities are owned by private interests, Mr. Johnson pointed out that their securities are held by 2,000,000 citizens and 29,000 banks. The banks have placed $1,700,000,000 belonging to 27,000,000 depositors, as an investment in these utilities.

The fact that one company alone reports that it is placing meters at the rate of 6,000 a month is an indication of the rate of increase in customers' service. It is estimated that by Dec. 31 of this year there will be 13,356,000 central-station company customers in the United States, or an increase of 1,150,000. Of these, 125,000 will be new commercial customers and 25,000 new power customers.

Extension of electric service to rural communities is another problem which is giving many company executives considerable concern. In this field there is great opportunity for development, coupled with considerable danger of overdevelopment, or at least too rapid development, being urged by the agricultural element and by political agitators. This development, even more than urban development, must be made upon a sound economic basis; it must be commercially practicable from the viewpoint both of the electric light and power companies and of the farmers. Mr. Johnson alluded to the steps being taken to solve the problem through the co-operation of the United States Department of Agriculture, the National Electric Light Association, the American Farm Bureau Federation, the American Association of Agricultural Engineers and isolated farm-plant manufacturers. Rural-line extension and the development of farm electrification are closely tied in with the so-called superpower development, he said. Whenever and wherever existing systems are interconnected and new distribution systems are built and interconnected the possibilities of extending service to the farmer are increased.

Superpower upon a national scale or upon any scale very much more extensive than that already under way will require considerable additional investment and new capital, the speaker went on. It is estimated that the national superpower plan, as outlined at the N. E. L. A. convention last June, would require a minimum of $5,000,000,000, an amount nearly equal to the total amount already invested in the industry. Since it is admitted that at least ten years would be required for building such a superpower system, an additional investment of $500,000,000 annually would be needed.

Today one-third of the entire population, living in 9,500,000 homes wired for electricity, are supplied with electric service, Mr. Johnson declared, and in 1920 more than 33,000,000,000 kw.-hr. of electrical energy was sold to industrial customers alone.

Water Powers of Czechoslovakia

THE Czechoslovak government, realizing the importance of coal as an item of export and the necessity of curtailing consumption of coal by domestic industries, is contemplating extensive improvements to develop and conserve the country's water power, according to a report by American Consul C. S. Winance, at Prague.

The most important project now under consideration is the building of three dams across the Thaya River, near the Austrian border. The first dam will be constructed between Bitov and Uranov, making a basin of 180,800,000 cu.m. content; the second dam will be near Podmole and will create a basin of 16,300,000 cu.m. content, and the third dam will be constructed at Znojmo and will create a basin of 7,000,000 cu.m. content. It is stated, the Consul says, that the dams of the Thaya will be the largest in Central Europe. The work has been begun under the direction of the Czechoslovakian national government and the Moravian provincial administration.

According to statements of experts, Czechoslovakia has water-power resources amounting to approximately 1,185,000 hp., with a possible annual production of 5,400,000,000 kw.-hr.

Who Sells Electrical Appliances?—I

A City of 500,000

"Electrical World" Survey of Retail Outlets for Electrical Merchandise, Showing Comparison of Sales by Electrical Dealers, Central-Station Company, Hardware and Department Stores, with Indications of the Trend

IN PRESENTING an analysis of the relative importance of the various retail outlets for electrical appliances in a given city it is interesting to know its size, the make-up of population and the nature of its industries and business. Such characteristics do not necessarily affect the electrical business more or less than they do any other business, but they do form an essential part of the picture for the purpose of comparison with conditions existing in other localities. The first city under consideration has a population of approximately half a million, including adjacent suburbs whose shoppers give most of their business to the local retail merchants. Approximately 80 per cent of this population are native-born, between 9 and 10 per cent are foreign-born and about the same percentage are colored. The city is situated in a highly developed agricultural section, and the chief industries are dependent upon the utilization of farm produce. The city is an important railroad center and because of its geographic location is particularly suited as a point of wholesale distribution.

Data on appliance sales have been confined to the principal devices sold by dealers of all classes in order that conditions in different cities may later be put on a comparable basis. Likewise, expressions by various retailers reflect their opinion upon fundamental principles or problems common to retail selling of electrical appliances. Four different classes of merchants—hardware stores, department stores, electrical contractors and dealers and the central-station company—were found to be the main retail outlets in this particular city.

There appears to be very little cohesion among the different branches of the electrical fraternity in the city. One man graphically termed it a "wildcat" town with respect to the wide variety and quality of merchandise sold. A movement is on foot, however, to form an electrical league with a paid executive manager, and it is hoped by this means to create a better spirit of co-operation. It is the aim to relieve price cutting on appliances and also to raise the general standard of electrical wiring. As the situation now exists there are a great many "basket" electricians.

Neither the department stores nor the hardware stores as a class figure largely in the total volume of appliance sales, although there is one store of each kind doing a very good business. The volume of business done by these stores and other retailers will be discussed in the order in which they were visited by a representative of the ELECTRICAL WORLD.

HARDWARE STORES

Hardware dealer "A" is one of the livest all-around merchants in the Middle West, and though bearing a certain reputation as a cut-price store, in actual practice the selling prices of articles are very close to customary figures. The standard lines of heating devices are sold at regular prices, and when leaders are offered they are merchandise specially purchased for the sale. One instance was that of a washer sold at a reduction on deferred payments. Sixty-eight of these were sold out of the store in one week. Extensive advertising is carried on in all of the principal newspapers. Much of this takes the form of "\$1.98" and "\$4.95" sales. The copy is good and resembles department-store advertising.

A most complete line is carried, including mangles and electric cookers. Electric appliances, according to the department manager, are one of the main items of the store's business. The volume of sales is increasing steadily, and the appliances form the best all-year-round merchandise in the store. Competition from the central station is considered fair and its advertising of benefit to other merchants.

The salesmen here appeared to be enthusiastic about electric devices and said that they were not difficult to sell; in fact, they enjoyed selling them. The amount of servicing has been comparatively small.

Hardware dealer "B" had an unfortunate experience with washing machines in that he was overstocked, had difficulty in moving them and is now retrenching on electrical appliances generally. He asserted that he was a hardware man, not in the house-furnishing business, and would stick to his own trade.

DEPARTMENT STORES

The one department store which is doing a large volume in appliances sells on deferred payments, and vacuum cleaners are handled on the resale plan. Outside salesmen are used and a service department is maintained. The merchandising manager here stated that the department store is one of the logical outlets for appliances as there is sufficient voluntary demand to make the business profitable.

Most purchases of electrical appliances are made direct from manufacturers, and thus discounts are satisfactory. Department stores, he stated, must be considered by the manufacturer on the same basis as a jobber and accorded the same discounts. The local central-station company, he felt, was not realizing as much as it could from appliance sales, partly because it had no outside sales force and partly because of the disinclination of some people to buy from the public utility. Competition was very keen because of the number of branch and specialty stores and price cutting by some of the dealers. He predicted that this business in the department store would increase rapidly for several years for two reasons: First, because the demand has not yet reached a point where it would level off and become steady, and, second, because more people are buying from department stores and not from dealers. He cited the fact that some fifteen electrical contractors who had engaged prominently in electrical merchandising had failed in the last three years. (This statement was later confirmed by the president of the contractors' association.)

Purpose of the Investigation

NOBODY knows today who is selling electrical appliances or the proportionate volume of sales by the different retail outlets. The need for more specific knowledge of the present status of the appliance business and the direction in which it is moving has become increasingly urgent. Electrical merchandise has assumed a most important position in the industry as a means of building up the residential load, as an important factor in public good will and as a source of profit to the manufacturer, jobber, dealer and central-station company. Because of this widespread interest the ELECTRICAL WORLD is conducting a personal investigation of the conditions now obtaining in representative cities throughout the country. It aims to determine by direct study, on the ground, who is selling the appliances, why and how many.

The ELECTRICAL WORLD survey has been undertaken with a view to setting forth the facts as found without attempting either to prove or disprove any theory, statement or premise. Opinions, when given in this or subsequent articles, bearing upon fundamental principles of the business are those expressed by the people interviewed. Observations of significant conditions are based upon definite trends or circumstances existing in a city. As most of the data and information are of a confidential nature, it is obviously impossible to publish the names of the localities surveyed, although certain peculiarities may enable readers to identify some of the cities.

THIS is the first of a series of articles to be published in the ELECTRICAL WORLD analyzing the volume and trend of retail sales of electrical appliances. The next will appear in an early issue, and when the series has been completed a composite analysis will be made.

Of the two other department stores, one carried only small appliances and the volume of sales was not large. The manager of the house-furnishing department stated that electrical merchandise was permanent in the store, but he believed that the growth of the business had been slow in their particular case. Deferred payments were not offered, and this store is not inclined to increase its stock until greater demand warrants. "Washers and cleaners," he said, "are too well represented by branch stores for us to engage in the business."

The third department store does not cater to installment payments, and this is reflected in its sales of washing machines and vacuum cleaners, which are very small. Other appliances of standard makes are carried and well displayed in the house-furnishing department. Not a great deal of advertising is given to electrical merchandising, and it appears that much of the business is of a seasonal nature. Most sales are made in the spring and around the holidays.

ELECTRICAL DEALERS

The dealers selling electrical appliances may be divided into three groups—factory branch or specialty stores, electric shops and contractors who also handle appliances. The factory branch is by far the most important, and it is rather difficult in some cases to differentiate between this and the electric store. Several of these are located in the heart of the shopping district and pay very high rentals. Competition is keen and not any too clean at times. Price cutting on standard makes of appliances is rather freely indulged in.

One store which sells only vacuum cleaners pays a rental of $13,000 a year for a comparatively small room. The manager declared that this paid because of the advertising value of keeping the name before the public and of having a good window for demonstration. Most of the sales, however, are made by outside men. During one week in August sixteen men had sold 107 cleaners, which was higher than the average for the year, as total sales are expected to reach 4,200.

This manager stated that the branch stores are responsible for the sale of 70 per cent of factory production, and this method has been found to be the most practicable way to train and control salesmen, put on campaigns and be sure of maintaining sales volume. Other factory branch stores were of virtually the same opinion, except those which have tied up with the central station or a department store under a resale contract.

It appears, as a general thing, that the manufacturers of electric appliances, especially the higher-priced ones, much prefer to be represented by the central-station company. This is natural, of course, in view of the established sales organization of the central station and its other advantages as an outlet for electrical merchandise.

The electric shops carry a varied line of appliances and do a good business. They are well located in the business section and they also pay high rentals. Competition is keen and various sales expedients are employed. Price cutting, the offering of premiums and rebating to the customer a part of a salesman's commission are the principal methods used to make or clinch a sale. While not exactly common practices, they are resorted to frequently. Little or no concern is felt by some of these shops as to the effect of their policy upon other dealers. The contractors are the most severe critics of the practice.

A number of the contractor-dealers in this city during the past three or four years have engaged in appliance selling on a rather large scale, but have dropped by the wayside for various reasons: First, merchandising is a side line for nearly all contractors, and when they engaged in this business they went at it on too ambitious a scale, without the proper selling equipment, location of store or familiarity with the business. Second, because of the smaller volume of purchases they were not able to earn as large a discount as were the department stores or some of the already established electric shops. Third, price cutting and keen competition generally are also given as reasons for their abandonment of merchandising. Fourth, factory branch and specialty stores occupy the field for the larger devices, and there is not a great opportunity for contractors to edge into the business

when it is conducted by them only as a small part of their total business.

An interesting comment on the general appliance situation was made by the manager of a factory branch which serves nine states. He pointed out that the electric appliance business is a house-to-house selling proposition so far as large appliances are concerned. This is particularly true of the contractor-dealer and the central-station company, because they do not have the crowds of shoppers in a buying frame of mind such as may be found in department stores and, to a less extent, in the hardware stores. All appliances must be sold, and while there is developing a certain amount of voluntary demand upon the part of customers, it is not such that the strictly electrical store or the central-station company, even, can depend upon it, with a certain amount of advertising, to make sales. He predicted that the small electric stores and contractor-dealers would gradually be eliminated as an outlet for electrical merchandise, and that out of the present transition period, which is very evident, there will be three merchandising plans very clearly defined, as follows:

1. Central-station companies will wake up to the fact that there is a very good profit to be made in merchandising and will handle the highest grades of articles in order to maintain a high standard of appliances on their lines. Selling policies will be formed which will closely parallel the department-store viewpoint, and the question of the energy-consumption value of appliances will not enter into the policy of whether or not the company should merchandise them.

2. Another outlet for electric appliances will be through local factory branches selling, perhaps, one or two large appliances which are the staple lines of the business, with a number of smaller devices carried as fillers. Such stores will depend to a large extent on the activities of outside salesmen, and their success will be determined by the attitude and capability of the local management. Stores of this kind would now be in much greater evidence throughout the country if it were possible to find a sufficient number of high-caliber salesmen to man the territories. The question of salesmen is one of the most serious which confront the electrical industry in retailing appliances.

3. A big volume of appliances will be sold through large stores, viz., department stores, hardware stores, central-station companies and a very few comparatively large electric specialty stores which put it straight up to manufacturers to standardize a method of selling and supply adequate co-operation in the form of national advertising, demonstration and sales assistance.

The development of salesmen appears to be the key to the solution of the selling problem, and it means the education and training of a large number of high-class men who can merchandise a specialty. Much of this training of salesmen will devolve upon the manufacturer of large appliances, because he cannot and should not expect the central-station company, or any other merchant, for that matter, to develop a market and a sales force for his products.

This factory branch manager estimated that in larger cities the central-station company is now selling approximately 25 per cent of the appliances in its territory, branch stores 37½ per cent and department and hardware stores another 37½ per cent of all appliances. At the end of five years the department and hardware stores will have so increased their sales that the totals will be about as follows: Central stations, 25 per cent; branch stores, 25 per cent, and department and hardware stores, 50 per cent.

From the trend of the last three years, this manager stated, central-station companies and branch stores have done the pioneer work in developing the market for appliances, and the department and hardware stores are now profiting and will continue to "cash in" on the opportunity which has developed. The department stores in the past could not afford to experiment or do any development work on new appliances, and they will sell only merchandise for which there is a marked demand. This point has now been reached, and the

SALES OF PRINCIPAL ELECTRIC APPLIANCES, SHOWING QUANTITY, VALUE AND PROPORTION SOLD BY HARDWARE STORES, DEPARTMENT STORES, ELECTRICAL DEALERS AND THE CENTRAL-STATION COMPANY

Kind of Dealer	Washing Machines	Vacuum Cleaners	Ironers	Flatirons	Curling Irons	Toasters	Percolators	Ranges	Total Sales Each Class of Store	Per Cent of Total for City
Hardware store—"A"	700	20		450	750	350	150	12		
Hardware store—"B"	30			100	75	80	36			
Total	730	20		550	825	430	186	12		
Value	$91,250	$1,050		$3,300	$3,712	$2,580	$2,232	$1,800	$105,824	7.6
Per cent of stores' electric appliance sales	86.2	1.0		3.1	3.5	2.4	2.1	1.7		
Department store—"C"	350	500		1,500	1,000	400	250	100		
Department store—"D"	6	12		225	300	125	150			
Department store—"E"				350	200	150	80			
Total	356	512		2,075	1,500	675	480	100		
Value	$44,500	$26,870		$12,450	$6,750	$4,050	$5,760	$15,000	$115,380	8.4
Per cent of stores' electric appliance sales	38.6	23.2		10.8	5.9	3.5	5.0	13.0		
Electrical dealer—"F"	300			100	100	75	40	100		
Electrical dealer—"G"	15	12		300	200	100	100			
Electrical dealer—"H"	225	350	20	225	125	125	80	10		
Electrical dealer—"I"	30	40		100	100	60	36			
Electrical dealer—"J"	24	36		75	40	24	12			
Electrical dealer—"K"	450	125		300	250	175	48			
Electrical dealer—"L"		4,200								
Electrical dealer—"M"	350	125		50	60	24	10	12		
Electrical dealer—"N"	325		12							
Electrical dealer—"O"	350	650		125	150	48	25			
Electrical dealer—"P"	100	75		140	60	36	10			
Electrical dealer—"Q"	400		75							
Electrical dealer—"R"	350	140		80	40	30	15			
Total	2,919	5,753	107	1,495	1,125	697	376	122		
Value	$364,375	$302,032	$16,050	$8,970	$5,062	$4,182	$3,512	$18,300	$722,483	52.5
Per cent of stores' electric appliance sales	50.4	41.7	2.2	1.3	0.7	0.6	0.5	2.6		
Central-station company	1,200	3,000	80	7,500	650	313	289	400		
Value	$150,000	$157,500	$12,000	$45,000	$2,925	$1,878	$3,468	$60,000	$432,771	31.5
Per cent of company's electric appliance sales	34.7	36.4	2.8	10.4	0.6	0.4	0.8	13.9		
Grand total	5,205	9,295	187	11,620	4,100	2,115	1,331	634		
Value—all dealers	$650,125	$487,452	$28,050	$69,720	$18,449	$12,590	$14,972	$95,100	$1,376,458	100.0
Per cent of total appliance sales	47.4	35.4	2.0	5.1	1.3	0.9	1.1	6.8	100.0	

department stores, with their superior buying power, their more thorough and effective advertising and the crowds which naturally pass through them daily, are enabled, if they so desire, to undersell other competitors.

CENTRAL-STATION COMPANY

Only within the last two years has the central-station company here resumed the merchandising of appliances. During and for some time after the war period this had been discontinued. The company has no outside salesmen working, with the exception of those supplied by manufacturers under resale contracts. It has a most attractive salesroom which is well equipped for demonstration purposes, and the salespeople are very attentive and courteous. The company plans to increase its merchandising activities by the addition of a crew of outside men, if high-caliber salesmen can be found. Appliances are sold on the deferred-payment plan, and a very considerable amount of newspaper advertising is carried on. Some complaints were made against the company offering special prices. Upon investigation, however, this was proved to be confined principally to electric flatirons and specials on toasters, and in the case of the flatirons it included a special offer whereby an ironing board was given away as a premium. Although the company aims to make its merchandise department self-supporting, it is conducted primarily with the object of increasing customers' consumption. The manager of this department was frank enough to admit that accounts were kept in such a manner that it was not possible to determine whether a profit was being made.

The vice-president and general manager of the central-station company was very emphatic in his declaration that the company would continue in the merchandising game, and he did not foresee any possibility of its retiring from the business. He criticised the attitude of some contractors and dealers who believe that jobbers and manufacturers should refuse to sell standard lines to drug and department stores. Where such a policy is in effect it tends to cause such stores to sell cheap, inferior products, which gives the business a bad name and in general demoralizes any efforts to insure a high standard of appliances being sold in a given city. The central-station company, he said, should not attempt to corner the appliance situation in a city, but should pursue an aggressive policy in order to stimulate other merchants to greater activity.

Contractors as an outlet for electric appliances and the electrical stores have proved, he said, to be most unstable and uncertain, and the casualties have been comparatively high. Factory branch stores or specialty stores which have concentrated their principal sales efforts on one or two appliances, with the smaller ones as a supplementary line, have been the most successful. What success they have enjoyed has been due largely to intensive sales methods. In this manager's opinion, all legitimate outlets should be encouraged to increase their sales, and if the policy of free trade is adopted, the question of inferior appliances will soon take care of itself.

CONCLUSIONS

The total sales of appliances considered in the survey of this city amount to $1,376,458 annually. Of this total hardware stores sell 7.6 per cent, department stores 8.4 per cent, contractor-dealers, factory branches and specialty stores 52.5 per cent and the central-station company 31.5 per cent.

There is a noticeable changing of attitude toward the appliance business among the smaller stores and dealers. A movement is under way among contractor-dealers and some of the factory branch stores to form what might be termed an electrical center. Already about half a dozen or so of these have located in a section of the business district which lies from three to five blocks away from the main shopping center. The main office and salesrooms of the central-station company is in this section but lies closer to the shopping center, having the best location. Many of the factory branch stores will not consider moving their locations but prefer to remain where they are now. It is difficult to see how dealers who are moving away from the busiest part of town will increase their business. It looks to be the forerunner of their retirement from the appliance business. Those dealers who have factory branch representation will probably continue in the business with a crew of outside salesmen, but will obtain very little business from voluntary visits to their stores. It appears inevitable that the number of contractor-dealers selling electrical merchandise must decrease, and some of the electric specialty stores are finding it difficult to keep up with expenses.

The department and hardware stores, with their widely diversified lines of merchandise and other natural advantages, show a decided tendency to increase their electric appliance activities. None of these will modify or slacken their efforts in this direction.

The central-station company, having but recently re-entered the merchandising field, is preparing to put additional effort into its sales.

FUTURE TREND

The indications are that both department stores and hardware stores will become more important factors as outlets for electrical merchandise. The contractor-dealer is rapidly retiring from the field, and some of the electrical shops and specialty stores show similar indications. Some of these latter will no doubt retire from the field. How far this will go it is difficult to say, but it seems certain that their sales of smaller appliances will soon be almost negligible. Their principal means of support comes from the sale of the larger devices—that is, washers and cleaners—very little attention being paid to the other devices.

The central-station company will probably not sell as large a volume of the larger devices proportionately, but will increase its sales of the small heating devices because of their energy consumption value.

Considering these facts, it appears probable that at the end of three years the following percentages will represent the distribution of sales among the four different outlets: Hardware stores, 10 per cent; department stores, 15 per cent; dealers and branch stores, 40 per cent; central-station company, 35 per cent.

It may appear at first glance that the percentage for department stores is too low, but it must be remembered that but one of the principal stores is showing any great activity, and the same is true of hardware stores. The fact that a number of dealers have already retired from merchandising and that some of the dealers and specialty stores are at present showing symptoms of retirement indicates that there is on the part of the public a definite trend away from buying at these stores. The central-station company's policy of increased merchandising activity will put it in a position to hold its own and in all probability increase its proportion of the total volume of sales.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Power-Factor Clauses in Contracts

To the Editors of the ELECTRICAL WORLD:

On page 898 of the ELECTRICAL WORLD, issue of Nov. 3, there is an editorial entitled "What Is the Basis of a Power-Factor Solution?" This editorial refers to the application of a penalty or bonus on the bill, which penalty or bonus varies with the customer's power factor.

It is my opinion that this particular way of thinking of the so-called power-factor difficulty is one of the fundamental reasons why the solution of the difficulty has been so long delayed. Would not the idea of a so-called power-factor clause be more acceptable if we did not think in terms of penalties but thought in terms of the customer paying for what he gets? When we buy a reel of wire we pay for the wire and not for the reel. The wire manufacturer does not sell us the wire and make a penalty of so many dollars for the reels. When machinery is bought it is quite customary to pay an additional charge for crating and hauling. This is not, however, looked on as a penalty.

Perhaps the illustration would be somewhat better if it were considered that the cost of furnishing the reels, the cost of delivering reels to the customer and the cost of returning the reels would correspond to the cost of supplying and delivering reactive amperes. However, if the customer supplied the reels to the manufacturer and paid all handling charges on the reels, he would not, then, be charged any amount for reels. This would correspond to the customer bringing his load up to 100 per cent power factor. In the case of the reels of wire it would reduce the manufacturer's total bill to the customer. In the case of the central-station company it would make it possible for the central-station company to make a lower charge to the customer.

I do not think that a rate which had a relation to the power factor could be looked on as carrying a penalty or a bonus any more than the reel for wire and the crate charges are looked on as penalties. The rate should be such that the customer pays for what he gets. Again, would not the so-called power-factor clause be more acceptable if it was not a power-factor clause at all, but a demand charge, varying with the total kva. supplied to the customer to fill the requirements of his motors?

It is a difficult job to explain a rate which makes an energy charge for kilowatts, a demand charge for kilowatts, and then a variation of the demand charge, depending upon the power factor. It is not particularly distasteful, however, to explain a rate made up of an energy charge based on kilowatts and a demand charge based on the volt-amperes which the customer draws from the central-station lines. It is not difficult to explain to the general business man that the cost of supplying his service varies, in general, with the amount of energy which he draws from the system and with the amount of his volt-ampere load. As one of the speakers at the N. E. L. A. convention in Atlantic City put it, the customer using an alternating-current motor should be required to pay for the exciting current of his motors, just as he would have to pay for exciting current if he were operating direct-current motors.

Can we not, therefore, stop referring to power-factor clauses and to penalties and bonuses and refer to a kva. demand and charges based on the kva. demand?

E. P. PECK,
General Superintendent Electrical Department.
Utica Gas & Electric Company, Utica, N. Y.

[The editorial under discussion tried to point out that the general trend of all studies looking toward an adequate measuring and rate plan was toward a rate based upon kva. demand and kilowatt-hour consumption. It will be recognized, however, by electrical engineers and central-station executives that this system is merely the best solution to the problem of charging for the service given, and that, when reduced to its elements, it does involve a penalty for low power factor or a bonus for high power factor. Mr. Peck is entirely sound in his contention for a simple rate to the customer. Of all definite plans proposed the one involving kva. demand and kilowatt-hour consumption meets with most approval and resists most criticisms. When it is made practicable from the standpoint of instrumentation it will doubtless be generally adopted and "bonus" and "penalty" rates discarded.—EDITORS.

Philadelphia's "Home Electric" Demonstration Has Encouraging Aftermath

To the Editors of the ELECTRICAL WORLD:

I have been deeply interested in reading the editorial in your Nov. 17 issue entitled "Kindle the Spark" and thoroughly agree with the thought that any endeavor to promote the electrical idea in a community must be supported by a co-operative effort of the industry and particularly of the central-station company.

I am speaking from recent experience, having had the privilege of heading the general committee that recently promoted the "home electric" in Philadelphia. There was no comprehensive organization to push forward the home or any other activity when the matter first came under consideration, and the central-station company therefore, could not commit itself to such a project; but the industry in Philadelphia overcame this obstacle by contributing funds and workers to such an extent that $12,000 was placed in the hands of the general committee, and of this amount the central station contributed nearly one-half.

The result of this co-operative effort was Philadelphia's first "home electric"—a home that was without parallel in its completeness and the manner in which is was presented to its guests, who numbered nearly 55,000; but even these amazing results were secondary to the effect it had on the electrical industry in our city. Within less than a month after the closing of the home a campaign lasting six days was put on to obtain more members for an electrical trade association, with the result that more than 250 new members were secured, giving this organization, with its old members, a representation of 400 to carry on the cause of spreading the electrical idea among the consumers.

The point I wish to stress is that, though the inspiration for such movements as the "home electric" may be contributed by an individual, it is impossible to push such a project to successful completion without real co-operation from the trade and without the sanction of the central station. This we have had in Philadelphia to an unusual degree. I look back on our successful campaign and appreciate how futile would be the effort of any individual or small group, and I feel that Philadelphia should be congratulated on its success in welding the branches of the electrical fraternity.

DAVID C. BIRDSELL,
Chairman Associated Electrical Industries of Philadelphia.
Philadelphia, Pa.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

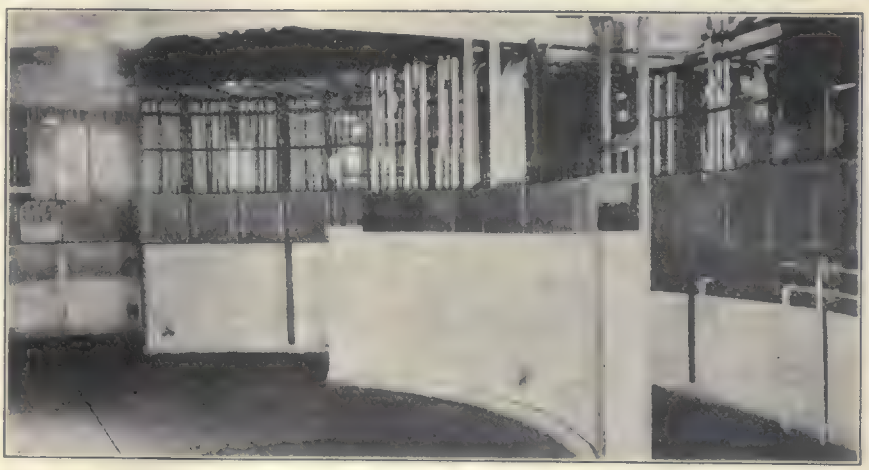
Control and Pipe Room Layout of the Delaware Station

By R. A. Hentz
Philadelphia Electric Company, Philadelphia, Pa.

THE operating room, the nerve center of every generating plant, is always of interest and importance. The operating room of the 200,000 kva. Delaware generating station of the Philadelphia Electric Company is shown in the accompanying illustration. Here concentration of control has been adopted to a marked degree, for in addition to the control of the six 33,333-kva. generators and the fifty-six outgoing 13,200-volt feeders, control of the 2,400-volt station auxiliary supply and of the 250-volt direct-current power and emergency excitation bus is also installed.

The necessity of safely installing the multiplicity of control wiring in such a comparatively small area led to the development of the pipe room directly under the operating room. An inspection of the illustration shows the neat arrangement under the bench board. Everything is visible, accessible and well illuminated.

With this room as a distributing point for all of the control, signal and secondary wiring, it is possible to avoid the congestion of wires often seen in the back of switchboards where the wiring coming from pipe in the floor is spliced directly to that on the back of the panels. Instead, these wires extend straight through the pipe in the floor to sheet-iron boxes placed at the ceiling of the pipe room. These boxes are partitioned so as to confine the damage should breakdown or fire occur on any of the leads. To the pipe room is brought all of the conduit from oil switches, instrument transformers, etc., not only from the main switchhouse and station auxiliary bus rooms, but also from the turbine hall and boiler house. The secondaries of the instrument transformers are wired to cut-out panels, solid links being used in the secondaries from current transformers and fuses in those from potential transformers. This forms a convenient point for testing instrument circuits and the location and elimination of trouble. Similarly, control circuits are sectionalized through fused knife switches which serve the same purpose. It is possible to find a ground on a control wire, for example, in a very short time, while without these sectional switches many hours of search would be required.



ADVANTAGE OF PIPE ROOM IS THE EASE WITH WHICH ADDITIONS TO THE OPERATING ROOM EQUIPMENT CAN BE MADE

A further important advantage of the pipe room is the ease with which additions to the operating room equipment can be made. To this end a large amount of spare conduit is extended to it from all parts of the station. In the switch-house wall a spare pipe is run for each generator and feeder section, from the top or bus galley to the basement with an extension into the pipe room, thus providing wiring for any additional equipment that may be required in connection with the 13,200-volt installation that should be controlled from the operating room. Extensions from these spare pipe outlets to any other point in the operating room where new switchboard panels might be installed can readily be made in the pipe room.

The above principles of design are not entirely new at this plant, they having been incorporated first in the company's Chester station, placed in

operation in 1918, and subsequently in the reconstruction of its older Schuylkill station. However, the greater size of the Delaware station, with the consequent greater amount of control, makes this installation of particular interest.

Estimating Electrical Construction Work

By R. L. Kirk
Engineering Department, Duquesne Light Company, Pittsburgh.

An unusual method of estimating the cost of new construction work which consists of subdividing the projects into its component units and carefully estimating the cost of each on a specially prepared form has been developed by the engineering department of the Duquesne Light Company.

With this method a transformer and switching station would be resolved into the following units: 22,000-volt line circuit, 22,000-volt transformer circuit, 4,000-volt transformer circuit, 4,000-volt lighting circuit, 4,000-volt power circuit, street-lighting circuit, station service circuit, general equipment, etc. Each of these units would then be carefully analyzed and estimated on the standard estimate sheet and properly summarized into the total estimated cost of the new station. The estimate sheets, printed in tablet form on thin paper to allow blue-printing, a sample of which is shown herewith, have several unique features which are best explained by the simple estimate of a 2,300-volt, single-phase regulated lighting feeder circuit.

The heading is prepared to suit the particular requirements of the office routine of the department. Below follows a space of cross-section on which is carefully drawn a single-line wiring diagram of the circuit or unit under consideration. Care is taken to see that every major piece of equipment required throughout the entire circuit is indicated on the diagram. Only minor articles that may properly be covered by a miscellaneous item are omitted. Note that even a line representing control conduit ties the instrument transformers to their proper instruments. This is of material assistance in checking the estimate as to proper relay and instrument connections.

To each article an item number is given, or preferably an item letter to prevent confusion between the item and the number required, and the article is listed below with proper description and cost.

The symbol column has proved a source of great advantage. It requires only a second or so to draw in a small symbol which brings quickly and clearly to mind the various items called for in the estimate. Furthermore, in checking or listing similar pieces of equipment throughout an estimate of some ten or twenty pages, it saves considerable time in locating the desired equipment, as the eye can quickly and easily run down the symbol column and locate the desired articles without having to read and assimilate all the written description. These symbols are likewise employed on the standard bill of material forms used by the company.

After the various circuits and general equipment have been analyzed and estimated, a summary sheet is prepared showing the number and total cost of the various units required in the complete project. Blueprints are then obtained for distribution to the proper authorities. An extra blue-print may be filed in the estimate file and indexed under the type of circuit. These various estimates, checked from time to time against actual construction costs, provide a valuable record for quickly and accurately preparing estimates of new work using more or less standard circuits.

A complete and up-to-date cost-finding system is likewise installed so that the actual cost of all equipment going into new combinations may be quickly and easily determined.

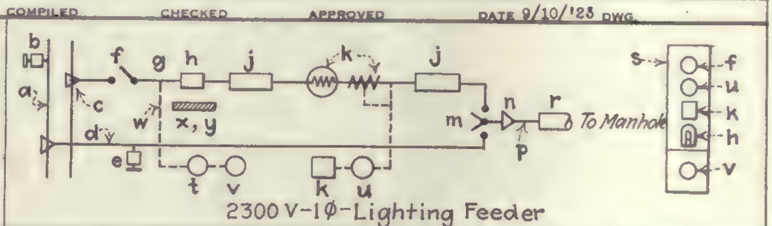
One of the greatest advantages of this system, outside of the accuracy obtained by the analysis of circuits into units, is the fact that the estimate sheets in themselves tell the complete story of the new design. Should the job be transferred from

ESTIMATE SHEET — Page 6 of 108

Eng. Dept. Duquesne Light Co. — I. D. O. 495

General Div. Sub Station. — A. F. I. 2478 — C. O. 5313

Compiled — Checked — Approved — Date 9/10/'23 — Dwg.



Item No	Symbol	Description of Equipment	No. Req'd	Estimated Cost: Unit	Estimated Cost: Total	Remarks
a		3"x1/4" Copper bar	15'	.60	9	
b		2300 V. Bus support-1-3"x1/4" bar	4	4.50	18	
c		Bus clamp-1-3"x1/4" bar & terminal	4	2.00	[illegible]	
d		500,000 cir. mil.- 2300 V. wire	150'	.60	[illegible]	
e		2300 V. Insulator 1-500,000 CM.	4	3.50	14	
f		600 A-2300 V S.P.S.T. disconnect	3	25.00	75	
g		600/5 A - Type KA Current Transf.	1	35.00	35	
h		600 A-15000V.-3 pole manuel-B13,O.C.B.	1	550.00	550	
j		2" Fiber duct	80'	.20	16	
k		400 A.-10% Regulator, complete	1	1500.	1500	
m		600 A.-2300 V. Selector Switch	3	35.00	105	
n		4 Cond. 350,000 cir. mil. Pothead	1	40.00	40	
p		4 Cond. 350,000 cir. mil. L.C. Cable	100'	2.00	200	
r		4" Iron pipe	90'	.90	81	
s		65"x24"x2" + 25"x24"x2" Panel	1	35.00	35	
t		500 A Ammeter	1	23.00	23	
u		150 V Voltmeter.	1	25.00	25	
v		4-12 A Type CO Relay	1	35.00	35	
w		1 1/4" Conduit & control wire			20	
x		Iron work	300#	.10	30	
y		1/4" Asbestos	50 01	.20	10	
		Miscellaneous			25	
		Labor at 20%			600	
					3544	
		Engineering & Contingencies at 10%			356	
		TOTAL				$3,900

ACCURACY IN ESTIMATING CONSTRUCTION COSTS OBTAINED BY DIVIDING CIRCUITS INTO UNITS

one engineer to another to follow through to completion practically all the necessary details are clearly presented on these forms. Furthermore, should the estimate cover a rush job, a blanket order for all material can be easily prepared and blueprint copies of the estimate sheets furnished the drafting room for its information in working up the necessary drawings. This method can also be used to advantage when either financial limitations or a poor supply of men makes it necessary to employ rather inexperienced engineers, as it requires a careful analysis of the job presented in a manner easily checked by a more experienced man. This eliminates to a certain extent the possible embarrassment resulting from the necessity of obtaining an additional appropriation for under-estimated work.

COMPLETE TESTING EQUIPMENT, SHOWING THE ARRANGEMENT OF THE REGULATOR, TRANSFORMER AND PANELBOARD

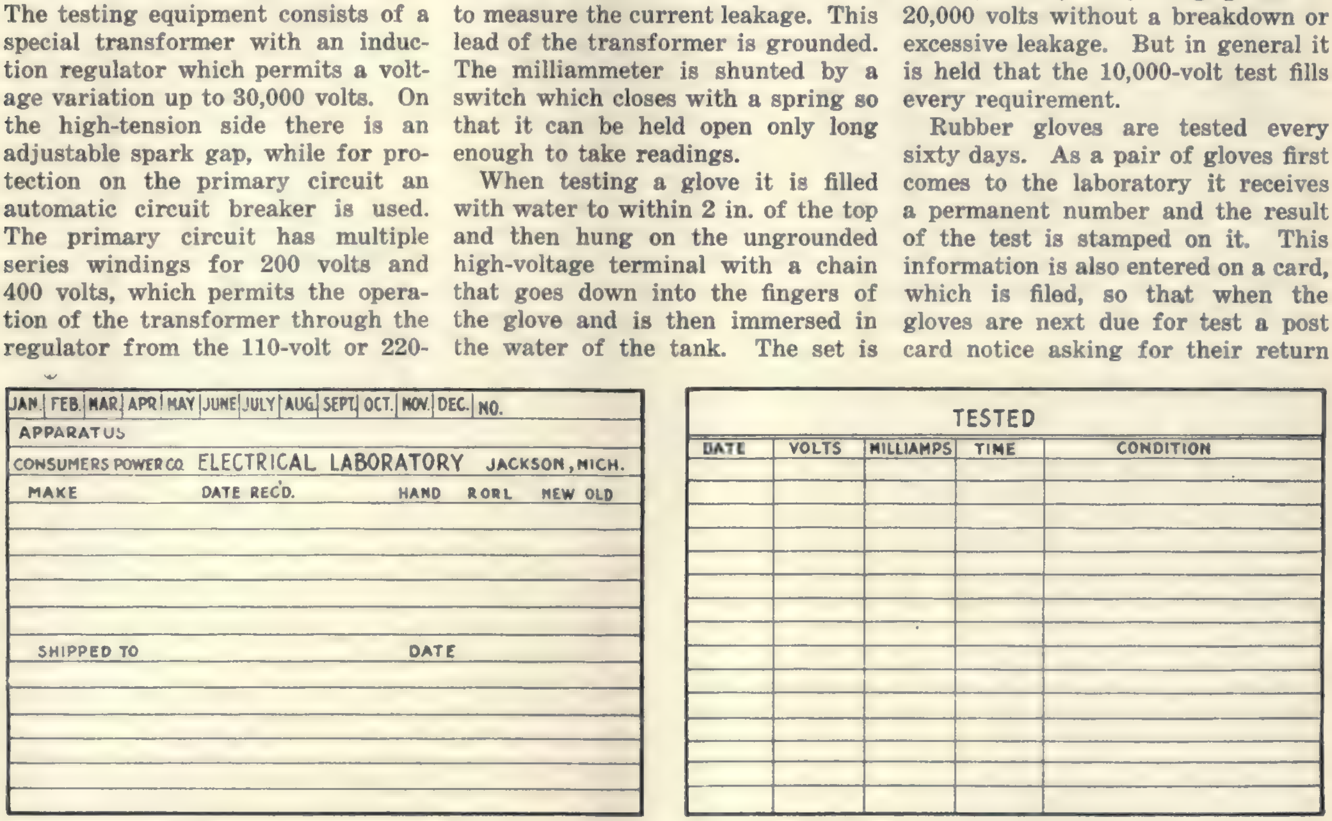
Rubber Gloves Tested for 10,000 Volts

TESTS on rubber gloves used by the Consumers' Power Company, Jackson, Mich., must withstand 10,000 volts applied for three minutes with a leakage current not exceeding 10 milliamperes, according to the report by James Kelly, chairman of the sub-committee on testing rubber gloves, central safety committee. The testing equipment consists of a special transformer with an induction regulator which permits a voltage variation up to 30,000 volts. On the high-tension side there is an adjustable spark gap, while for protection on the primary circuit an automatic circuit breaker is used. The primary circuit has multiple series windings for 200 volts and 400 volts, which permits the operation of the transformer through the regulator from the 110-volt or 220-volt supply. A separate potential winding is provided so that the voltage may be read accurately regardless of the load or power factor on the main winding.

One secondary terminal is connected to the inside of the glove under test and the other terminal to the metal water tank. The spark gap is set for the desired maximum voltage and connected across the high-tension terminals. The milliammeter is connected in series with the lead to the water tank in order to measure the current leakage. This lead of the transformer is grounded. The milliammeter is shunted by a switch which closes with a spring so that it can be held open only long enough to take readings.

When testing a glove it is filled with water to within 2 in. of the top and then hung on the ungrounded high-voltage terminal with a chain that goes down into the fingers of the glove and is then immersed in the water of the tank. The set is cut in a zero voltage and the potential slowly raised by means of the regulator to 10,000 volts. A reading of the milliammeter is then taken. If this is in excess of 10 milliamperes. the glove is discarded. If it is 10 milliamperes or less, the voltage is applied for three minutes and another reading taken. Should the reading still remain 10 milliamperes or less, the glove is stamped with the duration and voltage of the test and placed in stock. Special tests have been made by subjecting gloves to 20,000 volts without a breakdown or excessive leakage. But in general it is held that the 10,000-volt test fills every requirement.

Rubber gloves are tested every sixty days. As a pair of gloves first comes to the laboratory it receives a permanent number and the result of the test is stamped on it. This information is also entered on a card, which is filed, so that when the gloves are next due for test a post card notice asking for their return



JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. NO.

APPARATUS

CONSUMERS POWER CO. ELECTRICAL LABORATORY JACKSON, MICH.

MAKE	DATE REC'D.	HAND	R OR L	NEW OLD

SHIPPED TO — DATE

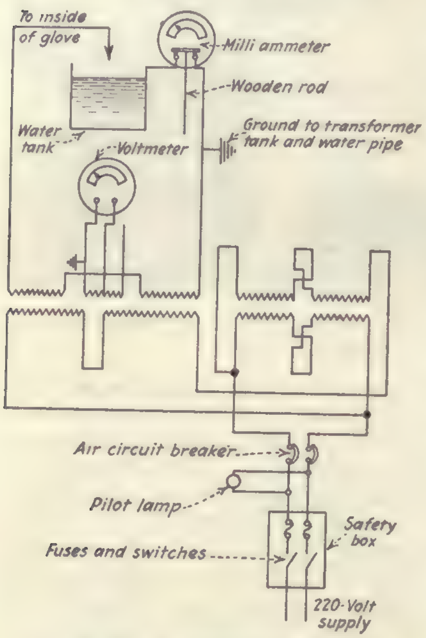
TESTED

DATE	VOLTS	MILLIAMPS	TIME	CONDITION

THIS CARD IS USED AT THE ELECTRICAL LABORATORY AND CONTAINS ALL THE TEST DATA ON GLOVES

can be sent to the holder of the gloves together with a pair of recently tested gloves. The result of each test is entered on a record card so that a complete record of every pair of gloves is kept from its first receipt at the laboratory until the time it is discarded.

Gloves failing to measure up to



INTERNAL CONNECTIONS OF THE REGULATOR AND TRANSFORMER

the standard of 10,000 volts for three minutes with a leakage not exceeding 10 milliamperes are stamped "condemned" and turned over to the gas department for use in washing meters, or to the construction department for work around hydraulic plants where it is necessary for the men to put their hands into cold water. No glove marked "condemned" must ever be used for protection from electrical shocks even on the lowest voltages.

Condenser-Tube Failures

THE two general characters of condenser-tube failures, according to W. R. Webster, vice-president of the Bridgeport Brass Company, who spoke before a recent Metropolitan Section meeting of the A. S. M. E., are spontaneous longitudinal splitting of the tube, known as season cracking, and the corrosive action on the tubes of the cooling water and substances carried in with this water.

Sufficient facts have not been established on the basis of scientific procedure to make it at this time possible for any one to predict with certainty, within very broad limits, that any particular lot of tubes will endure under average service conditions in a measurably superior degree from other tubes differing from them in material respects.

Tube failures in a condenser are usually such that the difference in crystalline structure is not indicated as a clue to the trouble. Air bubbles have been noted as being exceedingly active in causing corrosion. The characteristic of this failure is a bright surface along the inside of the tube. Plug-type dezincification is indicated by circular areas of small size eaten into the tube.

Failures in which the wall of the tube is dissolved in an irregular manner, frequently in the region of inlet areas, have been proved to be due to the presence of air in the condensing water. This leaves a bright surface. Soaking the tubes in quiescent sea water at 40 deg. C. for about a week forms a protective coating, in many cases of much benefit.

Among preventive measures frequent cleaning of tubes and also the use of an iron protective plate properly attached to the tube sheet are recommended. The omission of the final pickling operation in the manufacture of tubing appears worthy of trial, as this will leave the outside scale as a protective coating.

In the discussion that followed it was brought out that during the last twenty years there had been no very definite conclusions produced in regard to the causes of condenser-tube failures.

E. B. Ricketts brought out the fact that air bubbles had been specially serious, producing a deterioration that softened the metal so that it could often be cut with a knife.

The conflicting character of tube corrosion was strongly emphasized by Willis Lawrence. In one installation two condensers served the same turbine. In one condenser tubes in the upper part corroded badly, and in the second one tubes in the lower part were corroded, although both were made by the same manufacturer. In one case forty tubes were plugged and in the second about seven hundred during the same period of service. It had happened in one condenser that bad tubes were well distributed and in another case that there were a large number bad in one pocket. After twenty-one years of operation the causes are hazy in character.

Further discussion emphasized that the water compartments were not designed for good stream flow. Water in turning sharp corners tends to form air pockets, and under such circumstances corrosion is inclined to be rapid. In some cases air may be injected, and it often stays for a considerable period in one location in the tube before being absorbed by the circulating water. Dezincification is the principal trouble.

Mr. Price of the Scovil Manufacturing Company said that the Bureau of Mines considered that grain-crystal sizes were vitally connected with tube corrosion. Fine grain showed considerably less corrosion than coarse grain. In low-temperature annealing, such as 260 deg. C. for one hour, there was no evidence of recrystallization, yet the strains were relieved.

Line Construction for 60,000 Volts

TYPICAL construction on the 60-kv. line crossing the Sierra Nevada Mountains (Cal.), recently built by the Pacific Gas & Electric Company, is here shown. The line crosses the summit at an elevation of 7,300 ft. and owing to the heavy winter storms extra heavy construction was employed. The conductors are No. 2 stranded copper supported on 70,000-volt pin-type insulators. Spans at the higher altitudes are 150 ft., while at the lower levels this is lengthened to 200 ft. Class A, 45-ft. red cedar poles were used. The view on the left shows a 60-kv. pole top switch, while that on the right shows a typical dead end structure.

Reducing Distribution System Losses*

BY D. M. BUNN
Northern States Power Company, Minneapolis

IN LAYING out a distribution system one should study the present and ultimate requirements of the territory to be served and not make the mistake of putting up small copper. Small copper means excessive distribution losses as the load increases. In observing a number of distribution systems I have noted in every case where the practice of putting up big copper and keeping the number of transformers to a minimum and loaded as nearly as possible to full capacity is followed that the general losses have been 12 to 15 per cent. Those who have made no attempt to rebuild or to study the distribution systems as their loads increased, but have just added equipment from time to time and allowed transformers to be connected in a haphazard way, have high losses—18, 20 and 25 per cent.

Some time ago a study was made of the actual secondary losses on two circuits about three blocks long, parallel to each other, with a total of ninety meters connected. Each secondary circuit was supplied by a 5-kva. transformer tapped in at the end of each circuit. The secondaries were made up of two No. 8 copper wires. Before the test was started all house meters were adjusted to be as nearly accurate as possible. A meter was installed at each transformer to record energy input to the secondary circuit. To avoid error in reading meters the two circuits were killed long enough to read all meters and service was then restored. The tests ran for a period of twenty-one days. The power was shut off and all meter readings were again taken, with the following results:

Total input to meters at transformers, kw.	1,074
Total output of residence meters, kw.	932
Loss in meter shunts, kw.	60
Line loss, kw.	81
Line loss, per cent	7.6

It is evident that 7.6 per cent is too high for secondary losses. It was decided to rebuild the secondaries and complete them as a ring. Three wires (two No. 6 for the outside and one No. 8 for the neutral) were used, and the location of one 5-kva. transformer was changed to the far side of the ring. The next test showed the losses practically cut in half as follows:

Total input of meters at transformers, kw.	979
Total output of residence meters, kw.	768
Losses in meter shunts, kw.	68
Line loss, kw.	43
Line loss, per cent	4.4

Another way to reduce distribution losses is to correct poor power factor. I have had opportunity to observe static condenser installations in operation for power-factor correction in a number of industrial plants. In a manufacturing plant before correction was applied the energy consumption per unit of product was 0.89 kw.-hr., and for the same product after correction it was only 0.55 kw.-hr. This is a saving of about 30 per cent in consumption of energy in addition to improvement in power factor. Attention was called most forcibly to the installation in a large steel rolling mill. The power factor on this plant was 65 per cent, and it was necessary to keep two banks of transformers of 1,250 kva. each in service to carry a load of 1,518 kw. to prevent the transformer temperatures going beyond the danger point. Before the static condenser was installed the customer's bill for one month was:

Measured demand, kw.	1,518
Average power factor, per cent	65
Standard power factor, per cent	80
Kva. billed	1,859

With two 300-kva. static condensers installed the customer was able to discontinue the use of one bank of transformers of 1,250 kva. and carry the load on one bank. The bill for the following month shows:

Measured demand, kw.	1,518
Average power factor, per cent	93
Standard power factor, per cent	80
Kw. billed	1,294

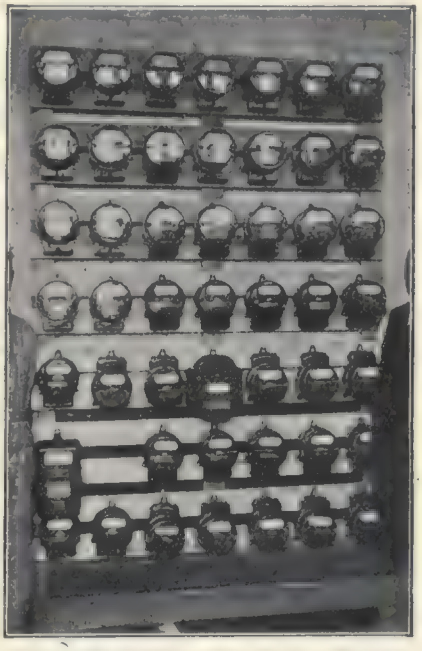
or 14.7 per cent less than the measured demand, on account of the high power factor. By discontinuing the use of one bank of transformers and improving the power factor from 65 per cent to 93 per cent, the customer's saving for one month amounted to $956 or about 9.6 per cent of the cost of the static condenser installation.

*Excerpt from paper presented before the North Central Division, N. E. L. A., Minneapolis, June 20-22, 1923.

Meter Testing Handled by Substation Operator

BY J. W. W. WALKER
Operating Superintendent Traction Light & Power Company, Anderson, Ind.

IN SMALL organizations which do not warrant the expenditure necessitated by a separate meter department much time and money is lost unless definite regulations are laid down regarding the maintenance and inspection of meters. The Traction Light & Power Company at Anderson, Ind., is using a system which has worked out very favorably since its installation in May, 1922. On that date the Alexandria substation, which lies northward of Anderson about 15 miles, was designated as the electrical testing laboratory of the system. This substation was chosen because the operator had had previous experience in meter-testing work. It was also chosen because it was in the center of our transportation system, thereby affording excellent facilities for the rapid movement of meters.



SUBSTATION OPERATOR HANDLES METER TESTING BESIDES REGULAR DUTIES

A meter rack was then constructed on the substation wall as illustrated. By placing the incoming meters on this rack a visible check is obtained on the amount of work laid up ahead for testing. This neat arrangement also prevents the meters from being scattered or injured by careless handling. Once these meters are placed on this rack, they remain there throughout the entire time of testing, long leads being used to connect to the standard.

In place of a rotating standard a 5-amp., single phase watt-hour meter is employed. The face of this meter has been removed and the dial graduated into 100 equal spaces. Red index lines mark the allowable 4 per cent limits, making it easy for the tester to determine if a meter is running too fast or too slow.

Giving the substation operator work to do besides his regular tasks has also enabled the company to reward him for his superior qualifications without any seeming injustice to other substation operators. Such an opportunity is often desirable.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

What a Continuous Residence Survey Has Done

One of the Most Extensive Examples of Organized Personal Contact with the Public by a Central-Station Company—Its Effect on Public Relations

By Will H. Fischer
Manager Department of Greater Service, Southern California Edison Company, Los Angeles

THE department of greater service of the Southern California Edison Company was organized April 1, 1921, the announcement thereof being contained in a circular letter from S. M. Kennedy, vice-president. The fundamentals of the plan are quoted from this letter as follows:

The work of the men in the "department of greater service" in each district will be fourfold:

1. To inquire from each consumer whether or not the service supplied by the company is satisfactory in every respect. This refers not only to the physical service, but also to the consumer's relations with meter readers, collectors, troublemen, clerks, telephone operators and other employees of the company with whom he may come in contact.

2. To give consumers, where the information is needed or desired, details regarding rate schedules and methods of charging for service, the welfare work carried on by the company in behalf of its employees and the present and prospective development work which is being carried on for the benefit of the communities served, the idea being to create an interest in the company's affairs and to convey the thought that the work the company is doing is for the benefit of the territory supplied and that the more rapidly the company's business grows and develops the more rapidly will southern California progress in its onward march.

3. To ascertain the mental attitude of each consumer interviewed, the idea being to find out whether the consumer is (a) in accord with the company's operations and prospective development work, (b) whether the consumer is indifferent to what the company is doing, or (c) whether he is in any way antagonistic to the company.

4. Assuming that the conditions under (1), (2) and (3) are satisfactory, the representative of the "department of greater service" will explain to the consumer the company's plan for customer ownership and its desire that all consumers, if it be possible, should become personally interested in the company's operations, even if only to a minimum amount.

The department was organized prior to the transfer of the Edison company's Los Angeles distributing system to the Municipal Bureau of Power and Light. For this short time there were about forty men in the field, but upon the transfer of service within the city the staff was greatly reduced. During the month of December, 1922, the writer, under the direction of Mr. Kennedy, took charge of the department and reorganized the work.

Number of Men and Calls

At the present time there are fifteen "greater service" representatives in the field. Their salaries average $150 per month. In a few instances necessary transportation is provided for them. They are covering twenty-four of the company's districts, and each representative interviews eleven consumers per day, on the average, when working along ordinary "greater-service" lines. This means that when so employed these men average 286 interviews per month. All remediable complaints discovered by them receive immediate attention from district offices. Troubles arising from imaginary complaints and misunderstandings are tactfully overcome.

The actual number of ordinary "greater service" calls per month, however, does not correspond with the average of eleven, because "greater service" representatives are called upon for many additional duties, which necessarily reduce the time spent on calls. With one report for the month incomplete, it is indicated that to Sept. 30, 1923, "greater service" representatives made 107,247 effective "greater service" calls and turned in cards from which the records have been built up. In many instances more than one call has been made on the same person, although only one card has been turned in. Numerous calls are made, also, where the customers are not at home. However, the word is passed along by neighbors, and knowledge of the fact that a representative visits the neighborhood has a salutary effect.

In addition to their regular work, our "greater service" representatives are coming to be general utility assistants to our district managers in all matters of public relations. These men have built up a virtually complete list of all organizations in the territory they serve. These lists cover (1) churches and clergymen, (2) chambers of commerce and their presidents and secretaries, (3) women's clubs and their principal officers, (4) Rotary, Kiwanis, advertising and other lunch clubs and their principal officers, (5) parent-teachers' associations and their principal officers, (6) fraternal organizations and their principal officers, (7) newspapers and their editors, (8) miscellaneous organizations and their principal officers, (9) municipal and other public officers, and (10) other persons of prominence in a community.

Personal Contact

"Greater service" representatives are required to become personally acquainted with those in charge of all such organizations and are expected to see them casually or otherwise with at least reasonable frequency. Through these contacts a great deal of good is accomplished. Very frequently our representatives receive intimate reports, suggestions and advice from the officers of these various classes of organizations, and not infrequently they are enabled to offset movements or activities during their formative stages which might prove inimical to the interests of the company. In addition, these representatives maintain a close and sympathetic contact with all persons connected with our district organizations. This contact results in greater club activities, a keener per-

ception of the necessity for and value of courteous, prompt and efficient service, and a general toning up of the district personnel.

Sources of Information

In addition to the card report on each effective call, the "greater service" representatives submit weekly reports in narrative form, the first copy being forwarded to this office and a duplicate copy being submitted at the same time to the district manager. These reports supplement daily conferences with district managers. By constant suggestion and training we are developing our representatives into excellent reporters, so that at the beginning of each week we have a comprehensive picture of all developments which might be deemed of importance in connection with public relations. We expect in these reports a review of political, civic, industrial, social and commercial activities. These reports as a whole are summarized at this office, a copy being sent to the principal officers of the company as well as to district managers and greater service representatives. Thus the best points are circulated for general information. They also have considerable suggestive value.

As Advance Agents

Another activity required of "greater service" representatives is that they make engagements for the lecture entitled "The Romance of Electricity," which is delivered by our field superintendent of education, who is connected with this department, and also for the "Edison Road Show," which consists of a series of electrical demonstrations by three experts who likewise work under the direction of this department. Considerable time and energy are required in this connection, but the results from the lecture and the road show are so gratifying that we believe the effort to be worth while, even at the cost of some reduction of time spent on consumer calls.

Frequently our "greater service" representatives are called upon by district managers to execute missions where tact and diplomacy are required. Sometimes managers go so far as to intrust to them bills on which our collectors have been unable to make returns. It is a notable fact that they almost invariably succeed. Likewise they sell no small amount of stock. In case company officers are engaged to appear before organizations in our districts, the "greater service" representative in the particular district concerned cooperates with the district manager in making necessary arrangements and assuring the attendance of important persons.

> At the annual convention of the National Electric Light Association in New York last June Managing Director M. H. Aylesworth recommended that the member companies undertake a national survey of residence installations, and such a survey was authorized by the convention. Its purpose would be to carry a message of public relations to every household in the land that is a consumer of electricity to secure a census of residence load and automatically to enjoy the large sale of additional appliances that inevitably would result therefrom. The development of a definite program for this great survey of all cities has been undertaken co-operatively by the Public Relations and Commercial Sections of the N. E. L. E. sitting as a committee with the following membership: H. T. Sands, Boston, chairman Public Relations Section; N. T. Wilcox, Boston, chairman Commercial Section; A. C. Marshall, Detroit; M. S. Sloan, Brooklyn; Charles J. Russell, Philadelphia: E. L. Milliken, Woonsocket, R. I.; R. H. Tillman, Baltimore; G. E. Miller, Cleveland; Earl E. Whitehorne, commercial editor *Electrical World*, ex officio.
>
> For the purpose of promoting a broader understanding of the opportunities in such a survey, as it may apply to an individual city, the *Electrical World* will publish hereafter from time to time the experience of central-station companies that have already conducted independent surveys. Here is obviously the best possible guide to follow as to both objective and method and the best indication of benefits which can be expected to result. One of the most extensive activities has been in Los Angeles, and the story of the manner in which this most successful survey has been conducted is here presented.

This department has also organized what in our shop talk we term "the Orpheum circuit." Four teams, each consisting of three prominent Edison men, go out from time to time on schedule to appear before our clubs and discuss subjects of interest. At these meetings we attempt to secure the attendance not only of our employees but also of stockholders, friends and the general public. "Greater service" men assist actively in promoting these meetings.

Experience necessarily varies according to districts. Some districts are urban, some suburban and some rural. In the latter class of districts the "greater service" representative manages not only to maintain close contact with individual farmers but also to keep in touch with farm bureaus, irrigation districts and similar organizations. The problems dealt with by such a representative are essentially different from those encountered by one who works on house-to-house calls in closely built-up territory. It is necessary, therefore, that each representative should not only observe the general principles of the service but should also specialize his activities. A representative working in a strictly industrial district like Vernon, on the edge of Los Angeles, a representative in the city of Long Beach and a representative in Tulare County cannot be expected to tell the "greater service" story in just the same way. The end sought by each of them, however, is the same, and they are provided from time to time with booklets and other literature which they hand out at their discretion.

Caring for Trouble

With reference to results, it is, of course, impossible to give a measurement in dollars and cents. We know, however, that the efforts of our district managers to render first-class service to consumers are being efficiently supported. Our men frequently find cases of small troubles. They report on these, and the causes are eliminated. Sometimes they find serious troubles and these are likewise corrected. Sometimes they uncover instances where employees have failed to exercise the courtesy and tact required of them by the company. They not only iron out these irritations so far as consumers are concerned, but also endeavor, through the district manager, to bring about an improvement on the part of the employees. We know that in territory previously not covered there were frequent, although often unjustified, complaints to the Railroad Commission, and that after "greater service" representatives were assigned to such territory these complaints ceased.

Such contact between consumers and company offices is extremely important in that it converts potential enemies into active and enthusiastic friends and very often into substantial stockholders. We are conscious of the fact that while our standing in our territory has always been good, there is a constantly increasing number of persons willing and anxious to speak a good word for us and if necessary to defend us against attack. We are conscious of a much

closer intimacy between the company and those it serves, and it is gratifying to realize that outside of the city of Los Angeles, which is the home of the Bureau of Power and Light, one practically never hears an unfriendly reference to the company itself, even from those who may personally be imbued with ideas in favor of public ownership.

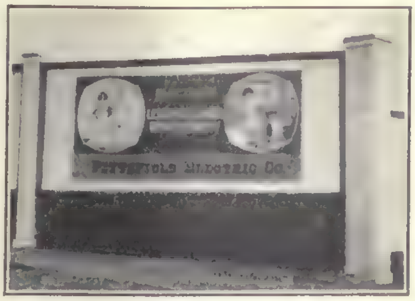
It goes without saying that the executive officers of the company and the district managers have a quicker contact and more intelligent conception of what is going on in company territory. Lastly, there is an immense satisfaction in feeling that through the operation of the greater service system as devised by Mr. Kennedy we are not only holding the fort but gradually, and permanently, I think, "winning the public."

Utilities Should Study Relative Merits of Refrigerators

THE public utility is going to be the ice man in the next five to ten years by serving domestic refrigerators, declared A. D. McLay of the Detroit Edison Company at the convention of the Great Lakes Division of the N. E. L. A. recently. For this prophecy to come true it will have to give refrigerating service, he contended, and not merely power, since ice manufacturers are already alert to the competitive situation. Already $60,000,000 has been spent by manufacturers to develop household electric refrigerators. Hence every utility should post itself on the relative merits of these systems. At least five systems have been employed, namely, compression, absorption, vacuum, air and "vapair."

The most extensively used is the compression system, although Mr. McLay expressed the belief that the "vapair" system has wonderful possibilities because of its simplicity and efficiency. The chief troubles with the compression system are with the stuffing box, expansion valves and thermostats. Furthermore, the fractional-horsepower motors need improvement in efficiency and power factor, since these are both less than 50 per cent. If the industry insists on better motors, the manufacturers will provide them, the speaker asserted. The absorption system has very low efficiency, and the vacuum system is liable to leakage and requires large equipment.

City's Visitors Reminded of Electrical Conveniences



THE Pittsfield (Mass.) Electric Company welcomes arriving travelers to the Berkshire city by an attractive billboard display featuring the labor-saving attractions of electric service and appliances. The board faces the Union Station and reminds the visitor of the advantages of things electrical as soon as he sets foot in this home of electrical manufacturing and progressive electrical service.

Information Bureau Supplies Good-Will Advertisements

TO PROVIDE the utilities of the state with suitable advertising copy for their use in good-will publicity the Michigan Committee on Public Utility Information has prepared a series of advertisements dealing with business and problems of the central-station and other public utility companies. The first of the series, which will be sent out monthly, is based on the obligation of the utility to render efficient service at low cost.

Concerning
Public
Service

UTILITY SERVICE
MUST BE ELASTIC

¶ Gas, Electric, Telephone and Railway Service must not only be adequate for all normal requirements and increases, but also it must be capable of great expansion on short notice or no notice whatever.

¶ When a convention or a football crowd invades your city any morning, hundreds and more often thousands of people must be fed and warmed, lighted and transported. No one ever makes advance reservations at the Gas, Electric, Telephone or Street Railway offices. The managements must be prepared—and they always are.

¶ This is a part of modern public service provided by efficient and forward looking operation.

(Insert Company Name)

SPECIMEN OF INFORMATION BUREAU'S GOOD-WILL COPY

The committee itself does not run any of the advertisements, simply supplying the copy set up in appropriate typographical form as shown in the accompanying illustration. The aim was to furnish copy for those companies which had no such facilities. It is expected that this service will be confined to good-will advertising and assist in balancing the campaigns of companies which now advertise only the merchandise side of the business.

What Other Companies Are Doing

Boston, Mass. — All previous records for installation orders completed during one month on the system of the Edison Electric Illuminating Company were broken during October, when 17,543 orders were put through, an increase of 5 per cent over September, 1923, and of 32 per cent over October, 1922. The record month figures mean the addition of 4,688 customers and 5,313 kw. in connected load. The total connected load of the system Nov. 1 was 521,977 kw., and the company's books listed 173,665 customers. The connected motor load of the system aggregates 211,119 hp. From Jan. 1 to Nov. 1 the number of meters in use on the system increased by 22,396, the total being 196,853.

Montpelier, Vt. — Preliminary surveys of the industrial lighting situation in the granite working plants of this district indicate that by applying modern methods of illumination many plants can be operated under conditions formerly causing a shutdown because of inability to observe color demarcations. W. S. Wallace, illuminating engineer for Charles H. Tenney & Company, Boston, operators of the Montpelier & Barre Light & Power Company, is making a thorough investigation of lighting conditions in the granite industry. It is expected that considerable off-peak lighting business may result.

Ashland, Wis.—The Lake Superior District Power Company announces that 100 per cent of its employees have purchased preferred stock of the company. The employees have been active in the sale of stock to customers, and thus investing their own funds in business has aided materially in convincing the public of the merit of the security.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Hydro-Electric Development and Steam Equipment

New Power Station at Belfast, Ireland.—The new plant of the Belfast Corporation's electricity supply has recently been placed in operation. At present the capacity of the station is 24,500 kw., with another 12,500-kw. unit on order. The station will have an ultimate capacity of 150,000 kw. Details are given of the building and foundations, fuel-handling system, boiler-room installation, turbine room and switchboard galleries. There are two 6,000-kw. and one 12,500-kw. unit installed.—*Engineer (England)*, Oct. 19, 1923.

Water and Coal Supply of the Western Slope of the Southern Appalachian Mountains.—J. A. SWITZER and W. R. WOOLRICH.—The authors correlate the present knowledge of the water powers in this region, recording present status of the power industry and its changing aspects, studying the base-load steam plants and discussing the labor situation.—*Mechanical Engineering*, November, 1923.

Hydraulic Turbines and Centrifugal Pumps.—H. W. COULTAS. — The construction and application of characteristic curves of reaction and impulse turbines and of centrifugal pumps are investigated, both theoretically and graphically. Among the specific subjects covered are velocity heads, measurement of water flow, turbine output, etc. The manner of plotting data obtained from turbine tests so that it will be of the utmost value is discussed in detail.—*Beama (England)*, November, 1923.

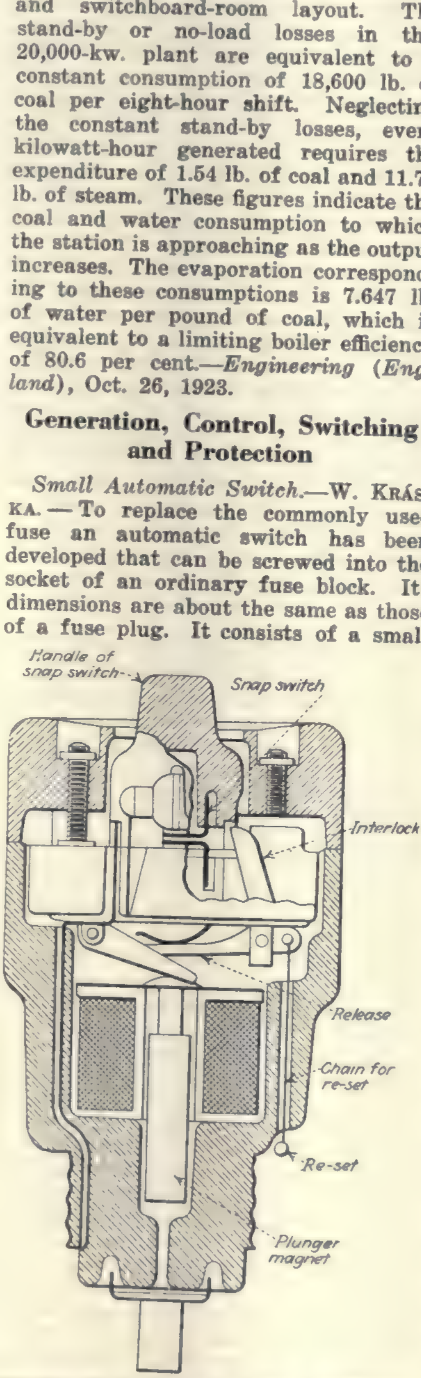
Remodeling Generating Plant. — H. W. BROOKS.—At a cost of $11 per kilowatt a plant installed twenty-two years ago has been modernized and all equipment put in such good operating condition as to effect a reduction in coal consumption of 20 per cent and a saving in maintenance at the same ratio. It is believed that the station will give effective service for ten to fifteen years, with the economies attained by the modern plant of equal size. The continued capacity of the station is about 18,000 kw. with 20,000 kw. to 22,000 kw. obtainable on the swings. Energy is generated three-phase, at 25 cycles and 2,300 volts.—*Power*, Oct. 30, 1923.

Developments of Southern California Edison Company.—H. L. DOOLITTLE.—The important water-power plants constructed by the Southern California Edison Company in the last two years are Kern River No. 3, Big Creek No. 8 and additional high-head impulse units in Big Creek plants Nos. 1 and 2, besides the new Big Creek No. 3 plant, which has recently been placed in operation. This paper, presented at the fall convention of the A. I. E. E., reviews some of the features of outstanding interest characterizing these plants.—*Journal of A. I. E. E.*, November, 1923.

Operating Results of Blackburn East Power Station.—Before actually giving the results from operation an outline is given of the equipment of this station, including the generating apparatus, boiler-room equipment, auxiliaries and switchboard-room layout. The stand-by or no-load losses in this 20,000-kw. plant are equivalent to a constant consumption of 18,600 lb. of coal per eight-hour shift. Neglecting the constant stand-by losses, every kilowatt-hour generated requires the expenditure of 1.54 lb. of coal and 11.77 lb. of steam. These figures indicate the coal and water consumption to which the station is approaching as the output increases. The evaporation corresponding to these consumptions is 7.647 lb. of water per pound of coal, which is equivalent to a limiting boiler efficiency of 80.6 per cent.—*Engineering (England)*, Oct. 26, 1923.

Generation, Control, Switching and Protection

Small Automatic Switch.—W. KRÁSKA. — To replace the commonly used fuse an automatic switch has been developed that can be screwed into the socket of an ordinary fuse block. Its dimensions are about the same as those of a fuse plug. It consists of a small rotary snap switch with a magnetic release by means of a plunger magnet placed in the bottom part of the plug. A very essential detail is that the switch cannot be closed again after it has been opened by an overload. To reclose it the plug has to be first unscrewed and a small lever pulled down by hand. This prevents closing the switch upon a short circuit. The protective switch is rated at 15 amp., 250 volts. — *Elektrotechnische Zeitschrift*, Oct. 11, 1923.



SWITCH THAT SCREWS INTO FUSE-PLUG SOCKET GIVES ADEQUATE PROTECTION AGAINST OVERLOAD

Sensitive Tripping Mechanism for Oil Switches.—An oil-switch operating gear which does not necessitate the use of any independent relays or tripping circuit is described. A low fault current from an instrument transformer is sufficient to trip the switch direct without the use of any intermediate electrical links. The device incorporates a very interesting feature in that the energy required to open the switch is applied to it while it is being closed and is stored up ready to be disengaged when the trip coils operate. This feature of the device leads to the important condition that the work required from the trip coils is independent of the pressure on the catch holding the switch closed, which is determined by the pressure between the switch contacts and the adjustment generally. There is consequently no need for the tripping arrangements to be calibrated for any particular condition, and there is no danger that the switch will not trip even if it is badly adjusted.—*Engineering (England)*, Oct. 26, 1923.

Transmission, Substations and Distribution

Group Operation of Systems Having Different Frequencies.—E. R. STAUFFACHER and H. J. BRIGGS.—An abstract of this paper, presented at the fall convention of the A. I. E. E., may be found in the Oct. 27, 1923, issue of the ELECTRICAL WORLD, page 863.—*Journal of A. I. E. E.*, November, 1923.

Electrical Apparatus for High-Tension Power Transmission. — S. Q. HAYES.—A descriptive article giving the latest developments of high-tension switching and transforming apparatus. Among the subjects discussed are high-tension transformers, bushings suitable for high-tension apparatus, oil circuit breakers for switching the high-tension circuits, disconnecting switches for isolating the oil breakers, lightning arresters for static protection and arrangements of transformers and switchgear suitable for high-tension installations.—*Electric Journal*, November, 1923.

Experiences with the Grounding Choke Coil.—P. VIDONNE.—The author gives a valuable account of the benefits which a French transmission system of medium operating voltage derived from the installation of a grounding choke coil of the Petersen type. The system comprises 93 miles of a single-circuit, three-phase line and 43 miles of a double-circuit three-phase overhead line, operating at 35,000 volts and 50 cycles. The transformers feeding the lines are

all connected "Y-Y." A dry-type transformer of 350-kva. rating, into the iron core of which a suitably dimensioned air gap has been introduced, is utilized as the grounding coil. The ground current of the two lines combined amounts to about 20 amp. at 20,400 volts. In case of a grounded phase the permanent ground current through the grounding coil is from 1 amp. to 1.5 amp. Even with a dissonance of as much as 20 per cent an arcing ground is relieved almost instantaneously. A small current transformer is placed between the Y-point of the coil and ground, energizing a signaling device whenever trouble arises. Particularly during storms, when branches of trees are often thrown across the lines, the protective apparatus functions frequently, without causing automatic breakers to open as was previously a common occurrence. Before the grounding coil was installed as many as twenty-five insulator flashovers occurred per month, a number which has now been reduced to a maximum of three. Transformer punctures have been completely eliminated. Telephonic communication over wires carried on the main transmission towers has not been affected.—*Revue Générale de l'Électricité*, Oct. 20, 1923.

Illumination

Lighting of Norfolk & Western Railroad Yards.—Recently the Norfolk & Western completed the installation of lights in fifteen of its yards. A system of flood lighting particularly suited to the requirements of classification yards has already proved a valuable aid and productive of increasing efficiency. Steel towers of Bates design fitted with a platform and railing at the top are used for supporting the lighting units. Each projector contains a 1,000-watt lamp properly ventilated. The effective ranges vary from 800 ft. to 1,600 ft. — *Railway Electric Engineer*, September, 1923.

Standards of Radiation Intensity.—For a number of years the Bureau of Standards has been investigating the instruments and methods used in radiometry, and during the past nine years it has provided investigators with standards of radiation intensity in absolute value. These radiation standards are of use to biologists, physiologists, psychologists and others, to standardize the light stimuli employed in their investigations. In this way the work throughout the country is becoming systematized and specified on a reproducible basis.—*Technical News Bureau No. 29 of the Bureau of Standards.*

Motors and Control

Measurement of the Quantity of Air Delivered by Ventilators and Compressors.—C. A. BERTELLA.—With a few formulas and many illustrations the author describes the apparatus to be employed to control exactly and rapidly the quantity of air delivered by ventilators and compressors. How the various measurements are to be made is shown, and practical data concerning laboratory experiences are given.—*Ingegneria*, September, 1923.

Electric Drive in the Printing of Newspapers.—CARL F. SCOTT.—The application of electricity in the production of the finished newspaper—that is, the actual printing—is outlined. The first part of the article is devoted to a detailed but brief historical review of the development of the modern types of newspaper printing presses, while the remainder describes the load characteristics of a press, the manner in which the electric drive is arranged to fulfill the requirements completely and the control equipment employed with modern printing presses. — *General Electric Review*, November, 1923.

Winding Electric Motors.—A. C. ROE. —The author describes steps in stubbing and connecting windings of two-phase and three-phase induction motors with an explanation of some two-voltage windings. The actual work which the repairman does with his hands and tools in making winding connections after he has checked up the diagrams and determined what connections to make is described.—*Industrial Engineer*, November, 1923.

Electrical Safety Inspection.—L. C. ILSLEY.—The author has written this paper especially for state mining inspectors, safety engineers of mining companies and others interested in electrical safety inspection in mines. It presents the important points that should be watched by inspectors and reviews the work of the Bureau of Mines in the testing of electrical apparatus or equipment to determine its permissibility for use in gaseous coal mines. The treatment of the subject is very comprehensive.—*Reports of Investigations, No. 2541, Bureau of Mines.*

Heat Applications and Material Handling

Stresses in Welded and Riveted Steel Tanks.—The work carried out last winter on stresses in welded and riveted steel tanks under hydrostatic pressure is reported in this paper. Four steel tanks, 4 ft. in diameter and 10 ft. long, made of $\frac{5}{16}$-in. mild-steel plates and designed for a stress of 16,000 lb. per square inch at 200 lb. working pressure, were used in these tests. Two of the tanks were butt-welded, one was lap-welded, and the fourth was of the ordinary lap-riveted construction. As a result of the analysis of the deformation and distribution of stress in these tanks, the following general conclusions seem warranted: (1) The commonly accepted theory for the design of tanks is, for all practical purposes, sufficiently accurate, provided the computed stresses are not influenced by secondary stresses. (2) For thin tanks the measured stresses, based upon the two-dimensional formula, are in close agreement with the design stresses computed by the usual pressure formulas, provided the former are not affected by secondary causes. This is borne out by the results obtained at the center of the end. (3) Secondary stresses resulting in high-stress intensity were caused by (a) faulty design of the attachment of the spherical end to the cylindrical shell, (b) non-conformity of the shell to an accurate circular section, and (c) discontinuities in the shell for the manhole and fittings. These may produce a possibly dangerous condition if they are near a welded or riveted joint or seam. (4) The stresses were increased by the presence of a seam.—*Technologic Paper No. 243 of the Bureau of Standards.*

Electrophysics, Electrochemistry and Batteries

Some Relations Between the Microstructure of Metal Surfaces and Electrodeposits Made Thereon.—A. K. GRAHAM. — The author discusses the influence of the structure of the base metal on electrodeposits. A distinction is made between primary influence, or true reproduction, and secondary influence, or the effect of this reproduction on the deposit at large. Where reproduction is obtained large crystals in the base metal produce the most marked secondary influence on the electrodeposit. Reproduction of the structure of both copper-base and brass-base metal, but not of nickel, was obtained in copper deposits. Results obtained with nickel deposits on both copper-base and nickel-base metal are uncertain owing to the difficulty experienced in attempting to reveal their structure upon etching.—*Paper presented before the American Electrochemical Society at Dayton, Ohio*, Sept. 27-29, 1923.

Traction

Concrete Poles for Railway Electrification.—Experiments carried on by the Cleveland Railway Company indicate that the original type of reinforced-concrete pole contained more material than was necessary to insure adequate strength. A series of tests were made to determine the relative value of different types of concrete poles for use in overhead construction on tangent track. The primary object of these investigations was to design a pole that would be adequate for this purpose. Detailed accounts are given of some of the more important tests that were conducted.—*Electric Railway Journal*, Nov. 10, 1923.

Telegraphy, Telephony, Radio and Signals

Modern Receiving Radio Stations.—UGO SORDINA.—A review of what has been done to improve the receiving part of a radio station. The most important requirements are discussed and atmospherical interferences are specially treated. The different systems of reception are also considered, and a survey of all the most important radio stations of the world is given. Many illustrations presenting a variety of circuit connections accompany this paper. —*Elettrotecnica*, Sept. 25, 1923.

Fire-Alarm Systems.—W. J. SMITH. —Several of the more important and most utilized fire-alarm systems are described and illustrated.—*Electrical Record*, October, 1923

New Books

Reviews of the Latest Contributions to Technical, Industrial and Commercial Literature of Particular Interest to Members of the Electrical Industry

English for Engineers

By S. A. Harbarger, Department of English, Ohio State University. First edition. New York: McGraw-Hill Book Company, Inc. 266 pages.

Primarily written to convince the engineering student of the importance of the English language as a tool of expression, this book contains many useful suggestions for the professional man. Letter writing, applications, wire communications, orders, the preparation of instructions, the practice of dictation, the preparation of abstracts, summaries, articles for technical journals and general professional writing are covered in a logical and workable manner. Especially comprehensive is a chapter on engineering reports, and the book is enriched by a short chapter on the value of engineering society meetings and by a large number of references to articles, books and editorials published since the war to stimulate interest and improve practice in writing by engineers. This bibliography is unusually comprehensive and suggestive. Some helpful thoughts on reading for general culture occupy a chapter of much practical value, and there is an excellent index.

The Outline of Radio

By John V. L. Hogan. New York: Little, Brown & Company. 256 pages, illustrated.

Here is a book for any one who is attracted by either the novelty or the present importance of radio and wants to know how it works. For those who have no scientific training it will have the appeal of an easy style and a beginning, under each topic, with facts and laws which are matters of daily experience to every one. Nor will they find it difficult to follow the author's explanations of the less familiar natural phenomena involved in the somewhat extended chain of transformations going to make up the complete radio message. Each of the links in this chain is taken up in its turn and its nature explained by analogy and comparison with other more familiar phenomena. So far back does the author go in some cases in his purpose to enable the uninitiated to pick up the thread that he occasionally approaches the metaphysical, as, for example, in his comments on the nature of intelligence, and that of the ether. The result, however, is altogether helpful to his constant purpose of a clear explanation.

To the scientist and engineer the book also makes its appeal by reason of its complete assembly of all the elements of the radio chain, and particularly by its presentation of the numerical limits of the various quantities involved and their peculiarities within the different ranges. The discussion of frequency is especially happy.

The easy style enlivens the historical review, as well as all that follows it, and a well-chosen series of diagrams also does much to help the unaccustomed reader on his way to an understanding of the nature of radio. Mr. Hogan reveals himself a good physicist and a good teacher. His book should prove a popular response to the present widespread demand for general knowledge of the nature and possibilities of radio.

Elements of Machine Design

By Dexter S. Kimball and John H. Barr. New York: John Wiley & Sons, Inc. 466 pages.

A thoroughly revised and enlarged second edition of this favorite textbook will be welcomed by engineers and engineering educators. The authors have rewritten and brought up to date the material in the early edition and have included a chapter on the balancing of machine parts. The book is really a dynamic textbook on mechanics directly applied to machines and machine parts. It presupposes a knowledge of mathematics and theoretical mechanics, and deals with the parts of machines, the energy changes, the resultant forces and the proportioning of the parts to withstand the forces. Gears, axles, screws, riveted fastenings, springs, tubes, sliding surfaces, rolling surfaces, lubrication, friction, efficiency and machine frames are some of the many details thoroughly treated. The new chapter on machine balancing will be very welcome, as this subject has long been neglected in textbooks.

Jahrbuch der Elektrotechnik

Edited by Dr. Karl Strecker. Munich and Berlin: R. Oldenburg. 233 pages.

The ninth annual edition of this yearbook gives a summary of progress in electrical engineering during 1920 by means of very brief references to the important articles in sixty German, Austrian, Swiss, French, English and American journals. The American publications include the ELECTRICAL WORLD, *Electric Railway Journal*, *Chemical and Metallurgical Engineering*, *General Electric Review*, *Bulletin of the Bureau of Standards*, *Physical Review*, and the journals of the American Institute of Electrical Engineers and the American Chemical Society. There are four general divisions, "Electromechanics," "Electrochemistry," "Communication" and "Measurements and Research." The material in each is very thoroughly classified, each section being handled by a specialist in that field.

P. H. DAGGETT.

Electrical Vibration Instruments

By A. E. Kennelly. New York: The Macmillan Company. 450 pages, illustrated.

This volume is one of the Engineering Science Series under the general editorial supervision of Profs. D. C. Jackson and E. R. Hedrick. It treats of the theory, design and testing of telephone receivers, oscillographs and vibration galvanometers. Fifteen chapters are devoted to the telephone, seven to the oscillograph and one to the galvanometer. The point of view from which the action of each of these instruments is approached is that of a reciprocating electric motor. In the body of the text the subject matter is developed with a minimum of mathematical calculations by means of the free use of graphical methods and mechanical analogies. The mathematical methods which are necessary for the quantitative solution of the various problems involved are placed for the most part in the fourteen appendices, which constitute between a quarter and a third of the volume.

A considerable portion of the material here presented has appeared in technical journals during the last fifteen years as contributions from Professor Kennelly's laboratory. The revision and co-ordination of all this work, in which he has had many collaborators, is written in the agreeable and lucid style for which the author is well known and makes the book a welcome addition to the libraries of all those who have occasion to employ this class of instruments for either instruction or research.

L. P. WHEELER.

Die Materialprüfung der Isolierstoffe der Elektrotechnik

Second edition. By Walter Demuth. Berlin: Julius Springer. 254 pages, 132 illustrations.

During the world war the central European states were deprived of a great many raw materials essential to electrical manufacture. To overcome this shortage a vast number of substitute materials were developed and offered to the factories, not always with full success. It became therefore essential to subject these "Ersatz" materials to rigorous electrical and mechanical tests to determine to what extent they could replace their missing prototypes. More than ever before a comprehensive collection of testing methods and testing machines was needed—a demand which the author satisfied excellently with the book under notice. Only one year after the first edition appeared a second edition was demanded and work on it begun—a fact which speaks for its timeliness and adequacy.

The book is divided in two main parts dealing respectively with solid insulating materials and liquid insulators. The first part contains testing methods and enumerates about sixty solid insulating materials of natural and synthetic character. The testing methods comprise mechanical, chemical and electrical tests. The second part deals with properties and tests of oils, lubricants,

lacquers and various liquid and semi-liquid compounds. All material is gathered from the very latest publications and personal experiences of the author and represents probably the most up-to-date collection of its kind. The American reader will find in foreign current literature and advertisements frequent mention of insulating materials of more or less mysterious names, such, for example, as "Pertinax," "Repelit," "Ambroine," etc. Sixty of such materials are fully described in this book, which gives it great value as a data collection alone.

The most recently standardized testing methods for transformer and breaker oils form part of the second section. It might have been well to include mechanical and electrical methods of testing enameled wires, which are being used very extensively in every modern electrical plant. The excellent paper and cuts used in the book are worth special mention. A. PALME.

Elementary Principles of Lighting and Photometry

By John W. T. Walsh. New York: E. P. Dutton & Company.

The author of this book is associated with certain scientific and technical aspects of light and lighting in England, and naturally the book reflects this environment. To those interested in lighting in the United States this book will illustrate the general advancement of this country in lighting matters as compared with England, but at the same time the book is one of many indications that progress in England is being rapidly made.

Mr. Walsh ably treats the many general subjects, such as production, measurement and distribution, in the first half of the book, but the later chapters, dealing with specific fields of lighting, reflect a limited contact with actual lighting practice, although they contain a great deal of useful material. As an example of the futility of trying to incorporate in a single book applied lighting as well as principles of production, measurement and distribution of light the case of artificial lighting in schools might be cited. This is treated in a page or two. Incidentally, the author's treatment of school lighting is a good indication of how rapidly progress is being made in lighting, as well as of the difference in standards in this country and in England. It is evident that the author borrowed material rather widely, and, although a list of references is given, the book would be more valuable if the references were more numerous.

The volume should be of interest to any one in this country who wishes to broaden his viewpoint on lighting. Nevertheless, its material in general is in keeping with a stage of development which was passed in the United States some years ago. It should serve well in England, where and for which nation it was written.

M. LUCKIESH.

Vectorial Method to Calculate Long High-Voltage Lines

By Ernst Schönholzer. 16 pages, 16 vector diagrams and tabulations. Winterthur, Switzerland: E. Schönholzer.

Basing his method upon the Le Roy-Blandel series, the author derives graphical representations and develops a combined, exact and complete transmission diagram containing all the required data, such as current, voltage and phase displacement. The general usefulness of this new graphical method is explained by a practical example, which is carried out in detail. Designers of long high-voltage lines may use this new and apparently very simple method as a welcome means to check their customary way of calculation. A. PALME.

Book Notes

The Design of Diagrams for Engineering Formulas. By L. I. Hewes and H. L. Seward. New York: McGraw-Hill Book Company, Inc. 112 pages, quarto.

A presentation of methods fundamental to constructing time-saving diagrams which obviate the necessity of calculation of formulas. The methods are logically developed by the aid of a large number of diagrams, only essential mathematics being employed. The fifty-four practical examples include three or four different types of solutions applying to the same formulas. The large-size page used, though not common to engineering texts, eliminates the cramping of diagrams or use of folded sheets. The problems are such as to render the book valuable as a text.

Grundzuge der Starkstromtechnik. By K. Hörner. Berlin: Julius Springer. 257 pages, 319 illustrations.

A modern textbook covering in terse but concise manner practical problems of the entire electrical field. The constant presentation of examples taken from actual practice adds materially to its remarkable clearness.

Freileitungsbau-Ortsnetzbau. Fourth edition. By F. Kapper. Munich and Berlin: R. Oldenbourg. 388 pages, 376 illustrations.

Four editions within ten years is a rather unusual record for a technical book. The vast and complex subject of overhead-line calculations and constructions, as standardized by the V. D. E., including the latest additions, such as full data on steel-aluminum cables, is covered in complete detail.

Standards of the Electric Power Club. Fifteenth edition. 176 pages, paper, 8vo. Cleveland: Electric Power Club.

This fifteenth edition of Power Club standards marks the first time that the standards have been published separately from the "handbook." This is a real improvement. The octavo size, superseding the old handbook size, permits a much more effective typographical arrangement. Power Club standards presented in this book are commercial engineering standards on electrical power apparatus. The book is fully cross-referenced to corresponding A. I. E. E. standards.

Yields of Bonds and Stocks. By David C. Johnson, Caleb Stone, Milton C. Cross and Edward A. Kircher. New York: Prentice-Hall, Inc.

This is a series of tables in which bond yields (to three places) are given directly for various prices, coupon rates and maturities without necessity of interpolating or prorating. Current income on bonds is also given. The book includes tables for yields of stock and an entirely new method of determining yields of premium bonds.

Principles of Direct-Current Machines. Third edition. By Alexander S. Langsdorf. New York: McGraw-Hill Book Company, Inc. 470 pages.

This third edition of the well-known textbook on direct-current machinery is largely a "refreshed" revision of the second edition, upon which it is an improvement. The design examples are kept as a necessary part of the treatment, though set aside typographically as illustrations.

A. S. T. M. Tentative Standards for 1923. Philadelphia: American Society for Testing Materials. 859 pages, illustrated.

Tentative specifications and testing methods for all kinds of material used in construction and operation of practically every industry. Copper wire, preservative coatings, waterproofing and insulating materials and rubber products are included.

Books Received

Elektronen und Ionen Ströme. By Dr. J. Zenneck. Berlin: Julius Springer. 48 pages, illustrated.

Advertising Campaigns. By Harry Tipper and George French. New York: D. Van Nostrand Company. 432 pages, illustrated.

Fundamentals of Radio. By James L. Thomas. New York: D. Van Nostrand Company. 207 pages, illustrated.

The Inspection and Testing of Materials, Apparatus and Lines. By F. L. Henley. London: Longmans, Green & Company. 355 pages, illustrated.

Messgerate und Schaltungen zum Parallelschalten von Wechselstrom-Maschinen. By Werner Skirl. Second edition. Berlin: Julius Springer. 137 pages, illustrated.

Technical Writing. By T. A. Rickard. New York: John Wiley & Sons. 337 pages. Second edition.

Continuous Current Circuits and Machinery. Vol. I. By J. H. Morecroft and F. W. Hehre. New York: John Wiley & Sons. 433 pages, illustrated.

La Construction des Bobinages Electriques. By C. Clement. Paris: Dunod. 202 pages, illustrated.

News of the Industry

Chronicle of Important Events and General Activities,
Announcements and Reports of Association Meetings, Court Decisions and
Commission Rulings and News of Electrical Men

Locomotive Speed Record

Electric Engine Makes 105 Miles an Hour in a Trial Test Made at Erie, Pa.

A RECORD for an electric locomotive was made this week when one built by the General Electric Company and the American Locomotive Works for the Paris-Orleans Railroad in France attained a speed of 105 miles an hour in tests before two hundred steam and electrical railroad men from all parts of the country. The tests were made at the Erie (Pa.) works of the General Electric Company. According to officials of that company, only the shortness of the test tracks prevented the engine being sent still faster, probably reaching 125 miles an hour.

The locomotive is equipped for quick "pick-up," and in the first ten seconds after power was applied increased its speed at the rate of 2 miles an hour per second. At the end of the first sixty seconds it was traveling at the rate of 60 miles an hour and in about two minutes reached maximum speed.

An exhibition run of an electric freight locomotive for the Mexican Railway was staged, with a regenerative braking contest during which the electric locomotive, connected to send power back to the line, was hauled by a steam unit at a speed of about 14 m.p.h. As high as 1,800 hp. was sent back into the system.

Floods Destroy North Italian Power Plants

Heavy rains caused a dike leading from the artificial lake at Dezzo, near Bergamo, northern Italy, to give way last Saturday and inundate the whole country round about, with heavy loss of life and property. Five generating stations belonging to the Società dei Concimi Idraulici Industrial, the Società Bresciana di Angelo and the Ferrovie di Voltri were badly damaged, leaving the city of Bergamo temporarily without light. Dezzo, Menaggio, Queggio, Teveno, and four other small villages in the valley were wiped out by the raging waters.

Bergamo lies north of and between the large manufacturing cities of Milan and Brescia. Transmission lines connect it with the large interconnected network centering at Milan. The generating stations damaged were of the hydro-electric type and none was very large, and it is probable that at this season of the year enough energy can be transmitted over the interconnected system to take care of Bergamo.

Semenza Becomes President of International Commission

A cablegram from Paris to Dr. Clayton H. Sharp, secretary of the American committee of the International Electrotechnical Commission, says that at a meeting of the executive council of the commission held on Dec. 3 in Paris Guido Semenza, consulting engineer of Milan, Italy, and local honorary secretary in that city for the American Institute of Electrical Engineers, was elected president of the commission in succession to Dr. C. O. Mailloux of New York. Dr. Mailloux was made honorary president, being the first to fill this newly created office. Three new nations were admitted to representation on the I. E. C., and an entirely satisfactory meeting of the council was reported.

GUIDO SEMENZA

Aberdeen, Wash., for, Bellingham Against, City Plant

The voters of Aberdeen, Wash., at a general election on Dec. 1 carried by a small majority a measure authorizing the expenditure of $2,000,000 on the Wynoochee River project, intended to provide additional water and hydro-electric power to the city as a municipal enterprise. The Mayor and City Council are, however, pledged to obtain complete cost data on the undertaking before proceeding.

The voters of Bellingham, Wash., on the same day defeated a proposed bond issue for $500,000 intended to be used to supply municipal power.

Muscle Shoals Fight On

Congress Is Preparing to Renew Its Contention Over Ford—Latter Sees the President

THE new Congress had not perfected its organization when bills for the disposal of the government's properties at Muscle Shoals were tossed into the hopper of the House. All of the several early measures provided for lease of the projects to Henry Ford.

Representative J. C. McKenzie of Illinois reintroduced without change the bill agreed upon in the last Congress by a majority of the members of the House military affairs committee. This provided for acceptance of the Ford offer for the hydro-electric development, the nitrate plants, quarry, railroad and other properties on the terms of the Ford bid, but excluded the Gorgas steam plant, now disposed of to the Alabama Power Company. It was the exclusion of this auxiliary plant which caused several minority bills to come from the committee in the last Congress.

Representatives Vinson of Georgia and Almon of Alabama introduced bills accepting the Ford offer without change. These bills evidently would make it incumbent upon the government to build a new steam plant on the Warrior River with a transmission line to Muscle Shoals.

Henry Ford, accompanied by one of his engineers and one of his lawyers, had a conference with the President on Monday which has been made the occasion for much speculation, but no authoritative statements have been made as to the purpose of the visit. Mr. Ford also visited Secretary Weeks.

President Coolidge on Muscle Shoals and Fertilizer

President Coolidge's opening message to Congress, delayed by the contest over organization in the House of Representatives, was delivered on Thursday. It contained this reference to Muscle Shoals:

"The government is undertaking to develop a great water-power project known as Muscle Shoals, on which it has expended many million dollars. The work is still going on. Subject to the right to retake in time of war, I recommend that this property with a location for auxiliary steam plant and rights-of-way be sold. This would end the present burden of expense and should return to the Treasury the largest price possible to secure.

"While the price is an important ele-

ment, there is another consideration even more compelling. The agriculture of the nation needs a greater supply and lower cost of fertilizer. This is now imported in large quantities. The best information I can secure indicates that present methods of power production would not be able profitably to meet the price at which these imports can be sold. To obtain a supply from this water power would require long and costly experimentation to perfect a process for cheap production. Otherwise our purpose would fail completely. It seems desirable, therefore, in order to protect and promote the public welfare, to have adequate covenants that such experimentation be made and carried on to success. The great advantage of low-priced nitrates must be secured for the direct benefit of the farmers and the indirect benefit of the public in time of peace and of the government in time of war. If this main object be accomplished, the amount of money received for the property is not a primary or major consideration.

"Such a solution will involve complicated negotiations, and there is no authority for that purpose. I therefore recommend that the Congress appoint a small joint committee to consider offers, conduct negotiations and report definite recommendations."

Utilities Commissioners Meet at Miami

Committees Declare Uniform Regulation by All States Desirable, Demand Continuous Service and Urge Close Supervision of Depreciation Reserves

ONE of the noteworthy reports presented at the Miami (Fla.) convention of the National Association of Railway and Utilities Commissioners, in session from Tuesday to Friday of this week, was that of Lewis E. Gettle, chairman of the Wisconsin Railroad Commission, who laid bare to the association at its open session the widely different methods that are pursued throughout the nation in the regulation of public utilities. Mr. Gettle, as chairman of a special committee appointed last year, presented a 300-page digest of railroad and utility regulatory laws of the various states, the first one of its kind ever compiled.

"Little or no progress has been made toward the unification of laws regulating public utilities," declared Chairman Gettle. "The marvelously rapid movement toward consolidations and extensions of electric properties, many times with power plants in one state and distributing systems partly in the state in which the power is situated and partly without the state, has suggested to forward-looking regulatory bodies a necessity for bringing about some measure at least of uniformity of practice in all the states concerned. The movement toward the development of superpower plants at or near the vicinity of the great coal deposits and the transmission of power over much longer distances than is at present accomplished has also seemed to emphasize the necessity for action in this direction.

"Our survey shows there are forty-nine commissions working under a wide dissimilarity of laws. In several of the states the commission, in fixing rates, is still limited to the establishment of maximum rather than absolute rates. In some of the states the commission has been granted extensive power and authority over the question of competition and the prevention of duplication of equipment through the use of the certificate of public convenience and necessity. In other states no such power has been conferred upon the commission. Many of the states have merely regulatory laws applicable to railroads. Others have laws for the regulation of privately owned utilities but exempting municipally owned utilities from such supervision. Power to regulate the issuance of stocks, bonds and other securities remains unprovided for in about half of the states, and in the states which do provide it there are fundamental differences. The vital subject of valuation is also subject to a marked degree of variation. While some uniformity does exist between the several states, there still remains much to be done in bringing about the efficiency and the sanction which results from sound and uniform regulation."

The committee is not yet prepared to submit tentative drafts of proposed uniform legislation.

Service Must Be Continuous

Basing his report on service of public utility companies on a situation in New Jersey where a railway company discontinued service for a period of fifty-one days because it claimed its earnings were insufficient to grant wage increases demanded, J. J. Divine, chairman of the committee and of the West Virginia Public Service Commission, recommended that it be declared to be the policy of regulation that "continued and uninterrupted service must be rendered to the public at large as long as the franchises are retained, that the franchise obligation to serve shall always be construed to mean continuous and uninterrupted service." It was suggested that state laws be drafted to establish this fundamental principle of service firmly and unquestionably.

The committee on public utility rates devoted the greater portion of its report to considerations of depreciation reserves. E. R. Hughes of the Oklahoma commission contributed the argument. In substance it asked that the handling and accounting of depreciation reserves should have strict supervision by commissions, so that it may not be dissipated in dividends or capitalized or camouflaged as operating expense, but be kept liquid and available as a guarantee or insurance of continuous service. The provisions of an order of the Oklahoma commission covering the matter were cited.

A prophecy that in the future electric power would be manufactured at points near the source of coal and water supply and transmitted to operate the industries and railroads of the United States by a gigantic system of interconnected transmission lines was made by W. S. Murray of New York, who spoke as the representative of Secretary of Commerce Hoover. He declared that in the North Atlantic States, despite the fact that the Potomac, the Hudson and the Connecticut Rivers ran through them, only 20 per cent of the needed power could be manufactured by hydro-electric plants.

Officers for 1924 were elected as follows: President, Henry G. Taylor, chairman Nebraska State Railway Commission; first vice-president, W. D. B. Ainey, chairman Public Service Commission of Pennsylvania; second vice-president, A. G. Patterson, president Alabama Public Service Commission; secretary, James B. Walker, secretary New York Transit Commission; assistant secretary, Lewis G. Thompson, Florida Railway Commission; general solicitor, John E. Benton.

Hoover Again Asks for Radio Regulation

"The rapid growth of radio communication makes necessary an affirmative declaration by Congress of a governmental policy in accordance with which the art is to be conducted and the empowering of some agency to carry that policy into effect. This can only be done through an officer with discretionary powers and under regulations which will be made by him in conformity with the general terms of the law. I most earnestly commend this matter to the attention of Congress."

In these words Secretary of Commerce Hoover will in his forthcoming annual report to Congress urge the importance of national regulation of the radio situation. The recommendations made by the second national radio conference last March and adopted by the department virtually in their entirety have, Mr. Hoover will say, reduced interference greatly; but he goes on to observe:

"Facilities for the enforcement of the present law are wholly inadequate. There are some twenty-five thousand stations now sending radio messages within our country or along our coasts. The law requires the inspection of all these stations, and if this inspection is to be sufficiently efficient to accomplish results in the character of equipment and prevention of interference it must be performed with reasonable frequency. To inspect these twenty-five thousand stations the department now has a total force of twenty-nine men, all that can be employed within the limit of the appropriation. Manifestly, under such a condition, effective inspection is impossible."

Hydro-Electricity Topic of A. S. M. E.

Held that Superpower Development Will Not Reduce Present Cost of Energy—Possibilities of Bleeding and of Extraction Cycles—Coal Handling and Storage

A FEATURE of the annual convention of the American Society of Mechanical Engineers held in New York Dec. 3-7 was an evening meeting on hydro-electric developments at which representatives of the A. S. C. E., the A. S. M. E. and the A. I. E. E. presented papers.

Of great interest to central-station engineers was a session on the possibilities of bleeding and of extraction cycles in securing greater economy in energy production. A digest of these papers and the discussion on them will appear in the next issue of the ELECTRICAL WORLD.

The convention program was replete with papers covering new developments in mechanical engineering and industrial management, and the attendance was very large. Outstanding papers of value to electrical men were "Salt Velocity Method of Measuring Water Flow," by C. M. Allen; "The Oscillographic Method of Measuring Water Flow," by N. R. Gibson; "Fundamental Factors in the Spontaneous Combustion of Coal," by O. P. Hood; "Coal Handling and Storage," by H. E. Birch and H. V. Coes, and "Economical Status of the Oil Engine," by L. H. Morrison.

Progress was made at the sessions on power test codes, fuels and other division activities. The very successful Power Show added greatly to the interest in the convention, the exhibits proving unusually interesting and instructive.

PRESIDENT HARRINGTON'S ADDRESS

The address by the retiring president, John Lyle Harrington, was a searching analysis of the engineer's status in industry, in business and in public affairs, with suggestions for overcoming some of the present shortcomings. It is only within recent years, Mr. Harrington said, that engineers have emerged from the artisan class, and something of the old tradition still remains in the public mind. The engineer has been so intent upon devising means of production that he has failed to establish his position as to the other leading factors in our social life. He is too prone to assume the rôle of an employee and devote himself to the interests of his individual employer. He is usually looked upon as a specialist, and there has not been accorded to him by financiers full confidence as a business man, but his scientific methods applied to those problems which are too complicated for the business man's solution or judgment should result in better understanding of the fluctuations in business and assist in remedying the conditions responsible for non-employment.

Citing the case of the railroad and water transportation systems, Mr. Harrington showed how the engineer has replaced speculative financing with most beneficial results. Another important problem awaiting solution on which the engineer can bring his training to bear is, he said, that of distribution.

While engineers consider themselves competent to organize industry, they have failed, the speaker maintained, to organize effectively their own profession. There are too many groups of narrow and specialized interests as contrasted with certain of the other professions, such as the law, in which the Bar Association exerts the whole professional weight in public affairs.

Mr. Harrington concluded his address with observations on professional ethics and the advisability of making engineering a closed profession by legally establishing the professional status of every private practitioner and of every engineer employed by others. Only a few states now require examinations and records that show the real status of the licensee. The only way to prevent the unqualified from assuming the name of engineer is by closing the profession, as has been done in law and medicine.

THE HYDRO-ELECTRIC SESSION

At the hydro-electric meeting on Wednesday evening President J. L. Harrington indicated the necessity for engineers to disseminate accurate knowledge of the possibilities of water power. Past-president L. B. Stillwell of the A. I. E. E., as presiding officer of the meeting, outlined the results that will be obtained by adequate hydro-electric development and spoke of the division of activity between the various kinds of engineers.

The principal address was given by John R. Freeman, past-president of the A. S. M. E. and the A. S. C. E. Mr. Freeman stated that applications have been filed with the Federal Power Commission to develop 21,000,000 hp., compared with 9,000,000 hp. now developed. Conferences on the subject, he said, have their greatest value through their educational effect on the public, and he outlined the fundamental principles which underlie the proper development of hydro-electric power as being, first, that a hydro-electric development must show a profit and, second, that it must contribute to public welfare in the highest degree. He could see no reduction in the cost of power through the use of superpower or mouth-of-mine plants because of the cost of distribution and transmission. The value of these developments would lie in their maintaining the cost of power at its present low figure.

Mr. Freeman outlined the marvelous technical developments in hydro-electric equipment and traced the historical development of the power industry. He then accented the limitations and discussed the problems associated with the development of water power as based on the two fundamental principles he had enunciated.

Conservation of capital, Mr. Freeman said, must always be considered along with the conservation of natural resources. This frequently will lead to a departure from the line of engineering development that would be ideal at a given site because of the menace of an unsatisfied interest charge upon capacity provided but not promptly put to use. He thought the rejection of the constitutional amendment designed to open the Adirondack region in New York State for the generation and transmission of electrical energy showed no real understanding of the facts by the voters at large.

ST. LAWRENCE POWER

Mr. Freeman quoted the opinion of "one of the most experienced among the builders and managers of large electric power developments in America" that there was no money to be saved by bringing hydro-electric power to Boston from the St. Lawrence and that steam plants could deliver energy just as cheaply. Other eminent engineers, he said, are just as strong in the opposite belief. Rare circumstances, he held, may present a condition of great blocks of power so abnormally cheap that an abnormally large percentage of loss in transmission may be allowable. Perhaps, the speaker concluded, ways can be found to bring St. Lawrence power to New York and Boston so cheaply that it will cost delivered, say, 0.1 cent per kilowatt-hour less than steam power generated at Fall River, Boston or New York.

The fundamental problems are: How soon will this power be needed? How much of it is needed? What will it cost? How much can be paid for it?

Col. John P. Hogan discussed the need of accurate engineering data before proceeding with the development. Many failures have occurred because of overestimation of the water resources and because estimated costs have been exceeded. Average run-off records should be used with very great care and the theory of probabilities should be applied to any short-term records. Hydro-electric sites should be properly explored before any cost estimates can be taken as worth while.

George Orrok discussed the cost of water power in comparison with the cost of steam power, particularly in connection with long-distance transmission. H. W. Buck discussed the distribution of power from the generating sources. He stated that the comparative cost of steam and water power befogged the issue, as in the East at least water power must be used in connection with steam power. William White discussed the great advantages that would ensue through the greater development of our power resources. J. P. J. Williams discussed the proposal of hydro-electric power production through public ownership and operation and cited the development of the Ontario system. L. B. Stillwell pleaded for standardization of potentials and frequency.

Electric Trucks and Good Will Topics at Salt Lake

Interest in the meeting of the National Commercial Section of the N. E. L. A. held at Salt Lake City Nov. 21 and 22 was, as already reported, concentrated in large part on the electric range meeting, but the discussion on electric trucks and an unscheduled public relations meeting came in also for their share.

Very encouraging progress in promoting the commercial electric truck was reported at the meeting of the Transportation Bureau, presided over by Chairman Skinner. Results accomplished on the Pacific Coast were brought out by the California delegates. It was shown that thirty-three trucks have been sold so far and that this number will probably be greatly exceeded before the end of the year. The national committee reported the sale of more than 800 street trucks this year. The revenue to the central station at 5 cents per kilowatt-hour is $300 per year for each truck. The average life of storage batteries is now three years, and this is gradually increasing.

So much interest was shown in the plan of the greater service bureau of the Southern California Edison Company as presented by W. H. Fischer of that company that a special meeting to discuss ways of combating municipal ownership was called. This meeting was well attended, and Mr. Fischer presented in detail the plan of his department for thoroughly organizing the employees. A. K. Baylor, Schenectady, favored making capitalists out of every one by the sale of securities. He thought that the fight against public ownership must be carried outside the electrical industry.

The next meeting of the Commercial Section will be held either in Cleveland or St. Louis, according to present plans.

Chicago Sanitary District Doubles Light Rate

The Sanitary District of Chicago has just notified the city of Chicago that, effective Jan. 1, 1924, the energy rate for the street-lighting system will be increased from 4.4 mills per kilowatt-hour to an arbitrary rate of 8.5 mills. This means an additional cost of $200,000 a year for operating the system. The new rate, however, runs hand in hand with the Commonwealth Edison Company's energy rate for the same type of service.

Commissioner John T. Miller of the Department of Gas and Electricity said that the contract under which the city and the Sanitary District have been operating for six years contained several features which interfered with the satisfactory operation of the lighting system. One of these has been the division of the city into three zones lighted at intervals of fifteen minutes, the last zone to be lighted being thus subjected to a half hour of darkness. To obviate this it has become necessary for the Sanitary District to drop its so-called commercial load, which means a serious loss of revenue to it. The Sanitary District is willing to incorporate in the contract a clause that will permit the city to adjust the rate at the end of each year so that neither a profit nor a loss shall be shown by the Sanitary District. In other words, the city will virtually control the Sanitary District's electrical department.

Another reason for the advance in rates is that the sewage-treatment program has now developed to the point where the plants in operation are consuming much of the Sanitary District's generated energy and may in two years consume its entire output.

Six Months' Work of New York Electrical Board

More than five hundred representative electrical men of New York City attended on Dec. 5 the first "members' meeting" of the newly organized Electrical Board of Trade of New York and heard reports of the board's achievements to date from its president, Arthur Williams; the chairman of its board of governors, Charles L. Eidlitz, and other speakers.

Theodore Beran, representing the manufacturers; William Kennedy, representing the jobbers, and Frank Pattison, consulting engineer, testified to the value of the electrical board of trade idea and the importance of full membership by the local industry. Tribute was paid to the work of Charles L. Eidlitz in directing the activities of the organization.

Called upon by President Arthur Williams, Mr. Eidlitz recounted the work of the board's office in handling individual and group trade problems, speeding up the granting of inspection certificates, eliminating the illegitimate transfer of contractors' licenses, promoting the abolishment of the one-dollar permits for work by building electricians, settling bankruptcy cases without legal costs, putting an end to price cutting on appliances between rival department stores, insuring elimination of the "all-saving" clause in engineers' specifications, reporting on moral risks of electrical business men, restoring stolen goods to owners, adjusting complaints against utility companies and contractors, establishing building loans and group insurance for electrical employees and abolishing special privileges. Altogether in the six months of its existence, estimated Mr. Eidlitz, the new organization has saved the industry about $500,000.

Asked to "pronounce a benediction," James H. McGraw, president McGraw-Hill Company, commented upon the inspiring and highly practical character of the work being accomplished by Mr. Eidlitz and assured his hearers that the McGraw-Hill electrical papers stood squarely behind the New York Electrical Board of Trade idea.

Substantial Rate Reductions for Wisconsin Towns

The Wisconsin Railroad Commission is making an intensive study of the rate agreement recently reached by representatives of forty-nine Wisconsin cities and villages and the Wisconsin-Minnesota Light & Power Company. (See ELECTRICAL WORLD, Nov. 24, page 1082.) While it will probably be some time before the commission submits its findings, it is expected that the agreement will not be greatly altered. This agreement is intended to produce a revenue in each of the cities concerned substantially less than the company collected on the same consumption under the "loop" rates of October, 1920. The schedule, if approved by the commission, is to remain in force for six months, during which time the commission is to work out its effect, subsequently increasing or decreasing it, if necessary, to produce the stipulated return. The yearly reduction in revenue in Eau Claire will amount to $60,744; in Chippewa Falls, $20,485; in La Crosse, $60,655; in Menomonie, $14,926; in Neillsville, $3,360 per year.

The important element of the proposed schedule is that it is based upon the actual cost of serving each community and not upon the average cost of serving many communities. The cost of service shows the cost of transmitting, transforming and local distribution. An example of how the reduced schedule will affect a five-room house is given as follows: In the new schedule 10 cents will be charged for the first 25 kw.-hr., 7 cents for the second 25 kw.-hr., and all in excess of 50 kw.-hr. will be paid for at the rate of 4 cents. Under the old schedule 10½ cents was charged for the first 50 kw.-hr. and 8½ cents for the next 50 kw.-hr., and all in excess of 100 kw.-hr. was charged for at the rate of 7 cents.

Supreme Court Reaffirms Its West Virginia Gas Finding

The United States Supreme Court on Monday of this week reaffirmed the decision it handed down in June declaring unconstitutional the West Virginia law which would have compelled natural-gas companies piping gas from that state to supply needs within the state before sending gas into other states in periods of shortage. The vote of the court was five to three, one justice not participating, as was the case in the original decision.

In its original decision the court declared that natural gas which has been piped into other states assumes the character of interstate commerce. A rehearing was granted West Virginia. The latest opinion merely recites that nothing was presented to change the first opinion of the court. The decision was on consolidated suits brought by Pennsylvania and Ohio against West Virginia. As previously pointed out, this decision has an obvious bearing on interstate transmission of electricity.

Radio Corporation Has Monopoly

Because of Its Control of Essential Patents, Federal Trade Commission Says, Transoceanic Competition Is Not Possible—History of Company

THE Radio Corporation of America has a virtual monopoly of commercial wireless communication between this and foreign countries, according to a report made public on Monday by the Federal Trade Commission. The report is the outcome of an investigation made under a resolution passed by the last Congress.

The commission first gives the outcome of a study of the radio industry from its beginning, going back to the organization on Nov. 22, 1899, of the Marconi Wireless Telegraph Company of America, the first to be formed in this country to engage in the transmission of messages by wireless, and 25 per cent of which was owned by the Marconi's Wireless Telegraph Company, Ltd., a British corporation.

The commission then gives in detail the history leading up to the organization of the Radio Corporation of America by the General Electric Company on Oct. 17, 1919, and says:

"On Nov. 20, 1919, the Radio Corporation entered into an agreement with the Marconi Wireless Telegraph Company of America whereby, in exchange for 2,000,000 shares of its preferred stock, of a par value of $5 a share, it took over the physical properties, patents, licenses and good-will of the Marconi company."

The original capital stock of the Radio Corporation, the report says, was $1,000, but at the first meeting of the stockholders it was increased to $25,000,000. On Dec. 31, 1922, there were outstanding 3,955,974 shares preferred stock, par value $5 per share, and 5,734,000 shares common stock, no par value. Of this amount the General Electric Company owns 1,875,000 shares common and 620,800 shares preferred, the Westinghouse Electric & Manufacturing Company 1,000,000 shares common and 1,000,000 shares preferred, and the United Fruit Company 160,000 shares common and 200,000 shares preferred. The remainder is held largely by the former stockholders of the American Marconi Company.

CROSS-LICENSE AGREEMENTS

"The Radio Corporation," the report continues, "has entered into agreements with the various companies which own or control practically all patents covering radio devices considered of importance to the art. The number of patents involved approximates two thousand. Agreements of this character have been entered into with the General Electric Company, Marconi's Wireless Telegraph Company, Ltd., American Telephone & Telegraph Company and its subsidiary, the Western Electric Company; the United Fruit Company and its subsidiary, the Wireless Specialty Apparatus Company; the International Radio Telegraph Company, the Westinghouse Electric & Manufacturing Company and the Radio Engineering Company of New York. With certain minor limitations, the Radio Corporation under these agreements has secured an exclusive divisible right to sell and use the radio devices covered by the patents involved or by patents which these companies may acquire before the termination of the agreements. The agreements with the American Telephone & Telegraph Company and the Western Electric Company are to terminate in 1930, while the remainder are to terminate in 1945. Provision is made for the mutual exchange of information relating to radio, and in most instances the Radio Corporation has granted to the other company a license under its patents to make and use devices in the particular field in which the other company is interested.

"The Radio Corporation, under these agreements, is made the selling company for practically all radio devices to be sold the public under the hundreds of patents involved. The General Electric Company and the Westinghouse Electric & Manufacturing Company are to manufacture, and to sell to the Radio Corporation only, these devices and apparatus, the Radio Corporation agreeing that 60 per cent of its annual requirements would be purchased from the General Electric Company and 40 per cent from the Westinghouse company. Until the expiration of the Fleming patents in 1922 the Radio Corporation had an absolute monopoly in the sale of vacuum tubes. On the expiration of these patents the De Forest Radio, Telephone & Telegraph Company, which had retained a right to manufacture and sell, commenced the sale of such tubes to the general public. In the sale of receiving sets the Radio Corporation has competition from seventeen concerns licensed under the Armstrong patents, although their sale of sets for use in conjunction with tubes is being contested in the courts at the present time. It is contended that their sale and use under the present patent situation constitutes an infringement of the tube patents of the Radio Corporation, which if upheld by the courts will prevent all competition in the sale of complete sets, since the Western Electric Company is manufacturing and selling only transmitting apparatus for commercial purposes."

TRANSOCEANIC MONOPOLY

The Federal Trade Commission says further:

"Because of the provisions in various agreements providing for service through the facilities of the Radio Corporation exclusively, it is not believed that it will be possible for any other company in the United States to conduct an efficient transoceanic service. In fact, a group of newspaper publishers in the United States who sought to erect a station for the receipt of radio messages, after conducting experiments in this country, eventually built such a station at Dartmouth, Nova Scotia. This station is now being operated, its service being supplemented by virtue of an arrangement with the British Post Office."

The commission confines itself to the presentation of the result of its fact-finding activities, leaving it to Congress to determine whether the anti-trust laws have been violated.

Pioneers

—From *American Farm Bureau Federation Weekly News Letter*, Nov. 8, 1923.

Beck Plans for Steam Auxiliaries to Hydro System

Sir Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario, confronted with a shortage of power from the hydro plants of that system, has turned to the plan of steam auxiliary plants. With the necessary permission from the government, he declared in a recent speech, he will be ready to proceed as soon as possible with the installation of a large steam unit in Toronto, costing probably between $8,000,000 and $9,000,000, with an immediate capacity of not less than 100,000 hp. and an ultimate development of 300,000 hp. This would release at once a similar amount for other municipalities.

"There is nothing for the East that I can see, unless we undertake some development on the Ottawa River or establish a steam unit at, say, Cobourg, with probably 50,000 hp.," he continued.

With these auxiliary units supplying 40 per cent of the total power output and the development of the St. Lawrence finally realized, Ontario would have, in thirty or forty years' time, 4,500,000 hp. or even 5,000,000 hp., said the commission chairman. Once the St. Lawrence scheme was accomplished, he said, it would be a simple matter to consolidate several of the present systems, reducing the twelve now existent to five.

Representative Bacharach Reintroduces His Bill

Congressman Isaac Bacharach of New Jersey has reintroduced his bill to amend the federal judicial code so as to prevent public utility corporations from appealing to the United States district or circuit courts to set aside decisions of state public utility commissions.

Mr. Bacharach will make a determined effort to obtain favorable action on his bill, he declared, and hopes to secure its enactment by Congress before spring. He introduced the bill first in January, 1922, but has been unable to get action on it by the House judiciary committee, to which it was referred. Hearings were held on the Bacharach bill by the judiciary committee in the summer of 1922 and again in the winter of 1922-3. Representatives of the utility commissions of New Jersey, New York and several other states appeared before the committee, as well as attorneys for the utility corporations.

Commonwealth Edison Pushes Crawford Avenue Station

The industrial demand for energy for southern Chicago is growing so rapidly that the Commonwealth Edison Company has been required to complete the construction of its switch house at the new Crawford Avenue station before the completion of the plant. A load of 15,000 kw. is soon to be distributed from this point, although the first unit of the new station will not be in operation for more than a year. Underground cables from the Calumet station, 17 miles away, will serve the subtation at 33,000 volts.

More than eight hundred men are now employed erecting this 600,000-kw. Crawford Avenue plant, which will cover 72 acres. To hasten the work huge batteries of floodlamps have been placed in use. An underground tunnel 537 ft. long was recently completed for the purpose of carrying the underground service cables to the various substations. This tunnel runs under the Chicago Drainage Canal and is the fifteenth built by the company.

Engineering Council for Interior Department Reform

Fearing failure of the Brown plan of government reorganization, devised by the joint committee of the House and Senate and sponsored by the late President Harding, the American Engineering Council of the Federated American Engineering Societies will conduct a country-wide movement to make over the Department of the Interior in accordance with that part of the Brown plan which affects this department, and a bill to accomplish this end will be introduced at the present session of Congress. A national conference on public works will be one of the events of the Washington meeting of the Engineering Council to be held in the second week of January. This public works conference will be held on Wednesday, Jan. 9.

The opening event of the week will be a meeting on Monday of the committee on procedure of the American Engineering Council, followed on Tuesday by deliberations of the executive board. On Thursday and Friday the full membership of the council will convene for its annual sessions, facing an agenda presenting a wide range of social, industrial and scientific questions.

A successor to President Mortimer E. Cooley of Ann Arbor, Mich., will be elected.

Brief News Notes

South Dakota and Nebraska Merger.—Permission for a two-million-dollar merger has been granted by the Nebraska Railway Commission to consolidate light and power plants at Columbus and North Platte, Neb., and Aberdeen, and Clark, S. D., and the Waterloo-Henry transmission line near Aberdeen.

A Twelve-Year-Old Rate Case Ends.—After twelve years of litigation, the city of Everett, Wash., has lost the rate reduction case instituted originally against the Puget Sound International Railway & Power Company. The city attempted twelve years ago to effect a reduction in lighting rates in Everett, and the case, after being dragged through one court after another, was finally settled on Nov. 13 by the United States District Court, which upheld the power company.

Big Project for Youghiogheny River.—A project to utilize for power the Youghiogheny River waters in Garrett County, Maryland, has been outlined to the Maryland Public Service Commission. The power would be sold to the Penn Public Service Company and distributed throughout western Pennsylvania. The plan contemplates the development of about 100,000 hp. and the construction of a water-power dam and tunnel. It would cost more than $35,000,000

Electric Truck Instruction Course.—A course of instruction designed for operators of electric trucks and garage attendants, under the auspices of the New York Electric Vehicle Association, began last Wednesday at Irving Place and Fifteenth Street, in the auditorium of the United Gas Company, and will continue until the end of May, lectures being given every two weeks. Charles R. Skinner, Jr., is secretary of the committee in charge.

Clintonville, Wis., Sticks to Central-Station Supply.—The City Council of Clintonville, Wis., has defeated a proposal to build a hydro-electric generating station at Big Falls at a cost of about $150,000 and will continue to purchase energy from the Central Wisconsin Power Company for the operation of the municipal electric plant.

Consumers' Power Starts New Dam on Manistee River.—Work has begun on a third dam on the Manistee River for the Consumers' Power Company. The new plant will develop 20,000 hp., which, added to the power now developed at Junction Dam, will make the Big Manistee River produce 50,000 hp., while the smaller dam on the Little Manistee adds several thousand more. The site of the new development is 15 or 20 miles farther up the Big Manistee than Junction Dam, on the line of Manistee and Wexford Counties, and the station will designated "Coline."

New Wisconsin Hydro-Electric Plant.—Another power dam will soon be added to the increasing number now built on the Wisconsin River. The Wisconsin Valley Electric Company is about to construct a hydro-electric power plant about 4 miles north of Merrill at Bill Cross Rapids. The power developed will relieve somewhat the excess loads now carried by the Wausau, Merrill, Stevens Point and other plants. It is expected to generate about 5,000 hp. during normal water-level periods. Later the company plans to develop a water-power site which it owns at Trappe Rapids, 5 miles from Merrill.

Progress of Flaming Gorge Project.—The Utah Power & Light Company expects to be ready within a few months to apply for a license covering its Flaming Gorge project. Borings have been completed, as has practically all the field work. It still remains to be determined which of the dam sites will provide the maximum of ultimate economies. This project will provide 3,000,000 acre-feet of storage, which will control the entire run-off of the Green River at that point. The improvement will have a beneficial effect on the low-water situation below.

Chandlerville Utility Sold to Public Service Company.—Because ninety-five of the citizens of Chandlerville, Ill., had subscribed for 315 shares of preferred stock in the Central Illinois Public Service Company, enough pressure was put upon the Village Council to vote the sale of the local municipal plant, which has operated on a dusk-to-dawn basis for the past twelve years, to the Central Illinois Public Service Company. The company is constructing a 10-mile transmission line to Chandlerville from Virginia, Ill., and will build a substation at the former place, besides rehabilitating the distribution system there. Rates for the new twenty-four-hour service will be lower than those charged by the municipal plant.

Great Falls of the Potomac Project to Come up Again.—Senator Norris of Nebraska has announced that he will do all in his power to bring about passage at the session of Congress just begun of a bill embodying the so-called Tyler plan for a hydro-electric plant on the Great Falls of the Potomac, 18 miles from the capital, which is designed to supply the federal government and the people of Washington with cheap electrical energy. This scheme provides for the construction of two dams, one at Great Falls and the other at Chain Bridge, and for three extensive storage reservoirs on Great Cacapon River, the North Fork of the Shenandoah and the South Branch of the Potomac. The appropriation called for, by figures of 1921, is $44,120,000.

Tacoma's Lake Cushman Project.—Bids for the construction of the first unit of the proposed Lake Cushman power project, under development by the city of Tacoma, Wash., will be received in December, according to Commissioner Ira L. Davisson of the Tacoma Light and Water Department. It is estimated that the city will ultimately expend $10,000,000 on this plant, with a total development of 140,000 hp. The cost is put at $9,905,000, or a little less than $71 per horsepower. The first unit will be rated at 50,000 hp., the second unit at 45,000 hp. The engineers expect to have the first unit completed by Dec. 1, 1925. A concrete dam, 235 ft. high, with wing walls on either side, at the top of the rock canyon on the Skokomish River, will be built.

Rapid Transformer Installation at Buffalo.—Thirty-six hours after the final inspection of a 30-ton transformer in Pittsburgh temporary installation had been made by the Buffalo General Electric Company at Station No. 2, Elk and Ohio Streets, Buffalo. The score or more of men who made the installation completed their work Monday morning, Nov. 26, after working all night. This is believed to be a record for the transportation and installation of a transformer of this size. The transformer without the oil weighs 54,000 lb. It holds 3,300 gal. of oil and has a rating of 2,280 kw. It was installed to replace one which had burned out Nov. 22.

Bangor Company Plans 30,000-Kw. Hydro-Electric Station.—Expansion of generating plant facilities by the Bangor (Me.) Railway & Electric Company is slated for the near future, according to a statement last week by E. M. Graham, president of the company, to a representative of the ELECTRICAL WORLD. Studies have been made for a new 30,000-kw. hydro-electric station, and by the early part of January it is expected that the full benefit of dam reconstruction above the present Ellsworth water-power station will be again enjoyed. Only about 75 kw. of steam plant capacity is in use on this system. Conditions in the lighting and power department are excellent from the standpoint of business development.

Eight Maryland Plants Unite.—It is reported from Elkton, Md., that the Eastern Power Company has taken over the Oxford (Pa.) Electric Company and the Rising Sun Electric Company, Port Deposit Power Company, Perryville and Havre de Grace Electric Light companies and Gilpin Falls Power Company of Elkton and North East, all in Maryland, and has completed a deal for the Home Power Company, which does business in Elkton and Chesapeake City. The Eastern Power Company is at present getting part of its energy from McCall's Ferry, Pa., but after the completion of the new hydro-electric plant at Conowingo the combined companies will derive their power from the Conowingo Electric Company.

Calumet (Wis.) Controversy Is Settled.—A settlement has been arranged between the Eastern Wisconsin Electric Company and the Badger Public Service Company of the dispute over the construction and operation of lines to furnish electrical energy in the town of Calumet. In November, 1922, the Railroad Commission granted the Eastern Wisconsin Electric Company permission to extend its lines into this town. Similar permission was sought by the Badger Public Service Company, and the Circuit Court decided in its favor, appeal then being taken to the Wisconsin Supreme Court by the Eastern Wisconsin Electric Company, where the case is pending. The two companies have now come to an amicable agreement, the Railroad Commission acting as arbitrator, limiting the sphere of each in supplying service to Calumet, and the case is to be dropped from the calendar of the Supreme Court.

Cumberland River Development Delayed.—Delay has been met by the Cumberland Hydro-Electric Power Company in its effort to begin the development of its 200,000-hp. project between Burnside and Williamsport, Ky., on the Cumberland River. The Cumberland company, which is backed by Insull interests and by D. H. Rollins & Sons, filed its application nine months ago along with incontrovertible evidence showing financial ability to carry through the project and a desire to proceed rapidly with it. Some delay was inevitable because the city of Louisville had filed previously on one of the sites. Two months ago, however, the district engineer, after conducting a public hearing, submitted his report to the Chief of Engineers. The report is still under consideration in that department, and it is reported that navigation interests in Nashville are opposed to the plan.

Associations and Societies

Byllesby Accountants at Convention.—For the purpose of improving the methods and increasing the efficiency of their accounting departments, more than two hundred accountants of the Byllesby Engineering & Management Corporation attended a four-day conference at Oklahoma City, Nov. 19 to 22. This was the fourth annual convention of this accounting section.

Middle West N. E. L. A. Conference.—A conference of the Middle West Geographic Division of the N. E. L. A., which includes Nebraska, Iowa, Kansas and Missouri, will be held at the Kansas City Athletic Club, Kansas City, Mo., on Jan. 11, for committee reports and discussions and to make arrangements for the annual convention next spring.

Pittsfield (Mass.) A. I. E. E. Section Has Varied Program.—D. H. Rodinger, resident engineer of the Big Creek development, told this section about the Southern California Edison Company's 220-kv. transmission system on Dec. 7. Among other topics announced for the winter meetings are "The Electrification of Railways," by A. H. Armstrong, General Electric Company, Dec. 13; "Transoceanic Radio," by F. H. Kroger, Radio Corporation of America, Feb. 7; "The Pallatophone," by Dr. C. A. Hoxie, General Electric Company, and "Type SCR Single-Phase Motor," by H. R. West, General Electric Company. President H. J. Ryan of the A. I. E. E. will address one meeting, and there will be papers at others on scientific subjects not strictly electrical.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

Accounting National Section, N. E. L. A.—Hotel Muehlbach, Kansas City, Dec. 10-11.

New York Electrical Credit Association—Building Trades Club, New York, Dec. 12. W. J. Kreger, 261 Broadway.

American Physical Society—University of Cincinnati, Cincinnati, Dec. 27-29. H. W. Webb, Columbia University, New York City.

American Engineering Council (F. A. E. S.)—Washington, Jan. 10-11. L. W. Wallace, 26 Jackson Place, Washington.

Kentucky Association of Public Utilities—Louisville, Jan. 10-11. E. F. Kelly, Louisville Railway Company.

Wisconsin State Association of Electrical Contractors and Dealers—Pfister Hotel, Milwaukee, Jan. 17-19. H. M. Northrup, 23 Erie Street, Milwaukee.

Western Association of Electrical Inspectors—Hotel Fontenelle, Omaha, Jan. 29-31. W. S. Boyd, 175 West Jackson Blvd., Chicago.

American Institute of Electrical Engineers—Midwinter convention, Bellevue-Stratford Hotel, Philadelphia, Feb. 4-8. F. L. Hutchinson, 33 West 39th St., New York.

Recent Court Decisions

Restrictions on Collection of Trade Statistics.—By a decision just handed down by the United States Court of the Southern District of Ohio in a suit brought by the Department of Justice against the Tile Manufacturers' Credit Association the collection of trade statistics by a manufacturers' association is virtually limited to those which may be requested by governmental agencies. This decision, which may prove of far-reaching importance to manufacturing associations in all lines of industry, is printed in full in the "Manufacturing and Markets" section of this issue, page 1195.

Confiscation and Contracts.—In reversing a decree of the Supreme Court of Georgia affecting interurban railway fares (Georgia Railway & Power Company vs. Town of Decatur) the United States Supreme Court made the following observation: "In deciding the constitutional questions presented this court will determine for itself whether there is in fact a contract and, if so, the extent of its binding obligations, but will lean to an agreement with the state court. . . . We see no reason to differ with that court in its view of the validity and binding quality of the contract. The contract being valid, we are not concerned with the question whether the stipulated rates are confiscatory."

Contract Providing Free Lighting to Municipality Rightly Set Aside.—The Supreme Court of Utah has handed down a decision sustaining the Utah Public Utilities Commission in setting aside a contract between the Dixie Power Company and the city of St. George by which free street-lighting service for twenty-five years was granted as part payment for the municipal power plant, conveyed to the company's predecessor. In lieu of the contract the commission allowed the city a credit of $9,907, and this arrangement is ratified by the Supreme Court. The court held that the Legislature of Utah had never surrendered its police power, which in the public utilities act it had delegated to the commission. "The purpose of that act," said the decision, "is to require all those who are similarly situated to pay the same rate for public utility service, to the end that all shall share the burdens of such service equally, and to deter public utilities from practicing favoritism. Take this case as an example. If under plaintiff's contract which it seeks to have enforced it would obtain electrical energy for less than it costs to develop and to distribute it to the plaintiff, then other cities and communities which are less fortunately situated would necessarily have to pay for what the plaintiff receives free. While such a result often arises under ordinary contracts, it cannot be tolerated under contracts for public utility service in view of the provisions of the public utilities act. It is for that reason the public utilities acts are held not to be subject to existing contracts except where the sovereign has expressly or by unavoidable implication surrendered its right to interfere with existing contracts. That, as we have seen, is not the case in this jurisdiction."

Wisconsin Supreme Court Holds that Commission Has Jurisdiction Over Meter Tampering.—The Supreme Court of Wisconsin has reversed the decision of the municipal and circuit courts of Kenosha County in the case of two customers of the Wisconsin Gas & Electric Company accused of tampering with their meters. The Supreme Court holds that jurisdiction belongs to the Wisconsin Railroad Commission and not to the courts. By this decision the company will be able to discontinue service where a meter has been tampered with and to refuse to reconnect until a settlement is made. The patron may then pay under protest and carry his case to the commission. In the suit just decided a bill for back service amounting to $750 was rendered and when the alleged offenders refused to pay service was discontinued. The customers of the company brought suit and obtained an injunction to prevent the company from discontinuing service, the lower courts holding that the company could not refuse service until it had gone into the courts and established the amount due.

Power Company and Seller of Right to Overflow Land Jointly Responsible for Damages to Timber Owned by Another.—In an action (Price vs. Ketchum) brought to recover damages for the destruction of timber owned by the plaintiff because of the erection of a dam by the Georgia-Alabama Power Company it was brought out that Ketchum after selling timber on his land to Price, allowing him five years to remove it, had prior to the expiration of that period executed an instrument giving the power company the right to overflow the land, which had been done, destroying the timber. The Court of Appeals of Georgia found that Ketchum and the power company were properly joined as co-defendants in the action inasmuch as Ketchum could not sell the plaintiff the timber and then sell to some one else the right to destroy the timber, while the power company on its part, knowing as it did that the timber belonged to the plaintiff, could not without purchasing or condemning the property overflow the land and destroy the plaintiff's possession. The rights of Price, a party in interest, were not met by an agreement when he received his deed to the timber that in certain contingencies the price would be lessened. (119 S. E. 442.)*

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Length of Notice of Discontinuance of Service.—While otherwise approving a contract between the city of Tipton and the Northern Indiana Power Company to purchase energy for the Tipton Electric Light Company, the Indiana Public Service Commission modified one of its provisions by insisting that before discontinuance of service for nonpayment of bill written notice to the delinquent customer should be given ten days previous to discontinuance instead of forty-eight hours.

Amortization of Excess Purchase Price.—In authorizing the sale of the gas property of the Watts Engineering Company to the Public Service Company of Missouri, the Missouri Public Service Commission, which observed that some consideration must be given to current prices in fixing the fair value of utility property for the purpose of ascertaining a proper sale price and a proper basis for securities, declared further that the transfer of utility property at a sale price in excess of the fair value should be authorized only on condition that the excess price be amortized out of net income available for return, surplus and contingencies, and that no portion of such excess should be charged to the operating expenses or to capital account.

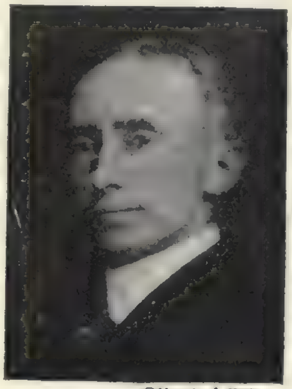
Summer Resort Schedules.—In adjusting complaints made by summer resort customers of the Indiana & Michigan Electric Company, the Michigan Public Utilities Commission, as previously reported, said that the fact that a consumer guarantees by an advance payment for the summer season a certain fixed amount for electric service does not justify a utility in giving that consumer a lower kilowatt-hour rate than a consumer who does not guarantee the company as large an advance payment. The commission went on to say that an optional summer resort schedule should be effective over a definite period and should be available to consumers only during that definite period, where a large number of the utility's summer resort customers desire an optional schedule to relieve them of minimum bills during winter months. Summer resort customers should make advance payment before service is rendered under such a schedule, the rate per kilowatt-hour should be on a per season basis, and no bills should be rendered to consumers who are served under the optional season rate schedule until the amount advanced by such consumers has been exceeded, based upon the kilowatt-hour rate. No charge should be made by an electric utility for connecting or disconnecting summer resort service under an optional schedule under which an advance payment is required.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

T. W. Martin Heads Southeastern Division of N. E. L. A.

Thomas W. Martin, president of the Alabama Power Company for the past three years, was elected president of the Southeastern Division of the National Electric Light Association at the convention held recently in Tampa, Fla. Mr. Martin has been in charge of legal work for the Alabama Power Company and associated companies since 1912 and three years later was appointed its vice-president and general counsel. It was in 1920, when James Mitchell resigned the presidency to become chairman of the board of directors, that Mr. Martin was elected to the office he occupies at the present time. In addition, he is president of the Alabama Traction, Light & Power Company and vice-president of the Alabama Interstate Power Company, the Alabama Power & Light Company and the Birmingham, Montgomery & Gulf Power Company. Mr. Martin is a native of Alabama and a graduate of the law department of the University of Alabama.



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T. W. MARTIN

M. J. Zurick, formerly associated with the West Penn Power Company at Charleroi, Pa., has assumed the duties of division manager of the Brooke Electric Company, Wellsburg, W. Va., a constituent of the West Penn system.

Samuel T. MacQuarrie has been appointed director of the New England Bureau of Public Service Information, with headquarters in Boston. Mr. MacQuarrie has been associated with the banking house of Curtis & Sanger, Boston, and for about twenty years was employed by the Fore River Shipbuilding Corporation at Quincy, Mass., and later by the succeeding Bethlehem Shipbuilding Corporation, Ltd., as assistant to the works manager and in charge of publicity prior to the Bethlehem acquisition.

E. H. Hubert, formerly associate editor of the *Industrial Engineer*, has become attached to the headquarters staff of the American Institute of Electrical Engineers. He will act as the secretary of the meetings and papers committee and be connected with the work of the technical committees and Institute sections. Graduating from the Georgia School of Technology in 1912, Mr. Hubert was connected with the engineering department of the Georgia Railway & Power Company for four years. Later he became an assistant editor of the ELECTRICAL WORLD, and for the past two years he has been in charge of the New York office of the *Industrial Engineer*.

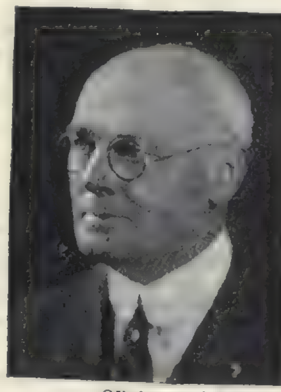
Emmet N. Britton, for the past two years assistant to the general manager of the San Joaquin Light & Power Company, Fresno, Cal., has resigned to join the King-Knight Company, which does a general manufacturers' agency and engineering business in San Francisco. Before assuming the duties of the office he has just resigned he was managing editor of the *Journal of Electricity*. Mr. Britton, who is a native Californian and a graduate of the University of California, is the son of the late John A. Britton.

Mortimer E. Cooley, dean of the engineering schools of the University of Michigan and retiring president of the Federated American Engineering Societies, was the guest of honor at a dinner given in Detroit on Nov. 23 under the auspices of the Detroit Engineering Society, the Detroit Section of the American Society of Civil Engineers, the Detroit Section of the American Society of Mechanical Engineers and the Detroit-Ann Arbor Section of the American Institute of Electrical Engineers. Hundreds of engineers and representatives of other callings attended.

Joseph B. Groce, director of the New England Bureau of Public Service Information, Boston, has resigned to join the staff of the Edison Electric Illuminating Company of Boston, with headquarters at the executive offices. He will devote himself to public relations in his new post, reporting to the president. Mr. Groce was formerly engaged in public relations work with the Bethlehem Shipbuilding Corporation, Ltd., at Fore River, Mass., and in August, 1922, was appointed the first director of the newly formed New England bureau, where he has rendered distinguished service to the public utility industries.

F. R. Low Takes Office as President of A. S. M. E.

Frederick Rollins Low, since 1888 editor of *Power*, a McGraw-Hill publication, was inducted as president of the American Society of Mechanical Engineers at the convention held this week in New York. He is a native of Chelsea, Mass., and for seven years previous to assuming editorial duties on *Power* he was with the Boston *Journal of Commerce*. Mr. Low is an inventor of some note, having to his credit in this field an arc indicator, a cleaner for vertical tubular boilers, a shaft-leveling target, an elevator control and a rotary engine which were developed by the Clark & Low Machine Company. He is the author of "The Power Catechism," "The Compound Engine," "Condensers" and "The Steam Engine Indicator." Mr. Low has been active in the American Society of Mechanical Engineers since becoming a member in 1886. He served as its vice-president in 1918 and was when elected president a member of the council, of the boiler code committee and chairman of the power test committee, the largest committee of the society. He will be the association's delegate to the World Power Conference in London. Mr. Low is a member of many other engineering societies, including the National Association of Stationary Engineers, American Society for Testing Materials, American Society for the Advancement of Science, the Engineers' Club of New York and the Engineers' Club of Boston.



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F. R. LOW

J. M. Barry, who was made manager of the southern division of the Alabama Power Company early this year, has been appointed manager of retail operations, with headquarters at Birmingham. Mr. Barry has been associated with the Alabama company since 1919, when he was placed in charge of the eastern division. Two years later he was made assistant chief engineer, which position he occupied until his promotion to the office of manager of the southern division.

Colonel Saltzman to Succeed General Squier

Colonel Charles McKinley Saltzman, senior colonel of the Signal Corps, has been named to succeed Major-General George O. Squier, chief signal officer of the army, who will retire on Dec. 31 after forty years of service. General Squier entered the service in 1883 after being graduated from West Point and has won distinction in the army as an electrical engineer and scientist, especially in radio development. Colonel Saltzman has been associated with the Signal Corps since 1901.

George Drake Smith, formerly sales manager of the Steinmetz Electric Motor Car Corporation, has been elected president of the Delmore Motors Corporation, New York.

R. C. Harvey, who has been associated with the Adirondack Power & Light Corporation, Schenectady, N. Y., for the past two years, has resigned to join Henry L. Doherty & Company of New York. Mr. Harvey will be stationed temporarily in Denver, where he will engage in the promotion of customer ownership of utilities.

K. F. Green, who for many years has been superintendent in charge of properties and operation of the Wisconsin River Power Company's hydro-electric power plant in Prairie du Sac, Wis., has been transferred to the Madison office of the Wisconsin Power, Light & Heat Company.

Ralph E. Dodson, formerly associated with the Louis A. Roberg Company, consulting engineers, Cincinnati, has entered the service division of the Westinghouse Electric & Manufacturing Company in that city. Mr. Dodson was previously associated with the Westinghouse company.

Fred H. Dorner, consulting engineer of Milwaukee, was recently elected president of the Engineers' Society of Milwaukee. Before forming the consulting engineering organization of which he is now head, Mr. Dorner was associated with the Bailey Manufacturing Company as chief engineer and sales manager, and he was previously with various departments of the Allis-Chalmers Manufacturing Company. He has been secretary of the Engineers' Society of Milwaukee for ten consecutive years.

C. B. Barnett is now superintendent of the municipal electric light plant at Huntersville, N. C., succeeding R. E. McDonald.

Sydney Whitmore Ashe, director of the educational and welfare department of the Pittsfield works of the General Electric Company, has been elected chairman of the employees' house organ section of the National Safety Council. Mr. Ashe is a graduate of the Brooklyn Polytechnic Institute and has had an extensive experience in the teaching of electrical engineering, in technical writing and in safety work. He is also editor of *Current News*, published by the Pittsfield works for the benefit of employees. His writings on accident prevention have been adopted for the university extension course of the State of Massachusetts as the principal reading text in the curriculum.

G. W. Partridge, British Inventor-Engineer

G. W. Partridge, managing director and engineer of the London Electric Supply Corporation, Ltd., commenced his professional career at the Hammond Electrical Engineering College, London, and later served in the workshops of Woodhouse & Rawson and the Anglo-American Brush Company of London. In 1888 he joined the engineering staff of the Grosvenor Gallery Supply, which organization later became the London Electric Supply Corporation. In this undertaking he became associated with Dr. Ferrenti in experimental and erection work, including the manufacture of transformers, meters, cables and electric generators in connection with the corporation's 10,000-volt power station at Deptford. When Dr. Ferrenti severed his connection with the corporation thirty-two years ago, Mr. Partridge became chief electrical engineer, and the responsibility for the development of the 10,000-volt alternating-current system, at that time singularly novel, devolved on him. In 1900 he was appointed engineer in chief and later engineer and manager, and in 1920 he entered upon the office he occupies at the present time.


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G. W. PARTRIDGE

Mr. Partridge has invented and patented many useful improvements in electrical machinery, including in 1892 the oil switch for alternating-current control now in universal use, a fuse, a grounding device and a pressure detector. He is a past-president of the Old Students' Association of the Faraday House Electrical Engineering College, originally the Hammond Engineering College, and has served on the council and many committees of the Institution of Electrical Engineers and as its vice-president in 1917. For many years past he has been engrossed in the problem of unifying the electric supply of London and is at present one of the engineers engaged in reorganizing and consolidating the numerous interests and power stations in the London area.

J. F. McCortney is now president of the municipal electric light plant at Bromide, Okla., succeeding W. O. Kitt.

V. O. Stafford, formerly commercial manager of the Northern Iowa Gas & Electric Company, Humboldt, Iowa, has been made manager of the securities department of the company.

A. C. Jones, formerly manager of the Clarion division of the Northern Iowa Gas & Electric Company, has been made commercial manager of the company, succeeding V. O. Stafford.

C. G. Bentley, formerly vice-president of the Ravenna (Ohio) Gas & Electric Light Company, has been made president of the company to succeed H. Wurdack. E. G. Crawford is now vice-president and secretary.

Frank A. Short, formerly electrical engineer of the State Accident Commission of California, is now connected with the Safety Electric Products Company of Los Angeles as a consulting and advisory engineer.

E. L. Booth, for thirteen years associated with the Edison Electric Illuminating Company of Boston in the sales department and also as district manager, has recently joined the Los Angeles office of the Western Electric Company as specialty appliance salesman in the supply division.

J. L. McQuarrie, assistant chief engineer of the International Western Electric Company, left New York on Saturday, Nov. 24, for Tokyo, Japan, where he will aid in the solution of Japan's telephone problem. The earthquake destroyed sixteen telephone exchanges and 82,000 telephone lines. Mr. McQuarrie will consult with officials of the Nippon Electric Company, a firm associated with the International Western Electric.

Percy H. Thomas of New York City will resume his practice as a consulting engineer on Jan. 1. As consulting electrical engineer for Guggenheim Brothers he has had charge for some years past of the power department of their engineering organization, which has developed the copper properties of the firm in Chile. He acted also as consulting and designing engineer for the Maitenes hydro-electric power station and the 110,000-volt transmission lines of the Compañia Chilena de Electricidad, Ltda., a large electric utility of central Chile controlled by English interests. Mr. Thomas collaborated in a consulting capacity with W. S. Murray in his study under government auspices of a superpower system for the region between Boston and Washington. He has contributed many valuable articles and papers on transmission to the technical press and the American Institute of Electrical Engineers.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Court Order Restricts Gathering of Trade Statistics

Decree of United States District Court in Ohio Dissolves Tile Manufacturers' Credit Association Under Provisions of Sherman Anti-Trust Law

COLLECTION of trade statistics is virtually limited to those which may be requested by a governmental agency in the final decree in the case brought by the Department of Justice against the Tile Manufacturers' Credit Association. The proceeding was in the United States Court of the Southern District of Ohio.

Before the decree was made final the law department of the National Association of Manufacturers urged the Department of Justice to permit the periodic collection of facts relating to capital employed, power used, wages, taxes paid, fuel consumed and machinery employed, in addition to production, sales, shipments, stocks, prices and like pertinent trade information. It was specified that all such information was to be a record of accomplished facts.

Decision of Far-Reaching Effect Upon Trade Associations

It is known that the Department of Justice gave long and careful consideration to the proposal. The significance of the decree is increased greatly by the fact that the collection of trade statistics is not made permissible after the department's study of the proposal. It is anticipated that this decree will have a far-reaching effect upon trade associations. Its provisions follow in full:

1. That the combination and conspiracy in restraint of interstate trade and commerce, the acts, regulations, rules, resolutions, agreements, contracts and understandings in restraint of interstate trade and commerce as described in the petition herein, and the restraint of such trade and commerce obtained thereby, are violative of the act of Congress of July 2, 1890, entitled "An act to protect trade and commerce against unlawful restraints and monopolies," known as the Sherman anti-trust act.

2. That the contract of association dated April 24, 1917, between the defendant tile manufacturers, under which the defendant Tile Manufacturers' Credit Association is organized, is a contract in restraint of interstate trade and commerce in violation of the aforesaid act of Congress, and the Tile Manufacturers' Credit Association is in and of itself a combination in restraint of such trade and commerce and an unlawful instrumentality organized, operated and maintained for the purpose of carrying into effect the combination and conspiracy described in the petition herein and constitutes a violation of said act of Congress.

3. That the defendants and their officers, agents, servants and employees, and all persons acting under, by or in behalf of them or any of them, be and they are hereby perpetually enjoined, restrained and prohibited from combining, conspiring or agreeing, expressly or impliedly, directly or indirectly, through any collective agency or agencies, or directly between themselves or any of them, to make or receive any or all of the reports described in the petition herein, or to collect and distribute the information or any part thereof specified in said reports, or either or any of them, or to make or receive any reports having the same general character or the same purpose and effect as said reports, or to collect and distribute information similar to that specified in said reports, or any part thereof.

Provided, however, that the defendants may, through the association or corporation hereinafter provided for, receive and compile for transmission to any governmental agency such information and statistics as it may request as to the production, shipments, the stocks on hand and the price of tiles, but are restrained from distributing said information among themselves, except that information respecting sales may be collected annually and used to enable the assessment of the several members for their proportionate parts of the several expenses of the association, and for no other purpose.

4. That the defendants and their officers, agents, servants and employees, and all persons acting under, by or in behalf of them, or any of them, or claiming so to act, be and they are hereby ordered and directed to dissolve and to forever discontinue defendant Tile Manufacturers' Credit Association, and that they be and they are hereby perpetually enjoined, restrained and prohibited from directly or indirectly engaging in or forming any like association, from making any express or implied agreement of association or arrangement similar to or like said agreement or arrangement, from carrying out or continuing in effect the contracts and agreements described in the petition herein, from making any express or implied contracts, agreements or arrangements similar thereto, and from using any other means or methods having the purpose or effect of restricting or restraining interstate trade and commerce in tiles.

Objects Permitted

Provided, however, that the defendants are not restrained or enjoined from maintaining an association, either voluntary or incorporated, for the following objects and purposes and none other:

(a) To advance or promote the use of tiles by research, publicity, advertisement and similar activities.

(b) To deal with engineering and trade problems for the purpose of advancing the manufacture and use of tiles and to secure the arbitration of trade disputes.

(c) To carry on educational work pertinent to the industry through fellowships in schools and colleges and experimental and research work and the instruction of mechanics and training of apprentices and workmen, and to provide for scientific research, lectures and the writing, reading and publication of papers on subjects pertaining to the industry.

(d) To maintain a traffic bureau to assist the industry in transportation matters before federal and state commissions and other bodies concerned in questions of transportation and tariff and also with common carriers, and, upon request of any member of the association, to furnish such member any information relating to rates upon its products or rules of transportation that may be contained in any public schedule or tariff, but all rates furnished shall be the actual rates between points of shipment and delivery and shall not be based on any fixed or basing point.

(e) To improve sanitation, safety appliances, working conditions, accident prevention, employment, housing conditions, insurance and matters of like character.

(f) To handle the insurance of its members, including fire, industrial, indemnity or group insurance.

(g) To maintain a credit bureau for the sole purpose of furnishing upon specific requests information as to the financial standing and the credit rating of persons and corporations purchasing or attempting to purchase tiles, but not to create directly or by inference a list or class of so-called legitimate or preferred dealers or purchasers. The gathering of information

solely for the purpose of providing credit information on special request shall not be considered a violation of any part of this decree.

(h) To secure and maintain the standardization of quality and of technical and scientific terms and the elimination of non-essential types, sizes, styles or grades of products.

OBJECTS PROHIBITED

5. That the defendants, their officers, agents, servants and employees, and all persons acting under, through or in behalf of them or any of them, be and they are hereby perpetually enjoined, restrained and prohibited from combining, conspiring or agreeing, expressly or impliedly, directly or indirectly to do any of the following acts:

(a) To adopt or use a uniform basic price list, or to fix and adopt list prices for their products.

(b) To establish or maintain uniform prices for their products.

(c) To establish and maintain individual prices that are uniform for all classes of purchasers or dealers and for all sales.

(d) To establish or maintain rules or regulations as to the acceptance of orders at prices in effect prior to changes therein.

(e) To establish or maintain uniform extra charges for built-up letters, for numbers or for beveled edges.

(f) To establish or maintain uniform limitations on the proportionate amounts of the lower grades of tile sold.

(g) To sell tiles f.o.b. factory with freight equalized with other factories in the United States manufacturing the same class of tiles.

(h) To compile and distribute freight rate books for use in making freight equalizations.

(i) To establish or maintain uniform terms of sale.

(j) To establish or maintain uniform conditions or for the acceptance of orders.

(k) To establish or maintain uniform charges for barrels, half barrels or boxes used for shipping tiles; to refuse to allow credit for old packages returned, to quote prices with package charges included, and to charge for packages whether used in shipment or not.

(l) To establish or maintain uniform conditions for the furnishing of tiles for sample purposes.

(m) To refuse to combine less than carload shipments into carload shipments invoiced to one of the purchasers.

(n) To refuse to sell to any persons or corporations because of any unpaid account or accounts.

(o) To formulate and establish or to retain in effect any requirements, circumstances or conditions non-conformity or non-compliance with which shall exclude any customer or customers from securing credit or shall impose any limitations or conditions whatsoever upon the credit granted.

(p) To restrict sales to dealers or contractors in tile or to establish uniform requirements for classification as dealers or contractors.

(q) To establish any system of co-operative purchasing of raw materials or supplies, or of co-operative owning of the sources of raw materials, which shall eliminate or tend to eliminate competition in the purchasing of said materials or supplies.

(r) To adopt or to use a common trademark.

(s) To pool orders or to enter joint bids.

(t) To prepare and publish any list or lists of dealers or of certified dealers.

(u) To advise or communicate with one another as to proposed advances or decreases in prices or to circulate among themselves in any way information concerning or relating to proposed advances or decreases in prices, or to prices charged or to be charged.

(v) To effect in any manner whatsoever any discrimination of any character in favor of or against any individual or corporation purchasing or attempting to purchase tiles, by reason of the fact that such person or corporation is a mail-order house, or a dealer in other supplies or commodities or a co-operative purchasing association, or a building contractor, or for any other reason, or to do any act or acts to effectuate any discrimination in favor of or against any person or corporation for any reason whatsoever.

Provided, however, that nothing contained in this decree shall be construed as prohibiting any defendant from doing or performing any of the foregoing acts or from selecting his or its own trade and from disposing of his or its own products to such persons and on such terms as he or it may choose, if done individually and without combining, conspiring or agreeing with any other defendant or with any other manufacturer of tiles or other person.

Overemphasizing the Jobber's Stock

BY A SALES MANAGER

IT IS needless to emphasize the value of a well-maintained jobber's stock in electrical merchandise and supply distribution, but it is a mistake to overemphasize this portion of the wholesaler's service to the industry. The place of the jobber has been discussed so often that it is difficult to write anything new about it, and yet I have encountered so much complaint about the jobber's present hand-to-mouth buying as I have talked with manufacturers within the past few weeks that I am moved to say a few words on this subject. They will be few, too.

Some people do not seem to realize that if the jobber overstocks some one must pay the cost of his mistaken judgment. We hear a lot of talk just now about the jobber's acting merely as a broker in the sale of supplies, with the conclusion that this is a service of little value. Is there any doubt that the jobber performs a truly valuable service by acting as a clearing station for orders? Is there any question that the manufacturer would be "up against" a very hard situation if he should lose the contact with the local trade which the legitimate jobber maintains? Who is going to pass upon the credit situations of would-be purchasers of materials and who can size up the character and business of the retailer in the way the distributor can in his own general neighborhood? It would be ridiculous for the manufacturer to undertake this activity. Think of the staff he would require to maintain the contact the jobber does with the local industry! Where would the cost of distribution go without the jobber's service?

Who can blame the jobber for not buying more supplies than he can sell within a reasonable period? It is admitted that the jobber should carry a stock equal to meeting reasonable fluctuations in demand; but if the manufacturer's enthusiasm for his product leads to overproduction is the jobber to blame? I wonder if a lot of good might not be accomplished if a little more horse sense could be used in estimating the market for the coming six months by jobber and manufacturer together, rather than slavish adherence by the manufacturer to the mass-production idea, with its possibilities of undigested accumulations of material which somebody must pay for in overhead.

The real jobber is doing the industry a vast amount of good by helping the contractor-dealers and other purchasers to buy intelligently, to use good business methods in running their establishments and to spread abroad co-operative ideas. I will go so far as to say that under such conditions of active demand as now prevail the maintenance of surplus stock is less important and less valuable to the industry than the jobber's service as a go-between between the retailer and the manufacturer. In the combination of orders, in co-ordinating selections, in following deliveries, in watching credits and in educating the less well informed, the jobber is performing a service that in my opinion gives him an impregnable place in the industry.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

THE usual pre-inventory conservatism began to manifest itself last week generally throughout the country, jobbers instituting the policy of buying in the smallest possible orders and sacrificing the quantity discounts to hold down stocks to the minimum and reduce the burden and expense of inventory taking. The Christmas demand is still booming along, and manufacturers of appliances are busily engaged in turning out rush orders.

The price of wire, cable and reinforced cord has shown slight increases in the East and on the coast. Motor sales in New England are reported 40 per cent higher than last year. General business is excellent with central-station outputs increasing steadily at higher rates. Increased activity in the garment trades in New York has influenced a growing demand for second-hand motors in this city. A general spirit of optimism prevails throughout the Southeast owing to crop conditions. Collections have improved there, and the demand for electrical material is unusually heavy. In Chicago purchases of lighting equipment, radio and appliances have been very heavy. Building activities also continue, and wiring devices, conduit and kindred lines are running strong. Pole-line hardware and central-station equipment show a steady market, and in the pole country labor conditions give promise of good production.

Porcelain Makers Recover Market; Stocks Well Balanced

BUSINESS in porcelain products has picked up considerably during the last three weeks. According to the jobbing and manufacturing authorities, increased activity in old-house wiring in the Eastern districts of the country and extensions to telephone lines both in the Eastern and Southern districts have done much to bring about prosperity in this field after a sluggish market of almost six months' duration. During the early part of the summer deliveries to manufacturers of high-tension equipment in the Chicago district were very slow as it was a continual struggle to keep up with the demand caused by unusually heavy purchases of central-station line material and equipment. Labor troubles, coupled with increasing difficulty in securing primary raw materials, caused the most serious trouble in production experienced for some time in this industry.

A little more than two months ago, when manufacturing facilities had begun to improve and when stocks were more plentiful, a slump in building operations and a short let-up in the activities of the central-station and telephone companies caused another bit of hardship among the porcelain manufacturers and sellers. A leading authority, commenting on the general condition last week, stated that conditions have been much improved by well-balanced stocks and an even demand from all sections of the country. Another feature of the present market is said to be the fact that wiring-device manufacturers during the last few months have been buying more porcelain parts.

Manufacturers of special porcelain report that the increasing business being done by the heating appliance and automotive spark-plug makers is holding up their orders to a rate exceeding any year since 1919. In this field the demand is for machine-turned products, and there is little interest shown by even the smallest manufacturer of appliances in poor-grade porcelain. It is pointed out that one may find many appliances on the market fitted with cheap heating elements, low-grade standards, but very few firms disregard the value of high-grade porcelain.

Set 192,000,000 Figure for Type "B" Lamps Produced in 1923

INFORMATION received from one of the leading authorities in the lamp-manufacturing industry during the last week is to the effect that 192,000,000 type "B" lamps were produced during the year 1923. According to this estimate, 48,000,000 type "C," 1,000,000 carbon and 100,000,000 miniature lamps were also produced during this year. These figures compare with production figures of lamps during the years 1922, 1921 and 1920 as follows:

	1923	1922	1921	1920
Type "B"	192,000,000	165,000,000	134,000,000	172,000,000
Type "C"	48,000,000	40,000,000	27,000,000	43,000,000
Carbon	1,000,000	5,000,000	7,000,000	15,000,000
Miniature	100,000,000	95,000,000	105,000,000	105,000,000
Total	341,000,000	305,000,000	273,000,000	335,000,000

Value of Delinquent Electrical Accounts Increased in October

ALTHOUGH the number and total value of delinquent accounts have increased in three of the five territories reporting to the National Electrical Credit Association, the average amount increased from September, 1923, to October, 1923, in only one territory—that of New York. In general the number of accounts delinquent in October, 1923, was more than for the same period in 1922.

In the four territorial divisions the total amounts in this same period increased. The central division still leads, with 981 accounts reported for October, 1923, against 760 for September, 1923, when the average amounts were $109.74 and $125.33 respectively. In Philadelphia the gain in accounts in October, 1923, over September, 1923, numbered eighty, although the average amount decreased to $99.84 for October.

DELINQUENT ACCOUNTS IN OCTOBER

Branch and Month	Number of Delinquent Accounts Reported	Total Amount	Average Amount
Central Division:			
Sept., 1922...	882	$98,818.90	$112.04
Sept., 1923 ..	760	95,252.94	125.33
Oct., 1922. .	872	102,465.56	117.50
Oct., 1923...	981	117,653.05	109.74
New York:			
Sept., 1922...	530	78,739.00	149.00
Sept., 1923...	365	61,731 00	169.00
Oct., 1922...	517	59,602.00	115.00
Oct., 1923...	442	77,479.00	175.00
Philadelphia:			
Sept., 1922...	264	39,060.19	147.96
Sept., 1923...	246	27,955.15	113.64
Oct., 1922...	262	24,609.19	93.93
Oct., 1923...	326	32,547.98	99.84
New England:			
Sept., 1922...	124	13,045.43	105.20
Sept., 1923...	56	8,156.49	145.65
Oct., 1922...	80	11,223.14	140.29
Oct., 1923...	51	3,808.88	74.68
Pacific Coast:			
Sept., 1922...	19	3,002.57	157.95
Sept., 1923 ..	26	6,998.20	269.16
Oct., 1922...	22	3,980.61	180.50
Oct., 1923...	23	5.804.78	252.38

Appliance Sales Speeding Chicago Market; Active Construction

HOLIDAY buying is increasing sales for the electrical trade, and purchases of lighting equipment, radio and appliances for gifts have been of great volume. Considerable emphasis is laid on the idea of giving these kinds of gifts this year. The building activity is continuing, and the demand for wiring devices, conduit, etc., remains exceptionally good for this time of the year. Much of this work is being rushed to completion before snowfall.

Rubber-covered wire is the same this week, despite the fact that cotton spot is about 38 cents. There were, however, some reductions made in the prices of lamp cords and portable cords. One manufacturer readjusted his price list, effective Dec. 26, with a reduction on these items. He also discontinued the manufacture of pure silk cords, making only the art silk. There has been a reduction in the price of street-lighting glassware. The new figures quoted include the packing charges. This reduction is made to obtain more action.

Pole-line hardware and central-station equipment purchases remain steady, with no changes in either price or supply. Pole producers representing about 27 per cent of the log output have now on hand 85 per cent of their labor requirements. This compares favorably

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.0354	$0.0354	$0.0304
Cold finished shafting, per lb.	0.0465	0.0465	0.039
Brass rods, per lb.	0.155	0.1525	0.17
Solder (half and half), per lb.	0.325	0.295	0.265
Cotton waste, per lb.	.10 to .13	.10 to .13	.09 to .11½
Washers, cast iron (½-in.), per 100 lb.	6.50	6.50	6.00
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.38	3.38	3.02
Machine oil, per gal.	0.297	0.297	0.33
Belting, leather, medium, off list	30-10%	30-10%	40-5%
Machine bolts, up to 1-in. x 30-in., off list	45%	40-10%	40%

with conditions last year, when only 60 per cent of the necessary men were available.

Weatherproof Wire Firmer in New England

HIGHER prices on the smaller sizes of weatherproof wire by about ½ cent a pound, base, were a feature of the market at Boston Monday, with other prices showing little change. Jobbers report a steady volume of orders in many lines, with cautious buying by them as the inventory period approaches. Appliance manufacturers in New England are extremely busy on pre-holiday production. Deliveries are excellent, although some delay on shipments from the Middle West is reported on the railroads.

Motor sales in the Northeast are running about 40 per cent above last year's in dollars. There is still some slack to be taken up during the next few days in retail heavy-appliance sales, but the outlook is good for the month. Lamps are moving at record-breaking rates.

General business in New England continues excellent, barring spotty conditions in cotton-textile manufacture and uncertain labor conditions in the leather industry. Building contracts are holding up well, with every prospect of substantial expansion next spring.

New York Market Is Strong; Jobbers' Buying Conservative

NEW YORK'S electrical market continues strong in all business relating to the holiday buying, but there is a slight tendency on the part of the jobbers to order in more conservative amounts in face of the approaching inventory period. During the week a slight marking up in code wire and lamp cord was noted. This advance is thought due to the increasing strength of the copper market during the last few weeks.

Second-hand-machinery dealers are enjoying excellent business due to the increased activity in the garment-making section and among the industrial plants of the city, which are calling for extra motors for special and short-time work. Motor manufacturers report production at a high rate, but sales are rather slow, in keeping with this time of the year.

Record-breaking amounts of Christmas-tree lighting outfits were sold in the dealers' stores during the last week. An interesting feature of this market is the apparent fact that many more people are beginning to realize that those Christmas-tree lamps bought in the lower-priced stores are of too short life, and consequently sales in the department and five-and-ten-cent stores are not great for this year.

Southeast Has Unusual Demand for Building Equipment

A GENERAL spirit of optimism prevails throughout the Southeastern territory. Good weather for harvesting crops and the high price of cotton have considerably improved the tone in the rural sections, and business in the towns is very satisfactory. Credit men report November collections as being good and showing some improvement over October.

Jobbers state that the demand for electrical building material is unusually heavy for this period of the year, and November building permits in Atlanta, which amounted to $1,889,264, would seem to indicate that the movement will hold up for some time to come. Lighting fixtures are going well, with the better-class residential type the most in demand. Jobbers' stocks are ample and no price changes are reported.

Retail business in Atlanta is looking up, and present indications are that the holiday buying will be well under way in another week. Christmas-tree outfits and toy trains are the only specialties that the majority of dealers are handling, but satisfactory stocks are on hand. Heating-device sales are going steadily, and this season will no doubt set a new high record.

Devices Selling Actively Along West Coast; Wire Advances

MANUFACTURERS maintaining San Francisco schedule material stocks for delivery along the West Coast report a remarkable increase in business in Seattle, Spokane and Portland. Among the best sellers are brass sockets and push and toggle switches. Candle sockets are selling specially well, and a competitive market is reflected in the present price of $10.15 per 100 for standard packages of the most popular style. Rubber-covered wire has advanced almost 5 per cent, and No. 14 S.B. solid is selling at about $7.40 per 1,000 ft. in 25,000-ft. assorted orders.

Range sales are good and fairly well distributed. An excellent holiday season is anticipated in the belief that the caution and economy shown by the average consumer all during the year have improved general purchasing power.

Caution in St. Louis Buying; Prices Continue Fairly Steady

NO SHARP improvements have developed in general business conditions in St. Louis electrical circles during the month of November as compared with the month of October. Irregularity continues, good business and fair activity being indicated in certain lines, while in others there has been a decided tendency to slow down. Purchases are being made on an extremely cautious and conservative basis. The total volume of business has been fair, but individual orders for the most part have been small.

Orders for radio sets, portable lamps and domestic appliances have been stimulated by the approach of the holiday season. The demand for special wiring devices has fallen off to some extent, and there is the usual seasonal slowing down in outside construction work by the utilities. Manufacturers report a splendid demand for motors, especially in smaller sizes, while the demand for battery-charging apparatus has taken a decided slump.

With the exception of a slight reduction in the prices of bare and insulated copper wire and cables, transformers and lighting fixtures, prices in general continue fairly steady on staples. Stocks are reported to be normal, except for a slight shortage in certain sizes of electric heaters and in some types of radio sets.

The Metal Market

THE copper market is firmly established at 13.25 cents per pound delivered. Rather important transactions were closed at that figure during the week, and the fact that big consumers who had been attempting to get concessions placed contracts at the 13.25-cent price leads to the belief that no large amount of the metal could be obtained at a lower figure. Inquiries are coming into the market again, and while there are no indications that the sales in the current month will reach the large total of November, it is believed in the trade that the volume will be comparatively good.

Export sales continue only moderate, but there is no price shading and the larger interests are getting the bulk of the business from abroad, indicating that all interests are holding to the regular quotations. Lead, zinc and tin continue at firm prices.

NEW YORK METAL MARKET PRICES

	Nov. 27, 1923 Cents per Pound	Dec. 6, 1923 Cents per Pound
Copper, electrolytic	12.62½	13.25
Lead, Am. S. & R. price	6.85	6.85
Antimony	9.25	9.25
Nickel, ingot	27.00 to 32.00	27.00 to 32.00
Zinc, spot	6.25	6.25
Tin, Straits	43.00	43.00
Aluminum, 98 to 99 per cent	26.00 to 27.00	26.00 to 27.00

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Electric Storage Battery Growth

Owing to the fact that business is developing beyond present facilities, the Electric Storage Battery Company, Philadelphia, is expanding, and extensions are being built to its Crescentville plants. When these plants were erected it was expected that they would be more than sufficient to take care of all demands for a long time, but this year's business has surpassed all expectations and necessitated immediate expansion.

The company has purchased a site in Chicago and will erect a large warehouse, an addition to its present large distribution equipment, which already numbers about a score of depots in active operation. Directors will meet in New York this week to take action on preferred and common dividends.

Novel Method of Advertising Electric Washers in St. Louis

The Frank Adam Electric Company, St. Louis, employed during the week of Nov. 19 a novel method of advertising the new Western electric washer. During this week three luxurious parlor cars were leased from the United Railways Company and fitted up for demonstrating this new electric washer. From 9 o'clock in the morning until 4 in the afternoon every day in the week these parlor cars traveled back and forth over some particular car line, every car being assigned to a different route each day. Eighteen different car lines were covered during the week. A sign on the front of the car read: "Frank Adam Special—Women Ride Free—Hop in!—We'll Bring You Back."

An advertisement in the daily papers read as follows: "Get on and ride free; you won't be bothered to buy. This is Frank Adam's thirty-eighth anniversary — Western Electric's fifty-fourth. They want you to see the most wonderful washer ever made. Two stores aren't large enough to hold the crowds that want to see it. That's why special cars are bringing it right into your neighborhood."

Chicago Holds Second Radio Show

With more than 125 exhibitors displaying their latest radio equipment, the second annual Chicago Radio Show was held at the Coliseum Nov. 20 to 25. The difference in present radio equipment compared with that of two years ago was particularly noticeable in the improved physical appearance of the sets and the simplification of circuits.

On Thursday evening Dr. Lee De Forest gave an interesting lecture on his early research work in the development of the three-electrode tube. Another feature of the show was the drawing of prizes held in connection with the "listeners' program vote," which was held for the purpose of determining the class of music the public desires.

Eureka Company Occupies New District Offices in Boston

The Eureka Vacuum Cleaner Company has moved its New England headquarters office and service station from 12 West Street, Boston, to 577 Washington Street in the same city. Growth of business in the Northeast has necessitated occupying the entire third floor of the building, giving the company about three times its former space.

W. G. Keay, New England manager, says that the total sales of cleaners by his organization in New England during 1923 will reach 20,000, compared with 16,000 in 1922, and that for the country as a whole his company's unit sales will run about 75 per cent ahead of last year. The new offices are in the heart of the retail shopping district.

Western Electric Organization Changes in Expansion Program

Important organization changes announced by the Western Electric Company involve the appointment of three new assistant works managers and two superintendents in the manufacturing department. These changes are part of a program of expansion being carried out in the new Western Electric Works at Kearny, N. J., which in their ultimate development may duplicate the tremendous plant at Chicago.

C. L. Rice, formerly production superintendent of the Hawthorne works at Chicago, and S. S. Holmes, general superintendent of installation of the installation department, have been promoted to assistant works managers at Hawthorne. R. C. Dodd, at present operating superintendent of the Hawthorne works at Chicago, has been promoted to assistant works manager at the new Kearny works. This appointment is effective March 1, 1924.

Mr. Rice entered the company's service as an apprentice course student in the West Street shops, New York, in 1902. On the completion of his course in 1906 he was assigned to the engineering department, and a year later he entered the shop output department. In 1911 he was promoted to works manager of the London factory and three years later returned to America to take up duties as superintendent of the production branch at Hawthorne.

Mr. Holmes started with the Western Electric Company in 1900 as an apprentice course student at Chicago in the Clinton Street shops. He became successively assistant chief inspector and chief inspector of the New York shops, chief of the inspection organization at Hawthorne and assistant general superintendent of installation. Since 1922 he has been general superintendent of installation.

Mr. Dodd became secretary of the Nippon Electric Company at Tokio on completion of his student course. Four years later he returned to America as chief of the installation department, with headquarters at Hawthorne. In 1916 Mr. Dodd became chief of the operating branch.

J. J. McKenna, who was formerly assistant general purchasing agent at Hawthorne, succeeds Mr. Rice as superintendent of production, and W. H. Meese, supervisor of installation methods and results, succeeds Mr. Dodd as operating superintendent at Hawthorne

Racine Manufacturing Company Enters Electrical Field

Through the installation of special equipment costing about $100,000 the Racine Manufacturing Company, Racine, Wis.—a branch of the McCord Manufacturing Company—is now in a position to enter into the manufacturing of switchboards and other electrical and telephone equipment for the Western Electric and American Telephone & Telegraph Company, from which companies it has received contracts for equipment which will keep the plant operating on a capacity basis for a year or two. Prior to its entry into the electric manufacturing field this company devoted all of its time and equipment to the making of automobile bodies. The company now employs 600 men and will increase this to about 900 when full operating capacity is reached.

The Blaw-Knox Company, Pittsburgh, manufacturer of steel transmission towers and poles, announces that Charles K. Wehn has been placed in charge of a special department devoted to Blaw-Knox standard steel buildings and structural steel in Illinois and adjoining states.

The Litlude Battery Company, Morgantown, W. Va., is planning for the erection of a new one-story plant at Connellsville, Pa., 38 ft. x 115 ft., for the manufacture of electric batteries and kindred products.

The P. A. Geier Company, Cleveland, will soon build an addition to its East 105th Street works, doubling the present floor space of both its plants. The extensions will include a four-story reinforced-concrete building, 68 ft. x 240 ft., a one-story wing, 56 ft. x 66 ft., and the addition of three stories to a one-story building. The additional space will be used for the manufacture of washing machines, vacuum cleaners and other electrical household appliances.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An exclusive agency is desired in Berne, Switzerland (No. 8,378), for accumulators and batteries.

Purchase is desired in Rouen, France (No. 8,353), for small engines, from 1½ hp. to 10 hp., for farms.

Purchase and agency is desired in Antwerp, Belgium (No. 8,379), for electric household appliances, such as vacuum cleaners and irons.

Purchase and agency is desired in Dublin, Ireland (No. 8,380), for electric household appliances, incandescent lamps, wire, switches, flashlights and batteries.

An agency is desired in Basel, Switzerland (No. 8,377), for electrolytic copper, in cakes, wire bars, round billets, ingots and ingot bars.

Purchase and agency is desired in Rangoon, India (No. 8,372), for torch and incandescent lamps.

TENDERS FOR ELECTRIC PLANT, WELLINGTON, NEW ZEALAND.—Tenders will be received by the secretary of the Public Works Tender Board, Wellington, New Zealand, until April 30, 1924, for power house and plant, section 2, Arapuni electric power scheme. For details see Searchlight Section.

TENDERS FOR SUBSTATION EQUIPMENT AND MOTOR-GENERATOR SETS, SYDNEY, AUSTRALIA.—Tenders will be received by the New South Wales Government Railways and Tramways Commissioners, Sydney, Australia, until Feb. 6 for equipment for substations. Tenders will also be received until Feb. 27 for motor-generator sets.

PROPOSED MUNICIPAL ELECTRIC PLANTS IN BRAZIL.—A number of municipalities in the State of Rio Grande do Sul, Brazil, according to *Commerce Reports*, contemplate the construction of municipal electric plants. Requests are frequently received from municipalities asking to be put in touch with American firms that would be willing to finance and install power plants or extensions to existing stations. The name of one municipality which has made a request as above stated, together with a list of firms and individuals of good reputation, recommended by Consul Bradley as prospective agents for American firms, may be obtained from the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., or co-operative offices of the bureau, by referring to file No. 112,053.

New Apparatus and Publications

ELECTRICAL APPLIANCES.—Bulletin No. 17-23 distributed by Harvey Hubbell, Inc., Bridgeport, Conn., covers its new small attachment plug, composition convenience outlet and brass flush plate with self-closing spring door.

PLATE RHEOSTATS.—The Ward Leonard Electric Company, Mount Vernon, N. Y., has added new sizes to its line of "Vitrohm" (vitreous-enameled) variable rheostat plate. They are now made in sizes from 5¼ in. square to 14 in. square and also include in the line a larger plate in standard size, 15 in. by 24 in. The round type of plates are made in sizes from 5-in. diameter to 19-in. diameter.

MOTOR-DRIVEN CHAIN HOIST.—Bulletin No. S-801 issued by the Motorbloc Corporation, Summerdale, Philadelphia, describes its "Motorbloc" motor-driven chain hoist.

INSULATING MATERIAL—"A Material of Endless Possibilities" is the title of a booklet issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., containing information about "Micarta" and the many uses to which it has been put and indicating the possibilities for other applications.

LIGHTING FIXTURES.—The Central Electric Company, 316-326 South Wells Street, Chicago, is distributing a catalog describing and illustrating the various types of its "Attalite" luminaire and its application in the illuminating field.

TRANSFORMER TESTING SET.—Bulletin No. 716 issued by the Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, describes and illustrates the "L & N" potential transformer testing set.

RENEWABLE FUSES.—The Buffalo Fuse Corporation, Buffalo, is distributing a leaflet covering the "Pierce" renewable fuses.

CEILING BRACKETS.—The United States Hardware & Manufacturing Company, Pawtucket, R. I., is distributing four leaflets describing its ceiling, wall and insulator brackets.

New Incorporations

THE CHIMNEY ROCK MOUNTAIN, INC., Charlotte, N. C., has been incorporated with a capital stock of $12,000,000. Under the terms of its charter it is given authority to operate hydro-electric plants and various allied businesses, to develop real estate, etc. The incorporators are: M. O. Dickerson, Jr., E. O. Thomas, B. B Deggett, L. B. Morse and others.

THE SOUTHERN WYOMING ELECTRIC COMPANY, Rock Springs, Wyo., has been incorporated by Eugene McAuliffe E. S. Brooks, G. E. Bisbonnet, N. H. Loomis and Edwin Rich. The company is capitalized at $150,000 and proposes to build hydraulic works and transmission lines and will operate under franchises in various towns and cities in Sweetwater County.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BINGHAM, ME.—The Central Maine Power Company is reported to be considering the construction of a hydro-electric plant on the Kennebec River with initial capacity of 60,000 hp.

BUCKSPORT, ME.—The Bangor Railway & Electric Company has been authorized to extend its electric service from Orrington to North Bucksport.

ENOSBURG, VT.—The Enosburg Falls Water Corporation contemplates the installation of electric pumping machinery in connection with waterworks extensions, to cost about $75,000. Lewis D. Thorpe, 200 Devonshire Street, Boston, is engineer.

NORTHAMPTON, MASS.—A new 13,000-volt transmission line is being erected by the Northampton Electric Lighting Company from Florence to Leeds to supply electricity to the Federal Psychopathic Hospital on Bear Hill. A substation will be erected at Leeds.

SOMERSET, MASS.—The Fall River Electric Light Company is reported to have purchased a site in South Somerset on which the proposed power plant of the Montaup Power Company will be located.

PAWTUCKET, R. I.—The Blackstone Valley Gas & Electric Company plans to erect a substation on Stiness Street, to cost about $55,000. Stone & Webster, Inc., 147 Milk Street, Boston, are engineers.

GEORGETOWN, CONN.—Arrangements have been made by the Gilbert & Bennett Company to purchase electricity from the Connecticut Light & Power Company, Waterbury, to be supplied by the Devon plant. The former company will discard its power plant.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by William H. Gompert, architect of the Board of Education, corner Flatbush Avenue Extension and Concord Street, until Dec. 14 for installing gas and electric fixtures in new Public School 100, on West Third Street, near Sheepshead Bay Road. Also for installing electric fixtures and fittings in new Public School 205, Twentieth Avenue and Sixty-seventh Street, and also installing electric fixtures and fittings in new Public School 210, Rochester Avenue and Park Place.

CORNING, N. Y.—The Corning Light & Power Company plans to erect a transmission line from Elmira to Corning with extensions to Riverside, South Corning, Erin, Gang Mills and Coopers, to cost about $50,000.

LONG ISLAND CITY, N. Y.—The New York & Queens Electric Light & Power Company has purchased the property of Remington Typewriter Company at Flushing, which it proposes to convert into a central storeyard and distributing station.

NEW YORK, N. Y.—The Long Island Railroad Company, Pennsylvania Terminal, has preliminary plans for the electrification of its lines in Queens Borough, to cost about $25,000,000.

NEW YORK, N. Y.—The Baltimore & Ohio Railroad Company, 2 Wall Street, has tentative plans for the electrification of its lines and terminals on Staten Island, to cost about $13,000,000.

NEW YORK, N. Y.—The New York Telephone Company is having plans prepared for the erection of a telephone exchange building at 204 Second Avenue, to cost about $750,000. It is also considering building an exchange on Sherman Avenue, to cost about $500,000.

NEW YORK, N. Y. — Bids will be received by William H. Gompert, architect, Board of Education, Flatbush Avenue Extension and Concord Street, Brooklyn, until Dec. 14 for installing gas and electric fixtures in addition to Public School 121, East 103d Street near Second Avenue, Borough of Manhattan.

OSWEGO, N. Y.—Bonds to the amount of $350,000 have been voted for a municipal electric light and power plant.

TUPPER LAKE, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 12 for the installation of an automatic telephone system at the United States Veterans' Hospital, Tupper Lake.

BRIDGETON, N. J.—The Illinois Glass Company, Alton, Ill., plans to install electric power equipment in connection with the rebuilding of its local plant, recently destroyed by fire with loss of about $250,000.

ALTOONA, PA.—The Penn Press Ice Cream Company, Front Street, plans to erect a new plant and power house at Beale Avenue and Twenty-eighth Street, to cost about $150,000.

CHESTER, PA.—The Delaware County Electric Company, owned by the Philadelphia Electric Company, is reported to be contemplating the construction of a large substation on Sixth Street between Welsh and Madison Streets.

PENNSBURG, PA.—The Pennsylvania Power & Light Company has applied for permission to acquire the properties of the Pennsburg Power & Light Company, the municipal power plant at Pennsburg, Redhill Electric Light, Heat & Power Company; Upper Hanover Power & Light Company, Palm Electric Light & Power Company and the municipal power plant at Greenville. The plants will be merged and additional transmission lines erected.

ANNAPOLIS, MD.—Bids will be taken at once by the navy supply officer, Naval Academy, for 1,000 screw-base lamps, 800 waterproof sockets and 250 receptacles. (Nav. req. 214.)

BALTIMORE, MD.—Electric power equipment will be installed in the plant to be erected at Mosher and Brice Streets by the Lafayette Mill & Lumber Company, Lafayette Avenue, to cost about $75,000.

CUMBERLAND, MD.—The construction of a new glass-manufacturing plant, including a power house, to cost about $100,000, is under consideration. W. R. E. King is interested.

ELKTON, MD.—The Eastern Power Company has acquired the properties of the Perryville Electric Company, Oxford (Pa.) Electric Company, Port Deposit Power Company, Rising Sun Electric Company. Havre de Grace Electric Light Company and the Gilpin Falls Power Company. The systems will be consolidated and transmission lines eected to connect the different plants. A contract has also been made with the Home Power Company for power supply.

INDIAN HEAD, MD.—Bids will be asked at once by the local navy supply officer for 87,000 ft. copper telephone wire. (Y. & D. req. 2.)

GLEN LYN, W. VA.—Plans are being prepared by the Appalachian Power Company, Bluefield, for a fourth addition to the Glen Jean hydro-electric station. Work is progressing on the third addition, which will increase the output to 60,000 kw. The fourth will increase the capacity to 80,000 kw.

MARTINSBURG, W. VA.—The Eastern Sewer Pipe & Brick Company plans to build a power house at its proposed local sewer-pipe, tile and brick plant, to cost about $250,000.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Dec. 17 for 21,000 to 26,250 dry batteries (Proposal C. P. 16079-1 C. P.); also for 2,550 pairs of protector mountings, without fuses, and 15,000 fuses (Circular CP 16318-1).

WASHINGTON, D. C.—Plans are being prepared at the United States Engineer Office, Old Land Office Building, for a hydro-electric power plant in Maryland, to include reservoir, conduits and filtration plant, to cost about $5,000,000. Major N. C. Tyler is in charge.

North Central States

BELLEVUE, MICH.—The Alpha Portland Cement Company has contracted with the Consumers' Power Company for service at its local mills. Substation equipment will be installed.

L'ANSE, MICH. — The voters have approved the proposal to purchase an auxiliary light plant for the municipal lighting system, for which contract, it is understood, has been placed.

CLEVELAND, OHIO. — Plans involving an expenditure of about $1,750,000 for extensions and improvements to the municipal electric plant are under consideration by the City Council. Charles G. Beckwith is commissioner of the municipal plant.

NEW PHILADELPHIA, OHIO. — The Ohio Power Company plans to build a new substation near the city, to cost about $1,100,000, connecting the transmission system from the generating plant under construction at Philo to Canton. A transmission asytem will be erected from New Comerstown to New Philadelphia.

OAK HARBOR, OHIO.—The Board of Public Affairs has authorized the replacement of the present wire with heavier wire in the municipal distributing system. The cost is estimated at about $5,000.

SANDUSKY, OHIO. — The Lake Shore Railway Company contemplates erecting a substation, to cost about $50,000.

LOUISVILLE, KY.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Dec. 26 for the installation of one electric passenger elevator, hoistway, etc., in the United States Marine Hospital at Louisville. For details see Searchlight Section.

VINCENNES, IND.—The Indiana Power Company has issued $500,000 in capital stock, part of the proceeds to be used for extensions.

CHICAGO, ILL.—Electric power equipment will be installed in the plant to be erected by the Continental Can Company, 61 Broadway, New York, at 4618 West Grand Avenue, Chicago, to cost about $500,000. Francisco & Jacobus, 511 Fifth Avenue, New York, are architects and engineers.

OLNEY, ILL.—The installation of electrically operated pumping machinery in the municipal waterworks, to cost about $75,000, is under consideration.

ROCKFORD, ILL.—The installation of new equipment is contemplated by the Free Sewing Machine Company, including a traveling crane, electric furnace, etc.

BELLEVILLE, WIS. — The Southern Counties Power Company has applied to the Railroad Commission for authority to issue $40,000 in capital stock to provide funds for extensions to its plant.

BELOIT, WIS.—The City Council is considering the installation of additional lamps throughout the city.

ELKHART LAKE, WIS. — The Badger Public Service Company contemplates extending its electric service to Calumet.

MILWAUKEE, WIS. — Plans are being prepared by Holabird & Roche, 104 South Michigan Avenue, Chicago, for the erection of a service building, power house, laundry, etc., for the Wisconsin Realty Company, 182 Third Street, to cost from $150,000 to $200,000.

NESHKORO, WIS.—C. G. Dahlke and F. L. Geise of Neshkoro, are reported to have started work on a hydro-electric project to cost about $50,000. Equipment, it is said, will be purchased about Jan. 1. The Jacobsen Engineering Company, Fawkes Building, Minneapolis, is in charge of construction.

FORT WING, WIS.—The Northern Wisconsin Hydro-Electric Company has applied for permission to issue $270,000 in capital stock and $60,000 in bonds, the proceeds to be used for the erection of a transmission line and distribution system in connection with its hydro-electric plant at Orienta Falls.

WHITEFISH BAY, WIS. — The Village Board contemplates the installation of an ornamental lighting system in the west end of the village.

ALEXANDRIA, MINN.—Bids will be received by H. S. Campbell, city clerk, until Dec. 10 for an ornamental lighting system on Sixth Avenue. The Charles L. Pillsbury Company, Capital Bank Building, St. Paul, is engineer.

PINE CITY, MINN.—The Eastern Minnesota Power Company plans to erect a transmission line to the Pokegama Lake section to connect with the Brook Park-Grasston transmission system.

SLAYTON, MINN.—The Northern States Power Company, Minneapolis, is planning to erect a transmission line from Slayton to Mountain Lake during 1924, where it will connect with a transmission line from Minneapolis.

ATALISSA, IOWA.—The Iowa Electric Company, Cedar Rapids, has applied to the Public Service Commission for permission to erect a 2,300-volt transmission line from West Liberty to Atalissa to supply electrical service at the latter place.

CLERMONT, IOWA.—The Northeastern Power Company, it is reported, is planning to build a new steam-driven electric plant at Clermont.

DENISON, IOWA. — Extensions to the municipal electric plant are under consideration.

OELWEIN, IOWA.—The Iowa Railway Light & Power Company, Cedar Rapids, is planning to erect a high-tension transmission line from Winthrop to Oelwein.

BOLIVAR, MO.—Bonds to the amount of $50,000 have been voted for extensions and improvements to the municipal electric plant.

BOONVILLE, MO.—The purchase of a 250,000-gal. motor-driven pump for the waterworks system is under consideration.

DESLOGE, MO.—The St. Louis (Mo.) Smelting & Refining Company plans to rebuild its crusher house, rolling plant, power house, conveyor house, etc., recently destroyed by fire. The loss is estimated at $200,000.

ST. LOUIS, MO.—The installation of an ornamental lighting system on the Delmar Boulevard is under consideration.

BUXTON, N. D.—The erection of a transmission line from Grand Forks, to supply electricity here is under consideration.

SIDNEY, NEB.—Extensions and improvements to the street-lighting system, including replacing the present four-lamp clusters with single lamps, are under consideration.

YORK, NEB.—The Nebraska Gas & Electric Company contemplates building a substation in York.

EMPORIA, KAN.—The Atchison, Topeka & Santa Fé Railway Company has tentative plans for the construction of a power plant at its proposed local shops, to cost about $300,000.

RUSSELL, KAN. — The installation of electrically operated pumps in connection with a proposed waterworks system, to cost about $90,000, is under consideration by the Council.

Southern States

CHIMNEY ROCK, N. C.—The Chimney Rock Mountain, Inc., is considering a power development to generate electricity for a proposed summer resort, to cost about $4,000,000.

WADEVILLE, N. C.—The installation of a municipal electric plant is reported to be under consideration by the town officials.

GREENVILLE, S. C.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Dec. 18 for the installation of a full-magnet electric freight elevator for the United States post office and court house at Greenville. For details see Searchlight Section.

ATLANTA, GA.—The Georgia Railway & Power Company is disposing of a preferred stock issue of $1,400,000, part of the proceeds to be used for extensions and improvements.

LEESBURG, FLA. — The Florida China Clay Company plans to replace its steam-power plant with a 600-hp. electric power plant, to include two units of 300 hp. each.

FORT PAYNE, ALA.—Application has been filed by the Fort Payne Power Company with the Public Service Commission for permission to construct a hydro-electric plant at De Soto Falls on Little River.

HEFLIN, ALA.—Extensions and improvements are contemplated to the local electric plant, recently acquired by John W. Kitchen.

NASHVILLE, TENN.—Charles D. Jones & Company are considering tentative plans for rebuilding their power plant, recently damaged by fire, causing a loss of about $500,000.

UNION CITY, TENN. — Bonds to the amount of $125,000 have been voted for extensions to the municipal electric and water plant and sewerage system.

FAYETTEVILLE, ARK.—The Northwest Arkansas Utilities Corporation, recently formed with a capital of $500,000, plans to take over and consolidate the Fayetteville Gas & Electric Company, Springdale (Ark.) Gas & Electric Company, and the Rogers (Ark.) Light & Power Company. Extensions are planned, including transmission lines.

LOREAUVILLE, LA.—The Vida Sugar Refining Company is planning to rebuild its sugar refinery recently damaged by fire, with a loss of about $100,000. The power house was destroyed.

DEWEY, OKLA. — The Dewey Portland Cement Company is erecting an electric transmission line from Bartlesville to Dewey.

BRECKENRIDGE, TEX. — The Southwestern Gas, Light & Power Company, recently formed, with a capital of $700,000, plans to take over and consolidate the Olney (Tex.) Light & Power Company, Breckenridge Gas Company, Newcastle (Tex.) Light & Gas Company and the Graham (Tex.) Gas Company. Extensions are planned, including additional transmission lines. Headquarters will be established at Fort Worth.

EL PASO, TEX.—The El Paso Cotton Mills Company plans to build a 600-hp. power plant at its proposed mill, to cost about $1,000,000.

LAMESA, TEX.—The Texas Power & Light Company has acquired the system of the Lamesa Light & Ice Company. Extensions will be made in the power plant to double the present capacity. The ice-manufacturing plant will also be enlarged and additional machinery installed.

LUBBOCK, TEX.—Bonds to the amount of $75,000 have been voted, of which $50,000 will be used for extensions and improvements in the municipal electric plant and $25,000 for an ornamental street-lighting system in the business section.

Pacific and Mountain States

KEYPORT, WASH.—Bids will soon be asked by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for an addition to the operating building at the local radio station. (Specification 4926.)

LOWELL, WASH.—The Walton Lumber Company plans to build a power house at its proposed local veneer mill, to cost about $500,000.

SEATTLE, WASH. — The Washington Irrigation & Development Company, Henry Building, has applied for permission to construct a hydro-electric plant at Priest Rapids, Columbia River, with ultimate capacity of 350,000 hp., to cost about $32,000,000. The plans provide for a dam 2 miles long and 90 ft. high.

ASTORIA, ORE.—The Crown-Willamette Paper Company, Pittock Building, Portland contemplates the construction of a power house at its proposed local pulp mill at the Youngs River Falls, to cost about $175,000.

MAUPIN, ORE. — Permission has been granted to J. H. and E. C. Woodcock to construct a hydro-electric plant at Dufur Springs.

BAKERSFIELD, CAL.—The Kern River Water Storage District plans to acquire existing canals and irrigation facilities and to construct a dam on the Kern River, install pumping plants and to build new canals, etc., at a cost of about $15,000,000.

COLUSA, CAL. — The purchase of the local system of the Pacific Gas & Electric Company to be owned and operated by municipality, is under consideration. If acquired, extensions and improvements will be made.

FORTUNA, CAL.—Steps have been taken by the Business Men's Club for the installation of a municipal electric fire-alarm system.

HAYWARD, CAL.—The National Ice & Cold Storage Company, Post Telegraph Building, San Francisco, plans to build an ice and cold-storage plant here, to cost about $75,000.

MERCED, CAL.—The San Joaquin Light & Power Corporation has applied for permission to construct a hydro-electric plant

on the Merced River, to cost about $1,100,000.

NATIONAL CITY, CAL.—Schiefer & Sons, Inc., San Diego, plans to build a power house at its proposed local furniture plant, to cost about $100,000.

REDDING, CAL.—The Pacific Gas & Electric Company contemplates the erection of a telephone line from Redding to the Vaca-Dixon substation, 88 miles, to cost about $100,000.

RIVERSIDE, CAL.—The Southern Sierras Power Company has acquired the properties of the Holton Power Company in the Imperial Valley district. The construction of a transmission line from El Centro west, about 100 miles, to cost $500,000, is under consideration.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company plans to erect a transmission line to Rincon, about 17 miles, to cost about $175,000.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company plans to build an addition to its substation at Commercial and Montgomery Streets, to cost about $500,000.

SMARTSVILLE, CAL.—Plans are under consideration by the Excelsior Water & Power Company for the construction of a dam, 100 ft. to 166 ft. high, on Deer Creek, with penstock and power house.

YUBA CITY, CAL.—Plans are being considered for the installation of an electric fire-alarm system.

PHOENIX, ARIZ.—The Arizona Power Company has issued $400,000 in bonds, part of the proceeds of the sale to be used for extensions.

Canada

ST. STEPHEN, N. B.—The Hollingsworth & Whitney Company, 185 Devonshire Street, Boston, Mass., plans to build a power plant at its proposed paper pulp mill on the St. Croix River, to cost about $450,000.

WOODSTOCK, N. B.—The Carleton Electric Company, Ltd., recently incorporated with a capital stock of $99,000, plans to erect a transmission line to Woodstock, from a connection with the lines of the Maine & New Brunswick Electrical Power Company at Aroostook Falls. Edgar R. Teed, Woodstock, is one of the incorporators.

FORT WILLIAM, ONT.—Plans for linking up the Nipigon hydro-electric plant with the power lines of the Kaministiquia Pulp & Paper Company to secure additional energy for Fort William is under consideration by the Hydro-Electric Power Commission of Ontario.

LONDON, ONT.—A bylaw providing for an issue of $150,000 in debentures for the construction of a dam in the River Thames at Springbank by the Public Utilities Commission will be submitted to the ratepayers at the municipal election.

TORONTO, ONT.—The City Council has authorized an issue of $2,375,000 in debentures for the rehabilitation and equipment of the railway lines within the city limits formerly operated by the Toronto Suburban Railway Company by the Toronto Transportation Commission.

TORONTO, ONT.—The construction of a steam-driven power plant with a capacity of 100,000 hp. and ultimately 300,000 hp. in Toronto, to supplement the Hydro-Electric system, is under consideration by the Hydro-Electric Power Commission of Ontario. The cost is estimated at between $8,000,000 and $9,000,000.

BRYSON, QUE.—Arrangements are being made by the Ottawa River Power Company for a hydro-electric plant at Bryson under a 61-ft. head. The ultimate capacity of the plant will be from 60,000 hp. to 75,000 hp.

CALUMET, QUE.—Plans are being considered by the provincial government for the construction of a dam at Grand Calumet Falls on the Ottawa River to develop 50,000 hp., to cost between $3,000,000 and $4,000,000.

Miscellaneous

TAMPICO, MEX.—Work is under way on the electrification of the Mexican Railway between Orizana and Esperanza (48 miles), which it is expected will be placed in operation in March, 1924. Electricity will be supplied by the Puebla Light & Power Company from its plant at the Orizaba Falls. The entire system from Vera Cruz and Mexico City (650 km.), it is expected, will be electrified as soon as possible.

Electrical Patents

Announced by U. S. Patent Office

(Issued Nov. 20, 1923)

1,474,367. COMBINED RHEOSTAT AND CUT-OUT; J. E. Jenkins, Chicago, Ill. App. filed May 20, 1922. For electron tubes.

1,474,371. ENGINE STARTER; A. T. Kirk, Chicago, Ill. App. filed Jan. 3, 1922. Means for engaging motor pinions to fly-wheel.

1,474,382. APPARATUS FOR WIRELESS TELEGRAPHY AND TELEPHONY; H. J. Round, London, England. App. filed March 31, 1920. Auxiliary apparatus for vacuum tubes.

1,474,384. ELECTRIC HEATING UNIT; T. C. Russell, Chicago, Ill. App. filed June 17, 1922. For percolators, flatirons, waffle irons, etc.

1,474,408. DETECTING CIRCUIT; R. W. Deardorff, Brooklyn, N. Y. App. filed Nov. 16, 1920. Transmission system employing carrier current.

1,474,426. SECRET COMMUNICATION SYSTEM; H. A. Affel, Brooklyn, N. Y. App. filed July 19, 1922. For radio carrier telephone and telegraph systems.

1,474,430. TELEPHONE REPEATER; O. B. Blackwell, Garden City, N. Y. App. filed May 29, 1919. For phantom transmission systems.

1,474,434. BATTERY CONNECTOR; J. E. McKee, Connellsville, Pa. App. filed March 30, 1921. Test clip.

1,474,451. ELECTRIC CANDLE; T. Stückelberger, Montmirail, Switzerland. App. filed Dec. 16, 1922. Small flashlight.

1,474,460. ELECTROPLATING ANODE; E. M. Beck, Greensburg, Ind. App. filed July 5, 1922. Core for platinum electrodes.

1,474,483. ELECTRIC HEATING APPLIANCE; C. A. Laise, Weehawken, and A. J. Gallager, West Orange N. J. Small utensil for household use.

1,474,486. ELECTRICAL CONDENSER; B. MacPherson, Roxbury, Mass. App. filed June 3, 1919. Condenser adapted for high-potential service.

1,474,523. STORAGE-BATTERY-CELL TOP; A. O. Garrett, San Diego, and C. E. Funnell and W. L. Hoffman, Los Angeles, Cal. App. filed Oct. 27, 1920. Hard-rubber top.

1,474,524. OIL HEATER; C. J. Garrigan, Millvale, Pa. App. filed May 22, 1922. For preheating fuel oil before burning.

1,474,528. ELECTRICAL WATER HEATER; W. Hurst, Winnipeg, Manitoba, Canada. App. filed Dec. 23, 1919. For preventing water in automobile radiator from freezing.

1,474,562. COMBINED ELECTRIC COOKER AND WATER-HEATER APPARATUS; T. R. Stancombe, Bristol, England. App. filed Aug. 6, 1923.

1,474,588. THERMOSTATIC SWITCH FOR FLATIRONS; R. D. Hetrick, Indiana, Pa. App. filed March 11, 1921.

1,474,594. METHOD OF AND APPARATUS FOR OBTAINING ION CONCENTRATION EFFECTS; E. A. Keeler, Norristown, Pa. App. filed May 1, 1922. Electrolytic action.

1,474,597. INDUCTION COIL; A. A. Kent, Ardmore, Pa. App. filed June 25, 1921. For ignition of internal-combustion engines.

1,747,608. AUTOMATIC TELEPHONE SYSTEM; R. G. Richardson, Chicago, Ill. App. filed June 29, 1917. Improved circuits for individual line or trunk selecting switches.

1,474,624. MAGNETIC CONCENTRATOR; E. W. Davis, Minneapolis, Minn. App. filed Jan. 14, 1921. For use in making magnetic-iron assays.

1,474,638. ELECTRIC WATER HEATERS; A. Martin, Ogdensburg, N. Y. App. filed March 14, 1922. Electric arc used as heating medium.

1,474,648. AUTOMATIC TELEPHONE SYSTEM; A. B. Smith, Evanston, Ill. App. filed Oct. 1, 1920. Relates to secondary non-numerical rotary switch.

1,474,693 and 1,474,694; OVERLOAD CIRCUIT BREAKER; F. Tobien, Essen, Germany. App. filed March 27, 1922. For protecting motors connected selectively in series or parallel.

1,474,723. ELECTRIC HEATING DEVICE; M. M. Levinson, Pasadena, Cal. App. filed April 12, 1921. Heating unit for soldering iron.

1,474,726. METHOD OF AND ARRANGEMENT FOR RECEIVING ELECTRICAL OSCILLATIONS; A. Meissner, Berlin, Germany. App. filed Aug. 8, 1922. Heterodyne reception of undamped oscillations.

1,474,735. ELECTRIC LAMP; A. J. Sanders, Spokane, Wash. App. filed July 22, 1922. Pedestal of floor lamp composed of mirrors.

1,474,736. INSULATOR; F. Schaub, Jersey City, N. J. App. filed May 21, 1920. Knob for open wiring.

1,474,739. STOP SIGNAL AND REAR LIGHT; S. J. Thomas, Youngstown, Ohio. App. filed April 17, 1922.

1,474,740. TAIL LIGHT AND STOP SIGNAL; S. J. Thomas, Youngstown, Ohio. App. filed Oct. 26, 1922.

1,474,757. WATER-COOLED TRANSFORMER; R. V. Bingay, Pittsburgh, Pa. App. filed Nov. 27, 1920. Automatic control of water circulation.

1,474,758. PLUG RECEPTACLE; C. H. Bissell, Syracuse, N. Y. App. filed June 21, 1918. For installations in which wires are inclosed in conduits.

1,474,761. SECONDARY CELL AND SEPARATOR PLATE FOR USE THEREIN; T. A. Campbell, New York, N. Y. App. filed Nov. 30, 1920.

1,474,763. ELECTRICAL APPARATUS; D. Conlan, Jr., Brooklyn, N. Y. App. filed Dec. 24, 1920. Special attachment plug.

1,474,777. ELECTRIC WATER HEATER; L. Jarkovsky, Vienna, Austria. App. filed Oct. 25, 1921. Tubes form short-circuited secondary of transformer.

1,474,780. IGNITION SYSTEM; L. S. Keilholtz, Dayton, Ohio. App. filed Aug. 10, 1918.

1,474,824. WELDING MACHINE; C. L. Hoff and G. G. Naugle, York, Pa. App. filed March 1, 1921. For welding chains.

1,474,825. PORTABLE COOKING OUTFIT; G. Howard, Michigan City, Ind. App. filed Nov. 27, 1922. Electric grill.

1,474,829. COVER FOR CONTAINING CELLS OF ELECTRIC BATTERIES; L. Lyndon, New York, N. Y. App. filed Dec. 3, 1919. Water-tight cover but with suitable ventilating means.

1,474,830. POROUS, ACID-RESISTING DIAPHRAGM; L. Lyndon, New York, N. Y. App. filed March 14, 1921. For separators in batteries, diaphragms for filtration or for electrolytic processes.

1,474,833. PRESSING DEVICE; O. Hauptman, New York, N. Y. App. filed Aug. 23, 1922. Trousers press electrically heated.

1,474,887. ELECTRIC HEATING ELEMENT; R. G. Bridges, Toronto, Ontario, Canada. App. filed March 27, 1922. Heating element covered with asbestos cord.

1,474,909. VAPORIZING ATTACHMENT FOR INTERNAL-COMBUSTION ENGINES; J. Medveczky, New York, N. Y. App. filed Sept. 25, 1918. Electric type.

1,474,936. DIRECTIONAL SIGNAL; W. B. Lawrence, Suffolk, Va. App. filed March 8, 1920. Rear signal for automobiles.

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For the Company or for the Department?

WHO is it that the employee of the central station is working for — his company or the department to which he happens to be assigned? This apparently innocent, rhetorical-looking question involves an important consideration. For to some individuals in every large organization and in many small ones the purpose or the viewpoint of a department often outweighs, and sometimes actually conflicts with, interests and objectives which are absolutely vital to the company.

The case of the meter reader and the collector will illustrate the point. These are two men who are continually in contact with most of the people of the community. To many householders they are the light and power company. They make or break its reputation. Day after day, they help or hinder the company in its efforts to improve public relations and to promote the idea to "do it electrically."

IT SEEMS reasonable that one of the primary qualifications in a meter reader or a collector should be a proper attitude toward the development of good customer relations and a proper interest in the ambitions of the sales department. To insure this and to simplify the work of guiding and inspiring these men properly some of the most progressive and successful companies believe that the sales department should have control of them. In most companies, however, the logic of this reasoning does not prevail. Because the actual work of these men consists of recording the readings of meters and collecting bills, they are for reasons of internal expediency linked with the bookkeepers under the control of the auditor. Straightway, speed and accuracy become the chief aims, and a most important opportunity before these men becomes the secondary consideration. It is inevitable that it should be so.

IT HAS long been a problem how best to capitalize on the possibilities of the customer contacts of these men. No employee should lack information and schooling as to the real purpose of his work and as to who it is he is really working for. There is always the necessity of getting the work done and done properly. But it is also important that the work of the various groups be so organized and co-ordinated that the direction of meter readers, collectors and any other group of central-station employees with public contacts shall be in the hands of officials who are disposed to insure that these men will work to further the true ideals and purposes of the company. No office expediency or departmental jealousies should be allowed to interfere, as is too often the case.

Guy Webster Talbot

A public utility executive who has a genius for organizing power and railway properties.

REMARKABLE ability to judge character and pick men who can take responsibility and the ability to organize, coupled with democratic and human qualities which have enabled him to develop the utmost loyalty among those in his organization, are the attributes which made Guy Webster Talbot, now president of the Pacific Power & Light Company, a utility executive at the age of twenty-nine.

He has a keen, analytical mind and is able to grasp the broader features of any situation quickly. His ability to meet and judge men of all types, his faculty of delegating responsibility to those under him and his knowledge of finance and business management have enabled him to build up a most efficient organization. Mr. Talbot was born in Centerville, Mich., Aug. 12, 1873. He obtained his public school education in Des Moines and later pursued a college course at Emporia, Kan. His first employment was with railroad companies. Beginning as a ticket agent, he advanced until in 1901 he became traffic manager of the Peoria & Pekin Terminal Railway Company, going on to the general superintendency and eventually being made vice-president and general manager.

In 1906 Mr. Talbot removed to Portland, Ore., where he became identified with the Astoria & Columbia River Railroad Company as vice-president and general manager. He held a similar position with the Corvallis & Eastern Railroad and in 1907 was made vice-president and general manager of the Oregon Electric Railway Company. In 1910 he was elected to the presidency of the Pacific Power & Light Company and the Portland Gas & Coke Company, both with headquarters in Portland.

Mr. Talbot has taken a very active part in civic affairs and during the war was in direct charge of all Liberty Loan drives in Portland. He has been an active worker in the National Electric Light Association, having served as president of a geographic division, the Northwest Electric Light and Power Association, during the association year 1917-1918.

Mr. Talbot has been a member of the water-power committee of the N. E. L. A. for a number of years, and in that capacity he spent much time and energy in helping to persuade the Federal Power Commission to adopt workable rules and regulations under the water-power act.

Editorial Comment

Electrical World, December 15, 1923

Volume 82 Number 24

Why Not Voting by Electricity?

MANY a man with an hour or two to spare in Washington goes to the Capitol and enters one of the House galleries, hoping it may be his good fortune to hear a new "Sunset" Cox as he soars in the oratorical empyrean, to see a present-day Blaine and Conkling clash in an argumentative joust, or at least to catch the House convulsed with laughter as some bewildered member inquires: "Mr. Speaker, where was I at?" The visitor is a hundred times more likely to hear the clerk droning, "Mr. Brown of Maine, Mr. Brown of Texas," and so on down the list. By the time the clerk reaches "Mr. Smith of Wyoming" on the third successive roll call the bored citizen in the gallery is apt to beat a retreat, resolved to spend in some other fashion the rest of the time till his train is ready.

For many years a bill has been introduced into every Congress providing for the substitution of electromechanical for *viva voce* voting. For some reason not apparent, unless it is the objection of chronic filibusters to have their favorite indoor sport interfered with, this bill has never become law, and what is in the aggregate a tremendous waste of the legislators'—and therefore the people's—time continues. Surely so simple an application of the electrical art could be adopted without unduly enriching any patentee or contractor or arousing a suspicion of wrongdoing on anybody's part. It would be in line with the practical character of which Americans are proud and with a hundred other applications in public buildings of every sort. Of what are our Congressmen afraid?

Residence Survey Plan Has Three Purposes

WITHIN the last year or two a number of central stations about the country have made separate surveys of their residence load. They have found that three things can be accomplished by such a house-to-house canvass of the community. An accurate knowledge can be obtained of the number and kinds of lamps and appliances in use in the homes on which to base future merchandising efforts. This is valuable. First and foremost, however, such a canvass brings an opportunity to carry to every customer, every householder, in a personal way an evidence of interest and good will and an interpretation of the service of the modern light and power utility and its place in the community. This is of tremendous benefit to public relations. Then, thirdly, it has been found that new interest has been automatically created in the use of electricity in the home which has influenced the sale of many additional appliances. In short, such a survey will finance itself, even though merchandising may be considered quite a secondary purpose in the enterprise.

It is well to have these three points clearly in mind in considering the plans now being developed by the National Electric Light Association for a national residence survey, for there has been considerable misunderstanding. It has been believed by some that the N. E. L. A. intends to call upon member companies to hire men and make an expensive survey of their entire territories within a year, with the prospect of developing a lot of interesting information but little more. This is not the case at all. In small cities a year would undoubtedly suffice to visit all present customers, but in larger communities it may be far more practical to make it a two-year undertaking, and on such a basis the cost of the survey need be an obstacle to no one. In one city already surveyed it is said to have cost 25 cents a call to make the canvass—and what company will not gladly invest 12½ cents per consumer per year in such an enterprise? Even if it cost twice that amount, it would be good business.

The electrical industry is now operating in almost total ignorance of the exact condition of its market in so far as the household is concerned. The information that such a national residence survey will bring will be of inestimable value. The benefits to public relations which will accrue from a systematic, personal, friendly, helpful contact with every consumer of electricity will also be past all calculation.

Why Not Advertise Our Accomplishments?

IT IS true, as an old playwright said, that "on their own merits modest men are dumb"; but modesty, however it may appeal to the cultured, is a handicap to any public utility in this day and generation. It is necessary to step "o'er the bounds of modesty" if the meritorious utility is to get the credit that is its due. And why not? Men show their dogs and horses if they possess merit and expect them to win blue ribbons. A manufacturer makes something worth while or better than his competitor and immediately advertises it. Should not electric public utilities do likewise? If a municipality takes over an electric system and, profiting by advances made in the art, toward which, by the way, it has contributed nothing, rehabilitates the system and reduces rates, the municipal authorities always make sure to inform the public of the hundreds of thousands of dollars the municipality has saved its citizens. It has done something worth while and has a right to be proud of it.

The difference between a municipally owned and the ordinary electric service company, however, is that the latter is continually making improvements which benefit the public, but rarely says much about it, knowing that a public utility is obligated to render the best service at the lowest possible rates. To possess such a sense of duty is noble, but the consciousness of doing well does not suffice in the public utility business. People must know of it. When municipalities tell of the immense savings they have made to users of electricity, the impression left is that the ordinary electric

service company has but one ambition and that is to keep rates up.

This is not so. Our electric public utilities are constantly striving to give improved service at the same or lower rates, and that is why they enjoy such popularity. The Brooklyn Edison Company, for example, has just purchased the electric property and franchise of the Flatbush Gas Company. Edison rates become automatically applicable in Flatbush, and 35,000 users there on the basis of present consumption save $250,000 a year. This is but one case, yet it is typical of the service which our electric public utilities are constantly rendering. It is certainly worth while doing and worth while advertising also.

The Passing of an Empire Builder

NOT to many in this country was Sir William Mackenzie known. His name, however, was for years a household word in Canada, his native land and the legatee of much of his work. The people of the maple-leaf country owed much to him and were in turn not unkind to the "Emperor of the North." Sir William's accomplishments were many and varied. He it was who laid the foundation of the electrical industry in Canada, who gave Toronto and Winnipeg their electric railway and lighting systems, helped harness Niagara, and whose electrical activities extended into Mexico and far-away Brazil. Mackenzie was of the pioneer, master-builder type, not unlike the late James J. Hill of this country, who himself, by the way, was born in Canada.

Sir William Mackenzie was quick to grasp the opportunities which a budding country like Canada offered and did much to build up the provinces. To transportation he devoted a great part of his life, and while he aided in the building of the Canadian Pacific, his crowning achievement was the Canadian Northern Railway, extending from coast to coast and undertaken after he had passed the prime of life. His interest in lumbering and mining was also large. It is given to few men to serve their country as greatly and as acceptably as Sir William Mackenzie served his, and we join with Canada in lamenting his loss and paying tribute to those qualities which made him a leader among men.

Personal Service and Public Relations

THE employees' service guide of the Illinois Power & Light Corporation, printed on page 1230 of this issue, embodies two basic principles essential to building good public relations. First, responsibility for customers' satisfaction is placed directly upon the personal service of the individual employee. Second, the employee's duties are clearly and definitely stated in a few brief instructions which constitute the guide. Thus he knows what is expected of him and has the added incentive to produce results through his own initiative. This is in contrast with some public relations efforts which have emphasized the quality of a company's service in terms of its continuity, close voltage regulation or the vastness of its power system, all valuable, but apparently overlooking the most important side—the human element—upon which the whole structure is dependent. Customers and employees alike are human beings, and, after all, in a business transaction it is personal service that counts most. For this reason alone the service guide of the Illinois Power & Light Corporation merits careful study by central-station men.

Overemphasizing Unit Costs in Plant Design

HASTY generalizations drawn from inadequate analyses of plant construction costs, whether estimated or historic, should be avoided by designing engineers and utility executives as the dissemination of such data becomes more common. There is a wholesome tendency at present toward increased thoroughness in the preparation of cost figures for use by regulative commissions, bankers, investors and operating men, especially in generating plant, substation and transmission-line developments. The filing of such information with utility commissions automatically throws it open to public scrutiny. Much of it finds its way into print and is of value to engineers, but a word of caution is not amiss in regard to unit interpretations.

Unit figures of final costs in plants or on systems completed according to scheduled development are naturally of prime value if dates of work done, localities and names are available. Obviously the reputation of the engineers responsible for such development establishes the value of cost information. Some estimates of anticipated cost by engineering concerns of high repute are worth more to the profession than are other indifferently kept records of cost in the field. Even if the locality and name of the job are omitted, there are many estimates and historical cost records of great potential value to the engineer prepared in practice from time to time, provided these give enough detail as to the project to permit rough comparisons to be made. Misinterpretation of unit figures, however, needs to be particularly avoided in plants for which estimates or outlays cover only a part of the completed scheme, and simple as this may appear from the arithmetical standpoint, it deserves consideration because not a few people lose sight of the influence of partial development upon earlier costs.

The cost per kilowatt of a new plant with a building large enough to house several generating units but covering one initial machine and a fraction of the ultimate boiler capacity becomes very misleading unless it is clearly understood that the figure applies to a partial development only. The growing use of electrically driven auxiliaries tends to put demands upon prime movers which amount to a decided increase in useful rating; but if this rating is not expressed in the divisor into a total cost figure for a given stage of plant development, inaccuracy may result in comparing the unit cost with that of a station using chiefly steam-driven auxiliaries. Usually the investment in crane equipment is completed at the start except for extending runways as the building grows, and often the feed pump installation, stack investment, boiler equipment and no small share of the fuel-handling facilities cover the requirements of more than one generating unit. The unit cost of the plant tends to diminish as it proceeds.

Clearly, the extent of plant development should always be kept in sight in studying both total and unit cost data, and in general the more symmetrical the development with relation to a well-rounded scheme of design and construction, the more valuable will be the unit figures. Total costs for different steps in piecemeal development are always useful if sufficiently de-

tailed to enable the work to be visualized from the engineering standpoint, but reasonable care should be employed in reducing such costs to unit bases.

New Steam Cycles Offer Possibilities for Economy

THE possibility of producing a kilowatt-hour for 12,000 B.t.u. certainly seemed visionary two years ago. But when outstanding engineers say that such an accomplishment is now reasonably possible on a commercial basis, operating executives should study these prospective super-economies in connection with developing the capacity of their systems to carry the growing loads.

At the power session at the A. S. M. E. convention several notable papers were presented dealing with possible economies in energy production from fuel, and in the brief abstracts presented in this issue the authors of the papers have given definite answers to many questions which have long been speculative. Air heaters both at Pittsburgh and Kansas City have proved economical and efficient for certain fuels and conditions. Tests have answered all questions as to their value in specific installations, and their place is established in central-station practice.

But of far more potential value to the industry are the reasoned statements of such authorities as Professors Hirshfeld, Wohlenberg and Ellenwood to the effect that the adoption of certain steam cycles, pressures and temperatures is both economical and practicable and will result in enormous gains in the thermal performance of power stations. Actual data are lacking to support their conclusions, but their careful studies and analyses can be taken as the approximate answers to many heretofore speculative questions. And it is rather unimportant that they disagree as to the particular cycle which is best to use, since either the bleeding cycle or combination bleeding and reheating cycle results in expected performances much superior to those now obtained. Even the question as to the relative advisability of using 800 lb. or 1,000 lb. pressure is unimportant, since either pressure gives worth-while results when used with the proposed cycles.

From the cost standpoint, with due consideration of the price of fuel, stations incorporating the high thermal efficiencies are commercially feasible and should be profitable. As pointed out by V. E. Alden, studies made on a basis of output per unit of capacity may even show high-pressure stations to be cheaper than low-pressure plants.

But the authors of the papers warn their readers that it is unsafe to generalize from their analyses, that many of the data are extrapolated, that many items of equipment remain to be developed commercially, and that local conditions such as load factor and fuel costs are decisive elements in designing a given station. In their opinion no great obstacles from a thermodynamic or mechanical standpoint stand in the way of actual accomplishment, but predicted results must be corroborated by actual data before generalizations are made. They have defined the limits in pressure, temperature and costs broadly and, like the rest of those interested, await the completion of plants now building for proof of their predictions. They are to be congratulated on the excellence of their studies and on the clearness and conservatism with which they outlined the theoretical and practical limitations involved in the applications of their conclusions.

Economical Loading of Distribution Transformers

LOADING distribution transformers on a temperature basis as a means of more economical operation is receiving the serious consideration of central-station companies as well as of manufacturers. The interests of these two groups relating to this particular problem are in some ways opposed, although, of course, in a broad way they are identical. The interest of the central station is to secure the maximum possible output from the transformer without loss of an unreasonable number of units by overload. The interest of the transformer manufacturer is to have the operating conditions such as not to shorten the normal life of transformers.

The output rating of transformers as given in the A. I. E. E. standardization rules is based on a maximum load without exceeding a given temperature in the windings. This, of course, does not mean that the transformer cannot operate for short periods at an overload or at temperatures slightly above those specified for continuous operation. It is generally understood that the deterioration of transformer insulation depends not only on the actual temperature attained but on the length of time the condition is maintained. In other words, short periods at a slightly higher temperature than 105 deg. C. may safely exist if they are balanced by periods at which the transformers are operating below these values.

While loading on a temperature basis is undoubtedly the proper condition, the peak overload should not be carried too far. Reference is made in the article by N. L. Dolph in this issue to certain cases where peak loads as high as 200 per cent may be practicable, and it is maintained that ordinary conditions justify a value of 165 per cent on lighting feeders. It is pointed out that the feeder regulator will take care of the voltage regulation under such extreme overload conditions. While this is true in general, yet it is a fact that a circuit controlled by a particular regulator usually carries transformers of different ratings whose normal regulation may differ greatly. Therefore, if the feeder regulator is set to take care of the regulation of a particular transformer under the high overload, it may give voltages too high or too low for another unit of different characteristics in a different location.

It is obvious that the application of distribution transformers on a temperature basis should be controlled by a visual temperature indicator and that the keynote of such a device must be reliability and simplicity. As pointed out, such a device need not be complicated by attachments which attempt to control the possible loading which may be carried due to seasonable changes in the air temperature. In the winter the loads are heavier and the air temperature lower, while in summer, although the ambient temperature is higher, the loads are less. In this way the two conditions approach something like a balance.

In general the application of transformers on a temperature basis should be controlled by the same spirit of conservatism and common sense which any engineering problem requires. The gain which can be accomplished by a conservative application of the principle is so large that trying to gain the last volt-ampere capacity of the transformer is not justified by the additional effort and risk required. Studies such as those of Mr. Dolph are very valuable in showing the governing elements in distribution transformer loading and should be used to advantage.

Street Cleaning Time Is Here

MANY streets appear as indicated in the upper right hand photograph until some wideawake central station executive or salesman calls attention to the fact that street cleaning is a valuable annual civic asset which should be applied to all civic institutions which are behind the times. The central view shows how underground construction and the use of modern trolley and light standards can be made to produce a distinctly better appearance in a street, and lighting at night as shown below means that shopping hours will be extended and downtown trade in general will be improved. Nothing modernizes a city more than the use of underground construction and up-to-date street-lighting and street railway equipment.

Loading Transformers on Heat Basis

Economic Study of Transformer Operation Shows Possibility of Great Savings if Lighting Transformers Are Operated on a Temperature Rating Basis—Other Load Limitations Discussed

By N. L. DOLPH
Transmission and Distribution Department, Philadelphia Electric Company

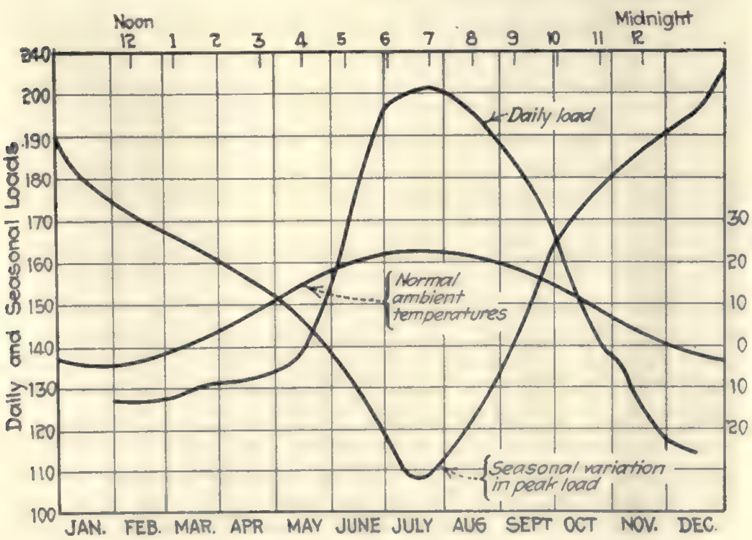
NEARLY every central-station company has a considerable number of transformers in service, ranging in size from 1 kva. to 50 kva., that are never called upon to carry peak loads equal to their continuous load ratings. In such installations the possible economies that might result from well-planned replacements or rearrangements of transformers are obvious. This, however, is only applicable to a relatively small percentage of the transformers on a system. But by taking advantage of the fact that residential lighting loads are at a maximum for only a few hours each day it is possible to utilize the overload capacity of transformers, thereby introducing economies that may be applied to nearly every transformer carrying such loads.

Modern distribution transformers are designed to comply with the Electric Power Club standards specifying a maximum temperature rise of 55 deg. C. Ratings are based on a rise of 55 deg. C., above an ambient temperature of 40 deg. C., under continuous load. The actual limit to the load a transformer may carry is, however, fixed by the coil temperature, which should not exceed 105 deg. C., as specified by the A. I. E. E. standardization rules for Class A-2 insulation. Temperatures higher than this may cause damage to the insulation, although exigencies arising from operating conditions sometimes result in temperatures slightly higher than 105 deg. C., apparently without serious deterioration.

Applying this principle to a specific case, the normal ambient temperature curve of Fig. 1 reaches a maximum of 23 deg. C. (73.4 deg. F.) during the summer months. On unusually warm days, however, ambient temperatures as high as 35 deg. C. (95 deg. F.) may be encountered at the time of day when lighting loads are maximum. The seasonal load curve shows that at the time of year when such temperatures occur the daily peak loads carried are at a minimum. During December and January, when the greatest demand is made on lighting transformers, the ambient temperature is normally less than 0 deg. C. (32 deg. F.), which leaves a margin of 40 deg. C. in permissible temperature rise if the transformer is considered as carrying rated load. Many transformers are liberal in design and do not have as great a temperature rise as 55 deg. C. As the ratings are based on continuous loads, it is evident that because of the comparatively short duration of the lighting peak there is an unnecessarily large margin of safety in overload capacity.

Considered in this light, it is not surprising that some transformers might safely carry loads as high as 200 per cent rating under favorable service conditions. Observations of coil temperatures have been made on transformers under various loads, both characteristic and continuous, and at ambient temperatures varying from — 5 deg. C. (23 deg. F.) to 40 deg. C. (104 deg. F.). The results obtained indicate that at the ambient temperatures ordinarily encountered it is practicable to carry consistently peak lighting loads as high as 165 per cent.

A study of the daily and seasonal load curves of circuit feeders supplying only residential and commercial lighting loads shows that the load varies through a well-defined cycle having a period of twenty-four hours (Fig. 1) and that the maximum load is carried for approximately two and one-half hours



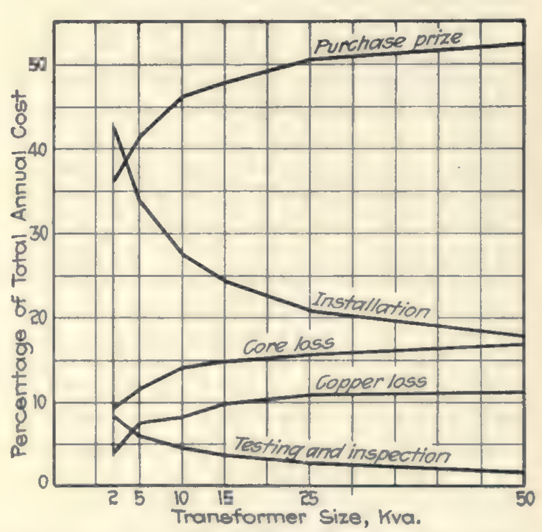


FIG. 1 (LEFT)—TRANSFORMER OPERATING CONDITIONS AND EFFECT ON TEMPERATURE RISE. FIG. 2 (RIGHT)—TRANSFORMATION COSTS FOR RESIDENCE LIGHTING LOADS EXPRESSED IN PER CENT OF THE TOTAL ANNUAL CHARGES AGAINST TRANSFORMER INSTALLATIONS WHEN THE PEAK LOAD EQUALS THE TRANSFORMER RATINGS

in twenty-four. The shape of this daily load curve is similar throughout the year, but the peak load is considerably greater during the winter months, as indicated by the seasonal peak-load curve, which indicates a growth of load of approximately 8 per cent during the year.

The distribution transformer receives energy from the primary lines and delivers energy to the secondary system. The most economical operating condition prevails when the total transformation cost per unit of energy delivered to the secondary is least. The attainment of this condition, however, may be subject to practical limitations to be considered later. The costs chargeable to a transformer installation include interest, depreciation and taxes on the total cost installed, energy losses, inspection and testing. Overhead charges may be included as a part of each of these items. Fig. 2 shows graphically the relative importance of these items for transformer installations ranging in size from 2 kva. to 50 kva.

The problem of determining the most economical operating condition may be solved by calculating the transformation cost per unit of energy chargeable to each size of transformer when operated under various assumed characteristic loads. A curve of such costs, plotted with transformer load as a base, will have a minimum point, which is, theoretically, the economical load for the conditions assumed. A series of such curves are shown in Fig. 3. It is necessary in making such calculations to know the total investment in a transformer installed, the cost of energy delivered to the transformer primary and the characteristics of the load to be carried. These curves show that the economy is improved as the load is increased up to a point that is well beyond 250 per cent rated load for 50 kva. and all smaller sizes. The characteristic loads assumed correspond to residential lighting service.

The curves of Fig. 4 show graphically the most economical size of transformer for characteristic loads up to 50 kva. It should be noted from these curves that for any transformer size represented the load at which it is more economical to use the next larger size is well above the maximum that may be safely carried. However, the gain in economy decreases as the load is increased (Fig. 3), so that there is little advantage in increasing the loads above 200 per cent.

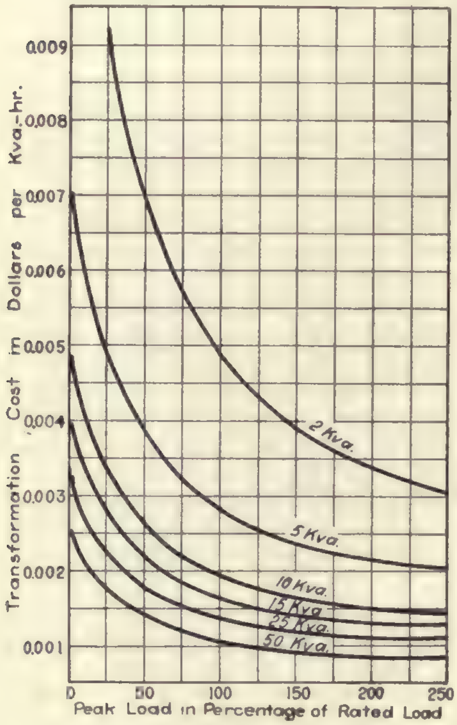
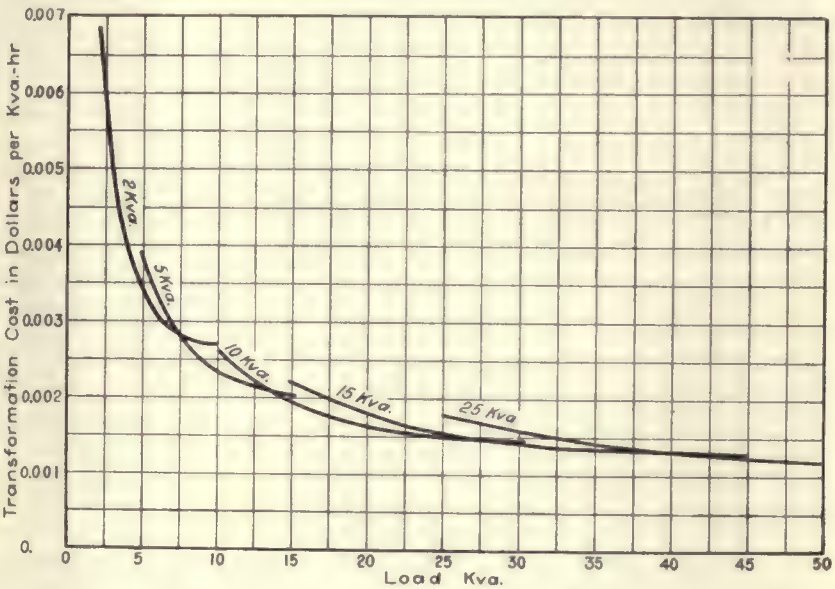


FIG. 3—TRANSFORMATION COSTS PER UNIT OF ENERGY CHARGEABLE TO EACH SIZE OF TRANSFORMER UNDER ASSUMED CHARACTERISTIC LOADS

(Equivalent hours, 2.27; load factor, 20 per cent; core loss energy, $0.01 per kilowatt-hour; copper-loss energy, $0.023 per kilowatt-hour.)

FIG. 4—MOST ECONOMICAL TRANSFORMER RATINGS FOR LOADS UP TO 50 KVA.



Curve 1, Fig. 5, indicates the characteristic loads that may be carried on a 5-kva. transformer throughout the year without exceeding a temperature of 105 deg. C. in the windings. Curve 2 indicates the characteristic loads that may be carried throughout the year without exceeding 65 deg. C. in the oil; that is, the loads at which a temperature indicator would trip if set at 65 deg. C. Both of these curves are based on the assumption that there will be no variation from the normal ambient temperatures of Fig. 1. However, variations in normal temperature from day to day are such that temperature indicators set at 65 deg. C. would indicate overloads consistently at about 165 per cent rated load during the winter months.

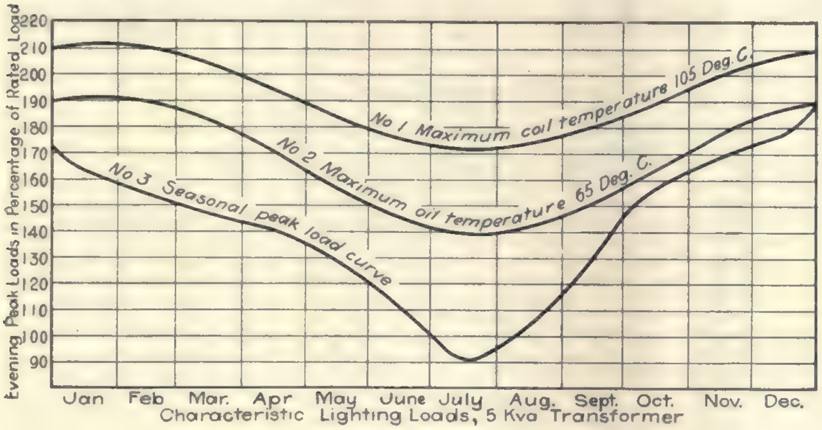
It is evident from curve 3, Fig. 5, which is the curve of seasonal peak-load variation, that if an oil temperature of 65 deg. C. is reached at the time of maximum load, the transformer will have carried loads considerably below the maximum during the previous year. The peak lighting loads are very greatly reduced during the summer months when the ambient temperature is high and the overload capacity of the transformer correspondingly low. It is evident from this that compensation for variation in ambient temperatures in the temperature indicator is not essential for such loads. The area bounded by curves 2 and 3 represents the normally unused load capacity of the transformer. Because of the seasonal characteristics of the loads under consideration this reserve can be of use only as an additional factor of safety during the period of occurrence. Periodic inspection for overloads may be made at less frequent intervals during this time than would be required during the period of increasing load previous to the maximum.

Good service requires both proper voltage regulation and freedom from interruptions to service. It is neces-

sary to consider these as limiting factors in plans for reducing transformation costs by increasing the load on transformers. The regulation of a transformer increases in direct proportion to the load, as does also the regulation of primary feeders. It should be possible to compensate approximately for increased transformer regulation by increasing the compensation for feeder regulation. As the required increase would in general be about 1 per cent, this should be possible without changes in substation equipment. Interruptions to service may result from the blowing of primary fuses due to short-circuit disturbances on branches of the secondary system or from burnouts due to excessive loads. Primary fuses on lighting transformers are usually large enough to permit from two to four times rated load on the transformer without blowing. This is necessary in order to prevent them from blowing when short circuits occur that should be cleared by fuses on the customer's premises. The function of such fuses should be to disconnect the transformer from the primary only when trouble develops that might otherwise cause a shutdown of the primary circuit. Primary

In general, at the maximum safe coil temperatures the oil temperatures are slightly higher in larger sizes; that is, the temperature gradient is less, so that a temperature indicator adjusted to indicate overloads on a small transformer would not allow the maximum load on a larger size. However, the economy curves (Fig. 4) show that as the load is increased the gain in economy decreases. This is more particularly true of the larger sizes, so that an oil temperature limit which would give maximum economy on small transformers would also result in very nearly maximum economy in the larger sizes. For practical purposes a standard temperature setting for all sizes is desirable.

The normal maximum demand on transformers is about 100 per cent rated load when the maximum demand on individual transformers is normally limited to 125 per cent rating. This is representative of the best conditions obtained at the present time. If the peak loads are increased to approximately 165 per cent rating by operating on a temperature basis, a normal maximum demand of 150 per cent rating is probable, indicating a general increase in load of 50 per cent of



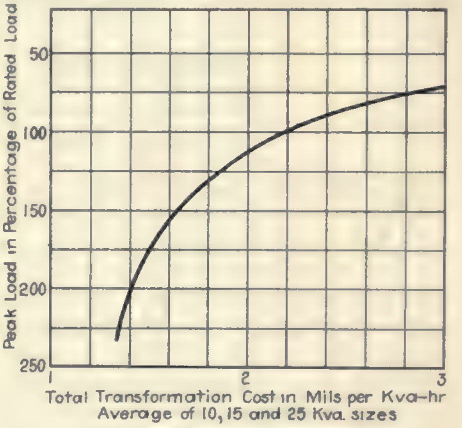


FIG. 5 (LEFT)—LOAD AND TEMPERATURE LIMITS ON 5-KVA. TRANSFORMERS DURING THE YEAR. FIG. 6 (RIGHT)—EFFECT OF INCREASING LOADS ON TRANSFORMATION COSTS USING 10, 15 AND 25-KVA. TRANSFORMERS

fuses should not protect the transformer against overloads. If the load on transformers is to be increased, the size of primary fuses must be increased in proportion.

At the present time most central-station companies do not attempt, systematically, to carry overloads in excess of 25 per cent on distribution transformers. If greater economy is to be attempted by increasing the loads, it becomes necessary to have a means of frequently checking up for overloads. Inspection for overloads at reasonably frequent intervals, especially at the time of year when maximum peak loads are encountered, should virtually eliminate burnouts due to overloads. Such inspection is readily made possible by equipping transformers with temperature indicators, which should be adjusted to operate at temperatures sufficiently below the danger point to allow time for routine relief of excessive loads. Such devices should, in order to make frequent inspections practicable, give an indication that may be easily observed without climbing the pole. They should be reliable as to the temperature at which they operate and should be easily reset after operation. With these qualifications the cost of frequent inspection should not greatly exceed that of the old method of making instantaneous current readings.

The maximum permissible oil temperature varies somewhat in different sizes and types of transformers.

the transformer ratings to be possible without increase in transformer capacity. The normal maximum demand on the distribution systems of many companies is 80 per cent or less of the total rated capacity of transformers connected.

The effect of increasing the loads on the transformation costs for 10, 15 and 25-kva. transformers is shown in Fig. 6. These sizes represent the greater part of the transformers carrying residential lighting loads in larger cities. If the peak loads on these sizes are increased from 100 to 150 per cent rating, the decrease in cost per kilovolt-ampere hour is 0.55 mill, representing a reduction on expenditure of 24.1 per cent from that which might be expected if the normal demand remained at 100 per cent.

A large central-station company may have six thousand or more lighting transformers connected to its lines. The total annual charges against this number of transformers would approximate $250,000 per year if the normal maximum demand is 100 per cent rating. Assuming the same load to be carried by transformers operating at a normal maximum demand of 150 per cent rating, the total transformer capacity would be reduced by one-third and the annual costs reduced 24.1 per cent, or approximately $60,000 per year.

Such a change could not be brought about at once without prohibitive expenditures in rebuilding and

rearranging existing systems. However, most companies find it necessary to maintain a steady increase in transformer capacity to take care of increases in load of from 5 to 20 per cent annually. A large proportion of this increase in capacity represents replacements of existing transformers with larger sizes in the same locations, or new installations made in locations near existing transformers, in order to take over part of the load by transferring part of the connected secondary. If temperature indicators were installed on existing transformers, the normal increase in load might in the course of a few years bring about the desired condition of loading on existing transformers. New installations should, of course, give the desired loading.

Operation on a temperature basis should result in a considerable reduction in the annual expenditures required for additional transformer capacity. Until a condition of loading approaching the maximum is realized, this reduction in expenditures should be from 50 to 90 per cent of the expected requirements, depending upon initial load conditions and the rate of increase in load. When the normal loading has been increased as far as practicable on an entire system the annual expenditures for replacements should continue to be about 30 per cent less than the requirements for equal increases in load under the present load condition.

Unless they are very much underloaded, there is little to be gained by replacing transformers rated less than 25 kva. with smaller units, because the cost of replacement will counterbalance the reduction in transformer investment and core losses. Such replacements should be made only where a material reduction in annual charges can be definitely determined. In locations where considerable increases in load may be expected within a few years both the cost of replacement with smaller units and the cost, later, of replacement to provide for increased load must be considered.

Possible Economy in Energy Production

Attainable Economy of 12,500 B.t.u. per Kilowatt-Hour Indicated in A.S.M.E. Papers—Upper Economical Pressure 1,000 Lb.—Materials Limit Temperature to 750 Deg.—Field of Air Heaters

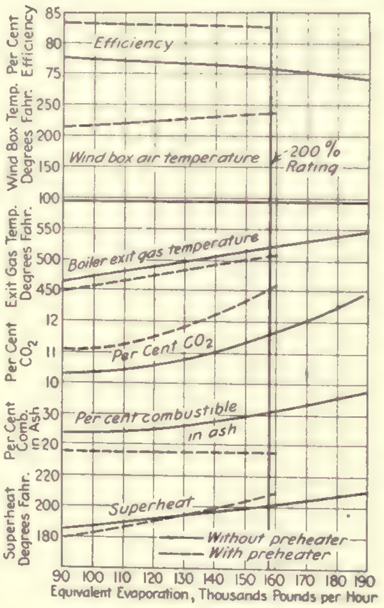
VERY great progress in determining possible economies in energy production was made at the convention of the American Society of Mechanical Engineers last week. Authoritative papers treated ideal cycles and conditions and then attempted to outline definitely the degree to which ideal conditions could be realized in practice. Only reasoned judgment could be used on the various questions because of lack of actual data, but a remarkable uniformity existed in the conclusions reached in the different papers. Particularly valuable was the conclusion that about 1,000 lb. and 750 deg. respectively are the upper economical and practicable limits in pressure and temperature.

A difference of opinion as to the advisability and degree of incorporating bleeding and reheating in station design existed, based on costs, equipment and operating convenience, but both cycles or a combination of the two offer decided possibilities for station economies.

Air-Heater Tests at Colfax

Tests on an air preheater installed at the Colfax station of the Duquesne Light Company were described in a paper by C. W. E. Clarke. The air heater was designed and made by the Combustion Engineering Corporation, and the test results were obtained between July 14 and Aug. 4 on a single boiler whose chief details are given in the accompanying table. The air heater was guaranteed to give a wind-box temperature of 235 deg. F. with the boiler having an equivalent evaporation of 144,000 lb. of water per hour from and at 212 deg. F. The curves reproduced show the test results with and without the preheater in service.

Air leakage gave trouble, but welding will help to obviate this in further designs. The performance of the air heater was very satisfactory, particularly as the tests were made on an existing boiler installation. The efficiency increase due to preheated air increased from 5½ per cent at 114 per cent boiler rating to 7 per cent at 200 per cent rating with a flattened curve because of the increase in air-heater heat transmission with increase of temperature and volume of flue gas through the heater. The installation proved to be simple, inexpensive, easy to maintain and to have small operating costs. The energy used to move the air was 5 kw. per ton of coal fired. In addition, the fuel bed was found to be more uniform, the fuel ignited more readily, carbon in ash was reduced and less



PERFORMANCE OF BOILER WITH AND WITHOUT PREHEATED AIR

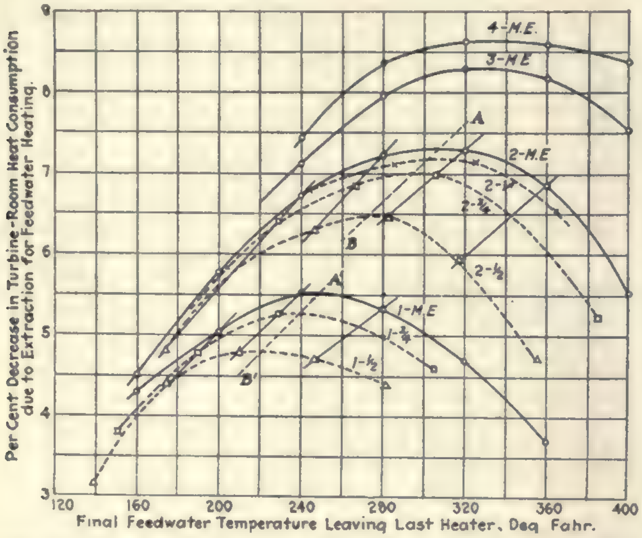
BOILER AND AIR-HEATER DATA

Babcock & Wilcox cross-drum, water-tube-type boiler (installation 1922):	
(20 tubes high, 51 tubes wide, 4 in. diameter, 20 ft. long; 60-in.-diameter drum, 34 ft. 1 in. long; setting, 30 ft. 1 in. wide inside of walls.)	
Heating surface	22,914 sq.ft.
Steam working pressure per square inch gage	275 lb.
Normal rating (100 per cent),	79,053 lb. of water from and at 212 deg. F.
Babcock & Wilcox superheater, containing 2,999 sq.ft. heating surface, installed in first pass of boiler:	
Furnace volume	7,500 cu.ft.
Westinghouse underfeed stoker, 17-retort, 20-tuyère, extra long stoker with side-wall tuyères.	
Clinker grinder, grinder, double-roll, separate drive on each side of boiler:	
Effective size of grate	29 ft. 10½ in. x 13 ft. 6 in.
Projected area of grate	218.31 sq.ft.
Grinder pit section	163.89 sq.ft.
Preheating surface	11,200 sq.ft.

trouble was encountered with clinkers. As a result of the tests more air heaters are to be installed in the Colfax station.

HEAT BALANCE WITH BLEEDER CYCLES

The use of bleeding for feed-water heating introduces complications in computing the heat balance of stations and offers several choices as to the number, type and location of heaters. In a paper dealing with



PERCENTAGE OF HEAT SAVING EFFECTED BY EXTRACTION HEATING WITH DIFFERENT NUMBERS OF HEATERS, AS COMPARED WITH NON-FEED-HEATING OPERATION

Results of accurate computations of complete cycles, considering all extraction variables (with exception of leaving loss) in a typical installation, showing net and comparative turbine-room gains for a representative large-unit high-pressure machine, though applicable to others with small error. Curve 1-M.E. is for a one-heater cycle, most economical load; Curve 2¾ is for a two-heater cycle at three-quarter load, etc.

this phase of plant operation, E. H. Brown and M. K. Drewry pointed out that three fundamental processes are necessary in computing feed-water heating economies: (a) Determination of the heating value of the extracted steam; (b) computation of the amount of steam to bleed; (c) determination of the effect of bleeding upon output and consequently upon economy.

To get the heating value of the extracted steam the authors recommend the plotting of turbine expansion lines on a Molier chart without any correction for bleeding, using the guaranteed performance data of the manufacturers. For the efficiency of representative generators the authors propose using the following empirical formula:

$$\text{Efficiency} = 0.98 - \frac{0.055}{\sqrt[3]{\dfrac{\text{kw. rating}}{1{,}000}}} \times \frac{\text{Rating}}{\text{Load}},$$

and to determine the mechanical losses, including bearing friction, gland and pump resistance, etc., the following rule-of-thumb equation is proposed:

$$\text{Mechanical losses} = \frac{4.0}{\sqrt{\dfrac{\text{kw. rating}}{1{,}000}}}.$$

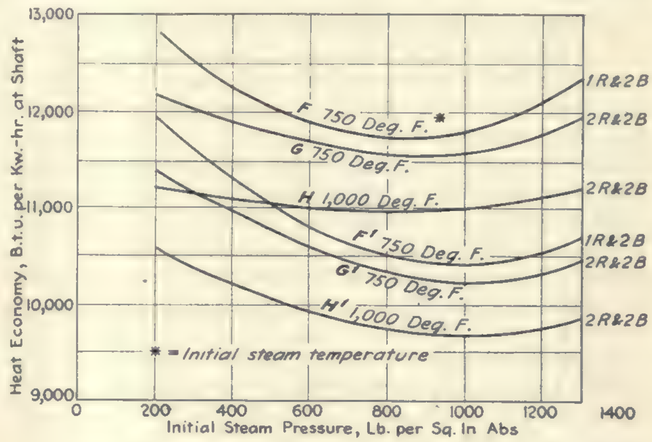
Applying the principles to one-, two-, three- and four-heater cycles, the authors find that the use of multiple heaters makes for the greatest gain in economy and also increases the range of operation over which good economy can be obtained. The proportionate gain in adding heaters decreases rapidly, however, and specific conditions will determine the number to use for a given installation.

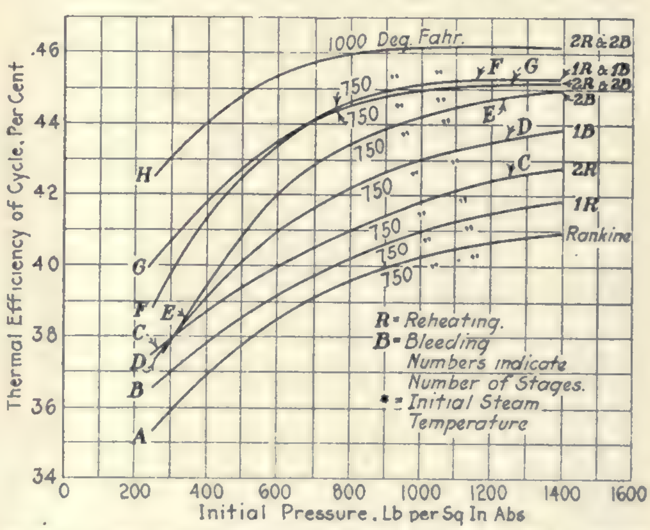
CHARACTERISTICS OF STATION USING 12,000 B.T.U. PER KILOWATT-HOUR

Initial steam pressure per square inch	900 to 950 lb.
Initial steam temperature	750 deg. F.
Back pressure	1 in. Hg
Steam cycle:	
Combination of two reheating stages and two bleeding stages.	
Reheating	120 B.t.u. per stage per lb.
Bleeding	49 lb. and 7.5 in. Hg.
Condensate	280 deg. F. and 180 deg. F.
Steam generator:	
(Surface equally distributed between boiler and economizer.)	
Average rate of heat absorption per square foot per hour,	3,000 B.t.u.
Air-preheater surface per square foot of surface in boiler and economizer	0.2 sq.ft.
Boiler, superheater and economizer surface per kilowatt (12,000 ÷ 3,000 × 0.88)	3.52 sq.ft
Boiler, superheater and economizer surface corrected for reheating per kilowatt (1,345 — 248) ÷ (1,345 — 248 + 240) × 3.52	2.89 sq.ft.
Reheating surface per kilowatt	Depends on position
Per cent of total energy absorbed in reheater per kw.-hr. (1,900 B.t.u.)	18
Air-preheater surface per kilowatt (0.2 × 3.52)	0.70 sq.ft.
Temperature of gases escaping from boiler	620 deg. F.
Temperature of gases escaping from economizer	350 deg. F.
Temperature of gases escaping from air preheater	260 deg. F.
Draft loss in boiler and economizer	1 in. water
Draft loss in air preheater	4 to 5 in. water
Fuel: Powdered coal burned with 20 per cent excess air.	

12,000 B.T.U. PER KILOWATT-HOUR

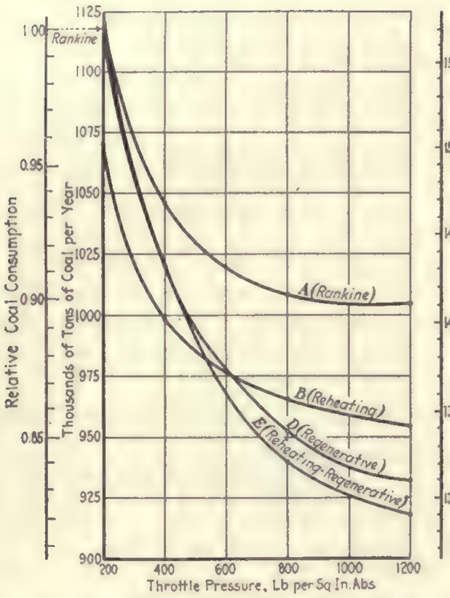
In an able paper on reheating and bleeding cycles for high-pressure stations Prof. W. J. Wohlenberg discussed the theoretical and practical advantages of the cycles for generating stations and arrived at the conclusion that a combination reheating and bleeding

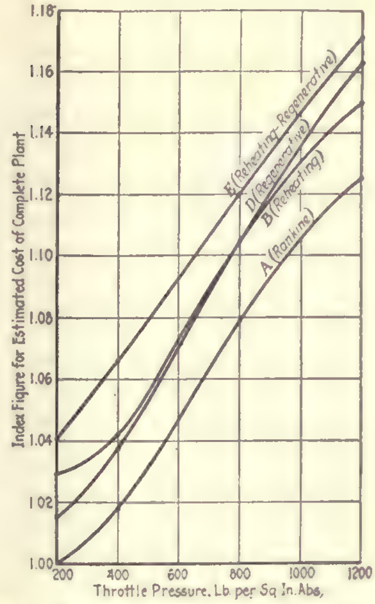




OVER-ALL THERMAL EFFICIENCIES AND ECONOMIES OF A GIVEN STEAM-GENERATING PLANT

(Auxiliaries, electric generator and pipe-line radiation losses not included.)
Curves *D*, *E*, *F*, *G*, and *H* for a stoker-fired plant.
Curves *F'*, *G'*, and *H'* for a powdered-coal maximum-efficiency plant in which steam-generator efficiency is 88 per cent.—Wohlenberg paper.





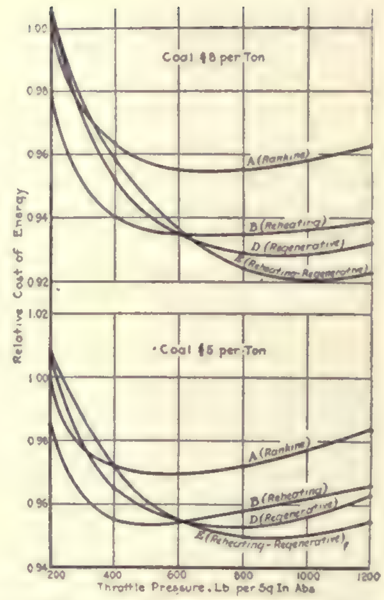


FIG. 1—RELATIVE COAL CONSUMPTION OF 200,000-KW. PLANTS. FIG. 2—ESTIMATED RELATIVE COSTS OF COMPLETE CENTRAL STATIONS, INCLUDING BUILDINGS AND LAND. FIG. 3—EFFECT OF STEAM PRESSURE AND CYCLE ON COST OF ENERGY AT SWITCHBOARD OF 200,000-KW. PLANT

Fig. 1—Capacity factor, 100 per cent; boiler efficiency, 84 per cent; throttle temperature, 700 deg. Fahr.; exhaust pressure, 1 in. Hg abs.; heating value of coal, 12,300 B.t.u. per lb.—Hirshfeld and Ellenwood.

Fig. 3—Capacity factor, 100 per cent; boiler efficiency, 84 per cent; cost of coal, $5 or $8 per ton as indicated; cost of energy taken as 1.00 for the Rankine cycle at 200 lb. per sq.in. abs.—Hirshfeld and Ellenwood.

cycle offered the best opportunity for realizing higher thermal economies. The paper gave an original method for determining machine internal losses by using the adiabatic end point of the expansion process from test data on large units.

As a result of analyses based on 750 deg. F. as the limiting temperature, the author showed that a station producing a kilowatt-hour for 12,000 B.t.u. is in sight and that it will have the characteristics given in the table. He concludes that the best gain in economy can be obtained with the combination cycle with steam conditions of 750 deg. F. and up to pressures not exceeding 800 lb. for stoker plants and 900 lb. for plants burning pulverized fuel. Increasing pressures above the limits indicated will result in an actual reduction in economy. As the optimum condition in stoker-fired plants a figure of 13,000 B.t.u. is given as in sight, and for plants burning pulverized fuel 12,000 B.t.u.

Investment Costs Accented

The thermal efficiencies obtainable in high-pressure plants were balanced against investment costs by C. F. Hirshfeld and F. O. Ellenwood in a fine paper dealing with six steam cycles using pressures from 200 lb. to 1,200 lb. and temperatures of 700 deg. and 800 deg. F. On an ideal basis the authors found the bleeding cycle most efficient, but the effect of turbine losses modifies the theoretical conclusions and improves the performance of the reheating cycle. The effect of auxiliary power and losses in other equipment was considered, and Fig. 1 shows the relative performance of these cycles under the conditions given. A detailed analysis of costs of equipment gave results indicated by Fig. 2.

In conclusion the authors favored a high-pressure steam plant using the bleeding cycle as the most practicable for commercial development and said that moisture separators at bleeder points and the use of air preheaters are possible and profitable developments. Pressures above 600 lb. at temperatures between 700 deg. and 750 deg. will, they held, be used in plants as time goes on, and these conditions are warranted by the economies that will be afforded. The reheating cycle was not looked upon as affording the same opportunity for commercial development as the bleeding cycle.

Discussion Valuable and Instructive

In discussing the papers Prof. C. W. Christie stated that air heaters offered a new development with good possibilities for economies under certain conditions, but that more efficient heaters should be developed. He submitted test data which agreed with the use of the adiabatic end point in determining turbine losses as proposed by Professor Wohlenberg and suggested further investigation of the method. He also stated that bleeding from the stages having superheated steam might prove economical under certain conditions.

Sanford Riley cited tests from a French air-heater installation which proved them unwarranted and urged that no generalization be made from any specific set of test data. L. Helander indicated the errors in the approximations used to determine the initial losses in turbines and said that accurate data should be furnished by turbine manufacturers. C. W. E. Clarke suggested that certain stations built on a unit basis might find it profitable to use the cycles and equipment proposed on some of the units, while other units could be installed from a more conservative design standpoint.

N. B. Broido urged the value of reheating and suggested methods and arrangements whereby separately fired reheaters using oil, coal or gas might be used and another arrangement where live steam could be used. He showed performance curves obtained in Europe on a reheating installation which agreed with the predicted performance curves of the papers.

A station operating at 375-lb. pressure is not necessarily more expensive than one operating with 225-lb. pressure, Vern E. Alden maintained. If designers used capacity as the fundamental design conception, costs would very likely be less for the high-pressure stations.

Ice Making with Electric Power

Use of Different Types of Motors in This Important Application—Controls and Switchboard Layouts—Reliability and Simplicity Are Chief Requirements—Typical High-Speed and Low-Speed Plants

ICE making has economical and reliable production as its governing condition, and electricity has found an important application in the industry. The load has been greeted with approval by the utility companies because very frequently off-peak power arrangements can be made, because the load occurs chiefly in summer and acts as a seasonal stabilizer, and because it can be adapted very readily to secure power-factor correction on the system through the use of synchronous motors.

The electric system is particularly well suited to ice making because it can be so cheaply adapted to the various requirements of the business. Large power units in the pump and compressor rooms, small agitator units, portable hoists and power conveyors can be handled economically in spite of the variation in size and the requirements of safety in those locations where workmen and equipment are together in a moist atmosphere.

In general, synchronous motors and induction motors of the squirrel-cage and wound-rotor type serve all power requirements for alternating-current installations and are particularly well adapted to remote and automatic control for the operating conditions encountered. This eliminates the necessity for many workmen and increases the reliability of production.

The general trend in practice in ice-making plants using alternating current for the chief power supply is to use synchronous motors to drive the ammonia compressors only and to use induction motors for the other applications. The synchronous motors are large and well suited to low-speed applications having unity power factor and constant-load operating characteristics. The other applications, such as exciter sets for synchronous motors, brine pumps, water pumps, air compressors, hoists and agitators, are well adapted to induction-motor applications as they are relatively small units, can operate at high speed and operate continuously with a steady load. When unloaders are available for air compressors and local utility rulings permit, only squirrel-cage induction motors are required for all the other applications excepting the hoists and conveyors. Either direct-current motors supplied from the exciter sets or wound-rotor induction motors can be used for these jobs. The use of synchronous motors for small high-speed applications is inadvisable because of their cost, the cost and complexity of their control panels and the more complicated operating rules. In fact, the use of unity-power-factor synchronous motors for the ammonia compressors is preferred to corrective operation because there is less necessity for skilled attendants in the operating room.

Two new ice-making plants have recently been installed in New York City which bring out several points of interest, as one is a low-speed compressor plant and the other a high-speed compressor installation. In one of these plants, that of the J. Chris G. Hupfel Ice Company, the equipment is installed in a remodeled

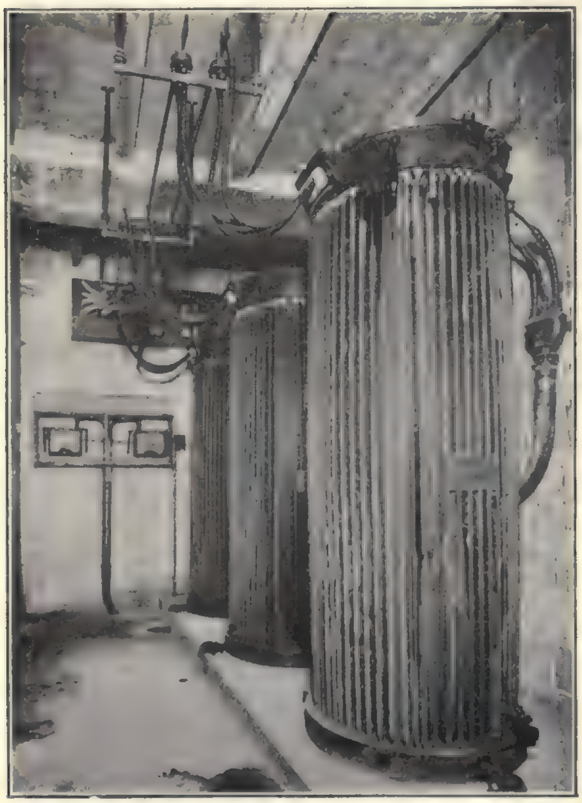


FIG. 1—UNDERGROUND TRANSFORMER VAULT FOR HUPFEL PLANT. TRANSFORMERS HAVE SIX FULL-CAPACITY PRIMARY TAPS

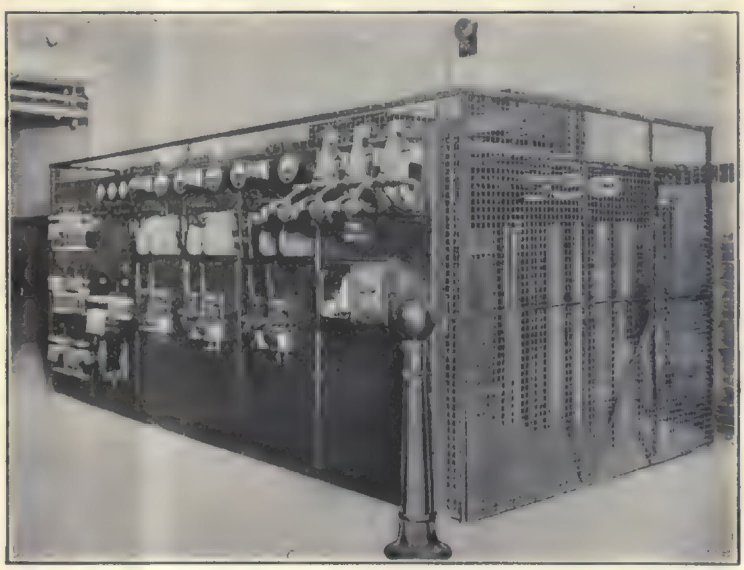
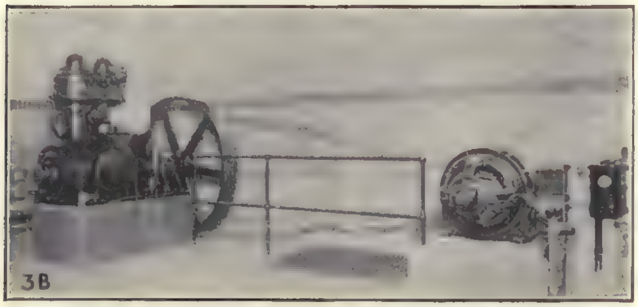


FIG. 2—SWITCHBOARD FOR CONTROLLING OVER 2,000-HP. LOAD OF HUPFEL PLANT

Left to right, incoming panel, three synchronous-motor panels, exciter panel, circuit panel.



brewery building. The plant has a daily capacity of about 275 tons, and the installation involved redesigning the interior and the elimination of a steam-power plant in favor of central-station energy. The United Electric Light & Power Company furnishes service through transformers installed in an underground vault (Fig. 1). This vault is ventilated by forced air which is drawn in at the side of the building and exhausted through the roof. The vault is of hollow-tile construction and the transformers are placed on a platform raised 5 in. above the floor level. The three transformers are supplied at 7,600 volts, three-phase, 60 cycles. Each is rated at 667 kva. and steps down the voltage to 440 kva. for the entire plant supply. The transformers have full-capacity taps of 7,200, 7,500, 7,800, 12,600, 13,200 and 13,800 volts to allow for future changes in the utility's distribution voltage. They are connected delta-delta and all metering is done on the high-tension side.

The energy from these three transformers is used in three ways:

1. Direct to 440-volt, three-phase synchronous motors driving York ammonia compressors.

2. Through a bank of three-25-kva. transformers, 440/220/110 volts, which supply the agitator motors at 220 volts and the ice hoists at 110 volts.

3. Through a 10-kva., 440/110-volt transformer to the plant lights.

Engine Room and Switchboard

The engine room contains the following equipment:

1. Synchronous-motor-driven York ammonia compressor rated at 350 hp., 90 r.p.m.
2. Synchronous-motor-driven York ammonia compressor rated at 450 hp., 80 r.p.m.
3. Synchronous-motor-driven York ammonia compressor rated at 150 hp., 164 r.p.m.
4. Slip-ring motor and belt-driven York ammonia compressor rated at 50 hp., 900 r.p.m.
5. Two exciter sets consisting of 75-hp., 440-volt squirrel-cage induction motors directly connected to 50-kw., 125-volt direct-current generators, 1,200 r.p.m.
6. Six-panel switchboard, consisting of:
   (a) One main panel with curve-drawing watt-hour meter and solenoid breaker.
   (b) Three synchronous-motor panels with starting and running switches, field ammeters, power-factor indicators, alternating-current ammeters, etc.
   (c) One exciter panel with induction-motor starting switches, direct-current switches, etc.
   (d) Lighting circuit panel.
7. Two 50-hp., 900-r.p.m. slip-ring induction motors driving air compressors by belt conections.

The synchronous motors are used because they proved cheapest and best for the low-speed compressors. For the exciters squirrel-cage induction motors are used, and for the air compressors and the small 50-hp. ice-machine slip-ring induction motors are used. Synchronous motors were considered for these applications, but a study showed that the efficiency of the induction motors for the high-speed operation was good, the cost and complexity of controls and switchboards were less, operation was more convenient, wiring was simplified

Fig. 3—Engine-Room Equipment in Hupfel Plant.

(a) Ammonia compressor driven by 450 hp., 80 r.p.m. G.E. unity-power-factor synchronous motor. (b) Small 50-hp. ammonia compressor driven by 900 r.p.m. G.E. slipring induction motor. (c) Ammonia compressor driven by 350-hp., 90 r.p.m. G.E. synchronous motor. (d) Squirrel-cage motor and direct-current generators for excitation and direct-current supply, 1,200 r.p.m.

Fig. 4—Transformer Vault of New Colonial Plant.

and the effect of power factor on a total plant load of 2,000 hp. through the operation of these units was practically negligible. The switchboard cost and complexity are decidedly greater for synchronous motors. Each synchronous motor requires a complete panel and added equipment, so that the cost increases about 20 per cent in comparison with the use of induction motors. Moreover, the heavy starting torque and slow acceleration requirements on the air-compressor installations were admirably adapted to slip-ring induction motors.

A feature of the incoming panel on the switchboard is the use of an air breaker which controls all the 440-volt supply to the plant. The cost of a breaker of this capacity was much less than that of an oil breaker; besides, it is much simpler and requires less attention.

In the rear of the synchronous-motor panels are the starting compensators each with taps of approximately 40, 60 and 80 per cent of normal voltage. These are used for starting the synchronous motors. This makes a very flexible arrangement, for the starting voltage can be raised to suit the starting torque required by the ice machine. Disconnecting switches are placed in the rear of these panels which, when open, kill each panel and compensator.

The simplicity of the exciter set control panel is remarkable, one 32-in. panel controlling the alternating-current and direct-current ends. Two DPST knife switches, unfused, each with equalizer for parallel operation when desirable, serve the direct-current ends, and two starting compensator switches with overload and low-voltage releases serve the induction motor or the alternating-current ends.

OTHER EQUIPMENT

A reliable circulating-water supply to the ammonia condensers is essential in ice making, and in this plant two centrifugal pumps are placed on the roof. These are driven by two 30-hp. directly connected squirrel-cage, 440-volt, 1,200-r.p.m. induction motors. These pumps lift water to the cooling tower on the roof and maintain the flow in the closed circulating system. Signal lights are placed in the engine room behind the switchboard so that the plant engineer can have a continuous indication when the motors are operating.

For driving the brine pumps, three single-phase, 440-volt, 1,800-r.p.m. squirrel-cage motors are used. A 25-hp. direct-current motor, supplied from the exciter sets, is used to drive the ice elevator, and two 1½-hp. direct-current motors drive conveyors used in ice floor haulage. A pipe shop and a woodworking department contained in the building use several alternating-current and direct-current motors. These are all controlled by circuit switches on the panel in the engine room.

For the agitators eight 3-hp., 1,200-r.p.m. vertically mounted squirrel-cage motors are used with General

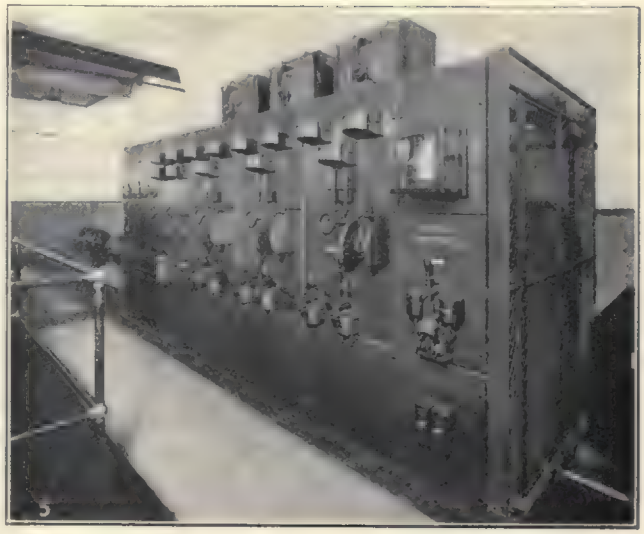
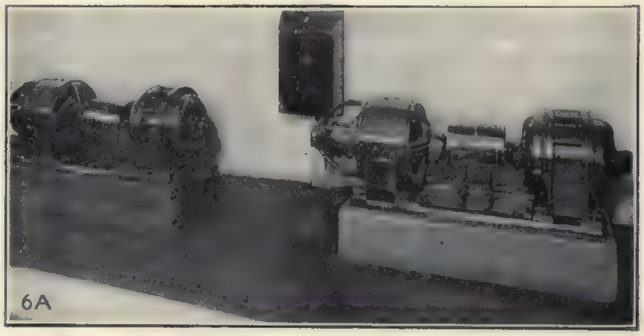


Fig. 5—Switchboard Controlling 1,600 Hp. Load in New Colonial Plant.

Note use of oil breaker on incoming panel and the simplicity of exciter and circuit panels on the left.



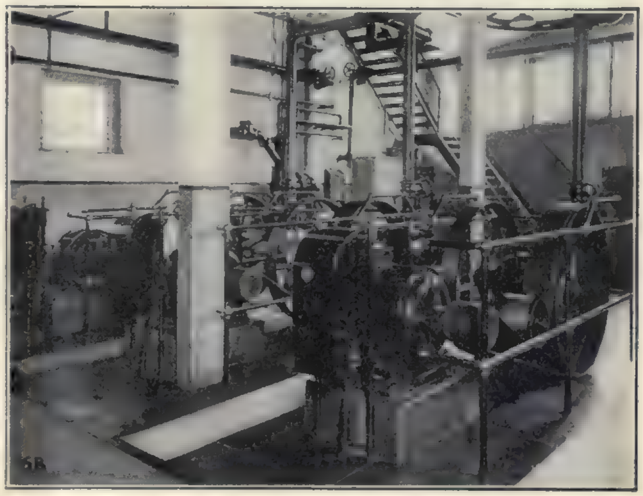


Fig. 6—Exciters and Compressors in New Colonial Plant.

(a) Two 25-kw. G.E. induction motor-generator sets controlled by push button station and automatic compensators. (b) Three 50-hp., 1,200-r.p.m. air compressors driven by G. E. squirrel-cage induction motors equipped with compensators and unloaders.

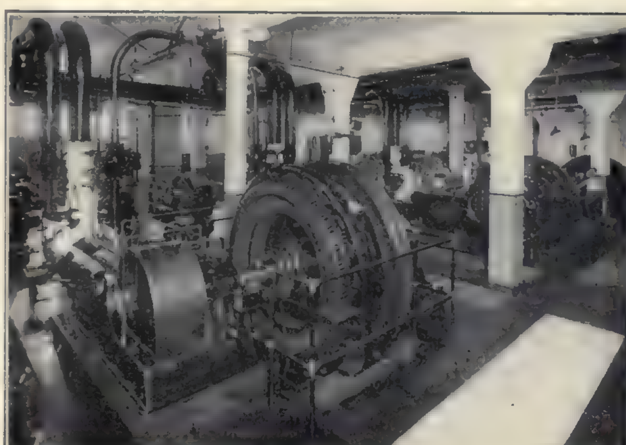


Fig. 7—Three 450-Hp., 180-R.P.M. G.E. Synchronous Motors Drive the Ammonia Compressors in the New Colonial Plant.

Electric CR-1038 safety switches mounted at each motor.

The Yale and Towne hoists on the ice floors are operated at 110 volts, three-phase, 60 cycles, for safety reasons, as moisture is present and operators may receive shocks. Figs. 2 and 3 show features of the installation.

A High-Speed Plant

The plant of the New Colonial Ice Company, Inc., in New York has a daily capacity of 375 tons and differs quite materially in its electrical equipment from the Hupfel plant. The United Electric Light & Power Company serves this plant in an underground transformer vault that differs from the other installation in that ventilating air is drawn directly into the vault through an opening in the wall and is exhausted at the top by the use of a 24-in. fan in a false ceiling. Fig. 4 shows the vault and transformers. The transformers are 400-kva., 7,600/440 volts, and supply the entire plant through a delta-delta connection. In the same vault with the main transformers are three 15-kva., 440/110-volt transformers for supplying lighting circuits and the ice hoists.

In the engine room three 450-hp., 180-r.p.m. synchronous motors are directly connected to De La Vergne ammonia compressors; three 50-hp., 1,200-r.p.m. squirrel-cage induction motors drive air compressors by belt connection, and a 50-hp., 900-r.p.m. squirrel-cage induction motor drives a small ammonia compressor. The switchboard is a six-panel General Electric unit very similar to that used in the Hupfel plant, but an oil breaker is used on the incoming panel instead of an air breaker. Its cost was little, the horsepower capacity of the plant being not so great as that of the Hupfel company.

The exciter sets are 25-kw. G. E. units, squirrel-cage induction motors driving direct-current generators. The alternating-current ends of the sets are controlled by start-and-stop push-button stations which operate automatic compensators on the wall back of the sets. A view of the circuit panel (Fig. 5) shows the simplicity of the switchboard control for the induction-motor circuits. This is reflected in a reduced cost of installation and greater ease in operation. Fig. 6a shows the exciter sets and compensators and Fig. 6b the compressors.

An unusual feature of the three 50-hp. air-compressor installations is the use of squirrel-cage induction motors. This is made possible by the use of unloaders in the belt drive, and the installation is very satisfactory from both a cost and an operating standpoint. Fig. 7 shows a view of the three synchronous-motor installations on the ammonia compressors.

On the roof two 50-hp., 1,800-r.p.m. squirrel-cage motors are used to drive Gould centrifugal pumps, and in the roof pump house two 3-hp., 1,200-r.p.m., squirrel-cage motors drive pumps for supplying the make-up water. These installations are controlled by push-button stations and by G. E. CR-1038 safety switches having inverse-time-limit protection. Ten 3-hp., 1,200-r.p.m. squirrel-cage induction motors operate the agitators and are also equipped with the same type of "safety-first" switches. Two 5-hp., 1,800-r.p.m. squirrel-cage motors drive the brine pumps and are equipped with the same type of control and protection as the other pump installations.

In the New Colonial plant the four Sprague ice hoists are equipped with both traction and hoist motors. All have the 110-volt, three-phase slip-ring type of induction motor.

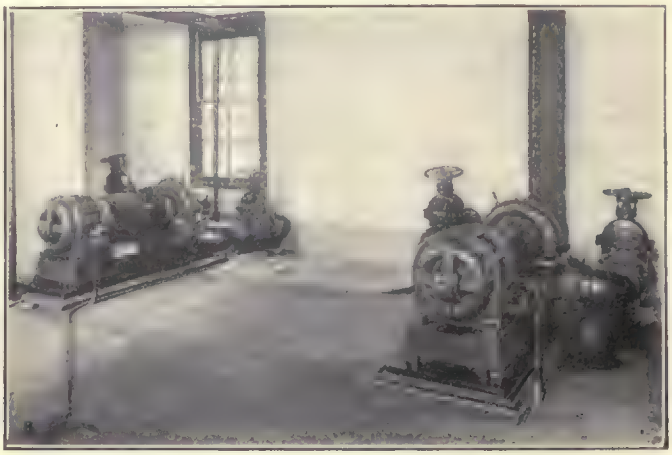


FIG. 8—PUMP INSTALLATIONS AT NEW COLONIAL PLANT

(a) Two 5-hp., 1,800-r.p.m. G.E. squirrel-cage motors driving brine pumps. (b) Two 50-hp., 1,800-r.p.m. G.E. squirrel-cage motors driving centrifugal pump supplying circulating water.

The general features outlined for the Hupfel plant governed the installation at the New Colonial plant. The synchronous motors proved best for the ammonia compressors and are rated for unity power factor only. Over-all cost and operating considerations led to greater use of squirrel-cage than of slip-ring induction motors in the plant, and the utility company also permitted their use on the air compressors when unloaders could be provided.

The two plants described have been operating successfully for over a year, and the owners are well satisfied with the installations. The governing idea of simplicity, reliability and efficient production has been successfully carried out in each of the installations.

Error in Extending Credit

IN THE article entitled "What It Means to Change from Overhead to Underground," on page 856 of the Oct. 27 issue of the ELECTRICAL WORLD, the company with which R. H. Parmalee is connected was given as the Philadelphia Electric Company. It should have been the Counties Gas & Electric Company, whose central offices are at Philadelphia. The latter company should be credited with the costs given.

An Experiment in Co-operation

A Remarkable Record of Achievement by the New York Electrical Board of Trade in a New Kind of Local Organization, as Reported by Chairman Charles L. Eidlitz to Five Hundred Electrical Men Last Week

IN JUNE last summer it was announced that an electrical board of trade had been organized in New York City as an employers' organization to undertake the fundamental work of harmonizing and co-ordinating the relationships of the associated organized and unorganized groups of electrical men within the metropolitan district. Charles L. Eidlitz, already functioning as "special commissioner," a sort of "Judge Landis" for the electrical contractors, was placed at the head of the new organization with a board of governors elected with terms to expire in January, their responsibility being to serve as an emergency board until the associated groups affiliated with the Electrical Board of Trade could arrange for the election of regular and official representatives.

The Electrical Board of Trade announced at one of its early meetings a platform of twenty definite aims to which its efforts would be directed. At a luncheon meeting at the Hotel Astor, New York City, on Wednesday, Dec. 5, attended by about five hundred men of the electrical industry of New York, including a notable gathering of executives representing a wide variety of interests, Charles L. Eidlitz presented this report of achievements by the board. It sounds a new note in local electrical organization that is of more than local interest. It is a refreshing evidence that there is a way to combat and cure some of the evils that will creep in and do exist in the electrical situation in large cities—provided that a leader of vision, courage and resourcefulness, who enjoys the confidence and respect of the entire community, can be enlisted for the work. Mr. Eidlitz' report, which is here printed almost in full just as he gave it, is a remarkable record of service.

THE first problem presented to the Electrical Board of Trade was that the City Electrical Department was so lax in its methods that contractors were being held up for months on certificates of approval, thus tying up their money and in many cases actually threatening their existence. We started a series of newspaper articles and attracted the attention of the public, to say nothing of those holding office in the Electrical Bureau, and by a fearless, but absolutely true, criticism of the department compelled it to realize that we meant business. We opened a department for helping our contractor members get the service which they were entitled to, with the result that today this part of the difficulty has been practically solved and all certificate troubles have been eliminated.

Now, don't get the idea that this helps only the contractor. If the contractor does not get his money, he does not pay his manufacturer or jobber, and if he does not get his certificate, the lighting company does not connect its wires and loses on energy consumption. If the contractor is compelled to spend his time running after certificates day after day, he cannot devote his time to his business, and his failure to furnish a certificate and light as soon as his work is completed is unsatisfactory to his customer and reflects discreditably upon the industry.

Running Down License Frauds

We found that the city license board which is charged with issuing licenses to contractors was not functioning at all and began an active attack on this situation. This has since been straightened out to a considerable degree, and while by no means perfect or satisfactory, I believe one more wallop which we have in mind to hand out shortly will put this into shape. We discovered that the records and methods in the city department were such that almost any one could do work either without a license or by having some one with a license put his work through for him, which is absolutely contrary to law and permitted incompetent men to do business. This condition is rapidly being cleaned up, and the Electrical Bureau in Manhattan and the Bronx is now working right with us in digging up these "bootleggers" and "canning" them. Today no license can be renewed without a personal appearance and a photograph, and I am satisfied that not fewer than 500 to 750 licenses now in existence will never be renewed because the holders do not exist in fact. Thus, this fake has been spiked.

Although the contractors' associations had spent considerable money in an attempt for the last two years to eliminate the special permit, they failed, but under pressure of this organization the Commissioner of Electricity has introduced this amendment to the ordinance himself in the Board of Aldermen, and we have every reason to believe that it will be adopted. This has been the cause of the worst type of construction and one of the greatest fire hazards in the business. Formerly when a concern found itself in financial difficulties the bankruptcy shark lawyers jumped in and picked the carcass clean, and the creditors were silent lookers on. Since we have taken hold of some of these conditions the shark has had rather a discouraging time of it.

We have now cleaned up several of these failures, saving from 60 to 75 cents on the dollar for creditors where nothing would have been left had the sharks got in. The result has been that as soon as a concern finds itself shaky it brings its balance sheet to us, and with our ability to reach the creditors we have only recently saved two concerns from difficulty and their troubles were never known to any one except one or two of their large creditors who helped them over the hurdle. We have established by our methods of handling these cases a rather new angle in business—that is, that if a man is honest but is in a temporary "jam," he should be aided, but if dishonest he should be put out of the industry. We are about to put one out very shortly, and if I have my way, we will aid in sending him where business will be the least of his troubles.

Owing to the fact that we have no personal interest in these cases we are able to get the absolute truth, and this results in having constantly increasing credit information which could not be got in any other way. We are now being recognized to such an extent that our request for detailed statements brings them to us at once.

Those who are using the board for this informa-

tion have expressed themselves as greatly surprised at what we can get for them.

Early in our being it was discovered that the electrical engineer and the architect were specifying in a way that led to misunderstanding and expense, to say nothing of loss and lawsuits. Meetings were held, committees appointed under the auspices of the board, and within a week or so practically all of these conditions will have been cleaned up by mutual agreement, and the results will be broadcasted by this board so that they will be recognized by all.

Smoking Out Unfair Competition

Difficulties arose in August between certain jobbers and utilities. An investigation by us showed conclusively that an injustice had been done the jobber, but unintentionally. This has been stopped and will probably never happen again.

Certain department stores in an attempt to sell dry goods used a popular device as a leader by advertising it at 39 cents below the price the store paid for it. The business of the concern in question in this locality was actually threatened, and the firm appealed to us. Conferences were arranged, and in less than forty-eight hours we sold the idea to the department store that this was unfair and the "ads" were withdrawn. The company for which we did this was not a member of the board, but we felt the thing was bad for the industry.

We are collecting unpaid bills for members at a constantly increasing rate. All we want to know is that the bill is fair and honest, and if we are convinced of this and the debtor has the money, we come pretty near to getting it or arranging for a settlement.

Architects and owners are daily consulting us as to materials, manufacturers and contractors. We refuse to recommend any particular line or firm, but we are giving them a list for their selection. In many cases they are asking our approval on an individual engineer or contractor, and in those cases we are giving them the answer.

Banks and trust companies are consulting us in an increasing number as to the moral hazard of men in the electrical line when these people open accounts or apply for loans or renew paper, and a number of these banks have stated that they have never before been able to get information of such value to them, and so they keep coming for more all the time. This, of course, is giving us an inside knowledge of what is going on in the finance end of the business, and the more we are questioned the more information we actually get.

Many irregularities in the business—that is, accepting and buying stolen goods—have been corrected by moral suasion. In many cases it is difficult actually to obtain legal proof of these activities, but we have found methods which seem to be operating successfully, and we have compelled a number of people to give up these activities from fear of exposure.

Although we clearly announced that we would not handle labor matters, the unions have insisted on recognizing our board and position and have consulted us in a number of important cases, and our advice and help to both sides has prevented strikes which, if carried out, would have involved large losses to the industry. One case would have meant several hundred thousand dollars' loss by a concern that could stand it; another undoubtedly would have ruined the company.

The public is appealing to us constantly for help concerning lack of attention on the part of public utilities, or failure of contractors to make good, and in every case so far we have been able to give almost instant relief by taking the case up with the utility company or contractor and urging action for the good of the industry.

We are constantly being asked for special types of men, or men with certain qualifications electrically, and have placed quite a number up to the present time, and as time goes on we will undoubtedly be compelled to establish a regular employment department so that competent people when released, owing to no fault of theirs, will not drift and finally leave the business, but will immediately be relocated in other employment, saving a considerable amount in turnover expense.

The Board of Education, through its architect, appealed to us for help in aid of the school building program. Conferences were held, with the result that the end sought has practically been accomplished.

A building loan and group insurance plan is being worked out now which will undoubtedly result in better feeling and will bring comfort to families suddenly bereaved of those on whom they were dependent. By aiding our employees to own their own homes much will be accomplished in the way of making them better and more reliable workers, and a stability will be lent to employment and backbone to the country generally.

It was rumored that certain devices were being imported into this country which were being misrepresented by those marketing them. We purchased some in the open market, have sent them to the Underwriters' Laboratories for a test, and if our suspicions are proved to be correct, we shall broadcast this fraud to the public. It affects practically every utility, jobber and dealer. No other agency could do this without being thought to be acting for its own benefit.

We are at present investigating certain activities of a special, apparently privileged few. We suspect that something rather startling will develop. If we are mistaken, nothing will ever be said of it, but if correct, the scheme will be exposed so that all may be warned.

Our attempted co-operative advertising campaign has been postponed for the present as there are so many activities under way that we have decided to give these a little more time to take root before we launch what will undoubtedly be a *pièce de résistance.*

Possibilities Ahead

I have mentioned some of the high spots, but there are hundreds of other matters of importance or of significance. There are many that cannot be referred to at all, not because of any illegality, but because they come to us in a confidential way and any mention, no matter how well disguised, might betray these confidences.

And now, if I may make what I believe is a most conservative estimate, I should say that so far—and we have hardly started—this institution has saved the industry an amount in actual dollars of not less than $500,000 in the few months that it has been in existence. By that I mean moneys that would have been dissipated under conditions existing prior to our organization. I can see now sums away beyond that in the very near future. There is no limit to what we can do. Our value and our activities are limited only by the use to which we are put and the support which we get. We are very young; we should, properly speaking, be in swaddling clothes at our age, but we are even at this moment wearing the trousers of a ten-year-old and pleading for long pants and suspenders.

Finally, back of all this is the fact that we have

established confidence in our fairness, lack of bias, ability to maintain and keep as confidential information furnished as such, which has resulted even in this short time in a condition where no information is refused us, all "bunk is eliminated" and every one is anxious to give us real unvarnished facts without regard to how these may affect his own interests. In other words, we have established in the minds of most people a conviction that we are operating for the good of the individual, the group, the industry and the public, and that service of the highest type and quality is our aim and ideal, that "pussyfooting" and side-stepping are to us unknown methods, but that fearless straight thinking, fair dealing and constructive handling of everything that comes our way—exposing dishonesty, but aiding the honest unbusinesslike individual—are the foundation on which we build.

Recalling Æsop's Fable of the Arab and the Camel

How Small Ground-Return Telephone Companies Have Sometimes Interpreted Help Accorded Them as Setting Up a Principle

BY W. J. CANADA
Director of Engineering, National Electric Light Association

AS EVIDENCE of the danger that lurks in friendly efforts by power utilities to meet much more than half way the situation created where telephone utilities of very limited resources are called upon to bring their systems to modern co-ordinative standards there may be cited the manner in which an informal commission report in Missouri has proceeded from certain incorrect premises to correspondingly incorrect inferences regarding an inductive co-ordination problem involving ground-return telephone circuits. This report is, in a portion of these premises and inferences, so clearly out of step with the trend and weight of recent engineering, economic, commission and court opinion that its issuance, even with its informal character, seems calculated to encourage a recrudescence of the rapidly waning effort of a few ground-return telephone utilities serving few persons to charge up to the power utilities serving many persons the cost of meeting modern conditions of telephone practice.

In this report, known as Case No. 2931, the fact that a power utility had "voluntarily" made contributions to the improvement of one such telephone system was taken to justify the inference that this power utility subscribes to the essential justice of such contributions in this and other cases, and therefore is admitting injustice in not similarly contributing in all other cases.

Proceeding from this informal report, and demonstrating the difficulties entailed in keeping an informal and perhaps carelessly worded report from being unduly quoted to the harm of all concerned, an article in *Telephony* (Nov. 3, 1923) indicates how some persons regard such an "informal" report. The writer of the article took occasion to laud the "line of argument" of the commission, to state that the "principle" set forth by the commission will be of "material help" to small telephone companies, and that such companies "should receive considerable encouragement" from this "order" (note the error in characterization) recently issued.

The report includes several erroneous expressions and implications, and it would appear likely to result in undesirable and unwarranted contentions by misinformed or ill-advised telephone companies, perchance misled further by articles or correspondence such as that noted above. Among the more outstanding errors in the report are repetitions of the statement or idea that "the building and operating of the transmission lines has substantially destroyed telephone service." Connected with this inference is the quotation of a stipulation by which the power utility has "voluntarily" agreed with another telephone company to pay the entire cost of work on the lines owned by the Buffum Telephone Company, necessary to overcome substantial interference brought about by the construction or operation of the transmission lines. From the one fact that the power utility *did* financially assist the Buffum Telephone Company came the inference that the transmission lines *did* substantially interfere with the Buffum service and are interfering with other telephone service now under consideration. This inference is clearly erroneous, the interference being brought about rather by the construction and operation of the telephone systems concerned.

As the writer of the commission report correctly states: "There is no known way whereby even fair service may be obtained over these telephone systems as long as they remain grounded." As he further states correctly: "There is satisfactory testimony in the record to show that most of the telephone lines in question were in a state of bad repair and needed extensive repairs, if not rebuilding." To proceed from these proper statements of fact to the inference that financial assistance from the power company to another telephone company renders such assistance the due of the telephone companies now concerned is a bit of logic which would assuredly not be accepted in any formal decision. Equally illogical would it be to infer from the fact that the power company had entered a stipulation with one company to remedy interference caused by the power system that the power company should also remedy interference caused by the peculiar characteristics of a telephone system.

As with other extensions and advances of our complex civilization that promote and are inseparable from the welfare of the whole community, a peculiar kind of telephone system possesses no inalienable rights, especially none that in the march of industrial, farm and social development would permit that system to remain incongruous or an actual impediment to the community's enjoyment of a more modern order of things.

The extent to which wrong inferences survive is indicated by the fact that in this instance not only were the telephone circuits of a peculiar kind, but they were in very "bad repair."

The highest courts have expressed this fundamental principle with particular reference to similar instances where several sets of facilities needed to be co-ordinated, rather than the responsibility placed on but one.

As summarized by G. F. Deiser in his work on "Conflicting Uses of Electricity":

> If it is at all possible, it would seem that both parties are bound to construct their plant in such manner as not to impair the exercise of other franchise holders. If the telephone apparatus is so delicately constructed that slight disturbances will impair its usefulness, then the remedy lies at the doors of the telephone company. It must adopt means to protect its apparatus from injury.

As summarized in the South African case:

> The principle of Rylands vs. Fletcher applies to a proprietor who stores electricity on his own land if it escapes therefrom and injures a person or the ordinary use of

property. It does not apply to the case of injury done to a peculiar trace apparatus unnecessarily so constructed as to be affected by minute currents of the escaping force.

As summarized by the Supreme Court of Washington State in the Kahlotus case:

The telephone company, in order to maintain its single-wire system, must make use of the earth, in which it has no rights, for the completion of its return circuit. It does not seem reasonable to hold that the duty was not upon it to standardize its line in a way that would prevent interference in accordance with good modern engineering practice, when to maintain a single line it must make use of something which it does not own.

As summarized by the United States Supreme Court in the Erie case:

The Passaic Water Company contends that the expense of moving its pipes cannot be thrown wholly upon it—mainly on the ground that the change of grade was unlawful. This ground fails, and the company must adjust itself to the lawfully changed conditions.

The commission's report is worth study by any one who is particularly interested in this general question.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Six Hundred and Sixty City-Owned Plants Abandoned—Why?

To the Editors of the ELECTRICAL WORLD:

The reference in the Nov. 17 issue of the ELECTRICAL WORLD to the abandonment of so many municipally owned plants and the comparisons drawn between the electric rates and the tax rates of localities served by private and those served by municipal plants depict a condition which may without question have a large influence in future operation of many existing utilities. Being interested in the operation of a municipally owned plant, I would call your attention to the development of such an organization, within the midst of large private corporations, wherein the electric rates and tax rate are considerably less under municipal operation than those in the surrounding territories served by private companies. I hold no brief against privately operated public utilities and, as a matter of fact, believe that it would not be possible to operate municipal plants on the scale of these companies, but do believe that there is a broad field for the municipal plant in a moderately sized city, provided that politics can be kept out of the coal pile and the watt-hour meter.

The municipally owned plant of the village of Herkimer, N. Y., started in 1885 with one fifty-light Sperry dynamo, has enjoyed a healthy growth to a modest plant of 1,750 kw. capacity, with a value of roundly $375,000. The amortization of the funded debt and interest charges to date has been cared for from earnings of this department and has never been raised by taxes in any way. During the year which closed Feb. 28 last the receipts from all purposes were roundly $109,000; the net income, after making all deductions, such as uncollectible bills, interest, etc., was roundly $16,000. During this time more than $7,000 was expended for street-light operation for which no return was received. Had this service been rendered at the usual rates, about $10,000 would be added to the net income, making this figure roundly $26,000. Totaling the annual street-lighting costs since the installation of this system, we find that the municipal plant in question has furnished street lighting to the total amount of roundly $115,000, which apparently would more than offset the loss in taxes which would have been paid by a private company.

The tax rate for the village of Herkimer during the past year was $6.39, which is admittedly low, yet the village is referred to as having more and better paved streets than any other village of its size in the state.

The lighting schedule starts at 8½ cents with 10 per cent discount for prompt payment, minimum monthly charge 50 cents; the power rate starts at 6 cents with the same discount, with a minimum charge of $1. Privately owned plants in this territory charge 9¾ cents and 11 cents respectively for the same lighting service and have a minimum rate of $1. They also receive a reasonable payment for street-lighting service, which is proper. Free service of any nature is not proper in either plant.

Possibly the greatest discouragement to the management of a municipally owned plant is what appears to the writer to be the narrow-mindedness of the state and national electrical organizations. If these organizations really mean what they say, that they are for the development of the electrical science, they would admit the managements of the municipal plants; but if they are devoting their energies to the business end of the private plants and issuing propaganda with regard to the municipal plant, then they are not true to the code of ethics which we like to believe exists between engineers.

Inasmuch as a municipal plant can function only within its own governmental territory, which is of course limited in area, and is under the same public service regulations, why can't these organizations work with their municipal companions, building up their systems of generation and distribution along proper lines, so that both parties will be in a position, when the time arrives, for an economical interconnection or complete operation? Would this not be a broader business and financial proposition than entirely neglecting a municipal block of power, as has been done on the interconnection map accompanying the splendid article appearing in the above-mentioned issue of your paper, just because it is municipal? ARTHUR T. CLARK.

Herkimer, N. Y. Superintendent Municipal Commission.

[In most states private and municipal plants are *not* under the same public service regulations. This fact has made comparisons and co-operation between them and private plants difficult. As to engineering or economic benefits of interconnection, these are naturally to be realized to just as great an extent whether any particular block of power is municipal or private.—EDITORS.]

Government Appointments for Farm Survey

To the Editors of the ELECTRICAL WORLD:

There is an error in facts contained in a news item which appeared on page 1084 of your issue for Nov. 24 under the above title and concerning which it is our desire to establish the correct impression. W. A. Durgin is a member of the Joint Committee on the Relation of Electricity to Agriculture, and his contribution to the contemplated research will consist only in such part of the established service of the Division of Simplified Practice, in the Department of Commerce, as the committee and the related industries may request.

EDWIN W. ELY,
Division of Simplified Practice.

Department of Commerce,
Washington, D. C.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Extensive Highway Lighting Installation in Pennsylvania

By R. C. L. Greer

Resident Engineer Eastern Pennsylvania Power & Railway Company, Pottsville, Pa.

APPROXIMATELY 8½ miles of highway lighting, besides the lighting of various side streets of the villages through which these highways pass, has recently been installed and placed in operation by the Eastern Pennsylvania Power & Railway Company. The roads which are lighted are a new concrete state highway from Brockton to Tamaqua and a township dirt road which is a detour from the main highway, passing through the villages of Maryd, Dutch Hill and Tuscarora and joining the main highway again beyond the last-named place.

Two types of lamps are used. For highway lighting 133 G. E. Novalux highway lighting units are installed with 250-cp. lamps, while in the villages fifty 600-cp. pendent units suspended on 14-ft. trolley-mast arms are used.

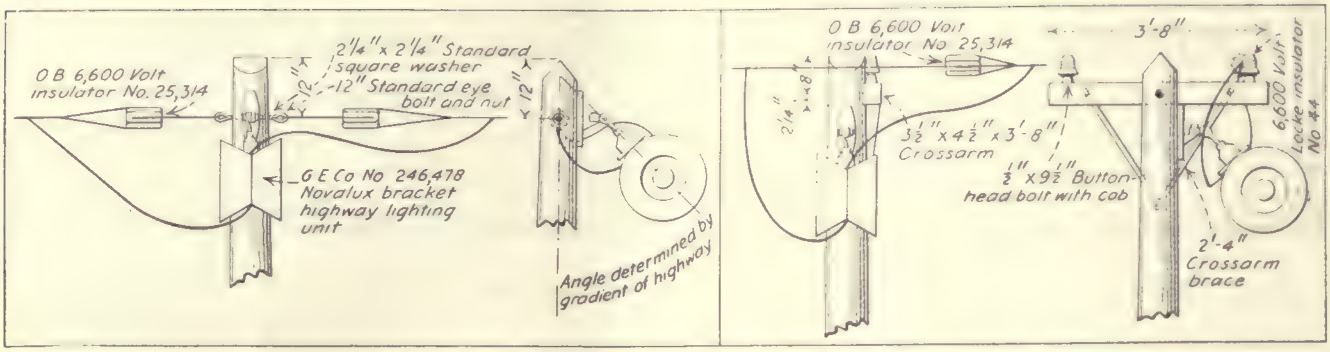
The highway units are installed one foot from the top of 35-ft. poles, making them 28 ft. above the ground. The trolley-mast arm for the pendent unit is 20 ft. from the ground, and the center of the lamp is about 18 in. lower. These lamps are also equipped with absolute cut-outs so that the units may be cut out of service and the lamps removed without affecting the rest of the circuit or endangering the lineman changing the lamp.

VERY LITTLE LIGHT IS THROWN OUTSIDE OF ROAD AREA

The highway units give a very pleasing illumination for night driving and are mounted high enough to prevent the motorist being affected by their glare. They give a so-called ribbon of light along the highway, and very little of it reaches the woods on either side of the road. Since considerable night trucking as well as pleasure driving is done on these highways, these lights are very beneficial. The expense of installing this system amounts to about $150 per lamp. The 600-cp. units are installed also at important crossroads along the highway. The highway units are installed approximately 300 ft. apart, depending upon the grades and curves in the road. Both types of lighting units are shown herewith, with construction details and method of installation.

In laying out this system it was found necessary to divide it into two circuits. The company already had 2,300-volt service at Brockton and Tamaqua, the two ends of the stretch to be lighted, so it was decided to divide the system at Tuscarora and

OUTDOOR TYPE SERIES LIGHTING TRANSFORMER AND VIEW OF HIGHWAY WITH UNITS ON EVERY OTHER POLE



STANDARD TYPE OF CONSTRUCTION FOLLOWED FOR ENTIRE INSTALLATION

feed the circuits from either end. The 600-cp. units are equipped with auto-transformers built into the top of the fixture and using a 20-amp. lamp. Each circuit is supplied by a 20-kw., 6.6-amp., 2,300-volt constant-current transformer installed in a two-pole substation. The meter, current transformer and time switch are mounted in a box on one pole. The transformer is protected by fuse cutouts on the primary side. Lightning protection is taken care of by compression-chamber arresters on the primary side and horn-gap arresters on the secondary side. No. 6 triple-braid weatherproof wire is used for the line wire.

From Brockton to the point where the township road leaves the state road the return wire is on the same pole as the feed wire. From this point to the point where the township road joins the state road again single-wire construction is used. On the pole carrying the lamp the wire is deadened on a 6,600-volt strain insulator. These insulators are fastened on the pole by means of a clevis through an eye bolt and eye nut on the opposite sides of the pole. The pole in between the lamp poles carries the wire on a pressed-steel pole-top pin. For lamp spacing up to 312 ft. only one intermediate pole is used. For the few instances where the spacing is greater than that two poles are used with equidistant spacing.

Combustion Rates and Efficiencies

By D. C. Hess
Stoker Engineer, Service Department, Westinghouse Electric & Manufacturing Company, Philadelphia

There is a certain combustion rate where the stoker and boiler operate at their highest efficiency. This can be determined by running a series of short tests at varying rates of combustion, and therefore an effort should be made to run as near this point as possible. Usually, however, this cannot be done because in the case of a new plant the designing engineers have to consider various elements such as first cost, labor, etc. In the case of old installations it will often be found that the load demand upon the station has outgrown the station, with resultant high capacities. In this discussion it should be considered that the plant will operate at the highest efficiency point. If the plant operates at any other point, the same considerations hold good, but in a lesser degree.

The results of a series of tests using Illinois coal in a six-retort Westinghouse underfeed stoker and a 558-hp. boiler are shown in Fig. 1. The grate area was 105.66 sq.ft. A rating of 328 per cent was obtained. The unit operated most efficiently at 160 per cent of normal boiler rating, when burning approximately 3,300 lb. of coal per hour, 550 lb. per retort or 31.2 lb. per sq.ft. of grate surface.

Results of a series of tests run with Pittsburgh district coal are shown in Fig. 2. Each 650-hp. boiler had a grate area of 123.27 sq.ft., which was supplied with fuel by a seven-retort Westinghouse underfeed stoker. The best efficiency was obtained at 185 per cent of normal boiler rating. It is also interesting to note the similarity between the combined efficiency and CO_2 curves of this test. There was a gradual rise in the flue-gas temperature as the boiler rating was increased.

The results brought out by these tests show the essential conditions which are necessary to maintain the best operation of the stoker equipment. The point of highest com-

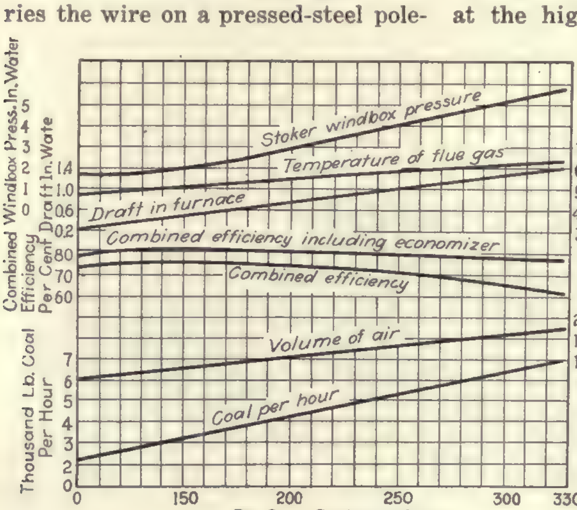


FIG. 1—PERFORMANCE OF A SIX-RETORT WESTINGHOUSE UNDERFEED STOKER FIRING A 558-HP. BOILER
Average B.t.u. of coal as fired = 11,877

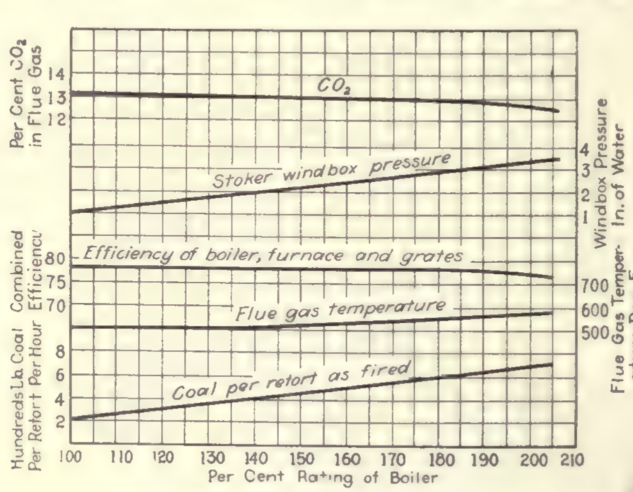


FIG. 2—PERFORMANCE OF A SEVEN-RETORT WESTINGHOUSE UNDERFEED STOKER FIRING A 650-HP. BOILER
Average B.t.u. of coal as fired = 12,358

bined efficiency for the first installation is 160 per cent of rating, while with the second installation the best efficiency was obtained between 170 per cent and 185 per cent of rating.

The operating force in this plant has found that it can force this equipment to 328 per cent of rating if necessary. The condition of the furnace after a high rating test will determine the effects of the high temperature on the furnace walls and stoker parts.

The type of stoker and fan driving equipment should be determined by the heat balance of the entire plant. If additional exhaust steam is required for feed water, then engine or turbine drive will be preferable from an economy standpoint. On the other hand, if plenty of exhaust steam is available, it might be preferable to use motor drive.

Messenger-Cable Suspension for Local Distribution

By F. A. Westbrook
Formerly Field Engineer Habirshaw Electric Cable Company, Yonkers, N. Y.

MULTIPLE-CONDUCTOR cables supported by messengers on poles for three-phase power transmission circuits where tree conditions render the use of open-wire construction impracticable have come into general use. However, little has been done about local distribution circuits at primary or secondary voltages under similar conditions. This situation is not so difficult to handle where only comparatively low voltages are involved, and several expedients, such as tree wire and tree guards, have been used with reasonably satisfactory results. Nevertheless, there are cases where these methods are insufficient.

One such case has arisen in the territory of the New York & Queens Electric Light & Power Company. This company has found it necessary to use 4,000-volt, three-wire primary circuits, and in certain sections most of the streets are lined with shade trees. Moreover, the city authorities are very particular about preserving the trees and will not permit any trimming to speak of, which, together with the higher voltage of the circuits, has created a situation where the old methods of tree protection are entirely inadequate.

The difficulty has been solved by running a messenger cable from pole to pole and suspending single-conductor, rubber-insulated and braided wires from them. This has been done by means of marlin hangers, but experiments are now under way to determine the practicability of suspension by means of rings through which the wires can be drawn in the same way as a cable. Wherever there is a space of a block or more which is clear of trees the insulated wires are discontinued and ordinary weatherproof wire supported is substituted.

Of course, the reason why the messenger-wire construction is an improvement is not only that it acts as a mechanical protection to the conductors but also because it is much easier to run one line so that it will not be injured by trees than to see that all the individual wires supported on a cross-arm will be free from interference or will not cause damage to the trees.

WHEN RUNNING WIRES THROUGH TREES SPECIAL INSULATED WIRES FASTENED TO MESSENGER AFFORD AMPLE PROTECTION

Left—Corner pole in trees beyond which the space is clear. The separate wires are fanned out to insulators on a cross-arm. As there is considerable strain at this point they are dead-ended on strain insulators. Sometimes conditions are such that they may pass directly to pin insulators. The method shown here is especially convenient on account of the taps run to the arresters.

Right—Transformer in trees. Note how the wires are run from the transformer to insulators on the cross-arms and are then bunched together and supported by a messenger in each direction.

Single-conductor wires are used instead of a multiple-conductor cable because of the frequent connections which must be made at service transformers in the case of primary circuits and the frequency of aërial service drops to consumers' premises in the case of secondary circuits. If multiple-conductor cable were used it would be necessary to have potheads at every transformer and for every service lead. Furthermore, it would not be so readily possible to resort to open wire and cross-arm construction even in short stretches which are clear of trees.

There was one condition encountered by the company's engineers for which there was no warning precedent. This was the action of corona on the rubber insulation. While the action of ozone, resulting from corona, on rubber is well known, it is not generally recognized as a source of trouble at primary voltages; but in this case when the voltage is 4,000 it is enough to cause trouble on the wires bunched together and supported by the messenger. Of course, the corona is not visible to the eye, but there is sufficient electrical stress to cause ionization. This called for a considerable amount of experimenting with different kinds of rubber compound. It was found that the better the grade of compound, that is from the standpoint of increased percentage of raw rubber, the more it cracked and went to pieces under the action of the corona; but by co-operation with manufacturers a compound was finally developed which apparently is not affected. It is obvious that this construction should not be used with either code or ordinary 30 per cent Heavea grades of insulation.

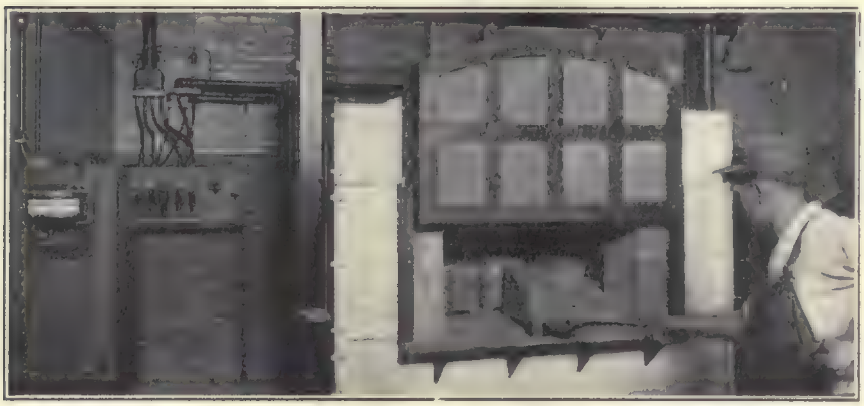
Electric Furnace Displaces Three Coal-Fired Units

FRESH examples of the economies of industrial electric heating emphasize the importance of planning such installations with due regard to engineering analysis. Recently a 75-kw. resistor-type electric furnace was purchased by the Cushman Chuck Company, Hartford, Conn., for use in general heat treating, with particular reference to case-hardening and annealing. The work was formerly done by two and sometimes three coal-fired furnaces, and in addition a gas-heated cyanide furnace was operated at a fuel cost of about $100 per month. The electric furnace has been in use a few

months, and the coal-fired outfits are to be scrapped; one man's time at about $30 per week has been eliminated, and the quality of the work turned out is far superior to that formerly produced on account of the uniformity of the heating.

The electric furnace has a capacity of twelve "pots" used in case-hardening chuck parts. It is operated with a temperature control varying the heating only about 2 deg. F. on either side of an average determined by the amount of energy allowed to flow through the resistors. The furnace can be run at about 1,650 deg. F. maximum or at a desired lower figure. About six hours are required for a single case-hardening run for a carbonization depth of $\frac{1}{32}$ in. The furnace is operated on a day rate of about 2.2 cents per kilowatt-hour, and from 10 p.m. to 7 a.m. on a rate 40 per cent less, under the regular schedule of the Hartford Electric Light Company. The total cost of the installation, including furnace, wiring control equipment and additional apparatus such as alloy pots, etc., was about $6,000. It is no longer necessary to operate the cyanide furnace, so that the gas bill is saved, as well as the wage above mentioned.

The electric furnace is run twenty-four hours per day and usually six days per week. The ability to operate the furnace on such a schedule at a substantial percentage of its rating contributes to its economy under the conditions of the Cushman company, the volume of whose business keeps the furnace active most of the time. The average cost of electricity for the furnace is about $200 per month. In the four or five months since its installation the cost of repairs has been practically nil, and it is expected that the furnace will pay for itself within eighteen months.



ELECTRIC FURNACE FOR CASE-HARDENING AND ANNEALING WILL PAY FOR ITSELF WITHIN EIGHTEEN MONTHS

Organizing Cable Tests for Routine Handling

REFERENCE has been made at various times in these columns to loose-leaf instructions used by engineers and foremen of the Worcester (Mass.) Electric Light Company to facilitate routine work on the distribution system and to insure covering all important points in handling inspection, test and repair tasks. The following instructions for cable testing have lately been added to the other scheduled activities and are reproduced here because of their comprehensiveness:

Instructions for Cable Testing

The meter engineer shall be responsible for the proper testing of all cable when requested to do so. The engineering assistant in charge of records shall be responsible to the general engineer for seeing that this is done.

All used cable before being returned to stock must be tested as follows: 13,000-volt cable to be returned shall be delivered by the line foreman to the transformer room, underneath the high-voltage test room, and all other cable shall be delivered by the line foreman to the basement near the 10,000-volt test set. The foreman shall attach a paper tag to each piece of returned cable stating the length in feet, size of conductor and normal working voltage. He shall also enter the words "Not tested." If there are any pieces over 8 ft. long which appear unfit for use, the day emergency man shall notify the distribution engineer or the general line foreman, who alone may order such pieces junked. In this case a suitable "junk" tag shall be filled out, signed and attached to the piece of cable affected by the man who orders it junked. One section of the tag shall be left attached to the cable; the other section (an exact copy of the first) shall be given by the man who signs it to the engineering assistant in charge of records.

After this, the yard man shall then remove such pieces and may remove pieces less than 8 ft. long without the "junk" tag. The emergency men shall prepare all other pieces for testing as follows: He shall remove the lead sheath for a distance of approximately 6 in. from each end and remove the insulation from one end for a sufficient distance to permit attaching a test terminal to the conductor. Rubber-insulated cables which have a layer of tape between the insulation and lead shall have the tape removed as far back as the lead. Where more than one cable of the same voltage is to be tested the ends of the conductor may be tied together with copper wire. When this is done the coils of the cable should be placed in such a way that the lead sheaths are in contact.

After the cable has been prepared for test the emergency man shall notify the meter engineer that it is ready and he will assign a man to make the test.

The test man assigned by the meter engineer shall be responsible to the meter engineer for the application of the proper voltage to the cable as follows:

1. Cable for 600 volts alternating current or less:

Size of Conductor	Test Voltage
No. 14 to No. 8	3,000
No. 7 to No. 4/0	3,500
250,000 circ.mil and up	4,000

2. Primary cable:

Size of Conductor	Test Voltage
2,300-volt alternating-current	10,000

3. High-voltage cable:

13,200-volt alternating-current	33,000

For intermediate voltages cable having rubber insulation shall be in general tested at a potential equivalent to 1,000 volts for each $\frac{1}{64}$ in. thickness of the rubber insulation up to $\frac{10}{64}$ in., and for greater thickness at 10,000 volts plus 1,500 volts for each $\frac{1}{64}$ in. over $\frac{10}{64}$ in. of insulation thickness.

The test voltage shall be applied for one minute. These tests are based on the A. I. E. E. standards as given in Volume XL (1921), pages 1666-1673, but the duration of the test has been reduced from five minutes to one minute.

The test shall be conducted in the following manner: In case of single-conductor cable the emergency man shall connect one terminal of the twin-wire test lead from the test transformer to the conductor and the other terminal to the lead sheath of the cable to be tested.

After making sure that the emergency man stands guard so that no one may come in contact with the live cable, the test man shall close the primary oil switch on the test transformer and raise the voltage by means of the hand-operated regulator from zero to the required value.

At the end of one minute the test man shall open the primary oil switch. If the cable contains more than one conductor, the test voltage shall be applied between each conductor and all other combined conductors and the sheath—i.e., three-conductor cable requires three tests for A, B and C conductors, first from A to B, C and the sheath combined, second from B to A, C and the sheath combined, and third from C to A, B and the sheath combined.

When cable breaks down under test the emergency man shall cut out the defective part of the cable, and if this operation leaves any piece greater than 8 ft. in length, this piece shall again be tested.

When all cable has been tested the emergency man shall notify the engineering assistant in charge of records of the results of the test. The engineering assistant on receipt of this information shall immediately attach the

proper metal tags and make the proper record of the cable. He shall also see to it that the stock department removes the tested cable from the vicinity of the test transformers.

When used 13,200-volt cable has been tested the engineering assistant in charge of records shall inform the general line foreman, who shall see to it that the ends of this cable are properly sealed. The stock department shall remove the cable from the high-voltage test room to some place in the stock room where this work can be done.

Preventing Water Losses Through Turbine Gates

BY FREDERICK KRUG
Superintendent of Hydro-Electric Plants, Porto Rico Railway, Light & Power Company, Bayamon, Porto Rico.

WHERE the stream-flow and water-storage capacity of hydro-electric plants is such that part of the load is carried at times by auxiliary steam plants, the prevention of loss of water through the plants during dry seasons is of prime importance in promoting economy of system operation. In most plants it is customary to close the main gates of reaction turbines when backing water, as the loss through the wicket gates with full head in the turbine casing is quite heavy, particularly with units that have been in service for some years. In one of the plants in the writer's charge a heavy water loss through turbines after the gates were closed was recently eliminated in the manner described below.

In addition to several larger units, this plant has four 750-hp. horizontal-reaction turbines, operating under a head of 175 ft. These have been in operation since 1907 and have been the subject of considerable repair in runner-seal sections in recent years. Each of these units is provided with a 30-in. main gate, mounted horizontally, which consists of a single sliding disk supported on guides. Both sides of the disk are provided with bronze seal rings, as are also both sides of the valve casing on which the disk rests.

It was noted after closing the gates of these turbines in the usual way that about one-half of full-head pressure was maintained in the turbine casing and considerable water lost into the tailrace. It was at first thought that this was due either to worn gate seal rings or to leaks in the by-pass valves, which were 4 in. in size. However, both were found to be in good condition.

Considerable difficulty was always experienced in attempting to seat the gates, and numerous pinions were broken in this operation. It was also found that the pressure in the turbine casing dropped from a normal of 75 lb. per square inch to about 50 lb. per square inch while seating the gate and with the by-pass valve still open. Calculations on the difference in pressure existing between the upper and lower faces of the gate disks led to the conclusion that in all probability the gates were not properly seated.

The water gates were then closed and the water was removed from the penstocks and the gate disks were examined from the turbine manholes. It was found that the turbine gates each lacked between 1 in. and 2 in. of being completely closed, and the loss of water when the gates were supposedly seated was explained.

This is a condition which gradually developed in the turbines. As the turbine casings became more and more worn at and around the wicket gates the loss of water at these points became greater and greater. As a consequence the 4-in. by-pass valves could not supply the water at a sufficient rate to maintain the turbine pressure as the gates approached closure. The resulting difference in pressure between the upper and lower faces of the gate disks caused so much friction on the disk guides that it was impossible to close the gates completely.

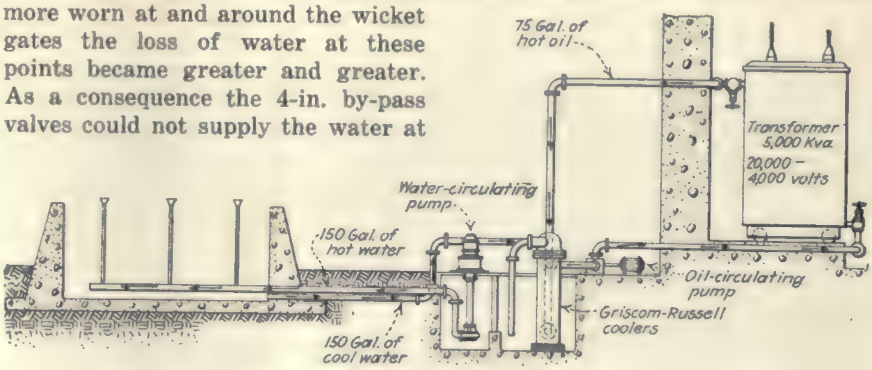
Consideration was given to rebuilding the turbine casings, but because of the expense and the expectation of replacing these units in a few years this was not thought advisable. Based on the loss of water through the wicket gates and the permissible difference in pressure on the two sides of the gate valves to permit their closure, it was estimated that 6-in. by-pass valves would correct the trouble. A by-pass valve and the necessary piping of this size were accordingly installed on one of the turbine gates, and this solved the difficulty in an entirely satisfactory manner. Similar by-pass valves were then installed on the remaining three units with good results.

Forced-Oil-Cooling System for Transformers

BY H. S. FOLEY
Chief Engineer Cia Hidroelectrica e Irrigadora del Chapala, S. A., Guadalajara, Jalisco, Mexico

AS CONSIDERABLE trouble had been experienced with previous water-cooled transformers, this company when reconstructing one of its substations made two new transformers to be force-oil-cooled. The transformers are rated at 5,000 kva., three-phase, 20,000/2,300/4,000 volts each. For cooling the oil two Griscom-Russell coolers are provided. These are installed in a pit below the level of the floor in which the transformers are placed, and the oil is circulated by two rotary pumps.

To avoid the possibility of leakage of water into the oil, a large quantity of water at low pressure is used so that the oil pressure is always greater than that of the oil. To accommodate this amount of water an open tank was built from which the water flows by gravity to the coolers and is discharged into a sump. As the tank has about 3 ft. of water below the ground level and has a cooler provided with a draft tube and on the discharge side, considerably more water is made available in case of necessity. From a hot-water sump the water is returned to the tank by one of the two sump pumps. The discharge to the tank is made through three spray nozzles.



COMBINED WATER AND OIL COOLING SYSTEM FOR COOLING TRANSFORMERS

An interesting feature of this installation is that all of the piping is electrically welded together with the exception of flanges. "T's" were made by burning a hole with the carbon arc in the main, butting the branch to this and welding them together.

All motors are operated from the main switchboard, it being necessary to operate only the valves of the coolers by hand and these are soon to be made remote controlled.

Accounting and Public Relations*

Amiable Contacts of This Department with Customers Important—Individual Employee Interest Essential for Building Good Will

BY E. A. DAVIS

Accountant Middle West Utilities Company, Chicago

FOR the average-sized company accounting work, in so far as it affects public relations, divides sharply into two separate and distinct functions—(a) direct dealing with the public; (b) indirect dealing with the public. In the first division is the direct contact with the customers at the cashier's window, at the order and complaint desk, and the incoming telephone calls. In the second division come the keeping of the customers' accounts, the rendering of bills, statements and the correspondence with customers. The handling of collections comes under both divisions and is a matter of great importance in its influence on public relations.

Considering their direct contact with the public, the work of the members of the accounting department wields a greater influence for good or for ill on public relations than that of any other classified group of employees of a public utility. To the public, in the case of companies of average size, the accounting people very nearly represent that intangible entity—the company—generally referred to by the public as "the office."

THE ORIGINAL COMPANY

Illustrative of this, let us consider Bill Smith. Bill lives in a rural community of, say, one thousand people. Being mechanically inclined and having a head for business, he thinks an electric plant would do well in the community in which he resides. So he puts his thoughts into action and installs a small gasoline-engine-driven generator, strings wires around the town and sets himself up as a budding public utility owner and operator. Everybody in town knows Bill so that if anything in connection with the service calls for a complaint or correction, it is a simple matter for them to drop in on Bill and have things rectified. Years pass. The town prospers beyond expectations of the most optimistic. Bill begins to learn that financing a public utility in a rapidly growing community is far beyond his ability. As a solution a corporation is organized with ample capital and financial backing to conduct the affairs of the utility successfully. Bill is glad to accept a fair price for his business and to retire from a field which has been giving him much worry for several years.

The new corporation opens and equips a modern office. Modern accounting methods are installed, and immediately a changed condition confronts the community. No longer does the electric plant represent Bill Smith. Hereafter grievances of any nature will not be taken up with Bill but with "the office." So that the accounting department, which comes in contact with the public now, typifies the Bill Smith of former days. Upon it rests the burden of seeing that to each customer who comes in the office with a grievance, be it ever so trivial, is accorded a courteous, sympathetic and patient hearing. Courtesy, sympathy and patience should not be forgotten, because these necessary attributes are the roots of building up good will. Every clerk must bear in mind that to the customer he typifies Bill Smith.

The case of customers coming to the office with their grievances has been stressed particularly for the reason that such cases require the most careful handling; for here public relations are strained, and it is of utmost importance that this condition be relieved. But in daily routine of business in contact with the public a great influence can be exerted toward improving public relations or maintaining good ones. And here again Bill Smith enters the picture. If Bill were on the job, he would very probably be able to greet every customer by name and very likely would inquire as to the state of health of some ailing member of the customer's family, or some other intimate matter. It is this personal touch that creates a friendly atmosphere about a public utility office and brings a favorable reaction from the public. It should be cultivated.

INDIRECT CONTACTS

Of first importance in indirect contact with the public is accuracy. Nothing destroys public confidence more quickly than inaccuracies in the rendering of monthly bills and statements. And to discontinue a customer's service for non-payment and then have him present to your gaze a receipted bill for the period is about the most destructive influence on public relations conceivable. Happily it does not occur frequently, but it should not occur at all. It is surprising how deeply an occasional customer's feelings can be wounded by the misspelling of his name on a bill or statement. This is another place where inaccuracies are harmful to the company.

The next item is the matter of neatness — or good housekeeping. Bear in mind that a large percentage of the customers who come in your office are women. A disorderly, untidy office doesn't cause them to feel any pride in the public utility with which they do business. Men, as a rule, are not so observing of such matters, yet while they may not notice them, unconsciously the effect is bad. Let the personal touch enter here, thereby bringing an air of good housekeeping into the office.

A SELF-INTEREST PROBLEM

In conclusion, let us look this subject of public relation squarely in the face and ask ourselves, "What is it all about? Is it something in which we as individuals have only a de-

*A paper presented before the Accounting Section of the Wisconsin Utilities Association, Madison, Wis., Oct. 23, 1923.

tached interest—something that we, as a part of our duties, are supposed to build up and maintain for the benefit of the company?" The answer is, "Most decidedly not." Each public utility employee has a very great and selfish interest at stake. In the first place, he has the selfish interest of his own personal advancement, which will be better assured with a growing and successful public utility company, because a company to qualify in this class requires good public relations as a main essential. Furthermore, if his relations are good, his day-to-day dealings with the public are a pleasure, his lot in life is the happier as a result. His selfish interest, therefore, lies in seeing that those favorable relations are maintained. If the opposite is the case, if poor or bad public relations exist, the company which employs him does not flourish. His own progress accordingly is checked, and his day-to-day dealings with the public are far from being a pleasure. His selfish interest clearly lies in seeing that these relations are improved.

A Central Station Nursery

Public Utility Performs an Unusual Service and Wins Many New Friends

THE San Joaquin Light & Power Corporation played a new part in this year's county fair at Fresno, Cal. and made for itself a brand new circle of admiring friends. Instead of the conventional booth devoted to electrical display, at the instigation of General Manager A. Emory Wishon it installed a nursery for babies, and several hundred mothers rise now in their gratitude to thank the San Joaquin company for a really enjoyable visit to the fair.

The "Kid Kilowatt Day Nursery," as it was called, occupied ground space 75 ft. x 50 ft. and was established under a group of trees on the main street of exhibit buildings. Mothers were invited to leave their babies at the booth, where a doctor, trained nurses and professional kindergarten teachers were constantly on hand.

At one end was partitioned off the real nursery, in connection with which was a mother's rest room. Each mother registered her name and address and received a number tag, a duplicate of which was pinned to the baby's dress. Around the nursery was ranged a row of cribs. Certified milk was kept in an electric Frigidaire machine and electric bottle warmers and sterilizers were also used. The room was heated with electric heaters. So popular did the nursery prove that three nurses were kept almost constantly busy, many mothers leaving their little ones at the company's nursery for hours at a time.

At the opposite end of the booth

VIEWS OF THE SAN JOAQUIN LIGHT & POWER CORPORATION'S "KID KILOWATT DAY NURSERY"

was a play yard, 25 ft. square, covered with a foot of clean beach sand. Here the toddlers up to five years old were cared for. Mothers were registered here, too, and the children were tagged. Seesaws, wheelbarrows, buckets, spades and other toys were provided, while the kindergarten teachers devised games, told fairy stories and supervised the play. Toy electric stoves were installed, and the little girls received lessons in biscuit making.

As a third element of service an emergency hospital was conducted, under the supervision of Dr. C. A. Mordoff, head of the company's medical department. During the week of the fair forty patients were treated at the hospital. The nursery took care of 150 babies, all of bottle age, while more than 400 toddlers were checked into the playground, 110 being checked in during a single afternoon.

In the opinion of Mr. Wishon and his organization, the experiment was a far greater success than had been anticipated. The very novelty of it had news appeal that the press immediately sensed, and much publicity resulted.

While there was no direct advertising, the use of electrical appliances was splendid indirect advertising. But above all else, declared Mr. Wishon, there was organizational satisfaction in the rendering of a real service, and beyond any question public good will was strengthened, as manifested by the many expressions of appreciation. A letter of thanks from the management of the fair declares that the day nursery was one of the best of its attractions. The nursery is to be a permanent institution, and plans have already been made to enlarge it next year and to introduce many new features.

An Employees' Service Guide

EVERY utility company which has recognized the full significance of its relations with the public has undoubtedly tried to impress upon its employees the responsibilities which they have in making these relations as friendly as possible. In some cases executives have tried to do this by calling in their department heads, impressing upon them the importance of the matter, and leaving it to them to adopt ways and means of bringing about the desired result.

If company executives are sincere in their appeal and forceful enough in demanding action, this method is often the best because it allows each department head to exercise his own ingenuity and gives him an opportunity to show relative performance. However, it has usually been found that the best results are attained where the chief executive is so imbued with a definite policy toward the public that this spirit is automatically carried down to the individual employees. The policy may not be the product of his own mind, but the chief executive must be its strongest proponent if the employees are expected to reflect it.

In the Illinois Power & Light Corporation, which operates chiefly in southwestern Illinois, the vice-president and general-manager, William A. Baehr, has had the accompanying employees' service guide posted conspicuously in all of the company's offices and plants. A copy has been given to each employee. It is printed in the company house organ and it is displayed in public so that the employees know what the company desires the public to expect from them.

Employees' Service Guide

OUR CUSTOMERS judge this company by what they think of you.

COURTESY ALWAYS PAYS and you are paid to be courteous.

NEVER LOOK UPON a customer's complaint as a nuisance. If justified, it is a service to the company, but justified or not, it affords an opportunity for courteous service.

IT TAKES TWO to make service perfect, the server and the served, and you are responsible for your part.

A CUSTOMER will believe what you know to be true. Do not ask him to believe what you do not believe yourself. Get the facts!

OLD CUSTOMERS were once new customers who were fairly treated.

THE RECOLLECTION of courteous treatment remains when everything else is forgotten.

IT IS A CUSTOMER'S RIGHT to understand what he is buying. It is your duty to help the customer to understand.

BEST OF ALL! Put yourself in the customer's place, and then do unto the customer as you would be done by.

Illinois Power & Light Corporation

Wm. A. Baehr,
Vice-President and General Manager.

What Other Companies Are Doing

Fitchburg, Mass.—A new local record for meter gains was made during October by the Fitchburg Gas & Electric Light Company when 195 units were added to the system. The company gained 1,294 meters during the first ten months of this year. There are 9,300 homes in Fitchburg, and 6,500 of these are now wired.

Sioux City, Iowa.—Three hundred employees of the Sioux City Gas & Electric Company, have pledged themselves to assist in the sale of $600,000 preferred stock, the floating of which was announced recently. W. J. Bertke, vice-president and general manager of the company, occupied the chair at a general discussion of the personal sales compaign which is to be carried on by the employees themselves.

San Diego, Cal.—The Electric Club of this city has arranged with the educational authorities to co-operate with it in the vocational education and guidance work of the schools. It is planned to have instructors from the high schools meet with committees of the Electric Club to discuss ways of making the courses up to date and practical from the industrial standpoint. One feature is to have students taking electrical courses interview the electrical men of the city on the practical aspects of their work.

Providence, R. I.—During the first eight months of 1923 the Narragansett Electric Lighting Company made a 8,209.5-kva. net gain in transformers in use, installed 4,236 new aërial services, 120 new underground services, set 1,192 new poles and erected 183 new street lights. In addition, hundreds of customers have been changed over from 250-volt to 104-volt service, the latter having been made standard on the Narragansett lighting system after many years of experience with the higher voltage.

Janesville, Wis.—For the purpose of promoting a closer relationship between utility companies an inter-utility meeting and banquet was recently held for the first time in the history of Wisconsin utility circles. It was attended by 130 executives and employees of all the public utility companies in this city, representing electric, electric railways, gas, water, telephone and telegraph services.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Hydro-Electric Development and Steam Equipment

Powdered Coal in Blast-Furnace Gas Plant.—In a boiler installation in the Ensley works of the Tennessee Coal, Iron & Railroad Company powdered coal supplements blast-furnace gas to maintain uniform supply of steam. Outstanding features of the plant are the automatic control of the air mixture and the feed of the powdered coal. —*Power*, Nov. 6, 1923.

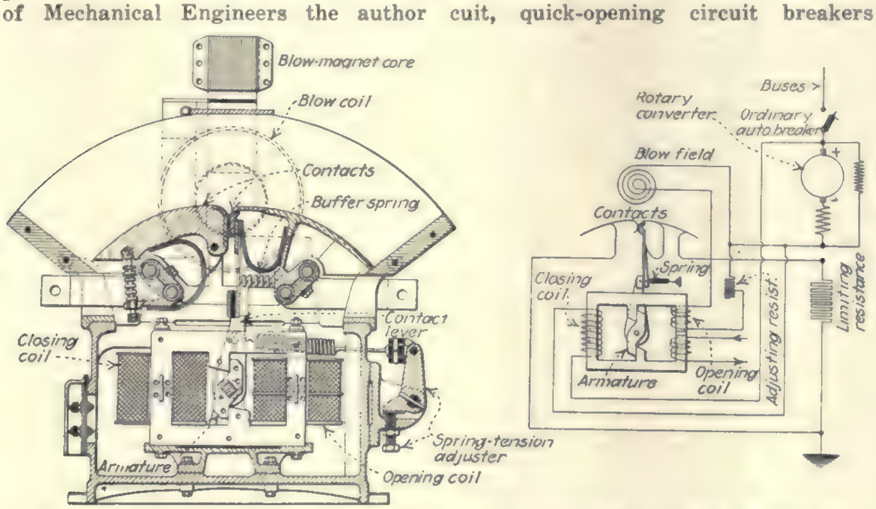
Economical Limits of Boiler Loading. —C. F. WADE.—The factors which will determine the upper unit of economical loading of any given boiler plant will vary with the local conditions obtaining in each individual plant, and are the available draft power, draft system, labor costs and class and quality of fuel used. — *Electrical Review (England)*, Nov. 9, 1923.

Mercury in Binary-Fluid Turbines.— W. J. KEARTON.—In a recent paper presented before the British Institution of Mechanical Engineers the author first discussed very briefly the methods of improving the efficiency of large steam turbines and then outlined the possibilities of the binary-fluid turbine with mercury and water as the working substances. After briefly describing a suggested form of pipe joint designed to prevent the escape of the very poisonous mercury vapor and discussing an arrangement of a combined mercury-vapor and steam-turbine plant, the paper deals with the thermodynamics of the subject. A somewhat involved explanation of the gain sought by using the binary-fluid principle is followed by an attempt to evaluate the relative economies of a pure steam turbine plant and one of the same output using steam and mercury vapor. Attention is given to incidentals, such as the choice of steam pressure in a binary-fluid turbine plant and the flow of mercury vapor through nozzles, while in an appendix tables are given on the thermal properties of mercury vapor after the manner of the more familiar steam tables.—*Engineering (England)*, Nov. 23 and 30, 1923.

Advance in Steam-Boiler Practice in Anthracite Region.—M. M. PRICE.—The importance of burning small sizes of coal at mines, changes in boiler and furnace design to insure efficient combustion, benefits of high stacks and the use of economizers for increasing the boiler capacity are among the subjects discussed in this six-page article.— *Coal Age*, Nov. 22, 1923.

Generation, Control, Switching and Protection

Extra-Rapid Automatic Circuit Breaker.—P. FORGET and L. WASSER.— To prevent flashing of the commutator on a rotary converter under short circuit, quick-opening circuit breakers have been developed which are capable of opening the direct current within the critical time of less than one-half cycle of the alternating current, or a speed of 0.003 second to 0.006 second. This paper gives a very detailed description of the breaker, recently built and tested by an Alsatian concern. Theoretical investigations have indicated that an electromagnetic tripping of contacts under spring tension does not give a sufficiently high speed. This new breaker is held closed by a constant magnetic pull against heavy springs and opened by the sudden collapse of this field, achieved by an auxiliary counter-field set up by the short circuit. To obtain high speed the moving armature is made very light (less than 2 lb. for a 750-amp. breaker), the spring tension is very high (400 lb.) and the opening contact has a very short travel (about ⅛ in.). These combined factors give the contact an acceleration of about 2,000 ft. per second per second. A powerful magnetic blow field is provided, the density of which reaches 10,000 gauss. Assuming a current of 7,000 amp., this blow field will exert a force of 14 lb. upon each half-inch length of arc. Tests with this breaker on an 800-kw., 500-volt rotary under a dead short circuit disclosed, by oscillograms taken, an opening time of about 0.005 second. This breaker is not used to open the circuit completely, but inserts into the circuit a protective resistance, normally short-circuited, which limits the current.—*Bulletin de la Société Alsacienne de Constructions Mécaniques*, October, 1923.



QUICK-ACTING BREAKER INSERTS RESISTANCE INTO CIRCUIT WITHIN 0.003 SECOND

Time Lag in Building Up Voltage of Self-Excited Direct-Current Generators. —Y. WATANABE.—A simple formula is deduced which represents the time required by the generator to build up in relation to the electrical constants of the field circuits, residual magnetism and the saturation effect. The time lag increases with the resistance of the field circuit up to a certain point, beyond which it decreases. Theoretical studies of the problem are compared with experimental data, and it is found that with no residual magnetism the time lag is much larger than that theoretically calculated.—*Journal of Institute of Electrical Engineers of Japan*, September-October, 1923.

Transmission, Substations and Distribution

Rotary-Converter Transformers.— G. BERG.—A discussion of the methods for regulating transformer voltage used to energize rotary converters. Voltage regulation may be secured by field regulation with series reactance, a synchronous alternating-current booster, induction regulator, extra taps on the transformer, and by regulating or split poles. Most of the article is taken up with a theoretical discussion of sandwich windings where the high-tension winding is placed between the two halves of low-tension winding.—*Electrician (England)*, Nov. 16, 1923.

Units, Measurements and Instruments

Power Losses in Insulating Materials. —E. T. HOCH.—It is shown that a satisfactory measure of power loss in a dielectric is the product of phase angle and dielectric constant. Although the dielectric constant need not be explicitly considered in the design of condensers, it is important in such cases as the design of apparatus panels and vacuum-tube bases. The method used in measuring phase angle and dielectric constant is discussed, with the factors affecting power losses and insulating materials and their variations with frequency temperatures.—*Bulletin B-29-1 of the Western Electric Company.*

Accurate Metering.—S. H. RICHARDS. —A close scrutiny of meters and the maintenance of their accuracy leads to a lower cost and smaller charges, producing in turn an increase in the number of customers. Meter accuracy can only be maintained by a frequent and intelligent inspection and test, not only when a meter has been received from the manufacturer, but also at periodic intervals after it has been installed. The article as a whole discusses the standardization work conducted by various countries, electric light associations, insurance companies and other controlling bodies.—*Electrical Review (England)*, Nov. 16, 1923.

Illumination

Lighting of Large Stores.—Several large English stores have recently been rewired and remodeled so that an up-to-date lighting system could be installed. Use of the totally indirect system, even light distribution and absence of glare or shadows, together with excellent illumination from a color point of view, have resulted in a very satisfactory system.—*Electrical Review (England)*, Nov. 9, 1923.

Lighting of Show Windows and Showcases—This bulletin has been revised to include tests on the effect of intensity and color of light on the drawing power of the show window. Additional information is given on the motor-driven dimmer and circuit changer for show-window work.—*Bulletin L.D. 103-B of the Edison Lamp Works of the General Electric Company.*

Motors and Control

Glass and Electricity.—F. A. CONNOR.—The different processes in making plate glass and the application of electric motors to these processes are described. The plant use as an illustration is the American Plate Glass Company in James City, Pa.—*General Electric Review*, November, 1923.

Polyphase Reaction Synchronous Motors.—J. K. KOSTKO.—The author develops the theory of the reaction motor, shows why its inferiority is mainly due to the faulty form of the rotor, and analyzes the construction, whose performance can be made comparable to that of any standard type of alternating-current motors.—*Journal of A. I. E. E.*, November, 1923.

Device for Testing Electric Fans.—In connection with the work of the Federal Specifications Board the bureau is designing a device for the rapid testing of electric fans. The usual test of the air delivery of electric fans is very unsatisfactory, because it takes considerable time and the results cannot be repeated with accuracy. It is believed that these objections have been overcome in the device now being worked out, the principle of which was tried and found workable some time ago. The present work applies this principle in a more convenient form for field use.—*Technical News Bulletin No. 79 of the Bureau of Standards.*

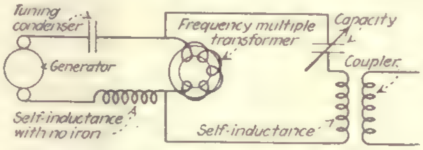
Heat Applications and Material Handling

Acid Electric Steel Castings.—L. J. BARTON.—In the author's opinion, as much skill is required to make good, regular acid steel as is necessary to make metal by the basic processes. It is harder to obtain absolute control of acid metal than of the basic metal. With this idea in mind, this article is written in detail, describing the handling of this process. Cardinal points in good practice, scrap and making bottom, charging and melting down and the making of high carbon and chrome steel are considered.—*Iron Age*, Nov. 8, 1923.

Refractories in the Steel Industry.—J. S. MCDOWELL.—After considering the strength of refractories, hot-load tests, thermal conductivity and resistance to temperature changes for various types of refractory material, the author describes its use throughout the steel industry.—*Blast Furnace and Steel Plant*, November, 1923.

Telegraphy, Telephony, Radio and Signals

High-Frequency Sender for Radio Telegraphy.—K. SCHMIDT.—The author claims that this newly developed frequency-multiplying device, using static transformers, may soon become a serious competitor of the now commonly installed vacuum-tube sender. Modifying the transformer so that its magnetic core was built up of extremely fine iron wires (0.05 mm. in



FREQUENCY-MULTIPLYING APPARATUS FOR COMMUNICATION WORK DEVELOPED IN EUROPE

diameter), it was possible to get as high as the forty-seventh harmonic with 50 per cent efficiency. With a 3.5-kw., 7,600-cycle generator and a multiplier of the above frequency an antenna output of 1.5 kw. and waves as short as 750 m. have been obtained easily with a very good sound, free from secondary noises. It was, however, necessary to provide the driving motor with an extremely sensitive speed regulator. Such a device has been developed which keeps the speed of the motor within 0.0001 per cent between no load and full load. This regulator is based upon the Tirrill principle. — *Elektrotechnische Zeitschrift*, Oct. 4, 1923.

Influence of a Sun Eclipse Upon Radio Receiving. — B. ILIIN.— During the sun eclipse on April 8, 1921, a laboratory near Moscow, Russia, made observations of the intensity of radio signals issued from several stations at distances of 5 km., 760 km. and 830 km. from the receiving antenna. It was found that the incoming signals reached a maximum strength at the moment of maximum eclipse, but that the atmospheric ionization reached at the same instant a minimum. These results are a perfect check on similar tests made on April 17, 1912, by other investigators.—*Jahrbuch der Drahtlosen Telegraphie*, September, 1923.

Technical and Economical Considerations on Commercial Radio Stations.—G. VALLAURI and G. PESSION.—After dealing with the most important problems concerning a radio station the authors give a classification of the stations, considering the kind of service they give. They explain how the different services have to be organized, how they work, the assistance required, the relative expenses, the cost of installation, etc., and what should be done in order to get the best results from all the stations scattered throughout the world.—*Elettrotecnica*, Sept. 25, 1923.

Electrophysics, Electrochemistry and Batteries

The Weight Efficiency of Storage Batteries.—S. MAKIO.—The weight efficiency is defined as the ratio of the total weight of the battery, including electrolyte, in kilograms, to the kilowatt-hour output at a particular discharge rate. Comparison is made of the weight efficiency for several types of batteries, and curves are given for the output of batteries for electric vehicles and for stationary purposes.—*Journal of Institute of Electrical Engineers of Japan*, September-October, 1923.

Electrochemistry of the High-Intensity Arc.—P. R. BASSETT.—Consideration is given to the progressive changes in phenomena of various types of arcs with increasing current. Carbon arcs and ordinary flame arcs change their behavior fundamentally with large currents. The tendency to produce two arc flames, a positive and a negative, is present in an obscure form in practically all arcs. In the high-intensity arc this phenomenon has been enhanced to a point where the two flames are separate and distinct and each flame performs a separate function. The high intrinsic brilliancies obtainable with this type of arc are discussed, and the carbide flame has been suggested as an explanation for the abnormal brilliancies produced.—*Paper presented before the American Electrochemical Society at Dayton, Ohio*, Sept. 27-29, 1923.

Traction

Systems and Methods of Railway Electrification.—H. M. SAYERS.—The decision to electrify a particular railway and the choice of systems and methods can be sound only when based on economic considerations. Approximate estimates of the capital and working costs of electrification and the increase in net receipts to be anticipated are necessary to justify the decision to electrify. The more important factors to be taken into account following the decision to electrify are discussed. —*Electrical Times (England)*, Nov. 15, 1923.

Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

Conducted by PROF. VLADIMIR KARAPETOFF, Cornell University, Ithaca, N.Y.

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Bearings, Overheating of, Relay Protecting

A cylindrical metal bulb fits in a hole drilled in the bearing, and serves as a thermometer at the source of possible trouble. A flexible hose, filled with a volatile fluid, connects this bulb with bellows. Heating of the fluid causes the bellows to expand and to trip a toggle mechanism which opens or closes an electric circuit.—*General Electric Company, Schenectady, N. Y.*

Lamp Filaments, Determination of Life of

It is possible to learn how long a lamp has been burned by placing a section of the filament before a very powerful projector especially developed for this purpose. The image of the filament as thrown on the screen is much enlarged, and every crystal and division is shown. By comparing the size of the filament particles and the condition of the wire itself with the results of tests made on filaments at all stages of lamp life it is possible for the metallurgist examining the filament to determine the approximate number of hours it has been burned.—*Westinghouse Lamp Company, 165 Broadway, New York City.*

Meter, Demand, with Synchronous Clock

The type R A demand meter is now equipped with a small synchronous motor designed for high torque and low speed (600 r.p.m. for the 60-cycle motor). The low-speed motor permits the use of spur-gear reduction between the rotor shaft and the worm shaft which is required to convert the horizontal rotation of the rotor to the vertical rotation of the minute shaft of the motor, thus giving a slow-speed worm. This eliminates the necessity of running the motor gearing in oil to prevent excessive wear of the worm gearing. The motor will remain in synchronism from 60 to 200 per cent of rated voltage.—*Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

CO_2 Meter on the Wheatstone Bridge Principle

The meter consists of two small identical platinum spirals mounted in gas chambers or cells. One cell is filled with air and sealed, the other is exposed to the flue gas under test. The two spirals form two branches of a Wheatstone bridge. Since the thermal conductivity of carbon dioxide differs from that of air by about 40 per cent, the temperature of the two spirals is different and the bridge is thrown out of balance. The galvanometer can be calibrated directly in percentage of CO_2.—*Brown Instrument Company, Philadelphia.*

Relay for Parallel Transmission Lines

The relay has three operating solenoids. The currents in the two outside (restraining) solenoids are proportional to the currents in the two parallel line conductors; the current in the middle (operating) solenoid is proportional to the difference of the two currents. When because of a line fault the difference in the current in the two lines becomes great enough to overcome the weaker of the two small solenoids, the movable-contact mechanism will rise and throw to one side, thereby completing the circuit of the trip coil of the circuit breaker in the line carrying the greater current.—*General Electric Company, Schenectady, N. Y.*

Steam-Pipe Covering, Efficiency of

Tests have been made on heat losses through steam-pipe coverings, both single and graded, and also on the advantages of jacketing with polished tin. For the data and conclusions see the Bulletin of the State College of Washington, January, 1923, Vol. 5.—*H. J. Dana, Pullman, Wash.*

Timing by Synchronous Motor

A timing mechanism driven by a synchronous motor has proved far superior to a spring-driven clock. It is not sensitive to ordinary changes in temperature, is not affected by vibration, and there are no exposed pivots to rust or spring balance to adjust, nor must they be installed in the level position necessary with a pendulum clock. Failures due to extreme low temperature may be avoided by installing small heating units. These motors are now applied to demand-meter contact-making clocks, portable and station graphic voltmeters, ammeters and wattmeters, time switches, time clocks, flow meters, temperature meters, pressure and water-level indicators, laboratory timing devices, etc. —*Meter Committee of the N. E. L. A.*

In Progress or Purposed

Daylighting from Windows

An experimental study is being made of the daylighting of interiors, upon which actual and detailed quantitative information appears to be meager. The data so far obtained cover actual utilization coefficients for typical daylight illuminations, together with curves and coefficients representing distribution of the daylight under a variety of conditions; also, data on the effect of width of mullions or columns between windows upon distribution of illumination in the room, on the relative effect and efficiency of light from various portions of the window area, on the effect of various methods of controlling the light from windows by means of shades and blinds, and on the effect of dirt accumulations on windows. A paper on the subject was presented at the 1923 convention of the Illuminating Engineers Society.—*H. H. Higbie and G. W. Younglove, University of Michigan, Ann Arbor.*

Ferromagnetic Substances, Correlation Between Mechanical Hardness and Magnetostrictive Effects in

In studying the changes in length due to a magnetic field which occur in steel rods of a definite carbon content, it has been found that different annealing temperatures of a group of rods quenched at 788 deg. C. give different changes in length, depending upon the duration of the annealing process. This analysis reveals definite relations between the magnetic and mechanical characteristics of steel. It is being extended to all sorts and conditions of ferromagnetic substances in the hope that more light may be thrown on the physical meaning of "hardness of metals."—*S. R. Williams, California Institute of Technology, Pasadena.*

Plant Growth, Stimulation of, by Artificial Light

A study of the stimulation of plant growth is being made with a view to commercial application of artificial lighting in horticulture. Tests have proved the feasibility of increasing the growth and development of flowering plants and of those having relatively large leaf area. The increased speed of germination of vegetable seeds has also been demonstrated, when the artificial illumination of an intensity in excess of 500 foot-candles is provided during a fairly large portion of the period of natural darkness. Plants seem to respond better to an intermittent treatment than to a continuous long period of high-intensity illumination. Further studies are being made to isolate the effects of heat from light and to determine possible changes in chemical structure of leaves and stems.—*Westinghouse Lamp Company, New York City.*

Porcelain Glazes, Hardness Test for

A hardness test is being developed for porcelain glazes which consists essentially in wearing away the glaze by means of a standard sand. This sand is allowed to run through an orifice of known dimensions and to strike upon the inclined surface of the specimen after falling a predetermined distance. Satisfactory results are being obtained in comparatively short intervals of time and with small amounts of sand. A circular letter has been sent to a considerable number of potters asking that samples be submitted for testing.—*Bureau of Standards, Washington, D. C.*

Apparatus Available

Machine for Vibration Tests

In many cases a piece of apparatus is intended for severe service conditions where mechanical vibrations determine the life of the device or the quality of its performance. It is therefore of great importance to produce such vibrations artificially in the factory, in order to test newly developed types of apparatus under conditions at least as severe as in actual service. Such a vibration-testing machine has been developed in which the character and the rate of vibration of the part under test can be governed at will.—*Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

Suggestions for Research

Dielectric Time Lag

Whether and how far and in what manner the time lag depends upon the configuration and size of the electrodes, the shape of the voltage wave, etc., is still largely unknown, and the entire field, though of high importance, is almost entirely unexplored.—*J. L. R. Hayden and C. P. Steinmetz in A. I. E. E. paper presented at Pacific Coast Convention, October, 1923.*

Generator, Direct Current, Protection of

As the result of tests on motor-generators one manufacturer is convinced that the automatic insertion of resistance in the shunt field of the direct-current generator has been sufficiently developed to protect the machine adequately under any condition of excess current to which the machine may be subjected. Another manufacturer recommends the use of a differential field winding on the direct-current generator as a means for handling excess currents with power flowing in either direction.

Lighting Fixtures, Depreciation in Efficiency Due to Dusting

A forced test for dust collection would be of usefulness in studying changes in design of lighting fixtures, with a view to improvement. However, the simple experiment tried with circulating dust in a closed room by means of electric fans shows that much checking would be necessary before placing full reliance on the results.—*E. A. Anderson and J. M. Ketch, National Lamp Works, Cleveland, Ohio.*

Switchboard Apparatus, Insulation of

Some of the latest European developments in switching apparatus are of interest, especially the use of an insulating compound for protection of the busbars and the corresponding switches, transformers and instruments, and other switchboard devices and arrangements worked out to co-operate with this new system. The advantages over present methods are said to be a great saving in space and greater use of standardized parts. I believe that the advantages of this method of insulation are such that we should push our own development as rapidly as possible.—*E. W. Rice, Jr., Schenectady, N. Y.*

Lamps, Colored, Standard Tints for

There is quite a demand for colored incandescent lamps for display and other purposes, but the number of tints asked for by purchasers is too large and the demand for each color too small to standardize on mass production. An investigation is desired as to the minimum number of really important colors, with the view of standardizing production. It is also of importance to investigate whether it is best to have the color in the lamp bulb itself or to obtain it by means of colored auxiliaries.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Suit Over "Wired Wireless"

General Squier Charges the A. T. & T. Company with Infringement of His Patents

A SUIT has been filed by Major-General George O. Squier, Chief Signal Officer, U. S. A., against the American Telephone & Telegraph Company, claiming infringement of the Squier patents for multiplex telephony and telegraphy. The case was before Judge John C. Knox, United States District Court in New York, last week and this week. Testimony has now been completed. It is expected that briefs will be submitted in January and that Judge Knox will render a decision in March.

The claims of General Squier, as set forth by his counsel, are that his patent, No. 980,356, granted Jan. 3, 1911, is basic in that it is a comprehensive covering of the principle of making possible several telephone conversations over one pair of wires by means of carrier currents of various high frequencies. It is claimed that previous to the time named only one conversation was possible over two wires, that the Squier invention of "scrambling" several conversations at the transmitting end and "unscrambling" at the receiving end extended the usefulness of the telephone wires, and that this principle has been used by the defendant company without payment to General Squier.

Dispute Over Patent Dates

The telephone company in answer claims that multiplex telegraphy was in use long before 1911, that multiplex (phantom) telephony was also in use prior to 1911 (three conversations on four wires), that telephone and telegraph messages were transmitted on the same two wires, and also that prior to 1911 patents had been described embodying essentially the Squier principle. Further, the company contends that since Squier took out his patent under the act of 1883 he dedicated it to the public and that he made public statement to that effect. The company also contends that the invention was unusable and impracticable in 1911 because suitable amplifying equipment and other necessary apparatus were not available. Thus, the company contends, Squier did nothing to advance the art, and furthermore it is maintained that the company is not now using the things specified in what it terms the three fundamental claims.

In rebuttal General Squier's counsel contends that dedication to the public "was to any governmental purposes and no more." Further, General Squier's counsel points out, with regard to the practicability of the invention in 1911, that he had actually had the principle working "over a distance of seven miles of cable, telephone cable, through three telephone exchanges in the city of Washington . . . without the knowledge of the telephone company at all." This is cited as the first instance in the history of the world where multiplex telephony was practiced.

Connecticut Companies Carry Dispute to Commission

Proceeding against the Union Electric Light & Power Company of Farmington, Conn., the Hartford Electric Light Company has petitioned the Connecticut Public Utilities Commission to investigate an unexpired contract between the two companies on the ground that it discriminates in prices against other customers of the Hartford company through the unwillingness of the Union company to agree to an upward revision. The case is of great interest on account of the principles involved and has been heard at length by the board. The contract was signed in 1913 to expire in 1929. An adjustment because of post-war conditions was sought by the Hartford company but denied by the Union company on the ground that the latter would suffer serious loss of industrial power business if forced to increase its rates to offset higher prices for wholesale energy.

At the hearing the Hartford company intimated that the commission, if it finds the present prices discriminatory as compared with other schedules maintained by the Hartford company, should set these aside and order the Hartford company to substitute non-discriminatory rates, not exceeding the prices set forth in its regular schedule of rates on file with the board. The contract with the Union company carried step rates ranging from 4.5 cents down to 1.3 cents per kilowatt-hour, with a 40 per cent discount between 10 p.m. and 7 a.m. In December, 1920, the Hartford company put into effect a power schedule with steps ranging from 7 cents down to 2 cents per kilowatt-hour, the off-peak discount being continued. The Union company purchased 1,737,800 kw.-hr. from Hartford in 1922.

The commission ordered each company to file a brief. The authority of a regulative commission to set aside a contract between public utilities is involved in the case, and findings of the United States Supreme Court are cited.

"Empire Builder" Dies

Sir William Mackenzie of Canada Promoted Light and Power as Well as Railroads

THE death at Toronto on Dec. 5 of Sir William Mackenzie, whose name is inseparably linked with the building of both the Canadian Pacific and the Canadian Northern Railroads, his being the dominating force behind the latter enterprise, removed an outstanding figure in the development of the Dominion and hence of the British Empire. His more spectacular feats in the railroad field somewhat obscured his achievements in other lines of industry, but he was none the less one of the foremost Canadian promoters of electric railway and light and power companies.

As early as 1889 Sir William had become interested in electric railways and in power development, and for thirty years he was the head of the Toronto Street Railway. He became one of the promoters of similar enterprises in South America, now grouped under the head of the Brazilian Light, Power & Traction Company, which estimates its assets at $250,000,000. The holdings of the Brazilian company are the São Paulo Tramway, Light & Power Company, the Rio de Janeiro Tramway, Light & Power Company and the São Paulo Electric Company. Sir William, who was chairman of the board, was associated with Dr. F. S. Pearson, the famous English engineer who went down with the *Lusitania*, in the acquisition of these valuable franchises.

His Widely Scattered Interests

Later Sir William became largely interested in the Winnipeg (Man.) Electric Railway Company, which does a general light and power business, and he was also a director in the Shawinigan Water & Power Company and the Canadian General Electric Company. He was president of the Monterey (Mexico) Railway, Light & Power Company. For many years he was the senior partner of the world-known railroad-building firm of Mackenzie & Mann.

With the changes wrought by the war Sir William was forced, as he grew older, to drop many responsibilities. The Canadian Northern Railroad was ultimately taken over by the Canadian government, the Toronto railway by the city of Toronto, the Electrical Development Company, in the organization of which for the development of Niagara power he took an active part, was acquired by the Ontario Hydro-

Electric Commission, and thus the chief enterprises in Canada with which he had been concerned passed to others and the group of financiers of which Mackenzie was the head was dissolved.

Sir William was born in Kirkfield, Ontario, in 1849. He began life as a country schoolteacher.

News from the National Capital

Division of Public Works Will Be Set Up in Interior Department if Congress Consents—Governor Smith an Obstacle to Superpower Conference—Muscle Shoals and Colorado River

PROSPECTS, according to the Washington correspondent of the ELECTRICAL WORLD, favor the success of the Brown plan for the reorganization of the administrative departments of the federal government in so far as concerns the setting up of a Division of Public Works in the Interior Department and as it pertains to the Department of Commerce.

The main objection to the Division of Public Works comes from the Corps of Engineers of the army. The plan will include, however, provisions to insure the assignment of engineer officers to river and harbor projects and other public construction.

The major changes in the Department of Commerce have been agreed upon unanimously. The President has authority in law to move the technical bureaus in that department. The Attorney-General now is considering whether existing law does not authorize the transfer of all technical bureaus affected by the Brown plan by executive order. It is admitted, however, that legislation will be required to bring about the creation of the Public Works Division of the Interior Department.

So far as the remainder of the proposed reorganization is concerned, there seems little chance of putting it through. Once the heads of departments become wedded to the bureaus under their charge, it is very difficult to reach agreements as to transfers. The remainder of the reorganization plan, it is believed, must await some new administration. If it can be accomplished within the first three months of an administration's course, before it has settled in its tracks, reorganization can proceed smoothly, it is believed.

GOVERNOR SMITH OBSTINATE

Further discussions of superpower plans for the Northeast are being delayed by the Governor of New York. It recently was proposed that the Governor of each state concerned designate a representative to make up a committee to enter upon a study of legal and other questions involved. Despite the fact that the committee's work is entirely one of investigation, intended to throw light on the situation, Governor Smith is understood to be antagonistic to the idea.

An essential to the interconnection is that there be an absolutely free flow of power across state boundaries. While the decision of the Supreme Court in the West Virginia natural-gas case demonstrates that no direct barriers can be set up, it is recognized that the separate states must be in full sympathy with the plan, because otherwise indirect steps could be taken which would interfere with the plan being carried through.

NEW BIDDERS FOR MUSCLE SHOALS

The President's proposal of a joint committee to consider offers for Muscle Shoals is simply an effort to set up an agency which will have authority to negotiate. The regular committees of Congress are not organized with the idea of entering upon such activities.

It is known definitely that there are other bidders besides Henry Ford. This means that there must be intricate negotiations and thorough analyses of each bid. It is believed that the special joint committee idea provides the best means for determining which bid has most value to the public.

It is understood that Mr. Ford is not worried because of the sale of the Gorgas steam plant. He does not seem to be greatly impressed with the need of duplicating that structure at some other point on the Warrior River. The assurance upon which he will insist is that right-of-way for a transmission line be guaranteed by the government. Under the right of eminent domain no difficulty would be presented in furnishing such assurance.

ARIZONA STILL AGAINST COMPACT

No indication has come out of Arizona that ratification of the Colorado River compact is any nearer. The Governor of that state has another year to serve and apparently is willing to continue holding up all development on the entire river and to continue in jeopardy the lives of thousands of persons who are protected inadequately from floods.

New Company to Take Over the United Light & Railways

The United Light & Railways Company of Grand Rapids, Mich., announced on Tuesday in a letter to stockholders that it proposes to sell to a new company, to be known as the United Light & Power Company, the properties of the present company, in order to permit of the enlargement of its business through the raising of new money. The securities of the new concern will be distributed to stockholders of the present company in equitable proportion, according to classes and preferences in due course, the letter states. The new company will be organized under the laws of the State of Maryland.

Falls of Ohio Permit Issued

Goes to Louisville Hydro-Electric—Many Small Projects Acted on by Federal Board

A PRELIMINARY permit covering the development of power at the Falls of the Ohio River was issued by the Federal Power Commission on Dec. 4 to the Louisville Hydro-Electric Company, following the disapproval of a conflicting application from the city of Louisville. In line with this action the commission also denied the application of Louisville for preliminary permits covering proposed developments on the Cumberland and Green Rivers. The decision in this contest had been withheld to permit a thorough consideration of the priorities which are to be allowed municipalities under the water-power act and of the question whether or not municipalities are in a position to conduct the distribution and sale of power in areas out of their jurisdiction.

PROJECTS IN MANY REGIONS

The commission authorized the Pacific Gas & Electric Company to increase the height of its dam on Fordyce Creek, in Nevada County, Cal., by 47 ft., making possible an average increase of 5,500 continuous horsepower.

Preliminary permits were authorized for the Mineral Range Power Company of Columbus, Mont., covering a 1,500-hp. project on Woodbine Creek and Stillwater River; the Southern Idaho Land & Power Company of Weiser, Idaho, covering a diversion of surplus water from the Little Weiser River into the Crane Creek watershed; L. B. Perry of Bishop, Cal., covering a small project on Milner Creek in Mono County, and Ralph Bennett of Los Angeles, covering a 300-hp. project on Rock Creek.

The preliminary permit of the Northwestern Electric Company of Portland, Ore., for a project on the Lewis River was extended until Nov. 6, 1924; the preliminary permit of the Elmore Copper Company of Mountain Home, Idaho, was canceled, and the preliminary permit of the Utah Power & Light Company for its Bear River project was extended three months.

The development on the Rappahannock River at Kelly's Ford, 33 miles above Fredericksburg, proposed by George W. Lucas, was found not to come under the jurisdiction of the commission; but it took jurisdiction in a proposed development of the Public Service Company of Oklahoma involving a 25-ft. dam in the Grand River, of two projects of the Hydro-Electric Company of Harrisburg at Clark's Ferry and Millersburg on the Susquehanna River, and of a project of the Bowersock Mill & Power Company of Lawrence, Kan., to raise its existing dam in the Kansas River.

The Minnesota Utilities Company of Eveleth, Minn., was authorized to transfer to the Minnesota Power & Light Company of Duluth its license covering a transmission line in the Superior National Forest, and the Michigan Hydro-Electric Power Company of

Three Rivers received permission to transfer its license to the Michigan Gas & Electric Company of Ishpeming.

TENNESSEE AND SUSQUEHANNA BASINS

The commission has approved a preliminary permit in favor of Leroy Park of Greenville, Tenn., covering a proposed development on the Nolichucky River, 20 miles above the mouth of Pigeon River. The proposed dam will provide a pool extending as far up the river as the existing dam of the Eastern Tennessee Power Company and is of interest as a further demonstration of the value attached to the power resources of the Tennessee River basin.

A joint application has been received by the commission from the Juniata Power & Water Company and the Watts Power & Water Company of Harrisburg, Pa., for a preliminary permit covering a project in the Juniata River near its mouth. This is the site on which Gannett, Seelye & Carpenter, an engineering firm of Harrisburg, filed about a year ago. The new application proposes the construction of a dam near Losh's Run and the installation of four 2,000-kw. units. The applicants are both affiliated with the East Penn Electric Company, which operates in that region. J. G. White & Company made the engineering investigation.

WYOMING AND FLAMING GORGE

Notice has been served upon the Federal Power Commission that Wyoming would like to be heard before action is taken on the application of the Utah Power & Light Company for a license covering its Flaming Gorge projects. If the Flaming Gorge license is to be issued with a minimum of delay, it would be advisable, judging from similar cases handled by the Federal Power Commission, for the power company and the state authorities to reach an agreement prior to a request that the commission grant the license. This issue does not concern a state in the upstream group and a state in the lower basin, as grouped in the Colorado River compact, but involves two of the upstream states. Nevertheless, it is anticipated that the Federal Power Commission would be inclined to withhold any action until the states concerned could reach an agreement.

John A. Shaffer of Indianapolis has declared his intention to construct an 18-ft. dam in the Wabash River, 6 miles below Logansport, Ind. It seems probable that the Federal Power Commission will not take jurisdiction.

Washington Again Approaches Ottawa re St. Lawrence

Inquiries have again been made by the United States government of Canada as to the possible negotiation of a treaty which would permit construction of a deep waterway from the Great Lakes to the Atlantic by way of the St. Lawrence River. This was admitted at the White House in explanation of the statement made by President Coolidge in his message to Congress concerning "the development of the great power and navigation project of the St. Lawrence River." The project received the President's indorsement.

The White House announcement made no mention of any reply to the new inquiries of the American government, and it is presumed that the Canadian government has not yet forwarded its answer.

Saxton Plant Running

Penn Central Light & Power's New Station on Juniata River Is Formally Opened

FIVE hundred business, industrial and professional men and public officials from all over central Pennsylvania were guests on Dec. 7 of the Penn Central Light & Power Company of Altoona, Pa., at the formal opening of the company's new superpower plant at Saxton, Pa. They were taken to Saxton on a special train. A handsome folder containing airplane views of the plant and the cities in the district it will serve was distributed to the guests.

The Saxton plant, which is on a branch of the Juniata River, is 500 ft. long and 100 ft. wide. It is divided into two units, with a total rating of 12,500 kva., and is operated at a steam pressure of 275 lb. and a temperature of 750 deg. Fahr. The generating voltage is 13,700, which is stepped up to 45,000. The transformers and switching stations are designed to handle 110,000 volts when the plant is running at full capacity. Despite the low stage of the river at this time, the supply of water carried by natural fall to the boilers and condensers is ample to meet all needs. It is the intention of the company to build a dam at Saxton, thus assuring a plentiful stock of water when the plant is operated at full capacity. Automatic control permits the entire plant to be operated by twenty-five men.

Radiating from the plant are four transmission lines, two running to Cresson 25 miles away, and two to Lewistown, 55 miles distant. These lines are carried on 785 steel towers. Two smaller lines carry lighter loads to nearer communities.

Coal is brought from the company's own mine, 3 miles up the mountain. Forty carloads of fuel can be stored at a time, the coal being fed by automatic stokers. The coal is subjected to chemical tests and weighed to the ounce as it is fed to the boilers by automatic stokers, and the fires are maintained at a maximum intensity by forced drafts. The ashes are automatically conveyed outside the plant, special devices crushing the clinkers so that they will pass into the conveyors. One of the interesting features of the plant is the carrier-current telephone system over the transmission lines.

The Saxton plant was designed by Day & Zimmermann of Philadelphia and was put into partial operation several weeks ago.

Hoover Lauds Government's Technicians

Speaking before the Washington Society of Engineers last week, Secretary of Commerce Hoover, after a discussion of the department's efforts to promote steady, as opposed to spasmodic, conditions of employment and to eliminate waste, paid a tribute to the technical men in the government employ.

"The matter of recruiting skill for the government's technical staff is a very serious problem," he said. "In three important technical bureaus a recent analysis shows a turnover of from 30 to 40 per cent per annum. This would indicate to the average executive that his technical staff must be greatly underpaid. I know of no body of men as heroic as those in the scientific employ of the government. The ability of these men and their technical accomplishments make them very attractive to private enterprise. Some of them stay at a sacrifice simply because they believe in public service. It is not fair for any government to require sacrifices such as have been suffered by its technical employees during the last ten years."

New Jersey Public Service's Customer Ownership Plan

On Dec. 1 the Public Service Corporation of New Jersey began another customer ownership campaign for the sale of 100,000 shares of 7 per cent cumulative preferred stock. The stock will be sold entirely by the employees on the basis of not more than twenty shares to one person. A partial-payment plan has been devised for the benefit of those who desire to purchase but cannot pay for the stock outright. The corporation will accept \$10 a share as an initial payment and bill the purchaser \$10 a month thereafter. The par value per share is \$100.

Pit River Transmission Line Raised to 220 Kv.

On Nov. 16 last the Pacific Gas & Electric Company began actual operation of one of its Pit River circuits at 220,000 volts. Although the twin-circuit line was constructed for 220,000-volt operation, it was not actually cut over to this voltage until this time owing to the fact that the line capacity was not needed and because all parts of the second circuit were not ready.

The Pit River development, with its 202-mile, 220-kv. transmission, has attracted much attention in engineering circles because this was the first transmission line to be originally constructed for operation at that voltage. At the present time the second circuit is being operated at 110-kv. in parallel with the 220-kv. line, and this method of operation will be continued until such time as the additional capacity of the second line at 220 kv. is needed. This change will be made when the Pit River No. 3 plant, now under construction, is put in operation during the summer of 1925.

Utilities Commissioners Favor Uniform Accounting Forms

One of the subjects of interest to lighting companies considered at the recent meeting of the National Association of Railway and Utilities Commissioners at Miami, Fla., was a form for the annual report of electric and gas corporations. The committee last year presented its standard classification of accounts in final form, and it reported at Miami that twenty or more states have adopted this classification and that it is pending before several other states. The work of the committee this year was to consider the form and substance of an annual report for electric and gas corporations to be presented for adoption by all states, thereby making for uniform practice.

The report form is to be in two sections, the first a financial section and the second a statistical section. The committee submitted a form for the first section which it felt embraced the minimum requirements of any state commission. The committee has so far been unable to obtain complete unanimity of views on the second or statistical section on account of the diversity of requirements of state commissions and governmental bureaus.

It was recommended that the members of the commissions give careful consideration to the forms prepared for annual reports for electric and gas utilities and adopt them unless they are in conflict with existing statutes and also that the association cause to be copyrighted in its name the forms of the annual reports submitted by its committee.

Priest Rapids May Deliver 200,000 Hp. in 1928

A significant feature of the application of the Washington Irrigation & Development Company for a license covering its Priest Rapids development is the statement in the application that construction work is to start immediately upon the issuance of the license. The first block of 200,000 hp. is to be ready for delivery in four years.

Priest Rapids is on the Columbia River, half way between Spokane and Portland. The Washington Irrigation & Development Company purposes to build a dam 2½ miles long. The shore ends of the dam are to be of the earthen-wing type. In between will be the power-house section, which in itself will be 660 ft. long. It will provide for a 700-ft. future extension. There is to be a concrete spillway, with a leg extending along an island for five-sixths of a mile. In the spillway sector there are to be 127 gates, each 30 ft. long, with a capacity sufficient to discharge a flood of 1,200,000 cu. ft. per second, or more than five times the flow of the Niagara River. The largest flood of record at this point carried 710,000 cu. ft. per second. Thus a large factor of safety is provided.

A head of 70 ft. will be developed at this dam. Provision is made for two navigation locks and for a fishway. The initial installation will provide six 40,000 kva. and two 29,000-kva. turbo-generators. The ultimate installation will be ten additional 40,000-kva. units, thus providing for a possible future output of 698,000 kva. The initial installation will cost $28,000,000, while the project in its final form is expected to represent an outlay of $41,000,000.

New England Electrical Men Confer on Code

Representatives of all branches of the electrical industry in southern New England held a successful conference on Dec. 5 in the assembly hall of the Hartford Electric Light Company to discuss the meaning of the 1923 Electrical Code. Joseph P. Rohan, chief electrical inspector of the Hartford building department, presided, and Thomas H. Day, Hartford, long identified with electrical fire protection, answered inquiries based upon attendance at the meetings of the electrical committee of the National Fire Protection Association which resulted in the revision of the code in its present form. The meeting was held under the auspices of the Hartford inspection department and of the Western New England Association of Electrical Inspectors.

A. D. Colvin, general manager Hartford Electric Light Company, was chairman of the committee of arrangements, the secretary being O. A. Frederickson.

Federal Budget Asks $385,000 for Bureau of Standards

The budget which just has been submitted to Congress provides $130,000 to enable the Bureau of Standards to co-operate with government departments, engineers and manufacturers in the establishment of standards, methods of testing and inspection of instruments, equipment, tools and electrical and mechanical devices used in the industries and by the government. This includes the practical specification for quality and performance of such devices and the formulation of methods of inspection, laboratory and service tests. The sum will permit of some expansion of this work. The amount appropriated for the current fiscal year was $100,000.

For the investigation of standards of practice and methods of measurements for public utilities, such as electric light, electric power, gas, water, telephone, central-station heating and electric railway service, and the solution of the problems which arise in connection with standards in such service, the budget carries $105,000. This is an increase of $10,000.

For technical investigations in co-operation with industries upon fundamental problems involved in industrial development, with a view to assisting in the permanent establishment of new American industries, the budget carries $180,000. This is an increase of $30,000.

Pacific Coast Jobbers Asked to Support Organized Effort

An unusually interesting program was presented at the regular quarterly meeting of the Pacific Coast Division, Electrical Supply Jobbers' Association, held at Del Monte, Cal., on Dec. 6-8. A plea was made by W. L. Goodwin, operating vice-president of the Society for Electrical Development, for the support of the Pacific Coast in national organized effort in the industry. The Coast represents 10 per cent of the industry's gross sales, Mr. Goodwin said, and should therefore support 10 per cent of national organized effort and take its place in the national scheme. The tendency is for the Coast to decline the services of the rest of the country, he observed, but it might very properly go forward and ask for national aid right now in combating the municipal ownership menace.

W. L. Frost of the Southern California Edison Company spoke to clear up the misapprehension which has been current since his company announced its intention of going into the merchandising business on the first of the year. The company is faced with the problem of building up its gross revenue to the point where it was before the recent rate reduction, which cut its gross receipts $2,500,000 a year. A survey indicates that, on an average, there are now only two appliances to a home, and an attempt will be made to increase this to five. Only the larger load-building appliances will be sold, and there is no intention of selling washing machines or vacuum cleaners. All merchandise will be sold at retail prices and will be purchased through the regular jobbing houses. The company will co-operate with the contractor-dealers, and there should be enough additional wiring to keep them busy. Furthermore, they will benefit from the interest aroused in appliances.

Southern Edison Announces Merchandising Policy

At a recent meeting of contractor-dealers in its territory the Southern California Edison Company of Los Angeles announced that it had finally determined to sell appliances as a load-building policy. In the year 1922 thirty thousand new residence consumers were added to the company's lines. This year, owing to the great activity in home building, about forty thousand new homes have been connected, and it is expected that fully this number will be reached in 1924.

In order to take advantage of the new market thus opened up as well as of the possibilities of increased consumption suggested by the recent rate reductions of the company, the Edison company said that it plans to sell certain popular appliances using 500 watts to 600 watts, retailing them at list prices. The company will also co-operate with the dealers in developing the sale of motor-driven appliances.

Serving Duluth District

Plants Now Operated by Minnesota Power & Light Are Rated at 86,575 Kva.

THE newly organized Minnesota Power & Light Company, which is controlled by the Electric Bond & Share Company, owns and operates an important system of electric power and light properties in an extensive territory in eastern and northern Minnesota. It also owns all the capital stock, except directors' shares, of the Great Northern Power Company and operates under lease the properties of that company, including its Duluth system. The electric transmission lines of the company extend north from Duluth to the Mesaba iron range, a distance of approximately 65 miles, and thence east to the Vermilion iron range, a distance of about 50 miles. The transmission system also extends south from Duluth, through Carlton and Pine Counties, a distance of approximately 65 miles. Including Duluth and Superior, forty-four cities and towns are served directly or indirectly—the total population being estimated at 250,000—besides mines and other large power users.

The Minnesota Power & Light Company operates electric generating plants having a total installed generating capacity of 86,575 kva., including 11,000 kva. under construction. Of this total capacity 73,475 kva. is hydro-electric and 13,100 kva. is steam. The proposed capacity of these plants is 121,300 kva. The companies own in fee power sites for the generation of 26,800 kva., which, when developed, will give, together with the proposed capacity of existing plants, a total installed generating capacity of 148,100 kva. The principal generating station operated by the Minnesota Power & Light Company is the Thomson hydro-electric plant on the St. Louis River, which has a present installed generating capacity of 54,000 kva. and a proposed capacity of 68,000 kva. This plant is leased from the Great Northern Power Company.

The Fond du Lac hydro-electric plant, now being built by the Minnesota Power & Light Company, which will have an initial capacity of 11,000 kva. and an ultimate capacity of 22,000 kva., is also on the St. Louis River, immediately below the Thomson plant. At the eastern end of the Vermilion iron range and the northeastern limits of the territory served by the company is the Ely hydro-electric plant. This plant is designed for 10,000-kva. generating capacity, of which 4,000 kva. has recently been completed and placed in operation.

The transmission lines operated by the Minnesota Power & Light Company aggregate 556 miles in length, including 51 miles of 110,000-volt line recently constructed between the Virginia plant and the new Ely hydro-electric plant to serve the eastern portion of the Mesaba iron range, the Vermilion iron range and adjacent territory. There is now under construction a 110,000-volt line, 65 miles in length, extending from the Thomson generating station north to the Mesaba iron range district, which will supplement the line now in operation between these points, and a line 25 miles in length from the Ely station west over a portion of the Vermilion iron range to Tower. Both of these lines will shortly be in operation.

The facilities of the Minnesota Power & Light Company will be steadily enlarged to provide for the rapidly growing power requirements of the territory served. An issue of $8,300,000 of 6 per cent bonds is now being floated to facilitate expansion.

TERRITORY SERVED BY MINNESOTA POWER & LIGHT AND GREAT NORTHERN POWER SYSTEMS, SHOWING EXISTING AND PROJECTED POWER STATIONS

Span of 4,402 Ft. on California Transmission Line

Although figures are not available as to record spans in line construction on wooden structures, the San Diego (Cal.) Consolidated Gas & Electric Company believes a record will be made when a new 11,000-volt line to Alpine which it is building is completed. On this extension will be erected two spans which will surpass the previous record made by that company.

The Alpine transmission line will have one span of 4,402 ft., followed immediately by another of 3,397 ft., both of which will exceed the 3,069-ft. Mission Valley span. The engineers of the company at first hoped to combine the two spans in one of nearly 8,000 ft., but contour conditions prevented the carrying out of this plan.

The two long spans will be pulled on three-pole structures to a tension estimated at 9,000 lb. Extra-galvanized special-high-strength $\frac{7}{16}$-in. steel-strand cable will be used. A difference of elevation of 108 ft. exists between the structures at each end of the first span.

Exceedingly difficult line construction conditions have been resourcefully met by the crews of the San Diego Consolidated Gas & Electric Company. An air compressor mounted on a special truck was driven over untracked brush country to within 900 ft. of the center structures of the long spans and air under pressure was piped to the crews digging the pole holes. In solid rock the pneumatic drills aided materially in the speed of sinking pole and anchor holes.

Federal Bureaus Report

Work on Electrical Statistics by Census Bureau—Standards Bureau's Aid to Electrical Art

EXPANSION of foreign trade, the greatly improved statistical service now rendered, progress in the elimination of waste, conferences with commercial and industrial committees, fuel distribution and many other activities are dwelt upon in the annual report of the Department of Commerce, just transmitted to Congress. Needed legislation is outlined.

Secretary Hoover's recommendations concerning the radio situation were noticed in the ELECTRICAL WORLD last week. Under the head of "Electrical Industries" the included report of the Bureau of the Census says:

The canvass for the collection of data concerning the operations of central electric light and power stations, electric railways, telephones and telegraphs was started promptly with the beginning of the calendar year 1923. The field work was practically finished by the close of the fiscal year, and we hope to publish the results before Jan. 1, 1924, thus making another record in the completion of a big investigation. Peculiar importance is attached to this inquiry, as the results will be used at the World Power Conference to be held in London, England, during next July. The figures will show the increase during the last five years in the use of electricity in the United States for light, power and other purposes.

It is regretted that the appropriations for this inquiry have never been sufficient to enable the bureau to collect data concerning the operations of isolated light and power stations. While the isolated stations are not engaged in the production of electricity for sale, and are operated primarily for the benefit of the activity with which they are connected, such as hotels, factories, mines, mercantile establishments, vessels, private residences, etc., many of them are very large and have a much greater kilowatt capacity than many of the central stations that are covered by the census. There are undoubtedly a greater number of these isolated plants than there are commercial stations, and their inclusion in the census would add greatly to the value of the statistics.

ELECTRICAL STANDARDIZATION

Another included report is that of the Bureau of Standards, which says, under the caption "Electricity":

Particular attention has been paid during the past year to the revival of fundamental investigations, such as the fundamental measurements of resistance, the ratio of the international to the absolute henry and the use of the absolute electrometer for high voltages.

The importance of the electrical work of the bureau in the industries is well illustrated by the lamp inspections, through which the government's purchases of incandescent electric lamps are controlled, and the investigation and testing work on electric batteries, of which a large amount is now being carried on. Although the government's purchases of electric lamps were smaller than usual this year, no less than 1,706 lamps, representing orders totaling 1,660,000, were subjected to life tests.

Radio communication is assuming a place of the first importance in the electrical field, and naturally a large part of the time of the division has been devoted to radio subjects. The bureau is endeavoring to aid in the commercial standardization of radio equipment, a progressive step of great importance and for which an excellent opportunity exists in this field owing to the newness of the entire subject. Progress has been made in the development of precise frequency measurements and other investigations connected with the reduction of radio interference. The work on electron tubes and insulating materials will have a most important industrial application.

The mitigation of electrolytic corrosion is a serious question in many localities, and the work which has been carried out, and which includes not only actual field surveys but also the development of an improved earth-current meter, is of very great importance.

In connection with safety codes, important progress has been made in preparation of new editions of the National Electrical Safety Code.

A revision of the bureau's circular on electric service standards has been taken up, and a complete survey of electric lighting conditions throughout the entire country, with the ultimate object of standardizing equipment of this kind, is now well advanced.

Brief News Notes

An Old Friend Reappears.—Among the flood of resolutions introduced into the House as the new Congress met was one by Representative Browne of Wisconsin asking for a commission to select an electromechanical voting system for quickly recording the votes of members, at a cost not to exceed $300 per member. The resolution carried an appropriation of $130,500.

Two Newfoundland Companies Are Merged.—The Newfoundland Light & Power Company has been purchased by the United Towns' Electric Company, Ltd., of Carbonear, Newfoundland, of which J. J. Murphy of St. Johns, Newfoundland is president. The United Towns company has a hydro-electric plant at Victoria Village and already lights twenty-seven villages on the island.

Oklahoma Express Company Purchases Electric Trucks.—The American Express Company of Oklahoma City intends to replace all its horse-drawn transportation in that city with electric trucks. New trucks valued at $100,000 have been purchased for immediate delivery and the construction of a battery-charging station is under way. The Oklahoma Gas & Electric Company will furnish electrical energy. Oklahoma City will be the first city west of the Mississippi River where the express company will have electric equipment exclusively.

To Celebrate Anniversary of Henry's Birth.—The one hundred and twenty-fourth anniversary of the birth of Joseph Henry is to be celebrated by radio on Monday next, Dec. 17. Brief addresses sketching his career will be broadcasted from Schenectady and Troy, N. Y., and the ringing of the small bell, now in the New York State Museum at Albany, which Henry used in his electromagnetic and telegraphic experiments will be heard by listeners to the programs from the stations named.

Southern Sierras to Purchase Holton Power Company—The Holton Power Company, supplying light and power in the Imperial Valley of California, has applied to the California Railroad Commission for permission to sell its properties to the Southern Sierras Power Company. It is proposed by the terms of purchase that the latter company shall pay $2,286,124 for the business, properties and assets of the Holton Power Company, with the exception of its ice-manufacturing property.

New Alaskan Cable to Transmit a Hundred Words a Minute.—Laying of the new 1,800-mile Alaskan cable will be begun by the middle of April and finished before the end of next summer. The successful bidder for the cable was the firm of Siemens Brothers & Company of London, whose bid was $1,250,000. The new cable will permit the transmission of one hundred words per minute. This is five times the capacity of the existing cable. The cable is designed to last one hundred years. No submarine cable is manufactured in the United States, it is explained, for the reason that the essential guttapercha is controlled entirely by European manufacturers.

Staley Electric Railway Project Disapproved by I. C. C.—The Staley System of Electrified Railways has been denied authority by the Interstate Commerce Commission to construct 1,307 miles of electrified railroad in southern California, Arizona, New Mexico, Colorado and Utah. Sixty-six miles would be in Mexico. The estimated cost of constructing the entire 1,307 miles was $76,024,236, including $6,000,000 for terminals on the Gulf of California. The applicant's estimate of traffic and revenue for the first year of operation was 2,274,732,417 ton-miles of freight and $45,087,550 of freight revenue. The commission regarded the estimates of revenues as excessive and held that there was no public necessity for the proposed line.

Southern Sierras and San Diego Companies Interconnect.—The Nevada-California Electric Corporation has placed in service a system whereby its subsidiary, the Southern Sierras Power Company, will maintain an interchange of electric power with the San Diego Consolidated Gas & Electric Company, safeguarding both interests against interrupted service. The transmission line over which the interchange of power will be carried extends from the Nevada-California's southern distributing station at El Centro to San Diego, a distance of 80 miles. Heretofore the Nevada-California's nearest source of electrical energy to El Centro and the Imperial Valley was the company's steam generating plant at San Bernardino, a distance of 175 miles.

Growth of Community Power & Light Company.—The Community Power & Light Company, a holding concern which, through its subsidiaries, serves thirty-one communities in Missouri, Kansas, Arkansas and Texas having a population in excess of 100,000, is floating bonds in order partly to finance acquisition of the Central Texas Ice, Light & Water Company, serving seven communities in or adjoining Limestone

County, Tex., and the Central Texas Ice & Light Company, serving seven communities in or adjoining Falls County, Tex., together with an ice plant at Helena, Ark., and substantial plant and transmission-line extensions in Kansas, Texas and Arkansas.

Contest for High-School Essays on Utility Regulation.—The Northwest Electric Light and Power Association has announced a scholarship prize, to be competed for by seniors in the high schools of the state and to be awarded each year for the best essay on the topic "State Regulation of Public Utilities." The prize will be a four-year university course in any of the public or accredited private institutions of higher learning in the state and will be in the sum of $250 a year.

Washington Superpower League Organized.—At a meeting of public ownership advocates in Tacoma recently an organization was effected under the name of the Washington Superpower League and adopted plans for a statewide campaign to pass at the November election next year a state initiative bill giving municipalities and larger districts authority to operate public power plants. The meeting approved the general principles of the power bill drafted by Councilman Oliver T. Erickson of Seattle, designed, its promoters say, to conserve the water power of the state while promoting public development of hydro-electric plants. It was agreed, however, to omit from this bill the provisions authorizing public operation of telephone systems by municipalities or larger public units.

Progress in Honolulu.—Plans for the expenditure of $1,250,000 for improvements to its power plant and transmission system have just been approved by the board of directors of the Hawaiian Electric Company of Honolulu. This proposed expenditure is exclusive of $500,000 for the erection of a new office building. The capacity of the power plant is to be increased 35,000 kva. A new 12,500-kva. steam-turbine unit and two additional 826-hp. boilers with modern auxiliaries will be installed, and a reinforced-concrete smokestack, 226 ft. high, will be erected. The company has entered into a three-year contract to furnish power for operating the lines of the Honolulu Rapid Transit Company. New power lines in the sugarcane plantation and other industrial districts of the island of Oahu are to be built. Extensions of the power distribution system in Honolulu alone will cost $150,000. There are now substations at Kaimuki and Manoa. A new one will be built at Waikiki.

Middle West Acquires Wisconsin Properties' Stock.—The Middle West Utility Company has acquired the entire outstanding common capital stock of the United Utilities Company, Lena, Ill. This utility serves twelve communities in the northwestern part of Illinois. It owns all of the bonds and common stock of the Wisconsin Utilities Company, a Wisconsin corporation serving ten communities in south central Wisconsin. The gross earnings of these two companies for 1923 will approximate $300,000. Two transmission lines rated at 33,000 volts are now being constructed from Orfordville, Wis., to Monroe, and from Freeport, Ill., to Lena. When these lines are completed the properties of the Illinois Northern Utilities Compay and those now served by the United Utilities and Wisconsin Utilities companies will be interconnected with the properties owned and operated by subsidiary companies of the Northwest Utilities Company. All the companies involved will thereafter be able to avail themselves of the interchange of hydro-electric and steam power.

Denounces Diversion of Lake Michigan Water.—An animated discussion of the diversion of water from Lake Michigan to the Chicago Drainage Canal took place at the meeting of the Rivers and Harbors Conference held at Washington last week. Mayor C. A. Maguire of Toronto declared that the Sanitary Commission of Chicago was appropriating about 14,000 cu.ft. of water a second to the great injury of Canadian shipping and power developments and in violation of the international treaty. He said he believed the United States government would take drastic action in the matter as soon as the Supreme Court gives its decision in litigation now pending. William G. Bruce of Milwaukee supported the attack, maintaining that the Drainage Canal was being maintained not so much for sanitary as for power purposes. Col. Robert I. Randolph of Chicago and Gardner S. Williams of Ann Arbor, Mich., on behalf of Chicago, claimed that the health and lives of three million people depended upon the continued operation of the Drainage Canal. They said the slight diminution in the lake levels was negligible and that Chicago is ready to restore the levels by erecting at her own expense dams and weirs in the St. Clair and Niagara Rivers.

Institute Prizes Awarded.—The two prizes established by the board of directors of the A. I. E. E. in 1921, each consisting of $100 in cash and a suitable certificate, have been awarded for the current year by the committee in charge as follows: The prize for the best paper on transmission to R. J. C. Wood for his treatise on "The 220-Kv. Transmission System of the Southern California Edison Company and Some 220-Kv. Researches"; the "first-paper prize," for the best paper by a member who has never before presented a paper at a meeting of the Institute or any of its sections, to C. H. Van Asperen for his treatise on "Mechanical Forces on Busbars Under Short-Circuit Conditions." Honorable mention in the transmission prize award went to H. B. Dwight for his paper on "Electric Characteristics of Transmission Lines," and in the first-paper prize award to E. B. Shand for his paper on "An Analytical Investigation of the Causes of Flashing of Synchronous Converters." The prizes will probably be presented at the Philadelphia meeting of the Institute in February.

Associations and Societies

Tennessee Association of Electragists.—This body has elected these officers: President, D. L. Nicholson, Nashville; first vice-president, C. E. Terrell, Chattanooga; second vice-president, J. G. Cason, Knoxville; third vice-president, R. L. Clift, Memphis; secretary and treasurer, J. A. Fowler, Memphis.

Providence Engineers to Hear History of Electric Light.—Before the monthly meeting of the Providence Engineering Society on Dec. 18, Henry Schroeder, engineer Edison Lamp Works of General Electric Company, Harrison, N. J., and author of the "History of Electric Light," published by the Smithsonian Institution, will speak on the "Historical Developments of the Incandescent Electric Lamp."

Coming Section Meetings of the A. I. E. E.—Meetings of Institute sections for next week are announced as follows: Syracuse, Dec. 17, "Electrical Development in Retrospect," Paul M. Lincoln; New York, Dec. 19, "Human Engineering," Prof. Franklin H. Giddings; Worcester, Dec. 20, "Industrial Control and Applications Thereof," William C. Gates. In Pittsburgh on Jan. 15 Noble Jones, general manager of the West Leechburg Steel Company, will describe the recent electrification of that company's works.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

American Physical Society—University of Cincinnati, Cincinnati, Dec. 27-29. H. W. Webb, Columbia University, New York City.

American Engineering Council (F. A. E. S.)—Washington, Jan. 10-11. L. W. Wallace, 26 Jackson Place, Washington.

Kentucky Association of Public Utilities—Seelbach Hotel, Louisville, Jan. 10-11. E. F. Kelly, Louisville Railway Company.

Wisconsin State Association of Electrical Contractors and Dealers—Pfister Hotel, Milwaukee, Jan. 17-19. H. M. Northrup, 23 Erie Street, Milwaukee.

Technical National Section, N. E. L. A.—Birmingham, Jan. 28-Feb. 1.

Western Association of Electrical Inspectors—Hotel Fontenelle, Omaha, Jan. 29-31. W. S. Boyd, 175 West Jackson Blvd., Chicago.

American Institute of Electrical Engineers—Midwinter convention, Bellevue-Stratford Hotel, Philadelphia, Feb. 4-8. F. L. Hutchinson, 33 West 39th St., New York.

Commercial National Section, N. E. L. A.—St. Louis, Feb. 27-28.

Recent Court Decisions

Workman Who Falls on Wire of Which He Knows the Existence and Danger Is Negligent.—In Bouchon vs. New Orleans Railway & Light Company a widow sued for damages because of the death of her husband, a painter who was killed when he fell across a heavily charged electric wire belonging to the company which stretched across a roof on which he was working. Evidence showed that the decedent knew of the existence of the wire and of its dangerous nature, and that he had replied to a shouted warning, "Damn the wire!" The Supreme Court of Louisiana therefore held that contributory negligence was clearly established and sustained the trial jury in finding for the company. (97 So. 587.)*

Orders of North Dakota Commission Reviewable as to Law and Facts.—In a rehearing, at the instance of the state, of the case originally brought by the Hughes Electric Company of Bismarck against the Board of Railroad Commissioners of North Dakota (ELECTRICAL WORLD, Sept. 15, page 561), the Supreme Court of that state reaffirmed the constitutionality of the public utilities act, declaring it not void as vesting legislative or judicial powers in administrative officers and holding that it did provide for a judicial review of both law and facts. In its finding the court defined the word "hearing" as meaning not only the privilege to be present when a matter is being considered, but the right to present contentions and to support them by proof and argument. (195 N. W. 292.)

Wholesaler of Electrical Energy Is Public Utility.—An electric power company which wholesales its product is a public utility and, under the terms of the statute, must furnish monthly reports covering its operations according to the finding of the Supreme Court of Oklahoma in Southern Oklahoma Power Company vs. Corporation Commission. The power company had declined to make monthly reports as directed by the commission, asserting that it was not a public utility inasmuch as it did not distribute its output, but furnished energy to other companies for distribution to consumers. In its decision upholding the commission the Supreme Court said: "The statute does not require that the corporation furnish the commodity to the public, but if it furnishes a commodity for the purpose of that commodity being delivered to the public for the production of heat, light or power, it comes within the statute defined in the order of the commission."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

"Public Necessity" Defined. — Sustaining a decision of the Illinois Commerce Commission which was contested by the Wabash, Chester & Western Railway Company, the Supreme Court of Illinois said that a court was not authorized to put itself in the place of the commission, try a question anew and substitute its judgment for that of the commission, which could be set aside only if arbitrary, unreasonable or in clear violation of law. The court further observed that when the statute requires a certificate of public convenience and necessity as a prerequisite to the construction of a public utility the word "necessity" is not used in its lexicographical sense of "indispensably requisite," but that any improvement which is highly important to the public convenience and desirable for the public welfare may be regarded as necessary. "If it is of sufficient importance to warrant the expense of making it, it is a public necessity." (141 N. E. 212.)

Commission Rulings

Company's Rates in One State Not Conclusive for Another.—Declining to allow the Indiana & Michigan Electric Company an increased minimum charge for electric cooking and heating, the Michigan Public Utilities Commission said enough evidence had not been produced to warrant the change and that it could not be approved merely upon the ground that such a minimum charge was applied in territory served by the utility in Indiana.

Service Extension Into Occupied Town Permitted.—The Bangor (Me.) Railway & Electric Company has been authorized by the Maine Public Utilities Commission to extend its service from Orrington to North Bucksport. The Central Maine Power Company already supplies electricity to the Bucksport section of the municipality, but declared to the commission that it does not desire to extend its service further in the town. The commission finds that public convenience and necessity require that a second public utility be authorized to furnish service in the locality.

Bonuses and Royalties Paid by Utility Company to City Are Disapproved.—In determining rates for the Helena Light & Railroad Company, which operates electric light and power, electric railway and gas departments, the Montana Public Service Commission ordered to the extent of its jurisdiction in the premises the relief of the company from the payment of bonuses or royalties to the city of Helena. The commission said: "With respect to the request for relief from the payment of bonuses or royalties to the city, accrued and to accrue, we have long held the opinion that these bonuses exacted an unlawful discrimination in rates from the patrons of the three utilities. It is true that the patrons of any public utility are charged rates constructed to include the company's taxes, but the bonuses and royalties prescribed in the several franchises of this company can hardly be said to be taxes, and even if so, they are taxes above and beyond the ordinary city, county, state and federal taxes, which the company pays in addition to these franchise bonuses. To their extent they simply increase the burden which the patrons of the utilities bear. As far as the street-railway and gas franchises are concerned, the bonuses cannot be said to rest on any sound principle, for those two franchises do not return the company a profit, but on the contrary entail a direct loss in performance of the franchise obligations. These bonuses provide a method whereby the city reaches into car riders' and gas and electric patrons' pockets to secure revenues in addition to the revenues collected by ordinary taxes. These relatively small groups are bearing a double burden."

Competition Between Public Utilities Undesirable.—In refusing to permit the operation of motor vehicles in competition with the street railway of Portland, the Maine Public Utilities Commission said: "Competition, which brings life and force and incentive to ordinary industry, cannot truthfully be said to be invariably desirable in the conduct of public utilities, which in their nature, although owned by private individuals, are dedicated to the use of all the citizens of the community and governed in many ways by the state itself. Public utilities must of necessity be limited in number in any given community in order to attract capital for maintenance and development. There may be exigencies when competition must be the exception to the rule, for industry must not wither by the slothful enterprise of existing utilities."

Inspection of Changes in Wiring of Plants.—A complaint alleging discrimination was made against the Commonwealth Edison Company by one Tegtmeier, who complained that six months' permits were issued to licensed electricians employed at various factories and other places, these licenses giving to such concerns the right to make alterations and receive service through meters theretofore installed, pending an inspection by the Chicago electrical department. The complainant asked that either this practice be discontinued or that energy be furnished by the company at any or all places where the complainant might install electric wiring without a city license or inspection. The Illinois Commerce Commission said that it was clear that some rule should be in vogue which would permit industries using electrical energy to make a change in wiring without first obtaining a permit, otherwise industries would often have temporarily to shut down.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

H. G. Taylor Elected President of Utilities Commissioners

Henry G. Taylor, chairman of the Nebraska State Railway Commission, was elected president of the National Association of Railway and Utilities Commissioners at the convention held last week in Miami, Fla. Mr. Taylor was elected a member of the Nebraska State Railway Commission in 1913 and has been associated with the commission continuously since that time, having been made chairman in January, 1920.

Throughout his entire membership he has been very active in commission work and in promoting the interests of the national association which he has just been elected to head. Mr. Taylor is a native of Nebraska, but spent his boyhood in Kansas. For a time he engaged in the newspaper business in Almena, Kan., and subsequently became the owner and publisher of the *Central City Nonpareil* at Central City, Neb. He spent approximately twelve years in the publication of this newspaper and during this time served as representative from Merrick County, Neb., in the 1911 Legislature. At the present time Mr. Taylor is general chairman of the Central Western regional advisory board of the American Railway Association.

D. H. Beardsley has been made district superintendent of the Consumers' Power Company at Alma, Mich., succeeding Paul T. Woodworth.

Paul T. Woodworth, who has been district superintendent of the Consumers' Power Company at Alma, Mich., for the past five months, has been transferred to Grand Rapids.

L. P. Sweatt, Jr., formerly district manager of the Alabama Power Company at Montgomery, has been appointed manager of the southern division to succeed Mr. Barry, with headquarters at Montgomery.

B. F. Bramble, for many years auditor of the Illinois Traction System, has been appointed comptroller of the North American Light & Power Company, according to an announcement made by William A. Baehr, president of the company. Mr. Bramble will divide his time between the Chicago and Champaign offices of the North American company.

Henry E. Rilling, for many years connected with the security and advertising departments of the Wisconsin Power, Light & Heat Company at Madison, has given up that post to become associated with the Eastern Wisconsin Electric Company at Sheboygan. Mr. Rilling will immediately be placed in complete charge of customer ownership sales and advertising promotional work.

Charles McKinley Saltzman, New Chief Signal Officer, U. S. A.

Col. Charles McKinley Saltzman, who has been named to succeed Major-General Squier as Chief Signal Officer of the army, as was announced in the Dec. 8 issue of the ELECTRICAL WORLD, was graduated from West Point in 1896 and was assigned to the First United States Cavalry. After service in the Spanish-American War he was appointed captain in the Signal Corps in 1901, and later in the Philippines he was assigned to duty as signal officer on the staff of Major-General Wood, commanding the Department of Mindanao, where he had charge of the maintenance of all land and ocean cable lines.

C. McK. SALTZMAN

When he returned to the United States in 1905 Major Saltzman was assigned to the United States Army Signal School at Fort Leavenworth as senior instructor and had charge of the electrical instruction of officers. From 1908 to 1913 he was in charge of the electrical division of the Signal Corps in the War Department at Washington, with supervision over the design of radio and other electrical equipment used by the Signal Corps and in the fire control systems of the Coast Artillery.

In 1915 Colonel Saltzman was sent to Panama as the army signal officer and had general charge of the installation of the radio, telegraph and telephone systems on the Canal Zone. On the outbreak of the late war he was recalled to Washington and made executive officer in the office of the Chief Signal Officer of the army. In 1919 he was awarded the distinguished-service medal for exceptionally meritorious and conspicuous service.

Newton Jackson, who is at present serving the Newport (R. I.) Electric Corporation in an advisory capacity, has recently become a member of the engineering staff of Sanderson & Porter, New York.

G. Ross Henninger, formerly in the supply engineering department of the Westinghouse Electric & Manufacturing Company, has become protection engineer for the Southern California Edison Company, Los Angeles.

David C. Hopper, for the past four years connected with the Northern Ohio Traction & Light Company as distribution engineer, has resigned to become assistant to the general superintendent of distribution of the Duquesne Light & Power Company, Pittsburgh.

J. N. Helpbringer, who recently resigned the position of general superintendent of power of the Kansas Gas & Electric Company, has been made general superintendent of the Staten Island Edison Corporation, the management of which has been recently acquired by the J. G. White Management Corporation.

Edward B. Hook, Jr., has been made manager of the Atlanta office of Lockwood, Greene & Company, engineers, succeeding Robert Barnwell, who has been transferred to Spartanburg, S. C. Mr. Hook is a native of Georgia and spent four years at the Georgia School of Technology.

E. J. Rosenauer, formerly general auditor of the Southern Colorado Power Company, has resigned to become assistant treasurer and general auditor of the Wisconsin-Minnesota Light & Power Company, with headquarters at Eau Claire. Mr. Rosenauer has been connected with the Byllesby interests for sixteen years.

Walter N. Ballou has been appointed manager of the transportation division of the Atlanta office of the Westinghouse Electric & Manufacturing Company and has charge of the light and heavy traction business of the company in that territory. In addition to handling the street and interurban railway business of the company in Atlanta since 1919, Mr. Ballou has done considerable central-station work.

Prof. Rich D. Whitney, head of the department of electrical engineering at Syracuse University and consulting engineer for the Bureau of Gas and Electricity of the city of Syracuse, was elected chairman of the committee authorized by the recent conference of mayors and other city officials of New York State to study street lighting. Professor Whitney is also chairman of the Syracuse Section of the American Institute of Electrical Engineers.

E. P. Winter is now vice-president of the Midwest Power Company, St. Paul, succeeding Jesse A. Gregg.

F. A. Rothier is now president of the Toledo, Bowling Green & Southern Traction Company, Findlay, Ohio, succeeding William Goepper.

A. S. Coleman, manager of the Alabama Power Company at Gadsden, has been made district manager at Montgomery.

W. Yerby has been made superintendent of district of the municipal water and light department at Wynnewood, Okla., succeeding O. P. Sammons.

B. T. Green has been made engineer of power station of the California Oregon Power Company, at Klamath Falls, Ore., succeeding C. C. Ragan.

H. W. Thomas has been made engineer of power station of the Coast Power Company at Tillamook, Ore., succeeding G. J. Grubb.

E. W. Legier, sales engineer with the American Blower Company, Detroit, has been made district manager of the company at St. Louis.

R. V. Worthing has been made local manager of the Clarion division of the Northern Iowa Gas & Electric Company, succeeding A. C. Jones.

L. B. Fauver, formerly secretary of the Oberlin (Ohio) Gas & Electric Company, has been made president of the company, succeeding Hugo Wurdack. E. G. Crawford is the new secretary.

Ernest B. Millar, formerly associated with the English Electric Company of Australia, is now connected with the Electrical Plant Manufacturers, Ltd., New South Wales, Australia.

Alexander Nyman, formerly engaged in engineering development work for the Westinghouse Electric & Manufacturing Company, has been made director of engineering with the Dublier Condenser & Radio Corporation, New York.

J. Harrison Belknap, formerly assistant professor of electrical engineering at the Oregon State Agricultural College, has joined the control engineering division of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Dr. Lee De Forest, inventor of the audion, was the guest of honor at a gathering of the Institute of Radio Engineers held in the Engineering Societies Building, New York, on Wednesday evening, Dec. 12. Dr. De Forest was presented with the Institute honor medal for 1922, awarded him for his invention.

Charles Hearn is now president of the municipal electric light plant at Amherst, Ohio, succeeding Henry Arndi.

R. C. Smith, advertising manager of the *Journal of Electricity*, a McGraw-Hill publication, has resigned to become advertising manager of the Pelton Water Wheel Company, with offices in San Francisco. Mr. Smith has been advertising manager of the *Journal of Electricity* since 1920, when he was transferred to San Francisco from the New York office of the McGraw-Hill Company.

William Porter White has been appointed to act as personal assistant to M. O. Troy, new executive assistant manager of the central-station department of the General Electric Company. Mr. White has been associated with the company since 1906, when he entered the student test course at the Pittsfield works.

Sir Alexander B. W. Kennedy, Consulting Engineer

Sir Alexander B. W. Kennedy, senior partner in the firm of Kennedy & Donkin, consulting engineers, is one of the foremost British engineers of the day. He was born in Stepney in 1847

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SIR A. B. W. KENNEDY

and was educated at the City of London School and the Royal College of Mines. In 1874 he was appointed professor of engineering in University College, London, where he established the first engineering laboratory, and when in 1889 he relinquished the duties of this office to engage in consulting engineering he received from the council of the college the honorary title of emeritus professor of engineering. In 1887 he was elected fellow of the Royal Society, and he received the honorary degree of doctor of laws from the University of Glasgow in 1894. Sir Alexander has designed electric light and power plants in many large cities, including Edinburgh, Manchester and Calcutta, and has served as chief engineer to the Westminster Electric, Central Electric and St. James and Pall Mall Electric Supply Companies and as consulting electrical engineer to the London & North Western and the London & South Western Railways and the London County Council. He is the author of several books on mechanics and kindred subjects and is a past-president of the Institution of Civil Engineers and of the Institution of Mechanical Engineers.

C. W. Thompson is now president of the Athens (Ohio) Electric Company, succeeding P. C. Morris.

G. T. King has been made engineer of power station of the Lancaster (S. C.) Light & Power Company, succeeding G. F. Floyd.

R. R. Knoerr, formerly connected with the generator design department of the General Electric Company at Lynn, Mass., is now engaged in electrical contracting with the firm of Knoerr & Fischer in Milwaukee.

Frank M. Kirby, formerly superintendent and estimator of the Edwards Electrical Construction Company, New York, has become a member of the firm of Kirby-Hellman with offices in New York.

P. E. Matteson, formerly president and general manager of the Tidewater Electric Company, New York, is now sales manager for the Inter-Mountain Electric Company, Salt Lake City, Utah.

Louis H. Hyde, for the past four years associated with the General Electric Company, has become power engineer for the Western Electric Company, Cicero, Ill.

James R. Cravath, formerly Chicago editorial representative for the ELECTRICAL WORLD, is now president of the Pioneer Electric Company, Richmond, Cal. Mr. Cravath is also doing consulting engineering work.

George A. Maher, for many years manager of the Kenosha plant of the C. M. Hall Lamp Company, Detroit, has been elected to the vice-presidency of the company. He will succeed L. T. Buchanan, who has served as vice-president of the company since its organization and who resigned that office a short time ago on account of ill health. Mr. Maher will not leave Kenosha, having arranged his duties so that he can continue his management of the local plant there.

Obituary

Joseph G. Fisher, superintendent of the Sapulpa division of transmission lines for the Oklahoma Gas & Electric Company, was killed on Nov. 25, when he came in contact with lightning arresters at the Kiefer substation. Mr. Fisher was thirty-four years old and had been employed by the company ever since the Drumright plant was purchased seven years ago.

Walter J. Baetje, foreman of the electric meter department of the Oklahoma Gas & Electric Company, died at Oklahoma City on Nov. 17, following an attack of pneumonia. Mr. Baetje joined this organization in 1909, going to Oklahoma City from Mobile, where he had worked for five years on switchboard construction and as an operator. Aside from a short period with the Wagner Electric Company at St. Louis, the Oklahoma organization was the only company with which he had been connected.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

The "If" in "Electrify"*

A Frank Appraisal of the Contractor-Dealer—With Some Definite Experience and Suggestions Pointing Out a Way to Strengthen His Usefulness

By O. Fred Rost

President Newark Electrical Supply Company, Newark, N. J.

THE electrical industry has established a most enviable record for rapidity of growth, but the electrical industry does not rest content. The recently inaugurated movement which has as its slogan "Electrify America" is characteristic of this will to win. It is indeed a big order to electrify a continent, and it will require continuous, earnest and strenuous effort in a balanced and co-ordinated program, for the process of electrifying America can go forward only so fast as energy, equipment and energy-consuming appliances are installed.

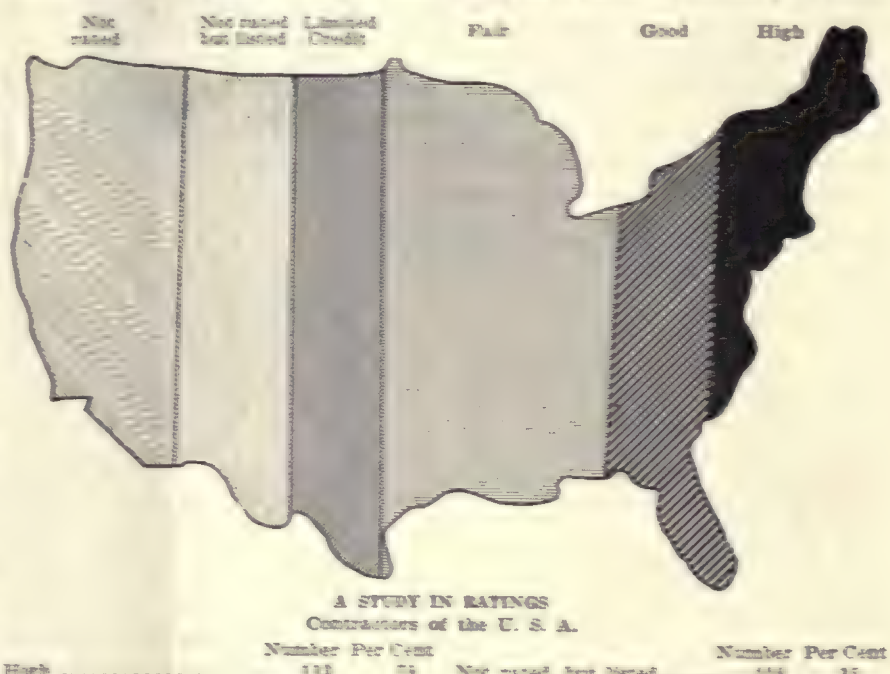
Since a chain is only as strong as its weakest link and the weakest member of the electrical family is the contractor-dealer, I want to ask you to examine the kind of a foundation upon which this very vital factor in the electrifying movement is built. I have chosen to put the group in the best possible light by confining the study to the membership of its national body, the Association of Electragists International, on the theory that in all probability membership in that association is representative of the best element in the group.

Financial Responsibility

The accompanying map of the United States represents the proportionate financial responsibility of the entire membership of the national association. The smallest area represents that portion of the membership which enjoys the highest credit rating. There are 7½ per cent in that group.

Those with a good credit rating come next, and, expressed in percentages, include 12 per cent. Those two groups, representing a total of 19½ per cent, might be considered that portion of the total membership who in applying for credit would probably pass inspection by the average credit man and to whom credit would be extended.

The next area represents the 34 per cent who have a fair credit rating. Then come 13 per cent who are considered of but limited means; then 15 per cent who are found listed but have a financial standing which warrants neither a capital nor credit rating. Finally 18½ per cent are not found listed at all in the most recent reports of the nationally known mercantile agencies.



A STUDY IN RATINGS
Contractors of the U. S. A.

	Number	Per Cent
High	111	7½
Good	168	12
Fair	502	34
Limited credit	191	13
Not rated, but listed	[illegible]	15
Not listed	[illegible]	18½
Total investigated	[illegible]	100

Translating these figures brings us to a realization of the fact that of this group, upon which the entire industry depends for the physical labor involved in the electrifying process, only 19½ per cent, or about one-fifth, are what I should like to term in step or in tune with the remainder of the industry, in that they have the financial structure and responsibility to render to the public the class of reliable, dependable and continued service which that public has a right to expect from so great an industry.

Out of the group of 34 per cent with a fair credit rating perhaps 5 per cent will graduate into the higher class, while the rest will either continue merely to make a living or before long disappear. As far as the 46½ per cent is concerned, which is made up of the limited, not rated and not listed groups, any electrical supply jobber can predict just what will happen to them. This study of financial responsibility provides a fair means for appraising the existing condition and the magnitude of the problem which confronts the electrical industry.

The electrical industry may be likened to a four-cylinder engine

*An address before the Electrical Supply Jobbers' Association, Buffalo, Nov. 15, 1921.

with the four cylinders representing the central station, the manufacturer, the jobber and the contractor-dealer. At the present time we might say that the contractor-dealer cylinder is missing fire. I need only to remind you of the last time you rode in a Ford car when it was hitting on but three cylinders to give you an excellent illustration of the electrical industry as it is to-day.

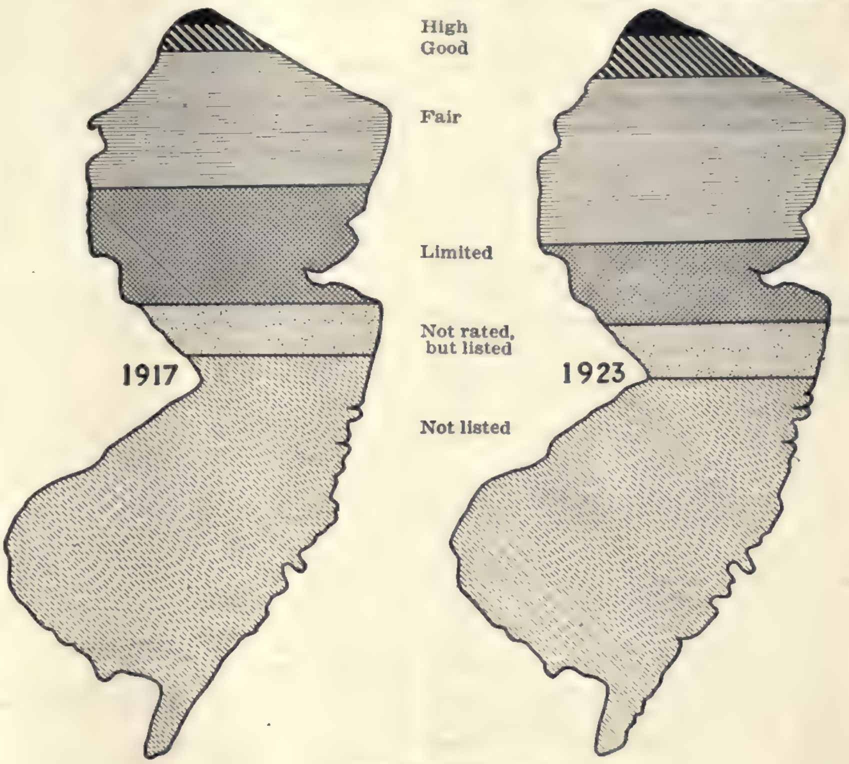
The contractor-dealer cylinder will begin firing only when a process of education is used to dispel and clear away the carbon of ignorance and mistrust which at present prevents it from working properly. If that fourth cylinder were made to work properly by the other three branches taking a keener interest in it and making a concerted effort at education, then the dead load which the three branches are now carrying would be lifted and the entire industry would work more smoothly and travel with the throttle wide open on the road to electrification.

I am convinced that you could take any honest man of average intelligence, provide him with a reasonable working capital and the electrical trade papers for his textbook, and that he could speedily obtain enough information and education to enable him to become a contractor-dealer and put his house in order to make a success of his business. In the fact that his house is not in order today we find a most powerful demonstration of the truth that you can lead a horse to water but you cannot make him drink.

Having learned by personal experience through numerous efforts that the contractor-dealer cannot be adequately educated through the press alone for the simple reason that he will not read, I came to the conclusion that if I wanted to build up dealer distribution in the territory covered by our company I should have to do that building up by means of a word-of-mouth process of education and by practical and continual personal contact and co-operation with those who, because of their ability or moral character or both, seemed worthy of the effort.

CONDITIONS IN NEW JERSEY

At the time when the program of education by personal contact was inaugurated there were listed in New Jersey altogether 538 contractors. The outline map of New Jersey represents the financial responsibility of those contractors in 1917. Half were in the group of those which were not found listed at all with any mercantile agency. Those 538 contractors installed approximately 17,754 meters, which was an average of thirty-three meters installed per contractor that year. At the time when these statistics were taken there were virtually no electric repair stores in the territory referred to, except about twenty-five branch offices and retail stores maintained by the central-station companies serving that territory.



A STUDY IN RATINGS
New Jersey Contractors

	1917	Per Cent	1923	Per Cent
High	3	½	19	2¾
Good	21	4	39	5¾
Fair	112	20¾	172	25½
Limited	92	17⅛	74	11
Not rated, but listed	37	7	46	7
Not listed	273	50	324	48
Total	538	100	674	100
Meters installed	17,754		74,265	
Average meters per contractor	33		111.8	

The first step was the selection of what at one time amounted to a total of thirty-five contractors, to whom we consigned a stock of electrical merchandise. They were selected in their respective localities because they seemed to offer the best, and in many cases the only available material for creating a contractor-dealer in communities or neighborhoods where my personal study made it seem desirable to have a contractor-dealer outlet.

To look after these dealers, help them in fixing up their stores, show them how to trim windows and co-operate in other ways, I selected a young man who was thoroughly familiar with our organization and our way of doing business, and who in addition was willing to learn and had the intelligence to grasp things quickly and follow instructions. He was given to understand that his job was not to make sales and bring in orders, but rather to co-operate with the dealers.

Of the original lot, approximately 25 per cent fell by the wayside. However, in no case did such failure involve a financial loss to us, owing to the close contact which we had with them. Half of the surviving members of our former consignment family today are enjoying a high or good credit rating, and many are discounting their purchases with us. Only two have remained in the group of limited credit risks. Since 1921 we have not consigned any goods, but nevertheless we are continuing to receive a fair share of business from all of those originally served on the consignment basis.

Several contractors were so hard to convince of the advisability of starting a store that for the first four or five months I paid part of their store rent. One of those today is actually worth several thousand dollars and incidentally is one of our very best customers. Another today owns the building he is in. Another recently started a branch in a town 15 miles from his first location. One of those who were induced to open a store is today confining all of his effort to doing a localized small jobbing business.

Another survey of the financial standing of New Jersey contractors in 1923 developed interesting evidence that the work which we had carried on in the New Jersey territory had been sufficiently effective to reflect itself in their financial standing as shown on the map.

This campaign of education which we have carried on embraces estimating, how to figure cost of doing business, basic principles of business management, the importance of proper financing and the wisdom of doing only such volume of business as physical and financial resources permit; helping with store arrangement, dressing windows, use of advertising material and other business-building methods.

The work has cost us an average of 1½ per cent of our total sales volume. But if you can increase the quality of your customers, speed up collection from the contractor-dealers and improve credit risks so that your credit losses grow smaller and smaller, then certainly that expenditure for education can be considered a most excellent investment.

A National Program

To undertake this work on a national scale I believe would require only that individual jobbers should engage in a similar work of education, each in his own territory, and that manufacturers direct part of the vast sums now being spent in printed advertising to further the equipment and organization of the contractor-dealer to do a better job.

There are many ways in which this can be done. There is one man ufacturer who already supplies a very useful plate-glass display case if a dealer purchases a certain amount of this manufacturer's material. Why does not some other manufacturer offer a six-foot silent salesman showcase as a premium, or a counter-charge machine, or a set of 100 estimate forms, say, with every standard package of sockets, so that the jobber can pass on those forms to his contractor-dealer customers?

Why could not all the manufacturers of electrical materials agree on some standard line of sectional shelving and cabinets and thereby enable a contractor-dealer to build up his store equipment by purchasing certain lines of material continually?

Why will electrical manufacturers persist in giving a phonograph or bicycle as a prize in their window-display contests, when a cash register or other store equipment would be much more useful to the dealer winning it? Why could not all the manufacturers of electrical material agree on a standard size and type of window background display and get standard display frames into the stores of dealers?

A national schedule of advertising and window-trimming material could be worked out so that one week all the dealers subscribing to this service would have in their windows a background showing a large electric flat iron, the next week perhaps a toaster, and so on.

Let manufacturers also contribute a small percentage of their advertising appropriation to a national fund for the purpose of endowing what might be termed an "Institute of Electragy." This institute might be operated by a neutral body such as the Society for Electrical Development, and it would train men in co-operative work so that after they have finished the course, they would be qualified to help contractor-dealers in behalf of jobbers or manufacturers in any problems that may confront them.

You, no doubt, remember the story in the Good Book where one brother, being asked about the other, replies, "Am I my brother's keeper?" If we want to electrify America, we must lend a helping hand to this brother of ours, who today is crawling alone. We must help to put him on his feet so that he can take his place as a strong unit in the chain and as a full-fledged member of the electrical family, able to work shoulder to shoulder with the rest and play his vital part in carrying out effectively and economically the industry's own command, "Electrify America."

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

According to reports received from the leading electrical market centers of the United States, there is an increasing unevenness of conditions as the year end approaches, and the present trend toward quickening of retail distribution and slackening of demand in most primary channels is a familiar occurrence in all commodity lines. Orders in the manufacturing and jobbing houses are largely deferred as attention is diverted to inventory taking, and the fact that increased operations have developed with many electrical manufacturing companies merely illustrates the contrasts which still mark the situation.

Holiday buying, of course, continues to take almost the entire attention of the trade, although there is much activity in the wire, lamp, wiring devices and motor markets. In New England the state of business is described by saying that retail buying is accelerated and is combined with a healthy demand for wiring supplies. In that section buying by distributors is confined chiefly to maintaining a flow of material for immedate uses as inventories among jobbers are being kept low. Buying in New York's holiday market shows great increases, and reports from the retail trade claim that sales are more diversified than ever before. Several large pole orders in the Eastern territory are reported.

Chicago has finishd a prosperous week. Rubber-covered wire advanced last week, and the entire line of code wire went up from 3 to 5 per cent, with No. 14 at $6.50 per 1,000 ft. Lamp sales there are reported as excellent. On the Pacific Coast large sales of rubber-covered wire took place before the expected advance, which was made during the week. No change is reported in Atlanta's business except a price reduction in non-renewable fuses.

Motor Sales Are Far Above 1922; Deliveries Much Improved

Although the decrease in motor business which started in October is continuing, the total volume of sales during the last quarter of the year is considerably above that of 1922, according to several motor manufacturers in different parts of the country. Manufacturers are not viewing the decline with much alarm since they realize that the exceptionally good sales rate during

the spring and summer months could not keep up indefinitely. This condition not only delayed deliveries but imposed serious problems of production and financing upon manufacturers, some of whom possibly had not calculated the requirements for such a rush of business. The present let-up has allowed them to catch their breath and improve their shipments. However, the present volume of business is of such wide diversity that manufactures are reporting increases in sales during the last quarter of 1923 ranging between 50 and 75 per cent higher than during the same period in 1922.

This diversity is spread over producers of pumps, printing, washing and plating machinery, crushers, ventilating fans and manufacturers of motorized equipment. A great majority of sales have been running below 15 hp., while the sizes most in demand are between 2 hp. and 5 hp. The feeling prevailing among manufacturers is that while prices are lower than during the earlier months of the year, their volume of business is very good when considered from a unit basis rather than from a money value.

With this sales decrease manufacturers are in a better position to promise immediate shipments than formerly. Where shipments formerly required several months owing to depleted stocks, most manufacturers are now in a position to promise shipment immediately, or within a few weeks. Accordingly, it might be well for the central stations and the industrial firms to anticipate their motor requirements during the early part of 1924. They can now get much faster shipments than will be possible after the rush has started again next year.

The outlook for 1924 among manufacturers is that a closer holding together of prices will characterize the market. This is because during 1923 most manufacturers ironed out their prices to a fairly constant competitive basis. One company felt that it might expect 25 per cent greater business during 1923 if Secretary Mellon's tax reduction was accepted and if conditions in the industrial field did not again become chaotic. From a price angle few changes are contemplated, although continued advances in both cotton and copper may increase manufacturing costs.

New York's Appliance Market Reports More Diversified Sales

BUYING in New York's holiday electrical market showed great increases last week, and reports from the dealers and department stores say that sales are more diversified this year than ever before. In this respect it is pointed out that the buying public are insisting on more sensible gifts to give their friends and relatives, and this desire is reflected in the electrical market in sales of toasters, percolators, flatirons, washing machines, etc., whereas last year the largest sales were in appliances of a more personal sort, such as warming pads, hair curlers and water heaters.

Meanwhile the wiring supplies and devices market continues at an even clip, with several increases in prices. Sales of rubber-covered wire are not so great as two weeks ago owing to the fact that consumers made large purchases at that time because copper base had advanced, buying great quantities just before rubber-covered was marked up. Lamp sales are increasing daily, the market being up by all kinds of replacement work for both interior and exterior lighting. The motor market continues at a heavy rate, with some improvement in production and lower prices. Several large orders of poles arrived in the Eastern territory last week for consumption by one telephone company and three central stations in extension work.

Fuses Advance, Rubber-Covered Wire Drops in Atlanta Territory

NO PARTICULAR change in electrical jobbing circles has been recorded during the past week, with the exception of a price reduction of 10 per cent on the 250-volt non-renewable cartridge fuse anounced by one jobber and a general price advance of from 2 per cent to 5 per cent on rubber-covered wire. Jobbers state that their business is fine, with a noticeable pick-up in the general supplies line.

With only a few shopping days left before Christmas, holiday buyers are at it in earnest, and electrical retailers report excellent business, particularly in the heating appliance line. During the past year the larger retail dealers in Atlanta have virtually discontinued the portable line, owing to the keen competition of department and furniture stores, but such as do handle portables report a satisfactory business. Contractor-dealers state that their lighting-fixtures business is unusually good for this period of the year, and this can partly be traced to contracts for new schools, a heavy school construction program having been under way in Atlanta for the past year.

Fast-Moving Appliances and Wiring Supplies in Northeast

ACCELERATION in retail trade combined with a healthy demand for wiring supplies characterizes the New England electrical market this week. Buying by distributors is confined chiefly to maintaining a flow of material for immediate uses, and inventories among jobbers are being kept low. All signs point to continued good business in early 1924.

Collections are fair, labor widely employed, and building expansion active, with unusually favorable weather for both inside and outside work. Progress is rapid in generating-plant expansion.

Appliance sales are far above last year's totals. Deliveries are well maintained, but last-minute demands for appliances will be hard to meet. The 1923 Christmas shopping public is closely governed by price considerations, retailers report. Textile manufacturing is improving somewhat, but labor conditions are disturbed in the leather industry. Industrial truck sales are dull.

Large Rubber-Covered Wire Sales Made on Coast Before Advance

BOTH jobbing and retail business in the Pacific Coast territory is good, and with present healthy stocks excellent deliveries are the rule. A summer of rather freakish weather ruined the fan season, and now the electric heater sales are being kept back by unusually warm weather. Country dealers are loaded with unsalable winter merchandise and are buying very sparingly. Large rubber-covered wire sales are reported at the recent advance in price, which had been unmistakably forecast by advances in bare copper. Non-renewable, non-indicating fuses have advanced about 5 per cent, except the 0-amp. to 30-amp., 250-volt sizes, which have decreased from 6 cents to a new price of 5 cents. Cartridge fuse cut-outs have fallen about 10 per cent. A four-carload fiber-conduit order for a power company and a two-carload telephone cable order for railroad dispatching are reported for the week. Of the seasonal lines, Christmas-tree lighting outfits, waffle irons and curling irons are moving exceptionally well.

In Seattle the retail trade during last week showed a tremendous increase in volume, and authorities in the trade predict that the holiday trade this year will eclipse previous records for December. Holiday shopping began early this year, and the increase in volume has been steady. The demand for better quality merchandise is apparent with less criticism of prices. Wholesale trade is reported satisfactory, although buying is for short-time needs and on a conservative basis. Collections are reported good.

Wire Advances in Chicago; Cable Deliveries Slow

THE electrical trade for Chicago, as a whole, experienced a profitable week. This season so far surpasses last year in interest shown and equipment purchased. Rubber-covered wire advanced this week, the entire line of code wire going up from 3 to 5 per cent, with No. 14 now at $6.50 per 1,000 ft., Chicago. Lead is about to advance, it is stated, so higher prices may also be expected on lead-covered cables. Conduit and loom prices remain firm, but there is a persistent rumor that higher levels will be reached soon.

Lamp prices are firm, with no expected change for the first three months of the coming year. Sales are excellent. Christmas-treee lamps are very much in demand, and manufacturers are unable to supply the quantities required as their stocks had been previously contracted for.

Reflector prices are firm, with stocks normal.

The cable situation is not encouraging. One manufacturer states that while sixty-day deliveries are promised for the first two months in the year, his capacity for the rest of this year is sold and no new accounts will be solicited. This is virtually true of most manufacturers. Prices naturally have an upward trend.

High-tension insulator deliveries have eased up somewhat. Deliveries are now being promised in five to six weeks, which is considerably better than those quoted a short period ago. The demand for this class of material has been so exceptionally good that manufacturers have been unable to keep up with it. The demand for low-voltage material has been slow for some time, as evidenced by price variations in this class of merchandise.

The Metal Market

CONSUMERS have been rather anxious to secure copper at 13 cents, delivered, during the last week, and have been freely intimating that they could get all they wanted at that price. So far sales at that level have been confined to a few carloads, although an appreciable tonnage has been sold at 13 cents for delivery in the New York district, where delivery charges are low. A small amount of copper has been sold as high as 13.25 cents, but 13.12½ cents, delivered, represents the bulk of the sales and is a fair average of all the business booked during the week. The volume of sales has not been large either here or abroad. Producers generally are holding at from 13.12½ cents to 13.25 cents.

The official contract price of lead by the American Smelting & Refining Company was advanced from 6.85 cents to 7 cents, New York, to 7.25. Lead is scarcer than at any time since last February, and some producers are not only completely sold out for December and January but are behind in their deliveries. The zinc market has been inactive all week, although inquiries are many. Smelters are not pressing the metal on the market at present prices.

NEW YORK METAL MARKET PRICES

	Dec. 6, 1923 Cents per Pound	Dec. 13, 1923 Cents per Pound
Copper, electrolytic...	13.25	13.25
Lead, Am. S. & R. price	6.85	7.00
Antimony...........	9.25	9.00
Nickel, ingot.........	27.00 to 32.00	27.00 to 30.00
Zinc, spot............	6.25	6.35
Tin, Straits..........	43.00	45.00
Aluminum, 98 to 99 per cent...........	26.00 to 27.00	26.00 to 27.00

Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Combustion Engineering Joins with Vickers of England

The International Combustion Engineering Corporation, New York City, and Vickers, Ltd., of England, have joined forces in the manufacture of power-plant equipment, according to George E. Learnard, president of the International firm. The arrangements which were completed by Mr. Learnard, who has just returned from abroad, will in no way affect the business which is now being carried on by either company.

Under the plan a new company, to be known as Vickers & International Combustion Engineering, Ltd., will be organized in England with an initial capital of £500,000, owned in equal shares by the two companies interested.

The plant of the new company is situated at Barrow-in-Furness, England, and manufacture will commence there of boilers especially adapted for the burning of coal in pulverized form, superheaters, economizers, pulverizers, dryers, air heaters and all other auxiliary power-plant equipment. The directors of the new company will be Sir Trevor Dawson, deputy chairman and managing director of Vickers; George R. T. Taylor, managing director of Taylor Brothers, Ltd.; George E. Learnard, president of the International Combustion Engineering Corporation, and Wilfred Wood, vice-president of the International firm.

New Battery Equipment Firm

Announcement has been made by the French Battery & Carbon Company, Madison, Wis., manufacturer of electric battery equipment, that its mechanical engineer, Edgar J. McEachron, will in the future be associated with a new organization to manufacture electric battery equipment in Wausau, Wis. He will be in direct charge of the manufacturing and distribution operations of the new company.

Electric Storage Battery Paid $5 a Share in 1923

Declaration of $1 a share by the Electric Storage Battery Company Philadelphia, as a regular dividend for the quarter just ended and an extra dividend of $1 make a total of $5 a share for 1923, which is equivalent to $20 a share on the old stock. Last year, when the recapitalization was put through, common stockholders received four shares of no-par-value stock for each share of old stock. The dividends in 1922 were the equivalent of $16 a share on the old stock. A total of $12 a share was declared in 1921, $11 in 1920, $6.50 in 1919 and $4 in 1918, the last named having been the rate for a long time preceding the more recent era of rapid growth in the business.

Ingersoll-Rand Secures Order for 35,000-Kw. Surface Condenser

The I-R surface condenser has aroused considerable interest in the last few years among engineers and power-plant men. Up to the present time very little information has been published on this condenser except in yearly reports of the N. E. L. A. For this reason the trade will be interested to know that the Ingersoll-Rand Company, 11 Broadway, New York City, has secured an order from the New York Edison Company for a 35,000-kw. surface condenser. This condenser is to be installed under a 35,000-kw. General Electric turbine at Waterside Station No. 1. The condenser is of the standard Ingersoll-Rand external-cooler design with single-pass water circuit.

The auxiliaries included are two Cameron class FV turbine-driven circulating pumps, two Cameron class DV turbine-driven condensate pumps, and two-stage I-R steam-jet vacuum-pump equipment. Ingersoll-Rand surface condensers are now installed or are being built in all the principal sizes from 300 kw. to 35,000 kw.

Canadian Allis-Chalmers Plant May Be Sold to du Ponts

A. E. Dyment of the Canadian Allis-Chalmers Company, Bridgeport, Ont., a subsidiary of the General Electric Company, last week said, regarding reports that the company's shipyard on the Niagara River was to be sold to the du Ponts, that tentative inquiries concerning purchase of the plant had been made, but that no sale had been consummated. Mr. Dyment said he did not know whether the inquiries came from the du Pont interests. The plant has been idle since 1919.

Pelton Company Gets Contract for Pit No. 3 Turbines

The Pacific Gas & Electric Company has awarded the contract for building three 33,000-hp. vertical reaction turbines at its Pit River No. 3 plant to the Pelton Water Wheel Company of San Francisco. These units will operate under a static head of 313 ft. and an average effective head of 280 ft. They will be of materially greater dimensions than any turbines so far installed in the West, the only units comparable with them in horsepower output being for considerably higher heads and therefore handling smaller quantities of water. Each casing will consist of five pieces, each piece weighing 10 tons or more.

The turbines will embody the most recent advances in design developed both by the Pelton Water Wheel Com-

pany and its associate the I. P. Morris Department of the William Cramp & Sons Ship & Engine Building Company.

One of these three turbines will be equipped with Pelton rubber seal rings, and if the test of service shows materially better results than for the other two units, rings will be installed on these as well. Each turbine will have disk-type guide vanes and a spreading draft tube.

The contract includes, besides the main units, the governors, oil-pumping sets and other accessory apparatus, as well as three 108-in. butterfly valves and an impulse wheel for operating a spare exciter set.

Electrical Equipment Exhibits at Lyons Fair, March 3 to 17

The Lyons Fair, one of the most important yearly expositions in Europe, will hold its next meeting in Lyons, France, from March 3 to 17, 1924. American manufacturers, especially those who specialize in electrical labor-saving devices and machinery, are invited to participate. Edouard Herriot, Mayor of Lyons, recently toured this country in behalf of the Lyons Fair and insisted on the urgent need of such machinery in practically every European country.

American manufacturers who cannot spare the time and money to attend the fair themselves are invited to join the all-American demonstration and trade exhibit now being organized by Emile Garden, 50 Church Street, New York City, official delegate of the fair for the United States.

United Electric Appointments in National Sales Force

The United Electric Company, manufacturer of stationary and portable electric cleaners, Canton, Ohio, announces the following developments in its sales force: Harry J. McDevitt, formerly sales manager of the Ohio Electric Company, Inc., New York City, distributor of the cleaners in the metropolitan territory, has become associated with the United Electric sales department. L. D. Gaddis has resigned his position as district sales manager for Colorado, New Mexico and Wyoming for the Eureka Vacuum Cleaner Company to take the position of district manager for Indiana with the United Electric Company.

J. L. Shaw has been appointed district manager for the central Pennsylvania territory. A. O. Engle, formerly branch manager at Toledo for the Stroud-Michael Company, and more recently local manager in that city for the Bissell Company, has been appointed district manager for Colorado, New Mexico and Wyoming. J. E. Foreman has resigned his position with the Electric Vacuum Cleaner Company of Cleveland to become district manager in the Dayton (Ohio) district for the United Electric Company.

New Jobbing House Organized in Denver

A new electrical supply house will shortly make its appearance in Denver, bringing the total of electrical jobbers in that city up to nine. Ernest V. Beck and James W. Ryall, both prominent in the jobbing business for a number of years, are the incorporators of the new company. Beck until recently was manager of the Central Electric Supply Company and previously was associated with the Hendrie & Bolthoff Manufacturing & Supply Company and the Poindexter Supply Company, both in Denver. Ryall will not sever his connections as manager of the electrical department of the Mine & Smelter Supply Company until Jan. 1. He formerly served as purchasing agent of the Western Light & Power Company and was also associated with the Mountain States Machinery Company. A location for the business has already been obtained in the new Barnes Building, 1414 Glenarm Street, but it is believed the store will not be ready for occupancy until the first of the new year. The new company, which was incorporated for $50,000, is to be known as the B. & R. Electrical Supply Company.

Wellman-Seaver-Morgan Engineers to Sell for S. Morgan Smith

Announcement is made that D. J. McCormack, H. E. Popp and H. T. Porter, formerly connected with the hydraulic turbine department of the Wellman-Seaver-Morgan Company, Cleveland, have taken positions on the engineering and sales staff of the S. Morgan Smith Company, York, Pa., builders of water-power equipment.

Mr. McCormack and Mr. Popp are at the main office and works at York, while Mr. Porter becomes manager of the branch office at 76 West Monroe Street, Chicago, filling the vacancy caused by the recent death of John C. Temple. This announcement corrects the impression which has erroneously gained publicity in some of the trade papers that the engineering force of the Wellman-Seaver-Morgan Company was included in the recent transfer of its hydraulic turbine business to the Newport News Shipbuilding Company.

Habirshaw Electric Settles War Contracts Claims

The sum of $379,000 has been recovered for the United States Treasury by the terms of a settlement accomplished by Attorney-General Daugherty with the receivers of the Habirshaw Electric Cable Company, Inc., and the Electric Cable Company of New York City of certain claims and counter-claims growing out of war contracts, according to word received from Washington Wednesday, Dec. 12.

During the war the Habirshaw Electric Cable Company and the Electric Cable Company had contracted with the government for the manufacture of outpost wire and had received advances from the War Credits Board of approximately $914,000. After the armistice contracts were suspended and the companies entered claims against the government for $435,000, leaving an unrecouped balance in favor of the government of about $478,000. The claims board of the War Department was unable to agree with the companies as to the exact amount, and in the meantime the company went into the hands of the receivers. The Department of Justice prepared a suit against the receivers, but before it came up for action a reorganization committee representing the companies offered in compromise and settlement the sum of $379,000, which has been accepted by the Secretary of the Treasury on the recommendation of the Attorney-General.

The American Battery Company, Norfolk, Va., has purchased a tract of 15 acres of land between Norfolk and Ocean View as a site for the erection of a new plant for the manufacture of electric storage batteries, for which bids will soon be asked. It will be equipped for an initial output of about 2,000 batteries per day.

The American Brass Company, Kenosha, Wis., subsidiary of the Anaconda Copper Company, will proceed with plans for the construction of an addition, 220 ft. x 540 ft., one story, to be equipped as a wire-drawing mill. The extension was projected about a year ago and is now being revived. The cost of the work is estimated at $250,000.

The Park Battery Company, Cleveland, has placed a contract for a factory building at 277 East 156th Street, to cost approximately $50,000.

The Walsh Electric Company, 456 Church Street, Toronto, Canada, has purchased a site at 55 Church Street, for manufacturing purposes. The present building will be razed and a new four-story or five-story factory will be erected.

The Killark Electric Manufacturing Company, Easton and Warne Avenues, St. Louis, is presenting to the trade a novel method of merchandising bell-ringing transformers, the feature of which is a display carton of five, with the caption "Simply attach to your light wires and forget your doorbell troubles."

The Tubular Woven Fabric Company, Pawtucket, R. I., has appointed E. C. Johnston, formerly with the Chicago Fuse Manufacturing Company, as district manager of the St. Louis territory, which comprises Missouri, southern Illinois, western Iowa, Kansas, Arkansas, Oklahoma and Texas.

The General Electric Company, Schenectady, N. Y., has plans for two additions to its warks at Bridgeport, Conn., each of one story. One structure will be equipped as a machine-shop extension and the other for general factory service.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An exclusive agency is desired in Gloucester, England (No. 8,403), for incubators of all sizes, etc.

An agency is desired in Buenos Aires, Argentina (No. 8,396), for electrical supplies.

An exclusive agency is desired in Sofia, Bulgaria (No. 8,420), for electric lamps.

Purchase is desired in Celbridge, Ireland (No. 8,448), for wireless apparatus, experimental type.

Purchase is desired in Halifax, Nova Scotia, Canada (No. 8,461), for pulp-wood grinders, four-pocket, wet machines, one 4,000-hp. motor, and machines and tools for machine shop.

Purchase and agency is desired in Bucharest, Rumania (No. 8,409), for insulating material, pipes and fittings, plugs, and precision instruments.

TENDERS FOR HEADWORKS FOR ARAPUNI (NEW ZEALAND) POWER SCHEME.—The date for the receipt of tenders for the Arapuni (New Zealand) power scheme, section 1, headworks, has been extended to April 30, 1924. See Searchlight Section.

PROPOSED HYDRO-ELECTRIC SCHEME IN TRAVANCORE, INDIA.—A conference has recently been held between the Travancore government and the revenue and irrigation members of the Madras government, according to *Commerce Reports*, for the purpose of discussing the adjustment of rights between the two governments in regard to a scheme for using the water of the Kaller River for power purposes. The river has its source in Travancore territory, but the state government wishes to build its electric plant over the state line in British territory.

PROPOSED EXTENSION TO ELECTRIC POWER SYSTEMS IN FRANCE.—The Union d'Electricité is planning to extend its system to supply electricity to the departments of the Seine, Seine-et-Oise and Seine-et-Marne. Eight underground and four overhead transmission lines are to be built, five of which will start from the power station at Gennevilliers and the others from the stations of the Ouest Lumière and the Triphasé companies, which operate under the former company.

New Apparatus and Publications

RECORDING INSTRUMENTS.—The Uehling Instrument Company, Paterson, N. J., has developed a new "Uehling" carbon monoxide (CO) recorder. Bulletin No. 150 issued by the company describes the "Uehling" combined barometer and vacuum recorder for power plants.

HEATER CONTROL AND ELECTRIC RANGE SWITCHES.—The Hart Manufacturing Company, Hartford, Conn., has issued a booklet covering its "Diamond H" heater control and electric range switches.

VOLTAGE REGULATOR.—The General Electric Company, Schenectady, N. Y., has developed a new design single-phase induction voltage regulator.

LACQUER.—A new lacquer, which is waterproof and is furnished transparent or in colors, is being marketed by the Greater Service Company, 329 Broad Street, Newark, N. J.

OIL-TESTING AND POWER-PLANT INSTRUMENTS.—The C. J. Tagliabue Manufacturing Company, 18-88 Thirty-third Street, Brooklyn, N. Y., is distributing catalogs Nos. 699 and 640-A, covering its "Tag" oil-testing instruments for petroleum products and for steam-power-plant instruments, including refrigeration applications, respectively.

TERMINAL SUPPORT FOR RESISTOR UNITS.—A new type terminal for the larger sizes of "Vitrohm" (vitreous-enameled) resistor units has been designed by the Ward Leonard County, Mount Vernon, N. Y.

VALVE.—The A. W. Cash Company, Box 135, Decatur, Ill., is distributing a leaflet covering the "Cash Standard" reducing and regulating valve.

OUTLET BOX.—A new type of outlet box, "Always Vertical," has been placed on the market by the Adapti Company, 2996 East Seventy-second Street, Cleveland.

ELECTRIC GRINDER.—An improved type of grinder has been placed on the market by the Bodine Electric Company, 2254 West Ohio Street, Chicago.

STABILIZER FOR FIRE-EXTINGUISHING SYSTEMS.—A new stabilizer for foam-type fire-extinguishing systems has been developed by the American Dyewood Company, 100 East Forty-second Street, New York City. It is known as "Amdyco" and has been approved by the Underwriters' Laboratories, Inc.

New Incorporations

THE NORTH CENTRAL UTILITIES COMPANY, Minneapolis, Minn., has been chartered with a capital stock of $30,000 by John A. Clark and others. The company proposes to operate electric plants, high-tension transmission lines. etc.

THE CARLETON ELECTRIC COMPANY, Ltd., Woodstock, New Brunswick, Canada, has been incorporated by Heber H. Hatfield, Hartland; Wilmot F. Anderson, Lakeville; Edgar R. Teed, Woodstock; Charles F. Gallaher, Bath, and F. B. Carvell, Ottawa. The company is capitalized at $99,000 and proposes to erect a transmission line from Aroostook Falls to Woodstock.

Construction News

Projects, Plans, Bids and Contracts Contemplated or Under Way

New England States

MALDEN, MASS.—Plans are under consideration for improving the lighting system on the principal streets of the city. The Malden Electric Company furnishes the street-lighting service.

SOMERSET, MASS.—The Montaup Electric Company, Fall River, has applied to the Public Utilities Commission for authority to issue $4,500,000 in capital stock to finance the construction of a superpower plant at Somerset. The total cost of the plant is estimated at $7,000,000.

TAUNTON, MASS.—Bids will be received at the office of Jackson & Moreland, Boston, until Dec. 15 for the construction of the structural work for three substations for the municipal electric light plant as follows: (1) For three steel outdoor substation structures with foundations; (1) two brick and concrete substation buildings; (3) underground conduits. Francis P. Callahan is chairman of commission.

Middle Atlantic States

ANGELICA, N. Y.—The Public Service Commission has authorized the village of Angelica to extend its electric lighting system to the Allegany County Home.

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Dec. 18 for boiler-feed pumps, electric drills and grinders, etc., for the Navy Supply Depot, South Brooklyn.

BROOKLYN, N. Y.—Bids will be received by William H. Gompert, architect, board of education, Corner of Flatbush Avenue and Concord Street, until Dec. 19, for electric equipment and fire signal systems (fire protection work) in Public Schools 31, 33, 38, 52 and 69, and additions and alterations to electric equipment and fire signal systems (fire protection work) in Public Schools 37, 53, 56 and 74, borough of Brooklyn. For additions and alterations to electric light equipment and fire signal systems (fire protection work) in Public Schools 123, 129, 145, 148, 155, 162 and 168, and fire signal systems (fire protection work) in Public Schools 68 and 88, borough of Brooklyn.

BUFFALO, N. Y.—Electric power equipment will be installed in the flour mill to be erected on the waterfront by the Russell-Miller Milling Company, Minneapolis, Minn., to cost about $750,000.

CATSKILL, N. Y.—The Upper Hudson Electric & Railway Company has applied to the Public Service Commission for permission to extend its electric lighting system into the towns of Jewett and Lexington.

HAMBURG, N. Y.—The Public Service Commission has authorized the Buffalo General Electric Company to extend its electric lighting system into the town of Hamburg.

NEW YORK, N. Y.—Electric power equipment will be installed in the machine and mechanical repair works to be erected by the Department of Plant and Structures, Municipal Building at 278-90 Avenue C, to cost about $3,500,000.

NEW YORK, N. Y.—Bids will be received by William H. Gompert, architect, board of education, corner Flatbush Avenue Extension and Concord Street, Brooklyn, until Dec. 19, for electric equipment in new automobile shop at Murray Hill Vocational School, 237 East Thirty-seventh Street. For additions and alterations to the electric equipment in Public Schools 63 and 65, borough of Manhattan. For installing electric wirings and fittings in new Public School 107, borough of Queens.

PANAMA, N. Y.—The Western New York Electric Company, Jamestown, plans to extend its electric service into the village of Panama.

ROCHESTER, N. Y.—The Rochester Refrigerating Company, 50 Meigs Street, plans to build a new refrigerating plant, to cost about $300,000.

ST. JOHNSVILLE, N. Y.—Preparations are being made by the Adirondack Power & Light Company to build a dam and power house at St. Johnsville.

KEASBEY, N. J.—Arrangements are being made by the Raritan Hollow Tile Company for rebuilding its plant recently destroyed by fire. The work will include a new power house, mechanical drying department and machine room.

TRENTON, N. J.—The City Commission is considering extensions and improvements to the street-lighting system in different parts of the city during the coming year. C. E. Clewell is lighting expert for the city.

ALLENTOWN, PA.—The Pennsylvania Power & Light Company has applied to the Public Service Commission for permission to supply electricity in Dalmatia and other towns in the lower part of Northumberland County.

CRANBERRY, PA.—The Cranberry Creek Coal Company plans to install and operate a street lighting system here and at Harwood.

EAGLESMERE, PA.—The Muncy Valley Light Company, recently organized, plans to erect a transmission system.

GALETON, PA.—The North Penn Power Company, Blossburg, which has acquired the local electric plant, contemplates connecting up with the towns of Gains, Watrous, Sabinsville and Westfield and other Cowanesque Valley towns.

GREEN RIDGE, PA—The Pennsylvania Power & Light Company, Allentown, plans to build a local substation, with transmission system for service in the neighboring coal fields, to cost about $200,000.

MACUNGIE, PA.—Plans are under consideration for extensions and improvements to the street-lighting system.

NORRISTOWN, PA.—Plans have been approved for the installation of an ornamental street-lighting system on Main Street, from Arch Street to Markley Street.

PHILADELPHIA, PA.—Arrangements are being made by the Brandle & Smith Company, Eighth and Dauphin Streets, for the construction of a power house at Fifth and Bristol Streets, in connection with its new confectionery plant. The cost of the works is estimaated at $625,000.

POTTSVILLE, PA.—The East Penn Electric Company has issued $467,500 in bonds, the proceeds to be used in connection with the acquisition of the properties of the Pine Grove Electric Light, Heat & Power Company and the Lykens Valley Light & Power Company, which will be consolidated. Extensions and improvements will be made.

TARENTUM, PA.—Plans for the proposed local glass works to be built by a new company now being organized by S. F. Lucas and H. E. Rutherford, to cost about $1,000,000, include a power plant.

OAKLAND, MD.—Plans for the proposed local plant of the United States Auto Chain & Twin Hook Company, Grafton, W. Va., include a power house, to cost about $80,000.

BEDFORD, VA.—Plans for the proposed local plant of the Bedford Tire & Rubber Company, recently organized, include a power house.

WASHINGTON, D. C.—Bids will be received by the Quartermaster, United States Marine Corps, until Dec. 28, for 500 porcelain knobs, 200 batteries, 200 telephone brackets, 20,000 insulated staples, 31,000 ft. wire, seven switchboard cords, one test clip, and miscellaneous specialties. (Schedule 255).

North Central States

ADRIAN, MICH.—The installation of an electrically driven pumping plant in connection with extensions to the waterworks and sewer system, to cost $595,000, is under consideration by the City Council.

ESSEXVILLE, MICH.—The Aetna Portland Cement Company plans to install electric power equipment in connection with proposed extensions to cost about $200,000.

FLINT, MICH.—The installation of a new lighting system the entire length of Saginaw Street is under consideration by the City Council.

CLEVELAND, OHIO—The Cleveland Safe Drivers' Club has submitted a proposal to the City Council recommending the installation of ornamental lamps on Superior Avenue from East Ninth Street to East Fifty-fifth Street, the lamps to be similar to those on Euclid Avenue.

SANDUSKY, OHIO—The proposed coal dock to be built by the Pennsylvania railroad company in Sandusky to cost about $300,000, will be equipped with conveying and unloading machinery.

UHRICHSVILLE, OHIO—Plans for the proposed new local sewer-pipe factory to be erected by the Federal Collieries Company, Leader-News Building, Cleveland, include a power plant. The equipment will consist of three 250-hp. boilers, a generator, mechanical stokers, etc.

ELIZABETHTOWN, KY.—Bids will be received by the Mayor and City Council until Dec. 17 for waterworks improvements, including four centrifugal pumps and electric motors. B. H. Klyce, Fourth and First National Bank Building, Nashville, Tenn., is the engineer.

LOUISVILLE, KY.—Extensions to the ornamental lighting system are under consideration by the Board of Public Works. It is also proposed to replace the present ornamental lamps with new lamps.

CROWN POINT, IND.—Bids will be received by the Commissioners of Lake County until Dec. 17 for construction of a sanitarium outside of the city limits, consistings of two hospital buildings, children's building, negro patients' building, power plant and garage, to cost about $350,000.

OWENSVILLE, IND.—The Consumers' Power Company it is reported, has acquired the system of the Owensville Light Company and will consolidate with its properties. Transmission-line extensions are planned.

DIXON, ILL.—The Illinois Northern Utilities Company contemplates an issue of $491,000 in bonds, part of the proceeds to be used for extensions and improvements.

APPLETON, WIS.—The Wisconsin Traction, Light, Heat & Power Company contemplates extending its transmission line on Lawrence Street to the western outskirts of the city to meet the increasing demand for service in that section.

BIG FALLS, WIS.—The installation of municipal hydro-electric power plant to cost $150,000, is under consideration. The erection of a transmission line to Clintonville is also contemplated.

EAGLE RIVER, WIS.—Preparations are being made by the Electric Light and Water Commission to extend the transmission lines of the municipal electric system along the Eagle chain of lakes to furnish electricity to the summer resorts in that section.

FOND DU LAC, WIS.—The Eastern Wisconsin Electric Company is considering extending its transmission line from Peebles to Calumetville, a distance of 12 miles, to furnish electricity to farmers and residents in that section. The cost is estimated at about $20,000.

MENOMONIE, WIS.—The Ford Hydro-Electric Power Company has applied to the Railroad Commission for permission to construct a dam and hydro-electric plant on the Menominie River in Florence County, to cost about $1,500,000.

DULUTH, MINN.—The Minnesota Power & Light Company is reported to be preparing plans for the construction of a hydro-electric power plant in the northeastern part of the state, to cost about $20,000,000, with transmission system. The company recently took over the properties of the Duluth-Edison Electric Company, General Light & Power Company, Minnesota Utilities Company and the Great Northern Power Company.

EAGLE GROVE, IOWA—Plans are being considered to establish a municipal electric plant in Eagle Grove.

HARRIS, IOWA—Donald Sterns and John A. Reed, it is reported, have acquired the municipal electric plant. Improvements are planned, including line extensions.

WINTERSET, IOWA—The Council has adopted an ordinance providing for the sale of electricity generated by the municipal electric plant at the city limits for the use of non-residents.

JEFFERSON CITY, MO.—The Missouri Power & Light Company, recently formed to merge ten light and power utilities in this section, it is reported, has tentative plans for the construction of a steam-operated generating plant, to cost about $2,000,000. The company has issued $4,000,000, in bonds, part of the proceeds to be used for expansion.

MOUNTAIN GROVE, MO.—The proposal to issue $40,000 in bonds for a municipal electric light plant was defeated at a special election, held recently.

WAPPAPELLO, MO.—Electric power equipment will be installed by the Taskee Iron & Ore Company at its proposed concentrating plant and washery, to cost about $110,000.

O'NEIL, NEB.—The Minnesota Electric Distributing Company, Minneapolis, has purchased the local electric light plant.

FORT SCOTT, KAN.—Steps are being taken to establish a municipal power plant to cost about $200,000. Roger Toles is engineer.

Southern States

GREENSBORO, N. C.—The Cunningham Brick Company plans to build a power house at its proposed plant near Gordontown, to cost about $85,000.

NORTH WILKESBORO, N. C.—Bids are being asked by the town of North Wilkesboro for two directly connected electric generating units, consisting of two oil engines (150 hp. each) and two 60-cycle, 2,300-volt generators, complete with switchboard, etc., and oil tank.

WILMINGTON, N. C.—Improvements are contemplated by the Tidewater Power Company involving an expenditure of about $600,000. The work will include the installation of a 6,000-kw. turbine.

BADHAM, S. C.—The Dorchester Lumber Company plans to install two generators, motors and other electric equipment at its plant.

DUNCAN, S. C.—Plans are reported to be under consideration by the Southern Power Company, 511 Fifth Avenue, New York City, for the construction of a steam-driven generating plant to supply electricity to the Pacific mill and bleachery at Lyman.

LANDRUM, S. C. — The Appalache Hosiery Mills, Inc., plan to build an electric power plant at their proposed local mills.

PIEDMONT, S. C.—The Southern Public Utilities Company has issued $4,000,000 in bonds, part of the proceeds to be used for extensions, including completion of the 80,000-hp. hydro-electric station at Mountain Island, now in course of erection.

MIAMI, FLA.—The Carl G. Fisher Company will install a light and power system on a tract of beach property now being developed, totaling about 40 miles of wire and cable.

NORTH CHATTANOOGA, TENN.—The Board of Commissioners has awarded a contract to the Tennessee Electric Power Company, Chattanooga, for the installation of street lamps.

BIRMINGHAM, ALA. — The Sudduth Realty Company is planning to install a lighting system on a tract of property near the city now being developed.

CALERA, ALA.—The Alabama Power Company, Birmingham, has acquired the local electric distributing system.

CRICHTON, ALA.—The Gulf Paper Company, Mobile, plans to install electric power equipment in connection with rebuilding its local mill recently damaged by fire with loss of about $200,000.

LITTLE ROCK, ARK.—The installation of 100 additional street lamps throughout the city is under consideration by the City Council. The cost is estimated at about $8,705.

BATON ROUGE, LA.—B. E. Perkins plans to install a street-lighting system on a tract of property now being developed, to be known as College Town

MELVILLE, LA.—The proposal to increase the expenditure for improvements to the municipal electric light plant and waterworks system from $45,000 to $60,000 was approved by the voters. Bids, it is understood, will be asked for within sixty days. Swanson-McGraw, Inc., United Fruit Building, New Orleans, is engineer.

HEAVENER, OKLA.—The installation of electrically operated pumping machinery at the waterworks plant, to cost about $100,000, is under consideration by the Council. V. V. Long & Company, Colcord Buildingfi Oklahoma City, are engineers.

OKLAHOMA CITY, OKLA.—The Southwestern Light & Power Company contemplates extensions to its steam-operated electric plant and extensions in transmission system to cost about $500,000.

WEWOKA, OKLA.—The proposal to sell the municipal electric plant to the Central Oklahoma Light & Power Company is under consideration. It is proposed to secure electricity from the high-tension lines of the Oklahoma Gas & Electric Company.

GALVESTON, TEX.—Bids will be received by the board of regents, of the University of Texas, care of H. L. Stark, chairman, Orange, until Jan. 14, 1924, for construction of administration building and power plant on the campus in Galveston, to cost about $308,000. The H. M. Greene Company, North Texas Building, Dallas, is architect.

HOUSTON, TEX.—Plans are being prepared for the construction of a new home for the Sisters of Charity of the Incarnate Word, at Wayside Drive and Cut-Off Road, to cost about $500,000. The project will consist of a novitiate building, chapel and power house.

TEAGUE, TEX.—The Community Power & Light Company, Marlin, has acquired the local electric light plant. Electricity for operating the local system will be secured from the Marlin plant. Surveys are now being made for the right-of-way for the proposed transmission line from Marlin to Mexia, via Groesbeck.

Pacific and Mountain States

BELLINGHAM, WASH—The City Council has adopted an ordinance providing for submission at the December election the proposal to construct or purchase an electric light plant, to cost about $500,000. C. M. Adams is city engineer.

TACOMA, WASH.—Ordinances have been passed for three bond issues, $4,000,000, $3,850,000 and $1,425,000 respectively, for the construction of three units, in order noted, for the Lake Cushman power project.

VANCOUVER, WASH.—The Vancouver Shillapo District contemplates draining Vancouver Lake to reclaim 50,108 acres. The project includes diking, ditching and a pumping plant, to cost about $517,488. W. A. Schwarz, Vancouver, is engineer.

ASTORIA, ORE.—The installation of a street-lighting system throughout the burned area of the city is under consideration.

MARSHFIELD, ORE.—The Mountain States Power Company is considering increasing the output of its power plant.

PENDLETON, ORE.—Permission has been granted the Pacific Power & Light Company to erect a 66,000-volt transmission line on city streets.

PORTLAND, ORE.—The Portland Pulp & Paper Company, recently organized, plans to build a power house at its proposed mill, to cost about $1,200,000, with machinery. Roy H. Mills, Broadway Building, is president.

PRINEVILLE, ORE.—The Central Oregon Sugar Company, Portland, contemplates the construction of a power house at its proposed local refinery, to cost about $700,000. The Schwartz Engineering Company, Denver, is in charge.

ARCATA, CAL.—Plans have been approved for the installation of an ornamental lighting system in the business section.

CALEXICO, CAL.—The construction of four hydro-electric plants is under consideration by the board of directors of the Imperial Valley Irrigation District. It is proposed to locate two of the proposed plants on Alamo River and two on New River.

CROWS LANDING, CAL.—The Stanislaus Irrigation District contemplates reorganizing its district, including about 36,000 acres. The plans include diverting water from the San Joaquin River for irrigation by the installation of electrically driven centrifugal pumps. E. N. Bryan, Forum Building, Sacramento, is engineer.

LOS ANGELES, CAL.—The County Supervisors are arranging for an ornamental lighting system on the Washington Boulevard, consisting of 130 standards.

LOS ANGELES, CAL.—Surveys are being made by the Public Service Commission for waterworks on Kings River in Fresno County, in connection with a hydro-electric development for the city of Los Angeles. The project includes the Simpson reservoir, 215 ft. high, 2,670 ft. long on top, 180 ft. on bottom and 20 ft. wide, 43,022 ft. of concrete tunnel, penstock 2,450 ft. long and 81 in. in diameter, and the Kings River power plant, to develop 34,023 hp. The cost is estimated at $7,050,000.

MODESTO, CAL.—The Modesto Irrigation District is considering a bond issue of $500,000 to provide funds for the completion of the Don Pedro power distributing system. H. Storrs is chief engineer.

PORTERVILLE, CAL.—Plans are being considered by C. M. Jones and W. W. Slayden to build a dam and power house to develop about 182 hp., at a cost of about $15,000.

RED BLUFF, CAL.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system in the business section.

REDDING, CAL.—The purchase of the local lighting system, to be owned and operated by the municipality, is under consideration.

REDLANDS, CAL.—The installation of an ornamental lighting system on East State Street from Sixth to Church Streets is under consideration.

REDWOOD CITY, CAL.—The Pacific Gas & Electric Company plans extensions and improvements to its local system.

SACRAMENTO, CAL.—The installation of ornamental lamps on portions of Twelfth and I Streets, to cost about $25,000, is under consideration by the City Council.

SAN FRANCISCO, CAL.—Bids will be received by the Board of Public Works until Dec. 19 for insulators for electric transmission line for the Hetch Hetchy power and water supply, to cost about $200,000. M. M. O'Shaughnessy is city engineer.

SAN FRANCISCO, CAL. — Plans have been prepared by Bliss & Faville, Balboa Building, for an exchange building for the Pacific Telephone & Telegraph Company to be erected on Bush and Larkin Streets, to cost about $300,000.

SAN FRANCISCO, CAL.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 16, for a fuel-oil storage system at the Mare Island navy yard, including electrically operated pumping machinery, air compressors and auxiliary equipment. (Specification 4717.)

SUISUN, CAL.—A movement has been started by the Community Club for the installation of an improved street-lighting system.

TORRANCE, CAL.—The City Council is considering an issue of $75,000 in bonds for the installation of an ornamental lighting system.

RENO, NEV. — The Truckee General Electric Company is reported to be considering extending its transmission line into the Stillwater and the Island District.

Canada

HALIFAX, N. S. — The Nova Scotia Power Commission contemplates building a second power plant on the East River with an ultimate capacity of 9,000 hp. The commission has signed a contract with the Albany Perforated Wrapping Company, Albany, N. Y., to furnish electrical energy to the amount of 4600 hp. at its proposed pulp mill at Sheet Harbor.

MILDMAY, ONT.—The Mildmay Electric Light Company contemplates extensions and improvements to its system.

MONTREAL, QUE. — The Algonquin Power Company is considering a hydro-electric development on the Rivière du Loup en Haute, near St. Paulin, to cost about $100,000. J. M. Robertson, Ltd., 20 St. Nicholas Street, is engineer.

MONTREAL, QUE. — Arrangements are being made by the Riordan Company, 355 Beaver Hall Square, for the construction of a power house on the Gatineau River, Chelsea Falls. The Montreal Engineering Company, 164 St. James Street, Montreal, is engineer.

Electrical Patents

Announced by U. S. Patent Office

(Issued Nov. 20, 1923)

1,475,121. METHOD AND APPARATUS FOR CONTROLLING SUGAR CENTRIFUGALS; F. H. Jones, Tuinucu, Cuba. App. filed Dec. 28, 1920. Control of driving motor.

1,475,124. AUTOMOBILE SIGNAL; A. S. Levey, Portland, Ore. App. filed March 16, 1921. Rear direction signal.

(Issued Nov. 27, 1923)

1,475,162. ELECTRIC HEATER; C. C. Abbott, Pittsfield, Mass. App. filed March 5, 1921. Heating unit of elongated tubular type for air heater.

1,475,164. SIGNAL TRANSMITTING SYSTEM; W. R. G. Baker, Schenectady, N. Y. App. filed June 9, 1922. Control of generation and transmission of high-frequency currents for telegraphic signaling.

1,475,174. ELECTRIC MEASURING INSTRUMENT; H. L. Decker, Toledo, Ohio. App. filed Feb. 25, 1920. Ammeter for automobile control board.

1,475,177. COVERING PLATE OF INSULATING MATERIAL FOR TRANSFORMERS AND OTHER HIGH-TENSION APPARATUS; K. Fischer, Cologne-Braunsfeld, Germany. App. filed Dec. 10, 1914.

1,475,184. IGNITION SYSTEM; W. W. Hawkins, Brooklyn, N. Y. App. filed Feb. 20, 1922.

1,475,185. AUTOMATIC MOTOR STARTER; B. W. Jones, Schenectady, N. Y. App. filed March 17, 1921. Compensator for alternating-current motors.

1,475,190. SOUND-DETECTING DEVICE; I. Langmuir, Schenectady, N. Y. App. filed June 6, 1919. Microphone for use under water.

1,475,198. ELECTROPLATING APPARATUS; L. Potthoff (deceased). App. filed Feb. 20, 1920. Plating articles passing through apparatus in succession.

1,475,201. TELEPHONE-EXCHANGE SYSTEM; J. F. Toomey, New York, N. Y. App. filed Dec. 18, 1920. Toll connections established by machine-switching equipment.

1,475,216. TELEPHONE SYSTEM; G. A. Yanochowski, Chicago, Ill. App. filed Aug. 5, 1918. Party-line systems.

1,475,219. RADIO SIGNALING SYSTEM; R. Bown, East Orange, N. J. App. filed Nov. 1, 1920. Operation of several transmission channels under one control.

1,475,232. APPARATUS FOR MEASURING INTERVALS OF TIME; C. W. Ingels, Washington, D. C. App. filed Jan. 30, 1922. Timing operation of relays and switches.

1,475,240. LOW-FREQUENCY MEASURING DEVICE; H. S. Osborne, New York, N. Y. App. filed April 11, 1919. Apparatus for determining impedance of low-frequency circuits.

1,475,251. GENERATOR REGULATION; R. H. Sullivan, Rochester, N. Y. App. filed Dec. 15, 1922. Third-brush type.

1,475,295. ELECTRIC SYSTEM; B. E. Getchell, Plainville, Conn. App. filed July 22, 1922. Automatic control of farm-lighting units.

1,475,297. WIRELESS SELECTION SYSTEM; R. B. Goldschmidt, Paris, France. App. filed June 25, 1920. Mechanical selection of signals.

1,475,334. PERCOLATOR; M. L. Warner, Meriden, Conn. App. filed Dec. 13, 1921. Construction of electric heating chamber.

1,475,338. CONDUIT FASTENER FOR OUTLET BOXES; E. M. Blake, San Francisco, Cal. App. filed Feb. 23, 1921. Adapted to armored cables.

1,475,356. MANIFOLD HEATER; A. E. Tausche, La Crosse, Wis. App. filed May 18, 1922.

1,475,389. HYDRAULIC TURBINES; R. S. Hyatt, Valentine, Neb. App. filed May 9, 1923. Preventing ice formation on metal parts.

1,475,394. MAGNETIC ORE SEPARATOR; F. A. Jordan, Duluth, Minn. App. filed March 22, 1922. Drum type.

1,475,434. SECONDARY OR STORAGE BATTERY; W. E. Kershaw and C. D. Galloway, Philadelphia, Pa. App. filed Dec. 29, 1920. Electrolyte with covering layer of comminuted gilsonite.

1,475,444. TOOL FOR MANUAL DIRECTION; H. B. Mayberry, Gladstone, N. J. App. filed Dec. 6, 1922. Hair clipper operated by electric motor.

1,475,448. ELECTRICAL TRANSMISSION OF COMMUNICATIONS; H. Rowntree, Pass Christian, Miss. App. filed May 16, 1921. Applies either to wireless or telegraphy.

1,475,457. MAGNETIC SEPARATOR; W. G. Swart, Babbitt, Minn. App. filed Aug. 18, 1922. Means for taking out fine magnetic material.

1,475,481. ELECTRODE HOLDER; W. H. Flood, Tooting, and D. T. Smout, West Dulwich, London, England. App. filed May 14, 1921. For arc welding, cutting, etc.

1,475,485. STARTING MECHANISM FOR INTERNAL-COMBUSTION ENGINES; H. H. Gordon, Washington, D. C. App. filed Aug. 11, 1919. Auxiliary engine started by batteries.

1,475,497. AUTOMATIC TELEPHONE EXCHANGE; F. A. Lundquist, Chicago, Ill. App. filed Aug. 16, 1917. Selector switches operated by pneumatic means.

1,475,499 and 1,475,500. LINE SWITCH AND CONNECTION; F. A. Lundquist, Chicago, Ill. App. filed Aug. 3, 1918. Applied to automatic telephone exchanges.

1,475,501. SWITCHING MECHANISM; F. A. Lundquist, Chicago, Ill. App. filed Sept. 9, 1918. For automatic telephone exchanges.

1,475,503. STORAGE BATTERY; S. M. Meyer and W. James, Brooklyn, N. Y. App. filed Oct. 27, 1921. Solid sheet-metal negative electrode.

1,475,506. ELECTRIC POWER PLANT; H. R. Patterson, Toledo, Ohio. App. filed Sept. 10, 1919. Farm-lighting unit with storage battery.

1,475,562. CIRCUIT ARRANGEMENT FOR TELEPHONE PLANTS; G. A. Betulander and N. G. Palmgren, Stockholm, Sweden. App. filed March 31, 1920. Test relays for locating free lines.

1,475,583. VARIABLE-CURRENT GENERATOR; C. A. Hoxie, Schenectady, N. Y. App. filed May 20, 1921. Controlled by photo-electric cell.

1,475,594. SIGNALING SYSTEM; G. A. Pierce, Philadelphia, Pa. App. filed Oct. 31, 1919. Annunciator systems.

1,475,608. COMBINATION GAS AND ELECTRIC STOVE; J. T. Templeton, St. Louis, Mo. App. filed Nov. 1, 1922.

1,475,612 and 1,475,613. MEASURED SERVICE TELEPHONE SYSTEM; J. Wicks, Chicago, Ill. App. filed Dec. 13, 1919. For automatic telephone systems.

1,475,630 and 1,475,631. THERMALLY CONTROLLED CIRCUIT BREAKER; C. Herbst, Chicago, Ill. App. filed Aug. 15, 1921. For electric water heaters.

1,475,632. PROTECTIVE DEVICE FOR RADIO RECEIVING SYSTEMS; H. B. Herty, New Orleans, La. App. filed Feb. 10, 1922. Antenna automatically connected to ground when receiving current is too large.

1,475,645. ELECTRIC WATER HEATER; O. Meyer-Keller, Lucerne, Switzerland. App. filed Feb. 21, 1922. Wedge construction for electrodes.

1,475,667. RHEOSTAT; W. S. Webster, Brighton, Mass. App. filed Nov. 20, 1920. For electric tube filament control.

1,475,715. TYPING SPEED RECORDER; A. E. Oswald, Bogota, N. J. App. filed Jan. 25, 1921. Clock and bell-ringing signal system.

1,475,722. INSULATOR FOR TELEPHONE AND HIGH-TENSION CONDUCTORS; J. Romandy, Harmarville, Pa. App. filed Aug. 25, 1922. Conductor-gripping means.

1,475,587. ELECTRIC REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed July 15, 1919. Voltage-regulator system for generators.

1,475,739. MEANS FOR REPLENISHING THE ELECTROLYTE OF ELECTROLYTIC CELLS; P. H. Brace, Pittsburgh, Pa. App. filed Nov. 13, 1919. Maintains electrolyte of constant composition and quantity.

1,475,746. AUTOMATIC LIGHTING SYSTEM; A. M. Candy, Wilkinsburg, Pa. App. filed Nov. 3, 1916. Automatic regulation of engine-driven generator.

1,475,751. ELECTRIC IRON; O. A. Colby, Irwin, Pa. App. filed March 10, 1922. Construction of heating element.

1,475,760. INCLOSED RANGE HEATING UNIT; C. J. Fay, Mansfield, Ohio. App. filed Oct. 20, 1921. Refractory plate-holding element covered by metallic casing.

1,475,766. ELECTRICALLY DRIVEN PLANER AND THE LIKE; S. Gowan, Sale, and L. Miller, Whitefield, England. App. filed Sept. 8, 1920. Dynamic-braking circuit.

1,475,822. ELECTRICAL SYSTEM; R. E. Hellmund, Pittsburgh, Pa. App. filed June 18, 1919. Lighting system for electric railway vehicles.

1,475,823. SYSTEM OF CONTROL; R. E. Hellmund, Swissvale, Pa. App. filed Jan. 5, 1916. Control for induction motors used in locomotives.

1,475,854. MOTOR-CONTROL SYSTEM; H. D. Murdock, Wilkinsburg, Pa. App. filed March 5, 1921. Railway motor control arranged so that motor cannot be reversed when car is moving forward.

1,475,855. TENSION DEVICE FOR ARMATURE BANDING; Wilkinsburg, Pa. App. filed May 24, 1921. Automatic control of tension on wire.

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The Price of the Heart

MORE money is paid out for the labor of men and women than for anything else in the world. Nature bestows freely upon mankind the products of the mines, the fields, the forest and the waters. Labor turns these raw materials into manufactured articles at a price that is, after all, just the sum total of the cost of the combined work that men have put upon them from their crude state to perfection.

Labor, therefore, is the greatest of all commodities. To all men it is the most important purchase and the most important sale. Yet it is bought and sold carelessly, with the most casual consideration and the most wasteful inefficiency. For labor is commonly paid for by the measure of time—so much an hour, a day, a week, a month, a year, according to the nature of the task. Could there be a more absurd, unthinking way to reckon the value of the work that men and women perform?

The true worth of work is not a matter of either hours or the task. Rather it is the quality of the service rendered that sets the value. Three elements there are that enter into each man's work—the hands, the head, the heart. From one you buy the labor of the hands only. From another you purchase again the labor of the hands, but this worker contributes something more. He puts his mind into his work—he sells the service of his brain as well—and to men like this employers gladly pay a higher price. These are the foremen, the department heads—these thinkers—and their time is worth much more than that of those who labor only with their hands. But when an employee who supports his hands with thinking also puts his heart into his work, then have we found the greatest value in the labor market.

A man's hands may be hired for money. A man's thinking may be bought for money, too, if he will sell it. But a man's heart he never sells for coin. It must be won from him by leadership, by inspiration, by human sympathy, by heart appeal to confidence, respect, enthusiasm, hope and loyalty.

Time clocks record the hours. Rules and systems guide and apply the thinking of those who are willing to sell their minds also. But there is no machinery to win men's hearts. This element in human service, worth more than all the rest, is only given in exchange to the employer who himself puts his own heart into the service of his employees.

Herbert William Young

An engineer who is a pioneer in outdoor installations, a leader in the movement for standardized equipment and a manufacturer who makes service the keystone of his business.

THE most wonderful thing about the electrical industry is the opportunity it offers a man with brains and vision. It has never run in a rut or stifled individual initiative because it grows so rapidly and its applications are so innumerable. Example after example may be cited to show how individuals have succeeded by developing an opportunity for giving a needed service whose possibilities they grasped in its infancy.

Such a man is H. W. Young, president of the Delta-Star Electric Company, who foresaw the trend toward outdoor installations and immediately set out against all opposition to prepare the equipment that would be needed. He worked consistently for the development of outdoor installations and equipment and in the early days of his business was forced to be at once inventor, designer, builder and salesman.

Born in 1875, Mr. Young started in life in the shops of the General Electric Company, later became assistant foreman in the meter department and then transferred to the engineering department, where as an assistant to the late C. D. Haskins he wrote the first handbook on meters. Later he was sales manager of the New England district for the Westinghouse Electric & Manufacturing Company and then spent two years as sales manager of the Central Electric Company.

Becoming convinced of the value of outdoor equipment, he incorporated the Delta-Star Electric Company in 1908 and developed high-voltage outdoor switching and protective equipment. He has several patents on air-break switches to his credit and has preached the gospel of standardization and service throughout his business career. One of his hobbies is giving engineering as well as manufacturing service to purchasers of outdoor station equipment.

Mr. Young is a member of the Union League Club of Chicago, the South Shore Club, the Evanston Golf Club and the Electric Clubs of Chicago and Los Angeles. He has served on N. E. L. A. committees, being at the present time chairman of the sub-committee on substations and transmission towers, and is a member of the A. I. E. E. His genial personality and constructive optimism have gained him a host of friends in the industry who take pride in his standing as engineer, electrical manufacturer and man.

Editorial Comment

Electrical World, December 22, 1923

Volume 82 Number 25

Saving Millions to Public by Rate Reductions

IF ANY testimony were needed of the value and efficacy of commission regulation, it is provided in the great savings that have been made by the public through rate reductions. Of course, there could be no reductions if the electric light and power companies were not zealous and conscientious in the discharge of their duties. Were they indifferent to the problems of the day, did they not seek to offset higher costs by increased efficiency and the installation of better equipment, rates would be higher than they are at present. The electric light and power companies and not the commissions make rate reductions possible; but freedom from competition is a great asset, and that is what the commissions now give public utilities. Commissions also safeguard the interest of the public, because as soon as the utilities earn more than a reasonable return on their investment rate reductions are ordered. Thus the two work side by side, the one laboring diligently and assiduously in providing a service at minimum cost, and the other seeing that the job is not interfered with. So it comes that many companies received awards of merit during the year, not in the shape of gold medals or engraved diplomas, it is true, but by a far better recognition of work well done—an order to reduce rates. The inhabitants of Philadelphia were spared one million dollars by that means this year and a million and a quarter a year ago. Residents of southern California likewise saved two and a half millions, and so the march of progress continues. Consumers save millions of dollars annually and the service grows better and better. Surely such a record is commendable.

Economy and Waste in Buying Habits

BEFORE the war a salesman was accustomed to having customers purchase on a yearly basis. His order book was usually filled with a few big orders. In contrast, the present habit of customers appears to be to purchase on a small-lot basis, and the order book becomes filled with many small orders. There is no doubt that this latter method of buying is causing real waste. It detracts from the efficient operation of industry, because economies in production are usually obtained by planning ahead on a known or fairly definite basis, and economies in distribution by dealing with large unit orders. Manufacturing organizations cannot purchase raw materials with confidence; they instead of the purchaser must carry the surplus supplies and manufactured products; the load factor on the plant is very poor, and the overhead, sales charges and administrative charges increase.

On his part, the consumer feels that economic conditions change so rapidly that business judgment dictates the purchase of a minimum amount of material and the depletion of inventory stock. Labor, materials and interest rates fluctuate rapidly and prevent planning with confidence for future developments, and the consumer always either hopes or fears that the general price level will drop.

This general situation is reflected in the electrical industry in many lines. It is serious enough to receive the thoughtful consideration of the leaders in the industry. If the present practice is indeed as uneconomical as it appears from a general analysis, co-operative steps should be taken to reach a solution even though this should involve participation in the councils of other industries.

Free Trade in the Sale of Electrical Appliances

THE futility of attempting to prevent or limit the sale of electrical appliances by non-electric dealers is clearly defined by conditions which are coming to light in the ELECTRICAL WORLD survey of retail outlets for electrical merchandise. In the first article, published Dec. 8, the opinion of the vice-president and general manager of the central-station company is most significant. Criticising the attitude of those who believe that manufacturers and jobbers should refuse to sell to drug and department stores, he said: "Such a policy tends to cause those stores to sell cheap, inferior products, which gives the business a bad name and, in general, demoralizes efforts to insure a high standard of the appliances being sold. The central-station company should not attempt to corner the appliance situation, but should pursue an aggressive policy in order to stimulate other merchants to greater activity. . . . If the policy of free trade is adopted, the question of inferior appliances will soon take care of itself."

Contrast with the foregoing a statement in this week's article, on page 1270, by a dealer who advocates boycotting of all jobbers and manufacturers who sell to department stores. Almost in the same breath this dealer declares that department store competition is not being felt. "Consistency, thou art a jewel." The survey, however, shows that two department stores in that city are selling 25 per cent of the electrical appliances and report their business as increasing rapidly.

Two very evident conclusions may be drawn from the opinions of these men in two different cities. First, stumbling blocks placed in the way of the non-electrical store handling "quality" merchandise only encourage the greater sale of inferior appliances, and when standard lines are obtained it is more than likely they will be offered at cut prices as leaders or for pure vindictiveness. Second, the fact that two department stores, with a comparatively recent start, are doing

one-quarter of the appliance business in a city of 200,000 indicates public acceptance and approval of that class of store as an electrical merchandiser. Shoppers will go where they are best served, and if the straight electrical dealer sees his business slipping away from him, he will do well to look for flaws in his own sales policy before trying to put his competitor out in the cold by coercing the manufacturer or jobber.

The Economic Urges to Higher Illumination Intensities

IT CANNOT be denied that tremendous progress has been made in raising the standards of lighting in the last decade; however, it is equally obvious that the average illumination is still far below what is now economically desirable. Any one giving the slightest serious thought to lighting must admit that it is next in importance to food and shelter, because it is essential to vision and therefore to safety and production and to human progress in general. The greatest inhibition to advancement in lighting is perhaps indifference. Human beings have always had light. There is nothing strikingly novel in lighting. It is a prosaic matter as old as time. This indifference is difficult to overcome even with the wonderful new possibilities of modern light sources. However, dollars always speak loudly and they are listened to with attention and reverence. Dollars are beginning to speak eloquently for higher standards of lighting.

The effect of intensity of illumination on speed of vision, reaction time, production and so forth has been studied both in the laboratory and in the factory. Although much remains to be done, the results of a number of investigations are so strikingly similar that there is no doubt that there is a real economic advantage in increasing present average levels. M. Luckiesh and his colleagues have shown that the speed of reading of black print on white paper automatically increases 20 per cent on increasing the intensity of illumination from 2 foot-candles to 8 foot-candles. When the contrast is reduced, as with black type on gray paper, the increase in speed of reading was found to be about 60 per cent for the same increase in illumination as in the previous case. These data apply without reservation to the very general process of reading, and it is not unsafe to interpret from them a real advantage from increasing the intensity of illumination in any visual process.

More recently Dr. P. W. Cobb has reported results of an elaborate investigation of reaction times for various visual test objects. The speed of recognition of black and white lines out of a clear field and also when the object was preceded and followed by confusion patterns (analogous to reading or other continuous visual processes) increased with each increase in illumination throughout a range of intensities from 1 foot-candle to 100 foot candles—the limit of his investigations so far. Dr. Cobb's researches may result in eventually classifying visual conditions, thereby aiding in appraising the probable increase in industrial production attainable by proposed improved lighting.

Experiments conducted in factories also point in the same direction, although the laboratory work is necessary for complete analysis. D. P. Hess and Ward Harrison have recently reported the results obtained in the inspection department of a factory. They found an increase in production of 12.5 per cent on increasing the intensity of illumination from 5 foot-candles to 20 foot-candles. From the viewpoint of cost, this 12.5 per cent increase in the output of the forty-four employees involved was obtained by an increase in lighting cost equivalent to only 2.5 per cent of the payroll of the employees. These values are in line with those obtained a few years ago by W. A. Durgin. Incidentally, in a factory recently, an increase of 10 per cent in production in the daytime resulted from cleaning the windows. In one year this increase was equivalent to twenty-eight times the cost of cleaning the windows, which were quite dirty, as many factory windows are.

All these investigations point to a substantial economic advantage in higher-intensity lighting, and along with this advantage come the benefits of greater safety, less spoilage and more cheerful surroundings. Money talks, and in this case loudly, for, if the illumination intensity of the factories of this country were increased two or three times, the value of the increased output would easily far exceed the entire cost of electrical energy consumed in lighting. In other words, by such a simple expedient we should obtain better and safer working conditions and light the entire country at no net cost. This is a great opportunity and should be the goal of the electric lighting industry. Some day it may be proudly said that the electrical industry is lighting this great country at a net cost of nothing.

Maine Should Export Surplus Power

IN A RECENT address at Bangor, reported briefly in the ELECTRICAL WORLD for Dec. 1, Clarence G. Stetson sounded a note of warning to the people of Maine which contains much food for thought. For many years, as is well known, the exportation of hydro-electric energy from that state has been forbidden by law. Potential power resources, to be sure, considerably exceed the market in sight for energy, but politicians stress the idea that if Maine withholds water power from interstate transmission, industries will come into the Pine Tree State and greatly increased prosperity will follow. Candidates for office declare themselves opposed to exportation and the public at large seems acquiescent.

Mr. Stetson declared that Maine confronts an economic crisis in power affairs in the advance of superpower into New England. He contended with no little forcefulness that Maine is likely to gain far more by permitting power exportation from potential developments now awaiting capital than by persisting in the policy of power isolation. The benefits of interconnection apply to a whole state as well as to individual hydro-electric and steam systems. Increased taxable valuations accrue from enlarged or new electric plants, and revenue flows into many local pockets from the operation of economically justified systems. There would seem to be ample power for new industries and for interstate transmission in the Maine case; and so long as only the surplus is exported the danger of commercial injury to the commonwealth would seem to be negligible. Continued opposition to the conservation and use of resources for which the local market is inadequate spells continued waste and excessive cost of power—emphasized only too clearly in the protracted drought of the early fall.

Some evidence exists that the people of Maine may not indefinitely adhere to the isolation policy if the benefits of interconnection are made clear to them. In fact, Commissioner C. E. Gurney definitely made such a statement at the recent commissioners' conference on superpower called by Secretary Hoover. Through customer ownership, remarkably well developed in Maine, and in other ways, the utilities of the state appear to have a wonderful opportunity before them to perform constructive educational service to the public in pointing out the benefits of interstate interconnection, properly safeguarded and intelligently carried forward on the basis of expert engineering analysis and financial good judgment. Otherwise Maine stands to lose an economic contact with her sister states which, if retained and capitalized, bids fair to achieve truly great results in the conservation of national resources during the next decade.

Standardization Which Will Not Handicap Developments

STANDARDIZATION of the details of design is a thing which no sane engineer would suggest because he realizes that it would be a great hindrance to development and progress. However, there are certain forms of standardization which have been undertaken by manufacturers' organizations with benefit to themselves and the users which might be advantageously extended to other equipment. For example, considerable difficulty has been experienced by some users of electrical apparatus in providing sufficient electrical clearances even where certified drawings of the apparatus were obtained.

In almost all of these cases the objection was that the over-all height of the actual equipment was greater than indicated by certified drawings. As a consequence designs which were laid out on the basis of the certified drawings were inadequate for the service. In distribution practice, where the appearance of the poles has a great influence upon public opinion, it has also been found difficult where several makes of transformers are used to provide an attractive installation because of the variety of shapes of transformer cases and the difference in elevation at which the units will be supported by their hangers.

Another subject of importance is the lack of interchangeability of oil-switch and transformer bushings. This has been a great handicap to companies in emergencies. Some trouble has also been experienced recently with non-uniformity of pinholes in pin-type insulators.

The point to be made is that it should be possible so to standardize the maximum over-all dimension or method of mounting that appearance, ease of installation and interchangeability shall not be sacrificed. With transformers for floor or ground mounting it might be advisable to standardize the maximum over-all height of different makes of apparatus of the same rating in order that the designer of equipment shall be able to provide adequate clearance without experiencing the present difficulties.

When found necessary to improve the appearance of pole-top mounted transformers it will be up to operating companies through their national organizations to agree on whether they want "squatty" or tall transformers before any standardization can be accomplished by manufacturers.

Standardization of the elevation at which transformers will be maintained with respect to cross-arms is another thing which will have to be worked out by the N. E. L. A. committees, if it is desirable at all. While manufacturers cannot be expected to agree upon the exact length of bushings for certain voltages, it would be of considerable help to users if the maximum length could be standardized as well as the dimensions of the base of the bushing which fits into the transformer or oil-switch case. Pinholes in insulators are already standardized, but there appears to be a necessity of standardizing tolerances in order that the insulators may be screwed down on their pins equally well. Evidently the difference in pinholes comes from firing, but even then it is evident that certain tolerances should be prescribed.

Where the users see these opportunities for standardization they can jointly agree upon their requirements in the committees now provided in their national organizations. Where manufacturers see such opportunities they can do likewise and can consult with the N. E. L. A. where they see that such standardization might affect the users seriously. In any standardization of this kind affecting both the manufacturer and user it seems almost needless to point out that there should be the closest co-operation between the manufacturing organization and the utility organization.

A Record Worth Being Proud About

INVESTMENT bankers, in their literature and advertisements on bond sales, invariably incorporate financial and other statistics taken from letters of the presidents of the companies whose bonds are offered for sale. Naturally these statistics are informative and assuring. Some are pompous in language, but all are brief and to the point. Of the many which have come to the attention of the ELECTRICAL WORLD lately, none has told so great a story with such becoming modesty as that of Samuel Insull, president of the Commonwealth Edison Company. The company has just issued $15,000,000 of first mortgage collateral gold bonds, and in his letter to the bankers, Mr. Insull has this to say about the management:

"The company is managed by experienced public utility men, whose ability as economical and efficient operators is evidenced by the successful manner in which the severe test of the war and post-war days was withstood without an increase in rates or a decrease in dividends paid."

When it is recalled that the Commonwealth Edison Company generates more than two billion kilowatt-hours of electrical energy in steam stations yearly, that it sells this energy on a very narrow margin, that all costs increased during and after the war, and that operation in that time was oftentimes extremely difficult and capital hard to obtain, what a volume is condensed into those forty-six words! But modesty has ever been one of the elements of true greatness, and Samuel Insull's modesty has been as much a part of his character as the ability which has placed him where he is today, at the top of the electric light and power industry. In the Commonwealth Edison Company he has reared to his fame a monument more enduring than brass. It is well for the industry to note such an achievement and the zeal which made it possible.

1. The Sin-Ogawa Street substation of the Tokio Electric Light Company was crushed but not burned. Six attendants were killed in the disaster.

2. The transformers at the Kawasaki substation of the Gunma Electric Power Company survived and did gallant service after the earthquake.

Electrical Industry in Japan Devastated

NEWS of the effect of the recent earthquake and fire in Japan shows that the electrical industry suffered a loss that will exceed $100,000,000, and it will require three to five years to restore pre-earthquake conditions. K. Kambe, president of the Tokio Electric Light Company, estimates a loss of $8,750,000 to the light and power supply companies. The following itemization gives an idea of the devastation and losses: Of seventy substations, twelve were destroyed; 27 per cent of the wood poles in Tokio and 34 per cent of those in Yokohama were burned; nearly all underground cables were damaged; 1,400,000 lamps (44 per cent of the total number) in Tokio and 270,000 (46 per cent of the total) in Yokohama were destroyed; motors aggregating 58,000 hp. (46 per cent of the total) in Yokohama were burned; losses in wire, 9,500,000 yen; in substations, 5,490,000 yen, and in stocks and supplies, 2,520,000 yen. In other branches of the electrical industry 100,000 telephones and a dozen exchanges were burned, all overhead telegraph lines were destroyed, 1,000 street railway cars were burned and tracks, overhead and bridges damaged. Of the manufacturing plants the Shibaura Engineering Works, which is affiliated with the General Electric Company and makes generators and motors, was completely burned; the Nippon Electric Company, affiliated with the Western Electric Company, and the Tokio Electric Company, lamp manufacturers, affiliated with the General Electric Company, were destroyed by the earthquake and hundreds of the employees were killed and wounded; many smaller factories making cables, motors, meters, batteries, line materials, etc., either burned or collapsed. (Courtesy of S. Hirota, chief editor of the *Ohm*, Kobe, Japan.)

3. Kiobashi substation of the Tokio Electric Light Company. The brick building was destroyed, but the re-enforced concrete building was undamaged. Fire destroyed all equipment.

4. Kawasaki Works of the Tokio Electric Company was crushed but not burned and was the only example of a re-enforced concrete building destroyed by the earthquake.

5. Ginza Telephone Exchange, being re-enforced concrete, withstood the earthquake but not the fire.

6. Effect of earthquake and fire on Sitaya substation of the Tokio Municipal Electric Bureau.

Communication Over 140,000-Volt Line

Duplex Automatic Installation on Power Lines of Consumers' Power Company—Details of the High-Frequency Apparatus Used—How the Installation Is Handled by the Load Dispatcher Under Operating Conditions

By C. A. BODDIE
Radio Engineer Westinghouse Electric & Manufacturing Company

THE installation of high-frequency telephone communication on the 140,000-volt lines of the Consumers' Power Company, between Jackson and Battle Creek, Mich., marks a distinct advance in the art. The basic advantage of the high-frequency telephone is the use of the power lines themselves as a communication circuit which, owing to its superior mechanical strength, affords a more reliable circuit than the usual telephone line. For distances exceeding 15 miles this system is cheaper to install and maintain than a wire line, and it has a most promising future for central-station use.

The initial installation of the Consumers' Power Company's system is between the steam plant at Jackson and the Elm Street station at Battle Creek. These stations are connected by a three-phase, 140,000-volt, 60-cycle power line. The transmission distance is about 50 miles, being part of an extensive high-voltage system. The high-frequency currents are superimposed on and received from the power lines by antennas strung on the same towers as the transmission lines. The antennas at Jackson are shown in Fig. 1. The transmitting antenna is attached to the small insulator on the middle arm of the tower, and the receiving antenna is carried by a similar pair of suspension insulator units on the lower arm.

The complete installation of the high-frequency apparatus at Jackson is shown in Fig. 2. The transmitter and rectifier are shown at the left and the receiver is near the center of the table. The cabinet to the right contains the selectors. To the left of the receiver is the desk telephone set. This set is equipped with a standard automatic call dial and is not the one ordinarily uséd for the control of the equipment, but is used for communication from the high-frequecy installation and for testing.

The load dispatcher's office is in the Consumers' Power Company building, about half a mile distant from the high-frequency apparatus shown in Fig. 2. Two wires run from the high-frequency apparatus at the Jackson steam plant to the dispatcher's office, where they terminate in a standard automatic telephone desk set similar to the one shown in Fig. 2. No apparatus other than the desk set itself is located at the dispatcher's office. Complete automatic control of the high-frequency apparatus is accomplished over these two wires.

THE CALLING OPERATION

The operation of calling is exactly the same as with a standard form of automatic telephone. For example. when the load dispatcher at Jackson desires to communicate with the station operator at Elm Street, Battle Creek, he merely lifts the receiver from the hook of his desk set and dials the number assigned to the Elm Street station. The act of unhooking starts up the high-frequency telephone apparatus at the Jackson steam plant and sends out a series of modulated high-frequency impulses over the 140,000-volt power line. This impulse sequence is picked up by the receiving antenna at Elm Street, where it is led through the high-frequency receiver and after being amplified actuates a pair of relay contacts which notch up a selector. If this selector pauses on the proper contact point, a circuit is completed through the station call bell, which then rings until the station operator unhooks and answers the call. The act of unhooking starts his high-frequency transmitter and enables him to communicate with the load dispatcher, just as though he were using a standard wire-line automatic telephone. It is to be particularly noted that the installation provides for the simultaneous two-way communication called duplex; that is, both parties are able to talk and listen at the same time, as is the case with the commercial wire-line telephone.


FIG. 1—ANTENNAS ARE STRUNG ON LINE TOWERS

When completed, this installation was immediately turned over to the load dispatcher and used in regular load-dispatching service. It has been demonstrated

FIG. 2—COMPLETE INSTALLATION AT JACKSON

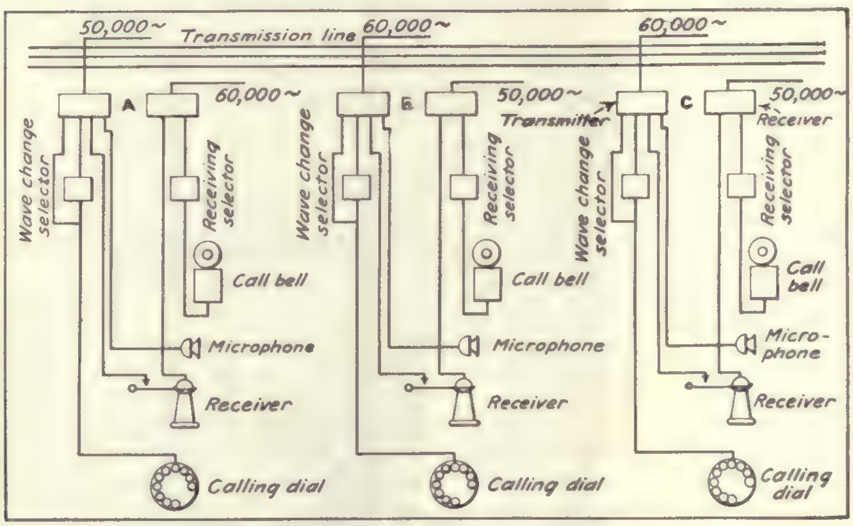


FIG. 3—SCHEMATIC DIAGRAM OF A THREE-STATION INSTALLATION

FIG. 4—A 250-WATT TRANSMITTER AND A RECTIFIER

that the ease of operation resulting through duplexing is of great importance. The special features which distinguish this completed installation are:

1. It is duplex.
2. Control is entirely automatic.
3. It embodies selective calling.
4. Calling is accomplished by a standard automatic telephone calling dial.
5. Wire-line extension is accomplished by two wires.
6. The transmitter is rated at 250 watts.
7. A vacuum-tube-type rectifier is used as a source of 2,000-volt direct current instead of a motor-generator set.
8. Provision is made for automatically changing the frequencies on both the transmitter and receiver.

The duplex type of communication is a great advance over the familiar simplex system used in radio and other high-frequency systems of communication as it permits automatic control, selective ringing and affords the same flexibility and efficiency of operation offered by the wire telephone. It does away with the old lock-out scheme of depriving the listener of the privilege of breaking in or interrupting the speaker until the speaker has finished and voluntarily surrendered the initiative by stopping the transmitter and listening in. At times of emergency a verbose operator will greatly delay action, and in the confusion both parties may be listening or talking at the same time, with no result and the feeling at each end that the other station is out of operation.

Previous attempts to obtain duplex operation in direct radio or with high-frequency current over power lines have aimed at the neutralization of the current induced in the delicate radio receiver by the local transmitter, while at the same time preserving a high degree of sensitivity to the reception of incoming signals. These attempts have usually resulted in an extremely delicate balance, owing to the fact that the transmitter output is thousands of times greater than that required by the receiver. Previous balancing methods have also been wasteful of the transmitted energy in that they usually took the form of a duplicate local antenna circuit whose purpose was the balancing out of the antenna current normally induced in the receiver circuit.

In the development of the present system of high-frequency communication a very simple and efficient means of neutralization has been discovered. The circuits are simple, inexpensive and easily adjusted, and, further, they do not waste any appreciable amount of the transmitted energy. The system requires two antennas, one for transmission and one for reception. The general scheme of operation may be appreciated by reference to the schematic diagram (Fig. 3), which shows three stations, A, B and C. Station A is assumed to be the load dispatcher. His transmitter is adjusted to produce 50,000 cycles and his receiver is tuned to receive 60,000 cycles. All receivers in the substations with which he wishes to communicate are tuned to receive the dispatcher's frequency, that is, 50,000 cycles. The substation transmitters are all adjusted to produce 60,000 cycles, since this is the frequency which the dispatcher's receiver is tuned for. Thus there are

two frequencies simultaneously in use during a single conversation.

The balancing system adopted may be so adjusted as to balance out almost completely the pick-up from the local transmitter even when the receiver is tuned exactly to the transmitter frequency. Without this balancing circuit the current in the primary would under these circumstances amount to from 60 to 80 per cent of the transmitted antenna current. The balancing adjustment is easily made and when once attained requires no further attention.

Calling is accomplished by means of the automatic call dial mounted as part of the desk telephone set. The high-frequency transmitter starts immediately on unhooking the desk-set receiver and sends out a stream of high-frequency oscillations over the power line. When the call dial is operated this steady high-frequency current is modulated at a low-frequency rate. Thus at each closure of the call dial contact the high-frequency current is modulated at approximately a 500-cycle rate. These modulated high-frequency impulses are received by the high-frequency receivers at the various substations on the transmission line. A special relay in each of these receivers closes its contact at each modulated high-frequency impulse.

A selector in many respects similar to those used in automatic telephony is actuated by the contacts of this relay, which therefore advances one step for each impulse of the calling dial. Thus all the selectors notch up a number of steps equal to the number of impulses coming from the call dial. By means of a combination of slow and fast relays only that selector closes its call-bell contacts which happens to pause on the contact corresponding to the number dialed by the station operator. Therefore, while all the selectors notch up five steps when No. 5 is dialed by the load dispatcher, only No. 5 selector will close its call-bell contact. The call bell at this substation will then ring until the station operator lifts his receiver from its hook. Two selectors are seen in the cabinet on the right end of the table (Fig. 1). The selector to the left is the wave-chain selector, whose function is to change wave lengths or frequency. The selector to the right is the calling selector, which is operated from the contacts of the calling relay mounted in the amplifier box.

Wire-Line Extension

The evolution of satisfactory duplex opened up the possibility of combining the voice currents supplied to the high-frequency transmitter and those delivered by the high-frequency receiver into a single pair of wires. Complete automatic control is now accomplished over two wires. This involves the operation of starting the high-frequency apparatus when the receiver is lifted from its hook, of calling when the call dial is operated, of simultaneously transmitting the microphonic currents from the desk-set microphone to the high-frequency modulating apparatus and transmitting the incoming voice currents from the high-frequency receiver to the desk-set receiver, and of ringing the operator's call bell. The energy for operating the desk telephone set comes from a storage battery installed as part of the high-frequency apparatus.

Transmitter Capacity

The apparatus necessary for effecting the separation of the voice currents in the line intended for the transmitter and coming from the receiver is contained in a box (Fig. 6). It contains two receiving-type vacuum

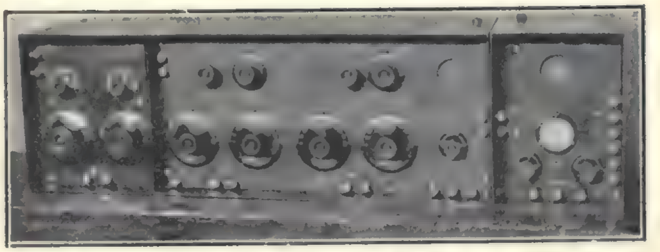


FIG. 5—HIGH-FREQUENCY RECEIVERS USED AT SUBSTATIONS ALONG THE LINE RESPOND TO MODULATED IMPULSES

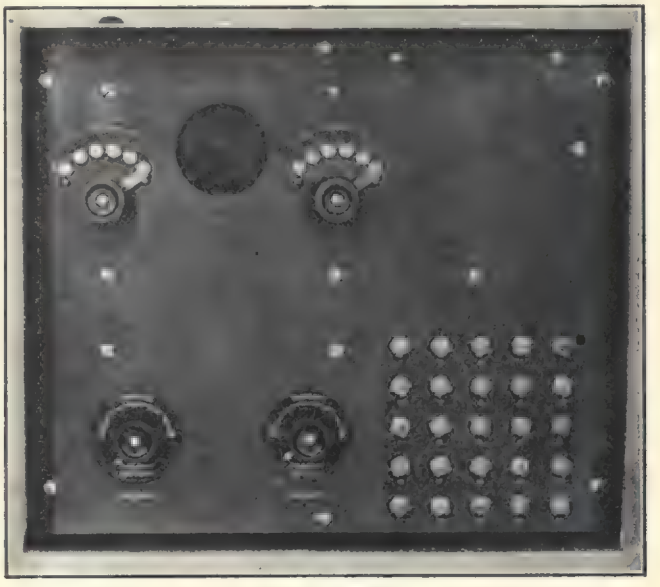


FIG. 6—APPARATUS FOR SEPARATING AND AMPLIFYING INCOMING VOICE CURRENTS BY MEANS OF VACUUM TUBES

FIG. 7—INSTALLATION OF PROTECTIVE EQUIPMENT AT JACKSON

tubes for amplifying the respective voice currents from the line and means for adjusting the degree of amplification. The necessary slow and fast relays for the automatic control of the set are also mounted in this box.

Reliable communication must be insured during emergencies, as in case of storms when some of the transmission lines are down or broken. To insure communication during these emergencies, which is the very time it is most needed, ample power must be used. This installation uses 250-watt transmitting equipment, which has been found to be the desirable size of transmitter and a size for which excellent tubes of this rating are commercially available. Transmission lines of great length that have numerous transformer taps may require still larger transmitting equipment.

The 250-watt transmitter and the rectifier installed at the Jackson steam plant are shown in Fig. 4, and Fig. 5 shows the high-frequency receiver. This receiver is of three parts, and the section to the left contains the circuits for balancing out the energy picked up from the local transmitter. It is this balancing equipment which makes duplex communication possible. The middle section is the tuner and is of the coupled-circuit type. The secondary is provided with Armstrong regeneration, which may be used if necessary. The unusual feature about this receiver is that it is provided with a double tuning of both primary and secondary to enable automatic transition from one frequency to another. The pair of dials to the left belong to the primary and the pair to the right to the secondary. The section to the right is the amplifier and contains two tubes, an amplifier tube and a detector tube. The function of the detector tube is to operate the radio relay used in the calling system. The radio detector is in the tuner box. When a modulated high-frequency current is received it is rectified in the usual way by the radio detector, amplified and fed into the second detector in whose plate circuit the calling relay is connected. When a modulated high-frequency signal is received the plate current of the second detector tube is greatly reduced. Since this current is drawn through the windings of the calling relay, its contacts close each time an audio impulse arrives. Each unit of the receiving apparatus is mounted in a metal box, the boxes projecting beyond the front panel to provide for a metal cover which totally closes the front. This cover may be put in place and locked after adjustments have once been made.

The 2,000-volt direct current required by the 250-watt vacuum tubes of the transmitter is derived from a vacuum-tube rectifier instead of from a motor-generator. Sixty-cycle, 110-volt current is required by the rectifier and is applied to the low-tension windings of a simple transformer which supplies high-voltage 60-cycle current to the plates of two high-voltage vacuum-tube-type rectifier tubes. Both halves of the 60-cycle alternating current are rectified, and the pulsations in the resulting unidirectional current are entirely smoothed out by suitable condensers and inductances, thus delivering a perfectly steady direct current of 2,000 volts potential to the high-frequency transmitter.

In addition, the 110-volt, 60-cycle source is transformed to 15 volts, so that it may be used for filament supply. As a result the entire power requirements for the set are drawn from the 60-cycle source. There is no dependence on moving parts in the installation.

Two wave lengths are ordinarily used in the system, but the dispatcher only can tune the equipment, with the result that the outlying stations must all clear through the dispatcher's office, since they are all adjusted to transmit 60,000 cycles and none are tuned to receive it. If, however, it is desired to permit the outlying stations to communicate between themselves, the frequency adjustment of the calling station must be changed to agree with that normally assigned to the dispatcher.

This change-over is provided for in the sets installed at Jackson and Battle Creek and will be included as a standard feature of all future equipment. It involves provision for changing taps on the transmitter and simultaneously changing condensers on the receiver. This is automatically acomplished by the call dial. When a station operator whishes to call a station other than the dispatcher he can do so by dialing No. 10 on his automatic call dial. This notches up a selector which closes its contacts on receiving ten impulses and throws a wave-change switch in the transmitter, at the same time energizing relays in the tuner of the high-frequency receiver, which substitutes an extra set of condensers previously tuned to the new wave length desired. Thus by merely dialing 10 an operator may immediately convert himself into a dispatcher so far as wave-length adjustment is concerned, which then permits him to call any station on the system, just as the dispatcher may call any station.

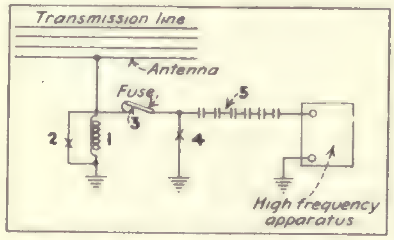


FIG. 8—SCHEMATIC DIAGRAM OF PROTECTION APPARATUS

Experience has demonstrated that it is necessary to protect against the possibility of the high-tension line coming in contact with antenna wires. The scheme adopted resembles that used for telephone lines exposed to high-voltage power lines except that it is more rugged and elaborate. Fig. 8 shows a schematic diagram of the protective apparatus. An inductance (1) conducts to the ground the 60-cycle charging current picked up by the antenna because of its proximity to the high-voltage power line. This coil acts as a low impedance to ground for the 60-cycle current and as a high impedance for the 50,000-cycle. It is an air-core inductance mounted in a weatherproof transformer case. Two rugged spark gaps are used, one shunting the inductance coil to ground and the other going to ground through the high-tension fuse (3). A group of seven condensers in series (5) separates the high-frequency apparatus from the antenna. In case of contact with the power line the high-tension fuse will blow and separate the high-frequency apparatus entirely from the antenna lead, which is then effectually grounded through the spark gap (2). Fig. 7 shows the installation of the protective apparatus at the Jackson end of the system. The boxes at the top of the tower contain the drain coils and associated spark gaps. The boxes at the lower level contain the high spark gap associated with the high-voltage fuse. The high-voltage fuses are mounted outside on the steel structure. The protective condensers are installed inside the building.

The installation at Jackson is the most highly developed yet produced and has been carried to the point where the high-frequency telephone is the complete operating equivalent of the automatic wire-line telephone. The system has already demonstrated its superiority during storm conditions.

Features of an Interconnection Contract

Essential Points of Agreement Between Four Utilities and a Commonly Owned Generating and Transmission Organization—Mutual Responsibilities and Benefits Defined with Minimum Resort to Legal Verbiage

A COMPREHENSIVE interconnection agreement was recently filed with the Massachusetts Department of Public Utilities by the Montaup Electric Company, Blackstone Valley Gas & Electric Company, Edison Electric Illuminating Company and Brockton, Mass., and Fall River (Mass.) Electric Light Company, in connection with the proposed development of a tidewater steam plant and appropriate transmission tie lines for the intersupply of energy along more economical lines than would be attainable by the enlargement of the existing plants of the last three companies. At this writing the issue of securities for preliminary work has been approved by the commission and the further development of the project is before the board. The Montaup company, formed by the three central stations named, was organized on the strength of a recent Massachusetts law permitting electric utilities to pool money for purposes of this sort. Stone & Webster, Inc., Boston, are actively interested in the project and are managers of the Blackstone Valley and Brockton companies. Because of the nation-wide interest in interconnection problems the essentials of the agreement are printed herewith.

Preamble

The contract was signed Sept. 11, 1923, by the Montaup, Fall River, Brockton and Blackstone companies. The reason for the agreement is that the Fall River, Brockton and Blackstone companies desire to secure an economical and assured supply of electric power at minimum cost in addition to the capacity of their respective steam-power stations, to meet requirements for present and increased demands and for emergencies, which may best be accomplished by the construction and operation of a tidewater electric plant in or near Fall River, by co-operation between themselves and the Power Company. The parties agree as follows:

Article I—Term

The contract term extends to July 1, 1963, and thereafter until terminated by one year's notice by one party to the others; but in case any party fails to perform its obligations, any other party may abrogate this contract in so far as it applies to its future participation in increasing the capacity of the Power Company's station and transmission system and may withdraw from such future participation upon reasonable notice to the other parties.

Article II—Definitions

(a) "Three companies" means the Fall River, Brockton and Blackstone companies.

(b) "Purchased capacity" is the total kilowatt demand which (on Sept. 11, 1923) the Fall River company is obliged to purchase from the New England Power Company* and the Blackstone company is obligated by contract to purchase from the Rhode Island Power Transmission Company.† It is agreed that these are as follows: Fall River company, 10,000 kw.; Blackstone company, 17,500 kw.

(c) "Purchased electricity" is electricity which the Fall River company and the Blackstone company are under contract to buy under "purchased capacity."

(d) "Relayed generating capacity of the three companies" is the generating capacity of their respective existing steam-power stations with the largest generating unit out of service. These "relayed generating capacities" are agreed upon to be as follows: Fall River company, 8,000 kw.; Brockton company, 10,000 kw.; Blackstone company, 13,500 kw.

(e) "Unrelayed generating capacity of the three companies" is the capacity of the largest generating unit now installed in each of their respective steam stations. These "unrelayed generating capacities" are agreed upon to be as follows: Fall River company, 6,250 kw.; Brockton company, 10,000 kw.; Blackstone company, 20,000 kw.

(f) Each of the three companies shall provide and maintain in operation the necessary instruments to furnish a permanent record of the total demand upon its entire system at all times. The instruments, their location, installation and the method of their periodic calibration are subject to the approval of the Power Company. The original instrument records for each month are to be delivered to the Power Company at the end of that month and not over ninety days later are to be returned to the company which furnished them, when requested to do so by that company, and are to be kept for not less than five years by that company and to be available at any and all times for the inspection by any part hereto.

The "daily maximum demand" in kilowatts for each of the three companies shall for any day be taken as twice the greatest number of kilowatt-hours which it has supplied to its customers during any thirty minute interval of that day, as determined by an authorized representative of the Power Company from the above instrument records.

(g) The term "maximum demand" as applied hereunder to any of the three companies at any time shall mean the average of the highest ten daily maximum demands of such company that have occurred previous to such time.

(h) The term "unrelayed maximum demand" as applied hereunder to any of the three companies at any time shall mean the amount in kilowatts by which the maximum demand of such company at that time exceeds the sum of its relayed generating capacity and purchased capacity, provided, however, that the board of directors of the power company may by unanimous vote temporarily determine the unrelayed maximum demand of a company by some method other than the above if, in the judgment of the board, this should be done to divide the fixed charges of the Power Company equitably between the three companies.

(i) "Estimated unrelayed maximum demand" for any future period is the unrelayed maximum demand defined in paragraph (h) of this article as officially estimated by each company and approved by the Power Company.

Article III—Electricity to Be Purchased by the Three Companies

During the term of this agreement the Power Company agrees to furnish, and the three companies agree to buy, all of their respective electrical energy requirements over and above the kilowatt-hours corresponding to 167 hours' use per month of their respective relayed generating capacity and their purchased electricity under existing contracts.

The Power Company agrees forthwith to begin and continue construction of its steam-power station and the transmission lines to be owned and maintained by it in order that it may be in a position to furnish power as promptly as possible, subject only to its obtaining the necessary authority therefor.

Article IV—Apparatus to Be Installed by Three Companies and Sale of Energy to Power Company

In order to make it possible for the Power Company to supply the desired electricity and give reliable service under all conditions with a minimum investment in the Power Company, each of the three companies agrees that it will at once at its own expense construct the transmission lines which are to be owned and maintained by it and install any additional capacity in boilers or other station equipment required to make its steam station capable of actually generating power under normal conditions to the full amount of its relayed generating capacity plus unrelayed generating capacity, and will make every reasonable effort continuously to maintain its station and transmission lines in condition for such full operation, and will, so far as able, supply power to the Power Company in any amount up to the full amount of its unused relayed generating capacity plus its unrelayed generating capacity, and at any time when requested by the Power Company to do so for compensation hereinafter specified.

Article V—Respective Ownership and Maintenance of Property

By reason of the nature, location and estimated relative cost of the generating station and of the various parts of the transmission system to be installed by the Power Company which are necessary to make the interconnecting systems of the three companies properly operative, as well as the relative values of such portions of the existing steam stations, improved as specified, are to be made available for supplying power to the Power Company, it is agreed that the Power Company will provide, own, maintain and operate at its expense, and each of the three companies will provide, own, maintain and operate at its respective individual expense, certain portions, as specified below, of the total property involved, and that this division, when considered with the other provisions of this agreement, represents an apportionment which is fair and equitable to each of the three companies.

The Power Company shall provide, own, maintain and operate the following:

(a) A complete tidewater electric generating station in Massachusetts near Fall River.

(b) All required step-up transformers.

(c) All transmission lines and auxiliary equipment in Massachusetts which are necessary properly to connect its generating station with the Pawtucket and Woonsocket systems of the Blackstone company.

(d) All transmission lines, together with their auxiliary equipment, which form the portion within 14 miles of the generating station of the Power Company, measured along the transmission-line right-of-way, of the necessary and proper connection between its generating station and the system of the Brockton company.

(e) All transmission lines, together with their auxiliary equipment, which are necessary properly to connect its generating station with the system of the Fall River company at the Hathaway street substation in Fall River.

The Fall River company shall provide, own, maintain and operate the following:

(a) All step-down transformers and other equipment required for the utilization of the power from the Power Company's transmission lines.

(b) The necessary apparatus to permit proper voltage regulation and economical

*A wholesale power organization operating in Massachusetts, not a party to this contract.

†A wholesale power organization operating in Rhode Island, not a party to this contract but affiliated with the New England Power Company.

operation of the transmission lines serving its system.

The Blackstone company shall provide, own, maintain and operate the following:

(a) All transmission lines, together with their auxiliary equipment in Rhode Island which are required properly to connect its Pawtucket and Woonsocket systems with the lines in Massachusetts to be provided for that purpose by the Power Company.

(b) All step-down transformers and other equipment required for the utilization of the power from the Power Company's transmission lines.

(c) The necessary apparatus to permit proper voltage regulation and economical operation of the transmission lines serving its system.

(d) Additional boilers, amounting to at least 2,230 rated boiler-horsepower, and any other additional equipment and structures required in its steam station to fulfill the conditions specified in Article IV.

The Brockton company shall provide, own, maintain and operate the following:

(a) All transmission lines, together with their auxiliary equipment, located at a greater distance than 14 miles from the generating station of the Power Company, measured along the transmission line right-of-way, which are required to connect its system with the line or lines to be provided for that purpose by the Power Company.

(b) All step-down transformers and other equipment required for the utilization of the power from the Power Company.

(c) The necessary apparatus to permit proper voltage regulation and economical operation of the transmission lines serving its system.

(d) Additional boilers, amounting to at least 1,200 rated boiler-horsepower and any other additional equipment and structures required in its steam station to fulfill the conditions specified in Article IV.

Each of the three companies shall as soon as possible after being requested in writing by the Power Company to do so provide, maintain and operate at its own expense any equipment which may be required to improve the power factor of the energy supplied to it by the Power Company so that this power factor shall not be less than 80 per cent at the low-tension side of the Power Company's step-up transformers. Any question arising under the provisions of this article may be referred to arbitration as provided.

Article VI—Apportionment of Financing

Subject to the approval of the public authorities when required, the three companies are to finance the Power Company's initial investment by subscribing for and purchasing the capital stock of the Power Company and such of its bonds and other securities as the directors of the Power Company shall determine, at par or such other price as may be approved by the Department of Public Utilities of Massachusetts; and the aggregate amount of such stock and securities purchased by each company shall be in the proportion which the estimated unrelayed maximum demand of each company in kilowatts bears to the sum of the estimated unrelayed maximum demands of the three companies for the first twelve months during which the steam generating station of the Power Company is operated. It is agreed that the proportions of the total initial investment made by each company as above provided and the estimated unrelayed maximum demands from which these proportions are determined are as estimated:

	Proportion of Total Initial Investment, per Cent	Estimated Unrelayed Maximum Demand, Kw.
Fall River company....	47.88732	17,000
Brockton company....	12.67606	4,500
Blackstone company...	39.43662	14,000
Total..............	100.00000	35,000

Whenever the directors of the Power Company determine that the investment of the Power Company (exclusive of transmission lines) is to be materially increased to provide additional capacity or more economical operation, the investment of each of the three companies in the Power Company is to be readjusted in such manner that, after providing the additional funds, the investment of each company shall bear the same ratio to the total investment in the Power Company that the estimated unrelayed maximum demand of each company for the next following twelve months bears to the total estimated unrelayed maximum demand of the three companies in the same period.

Whenever the investment of the Power Company in transmission lines is materially increased, the resulting additional inestment shall be apportioned between the Power Company and the three companies in such manner as is fair and equitable. Any question arising under the provisions of this article may be referred to arbitration as provided.

EXHIBIT "A"

(Illustrating application of Article VII to an assumed case.)

	Estimated Unrelayed Maximum Demand, Kw.	Ratio, per Cent	Capital Furnished by the Three Companies
Fall River company..	17,000	47.88732	$2,630,451
Brockton company..	4,500	12.67606	696,296
Blackstone company.	14,000	39.43662	2,166,253
Total............	35,500	100.00000	$5,493,000

The actual unrelayed maximum demands might in any month be as follows:

	Kw.
Fall River company.......	15,000
Brockton company	4,500
Blackstone company..................	15,500

Under article VII the normal capital requirements of the three companies would be determined as follows:

	Actual or Estimated Unrelayed Maximum Demand, Kw.	Ratio, per Cent	Normal Capital Requirement
Fall River company..	17,000	45.94595	$2,523,811
Brockton company..	4,500	12.16216	668,068
Blackstone company.	15,500	41.89189	2,301,121
Total............	37,000	100.00000	$5,493,000

Adjustment to equalize investments:

Credit to Fall River company:
$2,630,451
2,523,811

$106,640 × 8 per cent ÷ 12 = $710.93

Credit to Brockton company:
$696,296
668,068

$28,228 × 8 per cent ÷ 12 = $188.19

Debit to Blackstone company:
$2,301,121
2,166,253

$134,868 × 8 per cent ÷ 12 = $899.12

Article VII—Price of Electricity Sold by Power Company

The purchase price of electricity furnished by the Power Company to the three companies shall be determined as follows:

(a) At the end of each month the Power Company shall compute the costs which shall be determined by it to be properly attributable to overhead charges, as distinguished from operating charges, such as interest or other return unon capital, taxes, insurance other than liability insurance or other insurance properly chargeable to operating, reserves for replacements, renewals, obsolescence and like items, and such costs shall be apportioned among the three companies as nearly as may be in proportion to their respective unrelayed maximum demands based on the highest previously recorded unrelayed maximum demand or estimated unrelayed maximum demand, whichever is higher.

(b) At the end of each month the Power Company shall also compute the costs which shall be determined by it to be properly attributable to operating as distinguished from overhead, such as interest upon any current debts incurred for operating, liability insurance and other insurance properly chargeable to operating, labor, fuel, supplies, maintenance as distinguished from reserves for replacements, renewals and obsolescence, and like items not included in the computation under paragraph (a) of this article. To the costs so computed shall be added the actual cost of the electricity purchased by the Power Company. The sum of these two divided by the total number of kilowatt-hours sold by the Power Company shall constitute the operating kilowatt-hour cost for the month. Each of the three companies shall pay to the Power Company, as an energy charge, the operating kilowatt-hour cost for each kilowatt-hour of electricity sold to it. The energy charge per kilowatt-hour of electricity sold to it shall be the same for each of the three companies.

(c) The normal capital requirement of each of the three companies during any month is defined as the amount which bears the same ratio to the total capital furnished to the Power Company by the three companies that the unrelayed maximum demand or the highest previous estimated unrelayed maximum demand, using whichever is the greater in kilowatts, of each respective company bears to the sum of the three said demand figures similarly obtained.

To equalize the burden of furnishing capital when the actual amount supplied by any one of the three companies differs from its normal capital requirement, the following payments shall be made:

When the capital furnished to the Power Company by any one of the three companies is less than the normal capital requirement of such company, it shall make monthly payments to the Power Company at the rate of 8 per cent per year on such capital deficit.

When the capital furnished to the Power Company by any one of the three companies is greater than the normal capital requirement of such company, it shall receive monthly payments from the Power Company at the rate of 8 per cent per year on such capital excess.

(See Exhibit "A.")

If at any time it shall appear that the provisions herein contained result in an inequitable participation of any one or more of the three companies in the benefits accruing therefrom, upon the request of any such company there shall be a readjustment of their respective obligations and privileges hereunder by mutual agreement, or in the event of failure to agree, by arbitration.

Article VIII—Price of Energy Sold to the Power Company

The Power Company shall pay for electricity sold to it by the three companies at a rate per kilowatt-hour to be agreed upon between the selling company and the Power Company, this rate representing as nearly as possible the actual expenditure made by the selling company due to the furnishing of this electricity which it would not have incurred if this electricity had not been furnished. Any question arising under the provisions of this article may be referred to arbitration.

Article IX—Extraordinary Service

Whenever it becomes necessary or advisable for any of the three companies temporarily to make extraordinary demands for power upon the Power Company, such demands shall be granted provided the Power Company is able. If there is insufficient surplus capacity available to the Power Company to supply all of the demands in full, the available surplus power shall be divided between the companies in the proportion which the Power Company decides to be fair and equitable.

Payment to the Power Company for such extraordinary service shall be an amount to be agreed upon between the company concerned and the Power Company as being a fair and equitable settlement. If not so agreed upon, it may be referred to arbitration in the manner hereinafter provided.

Such extraordinary demands shall not be considered in computing the unrelayed maximum demand of any of the three companies.

Decision as to the existence and duration of the necessity or advisability of such extraordinary service shall rest with the Power Company.

Article X—Payment

Bills based upon the provisions of this agreement shall be rendered during the first part of each calendar month and shall be paid within fifteen days after rendering.

Article XI—Delivery. Metering and Standard of Service

The electricity furnished hereunder by the Power Company shall be delivered to the three companies as follows:

(a) In the case of the Fall River company, at its Hathaway Street substation, in said Fall River.

(b) In the case of the Brockton company, at the junction of the transmission lines of the Brockton company with the transmission lines of the Power Company.

(c) In the case of the Blackstone company, at that point or points where the transmission lines from Fall River to Pawtucket and Woonsocket cross the state boundary line between Massachusetts and Rhode Island.

The electricity furnished hereunder by any of the three companies to the Power

Company shall be delivered to the Power Company at the same points of delivery hereinabove specified.

The electricity generated by the Power Company shall be sold at the Power Company's steam generating station, and at the voltage at which the power is generated. The location of the meters necessary to determine the amount of electricity sold to each of the three companies shall be decided upon by the Power Company.

The electricity purchased by the Power Company shall be measured where it is purchased by the Power Company and under the voltage conditions at which it is purchased.

All electricity delivered shall be in the form of three-phase, 60-cycle alternating current. Except under abnormal or unusual conditions the frequency shall not vary more than 5 per cent above or below 60 cycles, and the voltage shall not vary to a greater degree than can be reasonably cared for by automatic voltage regulators. Momentary variations in frequency or voltage due to sudden or abnormal changes of load, which occur in connection with the starting up or closing down of manufacturing plants morning, noon and night, shall not be considered.

Notwithstanding the foregoing, it is agreed that the respective parties shall do all that they reasonably can to maintain a standard of service which will enable the other parties to render good service to their various classes of customers.

Article XII—Operation and Maintainence of Transmission Lines, Condensers, etc.

The Power Company and each of the three companies shall at its own expense operate and maintain the transmission lines, equipment and other property which it is to provide and own as specified in Article V. Each of the three companies shall also assume all transmission-line and transformer losses and losses in power-factor corrective apparatus in connection with all energy purchased by it from the Power Company, including losses in the step-up transformers at the Power Company's steam generating station for such energy as is generatel there. In case of energy purchased by the Power Company and resold to the three companies, each of the three companies is to pay the Power Company only for such losses as are actually incurred in the transformation and transmission of such energy purchased by it between the points where it is purchased by the Power Company and the point where it is resold by the Power Company. The Power Company shall determine the amount and value of these losses.

Article XIII—Franchises, Etc.

The obligations of the Power Company and the three companies are subject to and conditioned upon their securing and retaining all franchises, permits, rights-of-way and other rights necessary to enable each one to receive and deliver the electricity contracted for hereunder, provided that they shall take all reasonable steps to secure such rights and the consent or approval of all public authorities when required.

Article XIV—Arbitration

If any question shall arise under or in connection with this agreement concerning which the parties hereto fail to agree, any one or more of the parties hereto may request that the question be referred to an arbitrator for decision. Upon any such request, an arbitratrator may be selected by agreement of the parties hereto. If within fourteen days after the date of such request the parties shall not have agreed upon any arbitrator, the party requesting the arbitrator may within 10 days from the expiration of the fourteen days request any justice of the Superior Court of Massachusetts to appoint, and such judge may thereupon appoint, an arbitrator, who shall hear and determine the question. Such arbitrator may employ such technical advisers and incur such other expenses as he may deem necessary for the determination of the question. The expenses so incurred and the compensation of the arbitrator shall be borne by the four parties hereto in equal shares. The arbitrator shall notify in writing the parties hereto of his decision, which shall be final and binding upon the parties hereto.

The reference of any matter in dispute to an arbitrator as aforesaid for decision shall be a condition precedent to the bringing of any action, suit or proceeding, whether at law or in equity, concerning such dispute.

Article XV—Successors and Assigns

This agreement shall bind and inure to the benefit of the parties hereto and their respective successors and assigns, and the words "Power Company," "Fall River company," "Brockton company," and "Blackstone company," respectively, shall be construed to include their respective successors and assigns.

Witness the corporate names and seals of said parties, etc.

A Transformer Station of the Future

Novel Construction Proposed in Which Steel-Lined Concrete Tank of Oil Would House High-Tension Equipment, Eliminating Problems

BY M. M. SAMUELS
J. G. White Engineering Corporation, New York City

IN AN article in the ELECTRICAL WORLD for April 15, 1916, page 865, and also in a recent editorial (April 28, 1923, page 959) there was mentioned the possibility of a self-contained outdoor substation and radical changes in outdoor circuit breakers and transformers. In a paper before the American Society of Safety Engineers (see *Safety Engineering*, September, 1921, page 113) the author further expressed the opinion that to his mind the future type* of the large transformer stations would consist principally of a concrete tank for each phase located at a considerable distance from the power house and containing in the same oil the transformer, high-tension oil switch, current and potential transformers, thus saving from twelve to thirty bushings per circuit, which means saving an equal number of sources of trouble.

Since then the question has been discussed with prominent transformer engineers, switch designers and operating engineers, and the conclusion has been reached that this type of substation is not only a possibility but will in the near future become an absolute necessity.

LOW-TENSION BUSES BEING RAPIDLY ELIMINATED

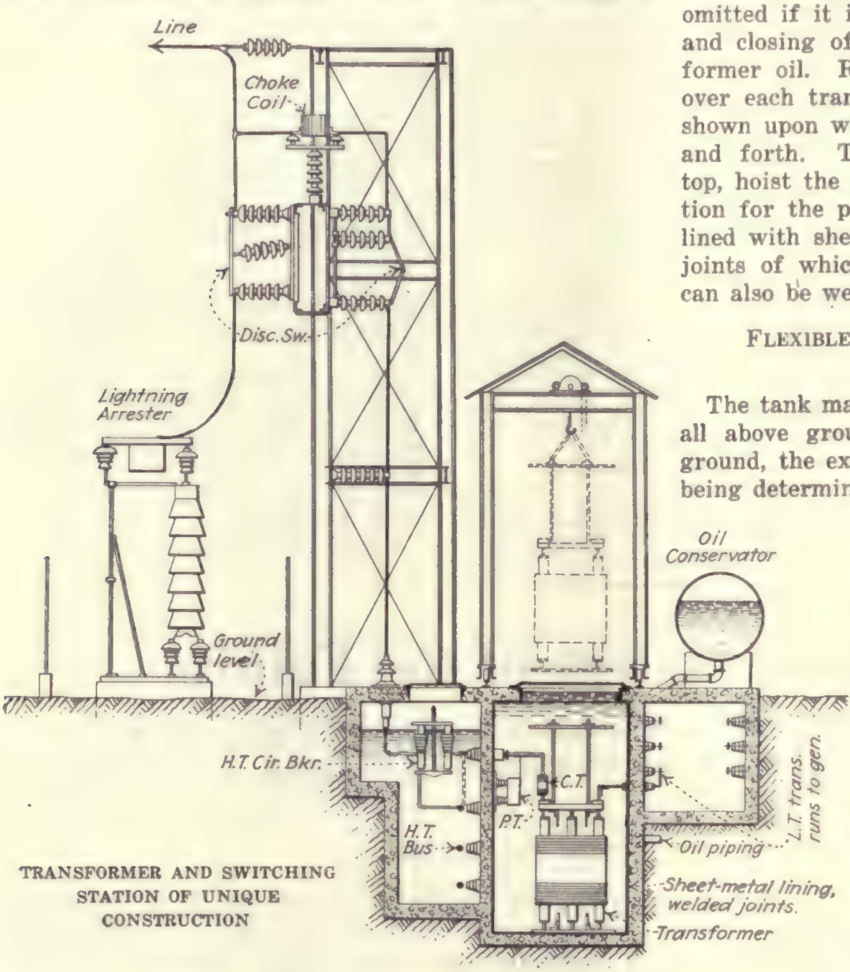
The transformer is growing larger and larger in size. Central stations are eliminating low-tension buses wherever possible and are making the transformer a continuation of the generator. Experience has shown that transformers give less operating trouble than turbine units and that the investment in large transformer capacity above the capacity of the turbine units is unwarranted and uneconomical. The tendency prevails even now to make the transformer a three-phase unit of the same capacity as the turbine unit to which it is connected, and it is generally accepted that the art of transformer design has advanced to a point where 45,000 kva. to 70,000 kva. three-phase units could be built, were it not for the difficulty of providing tanks of huge proportions. Even for many of the transformers now being built the tanks have to be shipped in sections and assembled in the field. The question at once arises, Why should it be necessary to ship a housing, which is really nothing but an enormous oil tank, from the East to the Pacific Coast and then to set this whole housing up on wheels, so that it can be moved with its oil and its transformer into a larger building for the purpose of repairs?

OIL BREAKER DEVELOPMENT HAS NOT KEPT PACE WITH CAPACITY DEMANDS

The second consideration of importance is the oil circuit breaker. The fact must be faced that the development of the oil circuit breaker has been rather disappointing in that it has not kept pace with the development of the transformer, and that the capacity of a central station is practically limited by the maximum rupturing capacity of the available oil circuit breaker. The idea of using oil for switching was original and epochmaking, and the well-known type H oil switch was likewise original and more or less epoch-making. But since then, in spite of the thousands upon thousands and perhaps millions of dollars spent on research,

*All patent rights reserved.

almost no new principle has been brought out, the development consisting largely in the steady increase in the volume of oil and the resultant increase in tank size, so that today the breakers used on the highest commercial voltages are placed in tanks which are almost as large as those of the transformers and equally difficult, if not impossible, to ship. Here again the logical question offers itself, Why make a large house movable?



TRANSFORMER AND SWITCHING STATION OF UNIQUE CONSTRUCTION

Third in importance are current and potential transformers, which are a necessary evil and give the station designer an endless amount of trouble, particularly because their existence is often forgotten in the preliminary design. Why have such large housings for such small transformers?

Last but not least in importance is the bushing. The voltage of a system is virtually limited by the maximum obtainable flashover value on bushings. High-voltage bushings are not only very expensive, but every bushing is a potential source of trouble, and since the majority of bushings used in a station are not for outgoing lines but are for connecting together apparatus such as oil switches and transformers, the logical question must be asked, Why use two expensive bushings for connecting two oil tanks together? Why not combine the two oil tanks into one and eliminate the bushings altogether?

The above considerations have been crystallized into the accompanying rough design of a self-contained-oil immersed substation, which is submitted for the consideration of the profession. It is so simple that it hardly requires any explanation. It consists of a concrete tank containing the transformer, high-tension and low-tension switches, current and potential transformers, buses and connections, the only bushings required being those for outgoing lines. Barriers are provided between the switches and transformers, which may be omitted if it is found by experience that the opening and closing of switches will not carbonize the transformer oil. Removable waterproof tops are provided over each transformer and oil switch, and a track is shown upon which a housed-in gantry can travel back and forth. This gantry can remove a transformer top, hoist the core and carry it to the end of the station for the purpose of repair. The concrete tank is lined with sheet metal of say No. 10 U. S. gage, the joints of which can be welded in place and to which can also be welded the necessary water and oil piping.

Flexible Arrangement for Oil-Immersed Apparatus in Tank

The tank may be installed either all underground or all above ground or partly above and partly below ground, the exact arrangement in each individual case being determined to a great extent by local conditions, such as the contours of the ground, the elevation of the required railroad siding, the cost of excavation, etc.

It is not necessary to design any special transformers, oil switches or other apparatus for this new arrangement. A standard transformer with its top but minus tank and bushings or a standard oil circuit breaker with its top and mechanism but without tank and bushings can be accommodated in the new design without difficulty. In the case of an outgoing line one of the bushings may be left in its place in each phase.

The whole proposition seems to offer very little difficulty either in design or in execution, and the enormous saving is so obvious that it is hoped that some progressive operating properties, particularly those considering very high voltage, will consider it worthy of serious consideration for future installations even though it involves some rather radical departures in existing practice. It would seem to offer very great possibilities for reducing investment and operating costs and improving operating conditions.

Correction of Errors in New Edition of National Electrical Code

IT HAS been discovered that a number of errors were made in printing the 1923 edition of the National Electrical Code. It was, indeed, to be expected that in such a sweeping revision and rearrangement of so voluminous and technical a book some typographical errors would creep in. Immediate steps have been taken to announce through the publication of an official errata sheet the changes which are necessary to make the code as printed entirely correct. The errata are printed on page 37 of the advertising section in the back of this issue, within a space which will enable them to be cut out of the page and pasted directly into the code, and it is suggested that in order to make these individual corrections still more effective, they be also noted in ink on the margins of the pages where the errors occur.

European Underground Cable Practice

In Milan cables are overlapped and cut to assure close abutment. Then they are bent vertically to allow ease for inserting compound.

Conservative Loading and Installation Without Conduit—Considerable Attention Given In Manufacturing Methods to Adapting Raw Materials to Product

Extensive use is made in Europe of the practice of connecting underground cable directly up to transformer casings.

IT IS very apparent from close observation of European cables that they are operated at more conservative ratings than in this country, declared D. W. Roper, superintendent street department, Commonwealth Edison Company, in an address before the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers on Nov. 26. According to first-hand studies made by Mr. Roper, who visited ten European countries, in the summer, the full-load ratings of the cables in England corresponded to a maximum temperature of 50 deg. C., until last May, when the maximum temperature was increased to 65 deg. Several members of the cable research committee of the British Institution of Electrical Engineers who have been most familiar with the research work which has been conducted on heating of cables told Mr. Roper that they had no evidence whatever to indicate that impregnated paper insulation such as is used in England might be injured at temperatures above 65 deg. C. The man who was responsible for that temperature limitation said that the reason he objected to a higher limit was based on the difficulties anticipated from expansion and contraction of the lead sheaths and the resulting voids, which cause ionization and a shortened life of the insulation.

There is very little difference in the materials available for manufacture of European cable, except in the paper. Where American manufacturers universally use a paper that is made of manila hemp-rope fiber (the source of supply being second-hand hawsers from ocean-going vessels), some of the English manufacturers use new fiber. However, the majority of the Continental manufacturers use a wood-pulp paper in which the pulp is prepared by a chemical process and not by grinding. Whereas the American manufacturers use a petroleum-distillate impregnating compound having the consistency of vaseline, the foreign practice is to use a lighter distillate, somewhat like cylinder oil. In one way foreign and American manufacturers are alike. They are all secretive about the details of their impregnating compounds and their processes. In America only a small percentage of rosin is employed, but in England and on the Continent a much larger percentage is customary. Abroad it ranges from 10 to 50 per cent in the high-voltage cables.

In the removal of moisture and the application of the impregnating compound Continental manufacturers use several methods. One frequently employed is first to put the reels of cable in an oven after the paper, which normally contains about 8 to 10 per cent of moisture, has been applied. The cable then dries for several hours or days at a temperature somewhat above 100 deg. C. Then the hot reels are placed in a vacuum tank which is equipped with steam coils for further heating. After the vacuum has been applied and held constant for a certain number of hours hot impregnating compound is introduced into the same tank. In some cases the tank is not only filled but a pressure is applied. After the impregnating compound has been allowed to cool the reel is removed and kept a day or so in a tank of oil before the lead sheath is applied.

Other manufacturers do not do any preliminary drying in the oven. They drop the reel of cable as it comes from the paper-wrapping machine directly into a tank of oil, where a vacuum and heat is applied gradually. Then, while the oil is still quite hot, the cable is removed into a second tank which contains the impregnating compound.

Another manufacturer employs a process that is radically different. He takes the reels of paper as they come from the paper mill, which are 3 ft. to 4 ft. wide, and runs them over hot rolls heated by steam, thereby driving out the moisture. Then the paper is led through some hot impregnating compound which thoroughly fills all the pores of the paper. This paper is then led up and down through a hot-air duct in which the compound is dried. The result is like a varnished paper. After a complete drying, this roll of paper is cut into strips and applied to the conductor in much the same way as most manufacturers apply the raw manila paper. Although the question of ionization comes up in such a process, the manufacturer using it was making 30,000-volt cable in this way without apparent trouble from that direction.

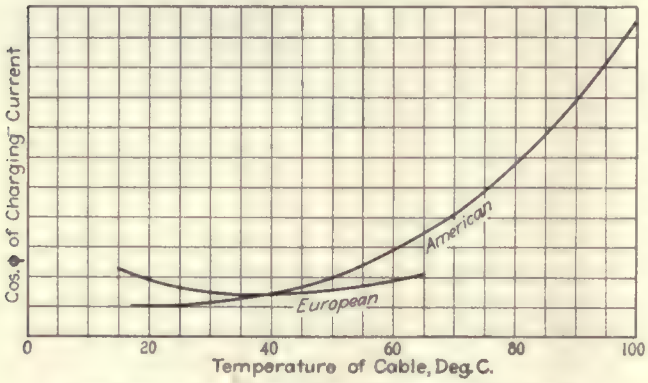
RAW MATERIALS RECEIVE CAREFUL ATTENTION

Raw materials receive more careful attention in acceptance tests in Europe than in America, according to the impression received by Mr. Roper while visiting many of the factories. Although their control tests for the impregnating process were not disclosed, evidently they watch them very closely. In the United States the principal grievance of cable manufacturers is the difficulty of getting the proper grade of raw materials in order to turn out the highest grade of cable, while in Europe the problem is quite different. Europeans are continually changing the percentages in their mixtures and the durations of drying and im-

pregnating in order to provide a fairly uniform grade of cable with a varying grade of raw material.

Another point of difference is that abroad most of the cables are laid directly in the ground, which allows the cable to operate when much cooler. Europeans use armored cable similar to that which Americans use for submarine cable. In Milan they lay armored cable in tile conduit about 6 in. wide.

A cable joint which is different from anything in this country is used in Milan. The two adjacent sections of the cable are laid so their ends overlap slightly. Then the two ends are cut at the same point (to assure close abutment) and each end is turned into a vertical position to facilitate later operations. After the lead sheath and insulation have been removed for some distance back from the ends a bell is slipped over



COMPARISON OF AMERICAN AND EUROPEAN CABLE DIELECTRIC LOSSES

the end of each cable and a template placed across the top to separate the three bare conductors. Then the bell is filled with a resinous compound which is about as hard as sealing wax when cold.

In one Parisian installation three 66,000-volt single-conductor cables are put side by side in a U-shaped trough, 2 ft. to 3 ft. long, and covered with sand over which a concrete lid is placed. The practice of running lead-covered cable directly up to a transformer casing through a terminal bell on the cable is quite common in Europe. This practice is also followed in two installations in Holland, where one 50,000-volt, three-conductor and one 50,000-volt, single-conductor cable line terminate in a substation.

Cable Testing

European bending tests are somewhat similar to the American tests but more severe. The standard bending test of the N. E. L. A. is that the cable shall be bent around a drum which is twelve times the over-all diameter of the cable, at a temperature in no case lower than — 10 deg. C., after which the cable shall be bent in exactly the opposite direction, and then this cycle of bending is repeated once. In England the same test is made except that there three cycles of bending are required instead of two, but at a room temperature. Temperature conditions in most of the European countries do not warrant the conducting of bending tests at a much lower temperature because not much cable is installed during freezing weather. In these bending tests is a clause which requires that the number of torn papers discovered on inspection and dissection of the cable after the bending test shall be a small quantity or zero. There has been some discussion on this point and it is difficult to get much information about it abroad. European manufacturers will say that no paper wrappings are torn. In some cases it is even specified that no paper shall be torn, but there are no standard specifications of that kind abroad. Most of the work is in the hands of consulting engineers for private companies.

Dielectric strength tests following bending are different in Europe from those in the United States. One manufacturer says that it is standard practice with him to guarantee a dielectric strength test of five times the normal working pressure before the bending test and four times the normal after the bending test. In America the standard high-voltage test after bending is two and one-half times normal. Foreign manufacturers declare that the problem of making a cable to withstand the bending test at a low temperature has not been presented to them; they have not been commercially requested to make such a cable. Regarding the dielectric-strength guarantees, there is another important difference. The highest dielectric strength test that American manufacturers will apply corresponds to about 150 kv. per centimeter as determined by the logarithmic formula. A number of foreign manufacturers are willing to guarantee 200 kv. per centimeter, and several will guarantee 250 kv.

Dielectric Loss Guarantees

The dielectric loss guarantees of European manufacturers are not greatly different from those of Americans, as applied to their maximum temperature. There is, however, a distinct difference in the shape of the curve, as seen in the chart. There is a striking similarity in the two types of manufacture at temperatures between 40 deg. and 60 deg. C. But it is impossible to ascertain the shape of the European curves beyond 60 deg., because measurements have not been made at such high temperatures. While American manufacturers guarantee specific dielectric losses in cables at various temperatures between 20 deg. and 100 deg., the European practice is to stipulate what the dielectric loss at one point will be between room temperature and 60 deg. Whereas the Europeans name only one figure, American manufacturers name several. In America, if it is desired to know the loss at a maximum temperature, the cable must be heated to that temperature. The foreigners measure their dielectric loss at room temperature, and they know by experiment and experience that their power factor between room temperature and 65 deg. C. is no higher. In some cases the power factor at room temperature is the same as the power factor at 80 deg. C. Where this condition exists the manufacturers can measure the power factor of every reel by a direct-reading method, thereby making sure that no reel has a dielectric loss above the guarantee.

Ionization is tested by several foreigners by observing how the power factor changes as the voltage applied to the cable is raised. Some of these manufacturers showed curves, Mr. Roper declared, that were perfectly straight lines up to about two and three times normal voltage. That meant that there was no change in power factor with any increase in operating voltage. Ordinarily, the curve will go up if no particular attention has been paid to ionization.

European manufacturers have been paying much attention to the ionization question during the past few years. Apparently, ionization is due to the action of high voltage on the air and moisture in the cable.

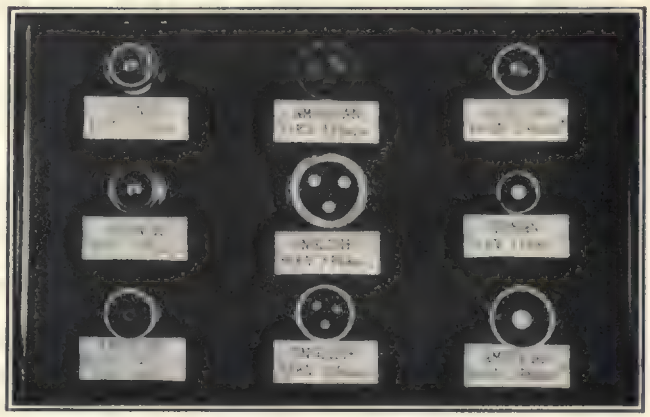
The only way to prevent it is to remove the air and moisture very thoroughly. That is one point of difference in the factory processes of foreign manufacturers. They invariably keep the reels of cable after impregnation immersed in a tank of oil until they are ready to be leaded. Then one end of the length in the oil is guided to the lead press, exposing only a few feet to the air at a time and then for only a few minutes. This is in distinct variance with the practice in America, where the cables are allowed to cool in varying degrees and removed from the impregnating tank when they are still warm, so that the compound is very fluid. In other cases the compound is in the nature of a grease, not quite as hard as vaseline. The foreign manufacturers say that they follow this practice in order to exclude the air from the insulation while cooling, thereby insuring more compound being forced into the cable by atmospheric pressure as the cable cools and contracts.

CABLE JOINTS

Various kinds of joints from a tape joint to combinations of the hand-wrapped insulation with a form of factory-made insulation were observed, Mr. Roper reported. In one city he found a joint for a 33-kv. cable with a clearance between the nearest portions of the exposed conductors of 2½ in. Other combinations, such as a hand-wrapped joint, a joint without any impregnation excepting the compound and combinations of the two, were also in use. Apparently, the foreign impregnating compounds are of a higher dielectric strength than those used in America. They can withstand 35,000 volts across spacings that cannot be used in this country.

Regarding the proposed use of 132,000-volt cable in tying together Chicago generating plants, Mr. Roper talked with several foreign manufacturers and found that one had actually made up a sample of a cable which he had designed for 130,000 volts, three-phase. It was a single-conductor, lead-covered cable with 19.8-mm. insulation. Other manufacturers with whom he discussed the question reported various figures between 19 mm. and 22 mm. In no case did he find any manufacturer who suggested a greater thickness than 22 mm. Such a thickness and the size of the conductor would give a factor of safety of two, according to one manufacturer. When this manufacturer was asked how much more insulation would be needed in order to obtain a value of three for his factor of safety, he decleared that there is no value in adding further insulation. A greater factor of safety is not to be obtained in this way; it can be obtained only by improving the quality of insulation. As nearly as Mr. Roper could determine from conversations with the European engineers, it is perfectly feasible to secure a cable for 132,000 volts abroad. When the subject of employing such high-voltage cable was mentioned to one engineer, his first question was: "How can I get in on the experiment which you are conducting?" Another foreign manufacturer who saw a reference to the contemplated use of 132,000-volt underground cable in one of the American periodicals wrote to his American agent requesting him to inquire if he also could participate in the experiment. So it might be said that two European manufacturers have applied for permission to furnish cables for that voltage. With so much energy concentrated in the Chicago territory, with the shifting of city limits and with the economics of distribution forbidding the installation of high-voltage overhead transmission systems, the trend of development must be toward higher-voltage underground installations. Apparently, therefore, when utility companies desire to operate single-conductor cable at 132,000 volts, such a voltage cable will be made available.

Regarding the factor of safety with sector and round conductors, Mr. Roper declared that the foreigners offer a 33-kv. cable with round conductors, having a thinner insulation than American cables and a dielectric strength five times the rated operating voltage. The best that the American will guarantee is four times normal. One manufacturer offered a 33-kv. three-conductor cable, round-conductor cable with $\frac{11}{32}$-in. insulation on each conductor and $\frac{5}{32}$-in. insulation on the outer belt, with a dielectric strength test five times the



SAMPLES OF EUROPEAN CABLE OBTAINED DURING INSPECTION TRIP

rated operating voltage. The opinion of several engineers in this country is that the dielectric loss which some of the leading American manufacturers can guarantee is now so low that some sacrifice can be made in the dielectric loss in order to obtain a cable with higher dielectric strength and without ionization.

To reduce the lead-sheath losses several European manufacturers lay three single conductors together and then bind them as a unit. With the lead sheath thus brought in close contact, the total sheath loss is reduced to about one-third of what it would be were the single conductors to be installed in standard ducts at ordinary spacings. Most of the companies making a single-conductor cable employ a cast-metal sleeve over the joint. Different non-magnetic metals are used for that purpose. Where they wish to break the circuit through the joint sleeve for any reason they use a bushing between the split metallic sleeve and the sheath of the cable. Between the two is placed a piece of impregnated wood. In addition, an expansion chamber is provided on the sleeve to insure the maintenance of an adequate amount of compound in the sleeve.

AMERICAN MANUFACTURERS PROMISE HIGH-VOLTAGE CABLE

In the discussion that followed Mr. Roper's address D. M. Simons, Pittsburgh, laid particular stress on the fact that American manufacturers have designed their cables to withstand an operating temperature of 85 deg. C. — E, where E is the operating voltage in kilovolts. The lower temperature at which European cables operate and the smaller temperature gradient produced by laying the cables directly in the ground do not impose

such serious manufacturing problems as are faced by American designers. Commenting on the tendency of Europeans to go toward thinner cable insulation, Mr. Simons expressed the belief that the American practice of using a thicker insulation is worth while in order to avoid possible breakdowns. Speaking about the relative diameters of cables, he referred to an English sample having a 300,000-circ.mil three-conductor cable with $\frac{7}{32}$-in. insulation on each conductor and in the belt which had a 7 per cent larger diameter than the standard American cable for the same conditions. Time alone will show whether cable will stand up under high voltages. Although the jump from 66,000 volts to 132,000 volts within a year's time is a large one, Mr. Simons expressed the belief that American manufacturers will be in a position to compete with the European manufacturers who are now promising high-voltage cable.

W. I. Middleton, Boston, felt that during the past years the American manufacturers have been so busy trying to produce ordinary voltage cable that they have had no opportunity to do much research work. The question that seems to confront American manufacturers is whether commercial lengths of cable can be made as good as the shorter experimental lengths now appear to be.

Who Sells Electrical Appliances?—II

A City of 200,000

"Electrical World" Survey of Retail Dealers in a Town Where the Local Electrical Family Is at Odds with Itself — Department Stores and Central Station Both Active Merchandisers

WIDESPREAD discussion throughout the electrical industry as to who is actually selling appliances has prompted the *Electrical World* to make a personally conducted investigation to determine the relative and actual volume of sales by all classes of dealers. This is the second of the series of articles in this survey covering a number of representative cities. It is found that strikingly different conditions prevail in different localities. In the city described this time the outstanding feature seems to be a chronic state of mild internecine warfare among the electrical dealers. It should be borne in mind that the *Electrical World's* representative knew nothing of the conditions obtaining prior to visiting the city, and, as stated in the first article, the facts are given as found without defense or censure of any existing policy.

LIKE the city described in the previous article, this one is situated in an agricultural belt, it is an important shipping and unloading point for a number of transcontinental railroads, and its industries are for the most part engaged in the preparation of farm products for the market. About 77 per cent of the population are native-born, 18 per cent foreign-born and 5 per cent colored. The commercial section is typical of a city of this size with a clearly defined shopping center in which most of the electrical dealers are established.

There is an electric association, of which the contractors, dealers, jobbers, manufacturers' representatives and central-station company are members. It has for its purpose bringing new industries to the city, raising the general standards of electrical work and fostering a spirit of co-operation among the various branches of the industry in the city. This organization, however, is not receiving the whole-hearted support of its members, who frequently permit their personal grievances and animosities to be aired, rather than take up some more constructive work. A number of the contractor-dealers have lost interest in the association because, so far as they can see, nothing has been accomplished toward eliminating cut-throat competition or standardizing quality. Throughout the entire local electrical family there is a very evident attitude of fault-finding and general abuse of the other fellow. This habit has come to be a sort of a "daily dozen" with many dealers, and as a consequence there is a vast amount of energy wasted. Price cutting, underbidding and criticism of competitors appear to be almost universal. Questioned individually as to why these conditions exist, each contractor or dealer declared that he was perfectly willing to hew to the line so long as the other fellow did, but the moment that unethical practices were adopted by a competitor he would immediately retaliate in like manner. It seems possible that if the present association had a paid executive manager in charge who could lay out a policy for all members and arbitrate differences which arose, the present state of affairs could be cleared up. It does not appear likely, however, that any local man could take this position, because there is too much mistrust and suspicion that he might have an axe to grind.

Hardware Dealers

So far as the total volume of appliance sales is concerned, hardware stores sell less than 1 per cent and, except for the fact that they do sell a few appliances, cannot be considered as a factor in the business. They are not inclined to increase their stocks or branch out into other lines. As a rule, what appliances they have on hand are not well displayed, and a good part of the stock is thoroughly shopworn. They do not offer deferred payments on the large appliances.

Department Stores

There are three large department stores, two of which may be considered as outlets for electrical merchandise. The third store sells for cash and caters principally to farmer trade, so, for the present at least, electric appliances are somewhat out of its line.

Department store "C" is of the first grade, has an excellent location and is well equipped to conduct an electrical merchandising business on a comprehensive

scale. Appliances are displayed on the same floor with furniture and are in charge of the housefurnishing department manager, who is attacking the merchandising problem strictly from the department store's viewpoint. According to his own statement, he does not have to consider the energy-consumption value of appliances; it matters little in his policy how his methods of selling will affect other dealers.

In selecting its stock of electrical appliances the store has gradually felt out the desires and preferences of its customers to determine what types and makes are most popular. For instance, in the case of washing machines it has been found necessary to stock five different makes. By so doing the manager feels that he can furnish customers any style or type of washer that they may desire, and it also gives a minimum and maximum range of prices so that sales are not lost when a customer thinks the machine too costly. Of the other large appliances not so wide a variety is carried, but the store is testing out two makes of ironing machines to determine which it will stock. Of heating devices two standard makes are sold, and the store is closing out a few low-priced appliances which it had on hand.

The manager of the housefurnishing department had no criticism to offer of the central-station company's merchandising methods. In fact, he stated that he felt that advertising and promotional work done by the local company was of direct benefit in increasing sales in the city. He had no objection to the long-time payments on high-priced appliances, as his store also offered the same terms to customers. In his opinion the contractor-dealers and the electric shops were not warranted in their criticisms of each other or the central-station company for any existing selling policies, and he pointed out that the more business done in a given territory or among a given population, the more there would be for each dealer or store.

The question of discounts on appliances appears to be satisfactory to this manager, but he called attention to the larger buying power of the department stores over that of the small dealers. Virtually all purchases are made direct from the manufacturers, and wherever possible carload lots are ordered. The store's total sales of electrical merchandise for 1923 will approximate $175,000, which will be an increase of almost 50 per cent over those of last year. While this rate of increase is not expected to continue from year to year, the store is confident that there will be a steady growth of the business for some time to come and is making definite plans to increase its facilities for handling electrical appliances, perhaps even going so far as to create a separate department.

Department store "D" is as large as the first one. However, not so much attention is paid to appliance sales, and the total volume of business for the present year will be approximately 40 per cent that of the other store. The attitude of the manager was that electrical appliances naturally are a part of the housefurnishing business, and therefore it is a logical line for a department store to carry. The business of this store has grown steadily, although not at such a rapid rate as the other. Not so much attention is given to the advertising or display of merchandise, which is distributed pretty much throughout the housefurnishing department and not confined to any one place on the floor. This manager also made no criticism of the methods or terms offered by the central-station company and felt that its promotional work was of benefit to others.

CONTRACTOR-DEALERS AND SPECIALTY STORES

All wiring contractors and fixture dealers, as well as specialty stores, carry electrical appliances to a greater or less extent. There are a few factory branch stores and also a few stores doing solely an appliance business.

SALES OF PRINCIPAL ELECTRICAL APPLIANCES, SHOWING QUANTITY, VALUE AND PROPORTION SOLD BY HARDWARE STORES, DEPARTMENT STORES, ELECTRICAL DEALERS AND THE CENTRAL-STATION COMPANY

Kind of Dealer	Washing Machines	Vacuum Cleaners	Ironers	Flatirons	Curling Irons	Toasters	Percolators	Total Sales Each Class of Store	Per Cent of Total for City
Hardware Stores:									
Store "A"	5	....	....	40	25	18	15		
Store "B"	....	....	....	60	30	24	12		
Total	5	....	....	100	55	42	27		
Value	$600	....	....	$600	$247	$252	$314	$2,013	0.3
Per cent of electric appliance sales	30.0	....	....	30.0	12.2	12.4	15.4		
Department Stores:									
Store "C"	650	400	10	1,200	1,200	200	250		
Store "D"	325	250	....	600	650	125	120		
Total	975	650	10	1,800	1,750	325	370		
Value	$121,875	$34,025	$1,500	$10,800	$7,875	$1,950	$4,440	$182,465	24.8
Per cent of electric appliance sales	66.3	18.6	1.3	6.0	4.4	1.0	2.4		
Electrical Dealers:									
Dealer "E"	250	30	....	30	24	24	15		
Dealer "F"*	650	350	100	600	550	350	50		
Dealer "G"	...	...	....	50	60	24	12		
Dealer "H"	6	15	....	175	100	100	15		
Dealer "I"	15	20	....	500	250	250	36		
Dealer "J"	125	100	....	350	300	150	48		
Dealer "K"	225	175	....	250	200	75	36		
Dealer "L†"	200	125	....	50	75	24	18		
Dealer "M"†	300	200	25	75	60	48	24		
Dealer "N"	12	15	....	80	36	24	15		
Total	1,783	1,030	125	2,140	1,655	1,069	269		
Value	$222,875	$54,075	$18,750	$12,840	$7,447	$6,414	$3,228	$325,629	44.2
Per cent of electric appliance sales	68.5	16.6	5.8	3.9	2.3	2.0	0.9		
Central-Station Company:									
One company	1,125	950	100	1,650	750	700	300		
Value	$140,625	$49,875	$15,000	$9,900	$3,375	$4,200	$3,600	$226,575	30.7
Per cent of company's electric appliance sales	62.0	22.0	6.6	4.4	1.5	1.9	1.6		
Grand Total:									
All dealers	3,888	2,630	235	5,690	4,210	2,136	966		
Value	$485,975	$137,975	$35,250	$34,140	$18,944	$12,816	$11,582	$736,682	100.0
Per cent of total sales	66.0	18.7	4.8	4.7	2.6	1.7	1.5		

* Electrical store. † Specialty or factory stores.

As mentioned previously, there is a considerable distrust of competitors among these dealers. This appears to be well founded, in view of several instances which were related.

Dealer "E" had been in the electrical business only for the past three months, having come into the store as a partner in a firm suffering from dry rot. His views of the local situation are interesting because of this fact and his prejudices, if any, are not of long standing. He felt that the local central-station company was a fair competitor, that its selling policy was constructive and of benefit to other dealers, that it had been chiefly instrumental in the promotion and introduction of electric appliances to the public, and that criticism of its methods was unjust and short-sighted. He declared that more unethical practices were being pursued by contractors and dealers than by any one else and that they themselves were to blame for the difficulties they were in. Competition among the salesmen of different dealers is keen, and many expedients are resorted to in order to effect sales. Among these are the rebating of their commissions to customers, the placing of two appliances on competitive trial at the customer's premises at the same time, and, if necessary, rebating the down payment that had been made on the first appliance. The common practice of some salesmen has been to follow the delivery wagons of their competitors and attempt to have one of their machines installed at the same time. He believed that if the other dealers were to hang together, agreeing to discontinue such practices, and really adhere to such a policy, there would be very little difficulty among the electrical retailers of the city. He was very pessimistic, however, as to the possibility of getting the men together on any working basis.

Would Boycott Manufacturers

Dealer "F" conducted a strictly electrical store with electric washing machines as the leading appliance. His sales were far larger than those of any other strictly electrical dealer in the city, and he is also the oldest hand in the business. He conducts his business on an extensive advertising and campaign basis in conjunction with the manufacturer. Direct-by-mail broadside advertising is used, followed up by outside salesmen. He also criticised competitors for some of their practices and felt that the central-station company was over-reaching itself in extending the long-time payments and, to a certain extent, was encroaching upon his field. Department-store competition was not, in his belief, becoming serious, but these stores, he thought, had no business selling electrical appliances. He asserted that jobbers or manufacturers who sold to the department stores should be boycotted by the electrical dealers.

Dealer "G" was essentially a lighting-fixture store, did no wiring and carried a small stock of appliances, total sales of which do not amount to more than $1,000 or $1,200 per year. He had the same general complaints to make against his competitors in the fixture business that other dealers had against theirs in the appliance business. Much of his business, he said, was taken on a competitive price basis, and underbidding one another was common among dealers. He had little to add or suggest further than to corroborate the statements that have already been recorded.

Dealer "H" was a contractor carrying a limited line of appliances, and most of his business was confined to wiring and the sale of fixtures. Regarding the sale of appliances, he also complained of the practices of other dealers and believed that the central-station company was offering too easy terms on the larger appliances. He believed that he could do a much larger business if it were not for the easy terms offered by others.

Dealer "I" was probably the largest contractor-dealer in the city and kept a very attractive store. A large wiring and fixture business was done, and all the appliances carried were of standard makes. Appliance sales are made either directly from the store or to new wiring customers at the time that work is being done for them. No outside men are employed. This dealer also criticised the central-station company for its time payments and was even of the opinion that the company should retire completely from the sale of appliances. Criticism of other dealers followed the same vein as previously noted.

Dealers "J" and "K" were really the same dealer, but two stores were conducted in different parts of the city. This one did not criticise the practices of the central-station company, but his attitude toward other electrical dealers was pretty much in line with the general sentiment. He said that the existing conditions simply meant that so long as they continued they would be met with an antidote of the same kind. The class of salesmen employed had a great deal to do with the matter of price cutting and rebating of commissions, but he did not know of any way this could be controlled so long as the owners themselves appeared to approve of it. Asked if he thought the local electrical association could do anything about the situation, he said only if it appointed a dictator from some outside city.

Dealers "L" and "M" were factory branch stores, and the managers of both declared that competition was very difficult. When told that they had been accused of questionable practices in making sales, they admitted that it might be true, but said it was simply a case of retaliation and that they were no more guilty than the other dealers had been. They were not inclined to criticise the central-station company's practice, but felt that every electrical dealer in the city was suffering from the sales methods and competition which had become so prevalent.

Central-Station Company

Merchandise sales are conducted by the central-station company primarily on a profit-making basis, and the energy-consumption value is of secondary consideration. The salesroom is in a very good part of the shopping center and it is very well equipped for the display of appliances. In addition to the sales force employed in the store, there is a crew of eight men working in the territory all the time. This year's appliance sales are running between 40 and 50 per cent ahead of those of last year. All advertising and sales campaigns are well thought out and planned beforehand, so that lost motion and wasted effort are reduced to a minimum.

The general manager and the commercial manager of this company deplored the existing conditions, but stated that they were at a loss to know what they could do further to remedy the situation. They feel that they are conducting their appliance business on an ethical basis; they are making a real profit out of it and are not selling appliances at a reduction because of their energy-consumption value.

From the foregoing it is apparent that the general discontent of the electrical contractors and dealers is pretty much a chronic state of mind and a matter of

habit. That this is so is evident from the attitude of both the department stores in the city, neither of which complained of unfair competition nor criticised the selling methods of its competitors. It seems very probable that if both the central-station company and the department stores were out of the business, the contractor-dealers would find just as much to complain about as they do now.

At the present time, eliminating the hardware stores from consideration, appliance sales are divided among department stores, electrical dealers and the central-station company as follows: Department stores, 24.8 per cent; electrical dealers, including specialty and factory branch stores, 44.2 per cent; central-station company, 30.7 per cent. Both the department stores and the central-station company are becoming better organized to handle the business, and it appears certain that their sales will increase at a more rapid rate than those of the electrical dealers. The latter are inclined to give too much attention to their troubles, and the form of competition which they indulge in will tend to retard their sales. Therefore it appears that within two or three years appliance sales may be divided about as follows: Department stores, 33 per cent; electrical dealers, 30 per cent; central-station company, 37 per cent. It may be that department stores will show a greater increase than this, but this tendency is offset largely by the general popularity of the central-station company, which appears to have the good will of its customers. They like to patronize the company because of the terms offered, its acknowledged reputation in giving service, and the fact that it seems to be the logical place for the average customer to go when he wants to buy an electrical device.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Who Is to Sell the Lamps?

To the Editors of the ELECTRICAL WORLD:

I have been considerably interested in reading the article "Who Sells Electrical Appliances?" in the ELECTRICAL WORLD of Dec. 8, but it seems to me that one very important item of information concerning conditions in the city under consideration is left out of the story, namely, the policy of the central-station company operating in that territory in regard to the sale of lamps. I do not believe the question can be given fair consideration without a knowledge of this policy, for whatever may be the attitude of the central station on the subject of merchandising appliances, if its policy on the sale of lamps is to give free renewals or sell at less than standard prices, it is unreasonable to expect straight electrical stores to do a satisfactory and profitable business.

Other outlets—namely, department stores, hardware stores and the central station itself—have attractions for the ordinary purchaser aside from electrical goods, and if the electrical store is practically cut off from the sale of the one item in its line which everybody buys, then its only chance is somehow or other to drag its customers in. There will not be any chance of their voluntarily coming to the store to purchase something in the nature of an every-day requirement, thus providing an opportunity to present to them the advantages of purchasing appliances which the store may carry.

F. E. STOW.

H. C. Roberts Electric Supply Company,
Philadelphia, Pa.

[In this, the first city surveyed, the lamp situation is entirely normal—that is, the central-station company sells at list and dealers can do a legitimate retail lamp business. In some cities already studied, however, central-station lamp policy does offer unmeetable competition and is a disturbing factor in the local merchandising situation. As the analyses of these communities are presented this condition will be clearly stated.—EDITORS.]

Opposes Plans to Light Country Highways by Electricity

To the Editors of the ELECTRICAL WORLD:

The illustration printed on the cover of the Dec. 8 issue of the ELECTRICAL WORLD, entitled "Country Highways Are Not Satisfactorily Lighted by Jove's Thunderbolts," as well as articles that have appeared in its columns from time to time pointing the same moral, bring up a matter well deserving of serious thought on the part of engineers throughout the country.

Naturally, it is the aim and purpose of engineers and central-station organizations to foster the multiplication of uses of electricity, not alone for the increased business resulting, but more especially to render an additional helpful service to humanity. But I do not believe an engineer who is a builder wishes to see his efforts spent in what seems to be little more than competition with the stars. There are only three classes that can be benefited by highway lighting—namely, pedestrians, those using horse-drawn vehicles and those using motor vehicles—and I believe any agitation in favor of highway lighting is based solely on the claim that it will benefit motorists. Most motorists will agree that any kind of light, except their own, works to their disadvantage, except on foggy nights, and even then the value of outside lights is doubtful. Street lights in cities cast objectionable shadows, and if their sole purpose were to assist motor travel, they would soon disappear.

In this day of ever-increasing tax burdens much care should be exercised in advocating any public improvement which is of such doubtful value as this. I firmly believe that a steam central station would do better to seek a residence electric heating load than country highway lighting. The only difference is that the former is a proved quantity of inefficiency, while the latter is anybody's guess.

E. J. DEL VECCHIO.

Akron, Ohio.

[That part of the taxes allotted to street lighting is one of the few public expenditures which are of benefit to every taxpayer. It is small in comparison with others, and often its results are equally small. Were it not for private lighting, such as is furnished by store windows, electric signs and other displays due to individual enterprise, most of our streets would be dim and dismal as soon as night falls, for very few of them are adequately lighted. Yet good lighting is not only essential to safety, but chiefs of police have time and again attested its value as a deterrent to crime. Country highways should be made as safe and as convenient for traffic as city streets. To pave them is not enough; they should be lighted as well. Roads are built for travel. If they are to be illuminated only by the stars, they fail in their purpose. All over the country macadam has replaced mud; but the job will be only half done till electric lamps at proper intervals dissipate the darkness.—EDITORS.]

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Analysis of Itemized Coal Mine Costs with Utility Service

THE total cost of cutting, hauling, hoisting, pumping, screening, loading, lights and incidental power for three totally electrified mines in Illinois was approximately 5 cents per ton during 1921, according to a paper on the use of central-station power in coal mines presented by C. O. Dunten, commercial manager Central Illinois Public Service Company, before the September meeting of the Great Lakes Division, N. E. L. A., at French Lick. The 1922 figures had not been used because of the five months' coal strike that year. The accompanying table shows the energy consumption, the days worked and the cost per ton for one mine employing approximately 500 men, with the shaft depths varying from 370 ft. to 415 ft. and mining a 7-ft. vein.

The advantages of a mine purchasing power rather than generating it are: (1) A large reduction in power cost per ton of coal produced; (2) greater flexibility for increasing the capacity within short notice; (3) independence from water supply; (4) reliable power supply during strikes; (5) low operating costs during strikes; (6) elimination of a large amount of labor; (7) reduction of time for repairs; (8) lowering of initial investment for generating equipment; (9) ability to mine coal at a greater distance from the shaft with very little increase in investment or production costs.

Power is required in the operation of a mine for four principal purposes—operating mining or cutting machines, haulage locomotives, hoisting and the operation of ventilating fans. The haulage locomotives require about 30 per cent to 40 per cent of the total power requirements for the mine and supply a very satisfactory load from the central-station viewpoint. Mining machines require 12 per cent to 18 per cent of the total power requirements of the mine, while the power for hoisting varies between 10 per cent and 20 per cent. This last load is probably the most undesirable unless proper equipment is installed. Because of the first cost, coal-mining operators usually desire to put in hoists operated by alternating-current motors, which will cause great instantaneous peak demands on the central-station system. It has become customary in the larger mines, however, to install a motor-generator set having a large flywheel and using a direct-current motor on the mine hoist. Operation of fans requires from 15 per cent to 20 per cent of the total power and is the best load from the central-station standpoint. It is necessary to operate the fan twenty-four hours a day for proper ventilation and usually thirty days per month.

The easiest load for a central station to obtain from an old mine is the cutting and haulage load. As the working face of a mine recedes from the shaft the power requirements for haulage increase continually. Those mines which use direct curent finally reach a point where it is necessary at heavy expense to install additional generating equipment and heavy feeder cables from the engine room to the working face. The operator realizes that it is only a question of time when further expenditures will be required and a point is reached where it is no longer economically possible to transmit direct current to the working face. Under these conditions the mine operator is usually receptive to the consideration of purchased power with its greater flexibility.

When the working face of a mine is within power-transmitting distance of the shaft, the motor-generator sets are usually installed in the engine room so that the direct current can be transmitted through cables extending down either the air or main shaft and along the entries to the working face. Recently, however, the practice of installing the motor-generator sets in the mine below ground, close to the working face, has come into being. Alternating current is transmitted by power lines above ground to a point directly over the point where the motor-generator set will

TABLE II—DISTRIBUTION OF POWER IN A COAL MINE

	Kw.-hr. per Ton	Per Cent Total
Power, top works	0.39	17.2
Power for hoist	0.76	32.8
Powei for motor-generator set	1.10	47.9
Power for alternating-current machines at bottom	0.05	2.1
Total	2.31	100.0

TABLE I—OPERATING COSTS OF A COMPLETELY ELECTRIFIED MINE IN ILLINOIS

Month, 1921	Tons	Days Worked	Kw.-hr. Consumption	Bill*	Cost, Cents per Kw.-hr.	Kw.-hr. per Ton	Cost, Cents per Ton
January	34,826	19	125,700	$2,485.44	1.98	3.61	7.13
February	36,727	15⅞	104,600	2,232.92	2.13	2.85	6.08
March	51,357	22	121,600	2,455.42	2.02	2.37	4.78
April	39,799	15⅝	94,700	2,129.06	2.25	2.38	5.35
May	38,902	14	87,000	2,145.17	2.5	2.2	5.50
June	54,466	19⅝	107,200	2,279.85	2.1	2.0	4.20
July	47,458	20	101,500	2,217.55	2.2	2.2	4.70
August	59,253	23⅝	121,700	2,448.07	2.0	2.0	4.10
September	57,598	19⅞	129,600	2,553.05	2.0	2.3	4.40
October	55,695	18⅞	107,000	2,585 33	2.4	1.9	4.70
November	44,602	14	106,300	2,618.55	2.5	2.4	5.90
December	64,509	19⅞	143,300	3,072.08	2.1	2.2	4.80
Total	585,286	222⅜	1,350,200	$29,222.48	....	...	...
Average	48,774†	19.36	112,517	2,435.21	2.16	2.31	4.98

* An overhead charge of $1,429.27 on transmission line is included under billing.
† Summary average per day of tons, 2,630.

be installed. A drill hole is then made from the surface to the mine and a 2,300-volt, three-conductor cable is installed in the drill hole to the motor-generator set. This method of operation has increased the life of some of the older mines to a great extent, since it permits the mining of small patches of coal in isolated sections which could not be mined by direct-current power on account of the distance factor.

In making a rate schedule to serve coal mines the low kilowatt-hour used per kilowatt of maximum demand must be taken into consideration. In making a rate schedule one must keep in mind the great diversity factor which exists between many individual loads and which results in the central station being operated at a high load factor. Coal mines show this diversity among themselves, and their peak loads do not occur simultaneously with those of other industries. As a usual thing, a rate averaging between 2½ cents and 3 cents per kilowatt-hour will show a material saving to the average coal mine over its present power-production costs. The mines that are operating their own power plants will show a much higher operating cost if accounting methods are correctly used, because most mine operators are not aware of their actual operating costs in a great many instances.

Protecting Fire Equipment Against Freezing

BY G. H. MCKELWAY
Westfield, N. J.

THE following rules for the protection of fire equipment against freezing have recently been issued by one of the large public utility companies in the East, this company being the owner of a number of power plants and substations as well as other buildings which are equipped with sprinklers, hose lines, fire extinguishers, etc.:

The engineering department will see that standpipe systems are drained where there is danger of freezing, valves controlling the supply of water to be closed and sealed and signs posted on the valves and the usual places about the premises indicating the location of the controlling valve. The hose is to be disconnected and the valve left open for a period of one week, then to be closed by the foreman in charge of the premises, who will also see that the hose is reconnected. The seal on the main controlling valve is to be broken only in case of necessity arising for operation of the standpipe system—that is, in case of actual fire—after which the engineering department will reseal the controlling valve and the hose will be disconnected and drained and then reconnected as above.

The foreman in charge of the premises will see that all water pails in exposed locations are emptied and filled with clean, dry sand to within two inches of the top; that all sand pails are inspected, and where it is found that the sand has caked by reason of moisture the pail is to be cleaned and then refilled with clean, dry sand. All water barrels in exposed locations are to be filled with a saturated solution of salt and water, this also to be taken care of by the employee in charge of the premises. All chemical extinguishers in locations exposed to frost are to be removed to heated quarters, and all concerned are to be notified.

Two Weeks to Assemble 22,000-Hp. Wheel

FACED with a possible curtailment of power service due to low water in other parts of its system, the Georgia Railway & Power Company recently succeeded in putting into operation a 22,000-hp. waterwheel generator at the Tugaloo development within two weeks after the stator and rotor were received. It was necessary to wind completely both parts and assemble together with the waterwheel. The permanent switchboard not having arrived, the only instruments available to control the operation of the wheel were an ammeter and a voltmeter. It became necessary to utilize the synchroscopes in the Tallulah Falls plant, 4 miles away, to get the unit onto the system. Since the wheel has been in service it has given complete satisfaction.

Investment Costs in Hydro Developments

DISCUSSING the items entering into the cost of water-power development in the second Aldred lecture before the faculty, graduate and senior students of the Massachusetts Institute of Technology on Nov. 23 last, Julian C. Smith, vice-president and general manager Shawinigan Water & Power Company, Montreal, presented the accompanying tabulation of the proportional investment as typical. Commenting upon this tabulation, Mr. Smith said that about 35 per cent is made up of items not connected with direct expenditures in the field; about 20 per cent is for temporary equipment like cofferdams, tracks, etc., which might be called preliminary work, and only about 47

Form Used by a Large Southern Company for Inspection of Oil Circuit Breakers

Inspection Report Form for Types C, C-O, H 3 and H 6 Oil Circuit Breakers

Name of breaker. Type. Serial No.

Amperes. Volts.

1—Are breaker and mechanism free from dirt and dust?
2—Are all bolts, nuts, cotter pins, etc., in place and properly tightened?
3—Are all bearing surfaces of the mechanism properly lubricated?
4—Are contacts properly aligned and do all contact surfaces bear with a firm and uniform pressure?
5—Are the circuit-interrupting contacts and arcing tips badly burned or pitted? Are they of the proper length?
6—Are all terminal connections properly tightened?
7—Is the oil at the proper level in the tanks and in good condition as required?
8—Are bushing insulators through the cell and tanks tight in their clamps and are the tanks held securely?
9—Are wooden riser rods tight in top levers and in cross-heads or moving contacts?
10—Will the electrical operating mechanism operate breaker over range of voltage 140 to 280, trip and close?
11—Will breaker operate by hand?
12—Are solenoids, signal switches, control relays, drum switches and wiring O.K.?
13—Are magnet clutch, cams for motor switch and tripping mechanism in good operating condition?
14—Make a report of condition of breaker when inspected and how left after inspection.

Date *Sign* *Remarks:*

per cent represents money going into permanent work.

Touching upon probable future developments in water-power engineering in its broadest sense, he pointed out that modern waterwheels operating under good conditions develop more than 90 per cent theoretical power. The possible gain here is not more than 4 or 5 per cent at best. The generators have efficiencies ranging from 95 to 97 per cent, and it is more a question of the amount of money one wishes to spend in the design and construction of a generator than any other factor that determines the maximum efficiency. Mr. Smith believes that generators of 98 per cent efficiency can be built if the purchaser is prepared to pay the price. The general arrangement of waterwheels and generators and the design of power-plant structures have in the last few years become more or less standardized.

If the speed of the generating units can be increased for a given head or if the speed of the water through the passages can be increased so that the passages can be made smaller, the over-all cost of the power plant and machinery will be reduced. Recent designs in some cases involve about double the speeds of Francis turbines under the same head for the same power. It is a fair assumption that by doubling the speed the cost of the electrical machinery can be reduced by 25 per cent, which means a reduction of 2 or 3 per cent in the total cost of development—a substantial and worth-while saving to work for in the future.

TYPICAL PERCENTAGES OF INVESTMENT COST IN WATER-POWER DEVELOPMENT

	Per Cent
Preliminary work, including expenses of engineering reports, legal advice, etc.	2
Lands, etc.	7
Discount on bonds	9
Interest during construction	9
Legal	1
Engineering and superintendence	5
Head office expenses	2
Insurance	1
Construction of buildings and camps	2
Construction plant	9
Cofferdams and tracks	7
Dams	13
Power house	13
Machinery	18
Operators' houses, roads, miscellaneous	2
Total	100

Unbalanced Electric Range Loads

Causes of Poor Voltage Regulation—Small Auto-Transformer as Part of Range Suggested as One Means of Overcoming Trouble

BY PAUL P. ASHWORTH
Distribution Engineer Utah Power & Light Company, Salt Lake City, Utah

GOOD voltage is essential to the satisfactory operation of an electric range. How to maintain good voltage at the terminals of the range and at the same time keep down the investment in distribution facilities to a point where electric range business is really profitable has been an important consideration to the distribution engineer. The heat developed in the elements of the range varies as the square of the voltage impressed. If the voltage is 10 per cent low, the heating will be 20 per cent below normal. Slow heating, the objection that is often raised to the electric range, is very often due to an unbalanced load, caused by the range itself, on the two sides of a three-wire secondary line serving the range.

An unbalance of 1,500 watts on one side of the line produces twice as much voltage drop to neutral as a balanced load of 3,000 watts equally divided with 1,500 watts on each side of the line. With 220 volts it is possible to handle four times the load with the same percentage of voltage drop to neutral as with 110 volts.

Take, for example, a range having two 1,500-watt elements on the same side of the line. If these two elements are the only ones in use, as will frequently happen during certain cooking operations, the percentage voltage drop to neutral on that side of the line will be the same as if a balanced load of 12,000 watts was carried on the three-wire circuit. With three 1,500-watt elements on one side of the circuit the regulation will be the same as that for a balanced load of 18,000 watts.

A consideration of these facts gives some idea of the havoc raised in voltage regulation by an unbalanced load on a three-wire secondary distribution circuit. The following suggestions are offered as possible solutions of the problem:

1. Install wire and transformers of sufficient size to give good voltage regulation even when the load is badly unbalanced. This method would make the cost of serving ranges so high as to make the business less attractive.

2. Rewire the ranges so as to leave less possibility of unbalancing the three-wire circuit. Manufacturers have already given considerable attention to this matter, but it is impossible to get a well-balanced load under all operating conditions.

3. Wind the elements for 220-volt, two-wire service. This would involve complications in switches, greater hazard to the user, smaller and less substantial wire in the heating elements, but would insure a perfect balance of the circuit and prevent the theft of energy by backing up a fuse.

4. Install a small three-wire auto-transformer on the range side of the meter. Two service wires only from the main would be required. The advantage of 220-volt transmission would be obtained and there would be no unbalance on the general three-wire system. The cost of the auto-transformer installation would probably be borne by the customer, either as a direct charge or as reflected in the rate for energy. A disadvantage of this scheme is that it might in many cases be difficult to find a suitable location for the auto-transformer, and therefore the cost might be excessive.

5. Install a small three-wire auto-transformer as an integral part of the range. This would increase the cost of the range by about $15, but would balance the load at the point where the unbalancing occurs; would require but two service wires to the range, and the use of a two-pole instead of a three-pole entrance switch, a two-wire instead of a three-wire meter; would prevent the theft of energy, and would insure good voltage to the heating elements regardless of the method of operating the range. Naturally the design of the transformer must be such that the core loss is insignificant, or else a suitable switch must be provided to disconnect the transformer when the range is not being used.

6. Install a small three-wire auto-transformer on the pole off which the range service wires are taken. The connection from this point on would be the same as if no auto-transformer were used. This method has the disadvantage of increasing the cost of supplying service to range consumers, although in most cases it is preferable and more economical than either running heavier copper or installing a special transformer for each range.

It is evident that the scheme proposed under "5" above is to be preferred as being the most direct solution of the problem, and it is therefore recommended for the consideration of manufacturers and the industry in general. Until such time, however, as the manufacturers can be prevailed upon to adopt this construction operating companies will have to content themselves with one of the other methods suggested above. The one described under "6"—i.e., installing an auto-transformer on the pole off which the range service wires are taken—is probably to be preferred. Several large companies, notably the Portland (Ore.) Railway, Light & Power

Company, have been following this practice for some time with satisfactory results. The use of autotransformers for this purpose was described in the issue of the ELECTRICAL WORLD for March 11, 1922, page 487.

High-Speed Graphic Meter for Measuring Demands

By L. D. Snow
Service Division, Puget Sound Power & Light Company, Seattle, Wash.

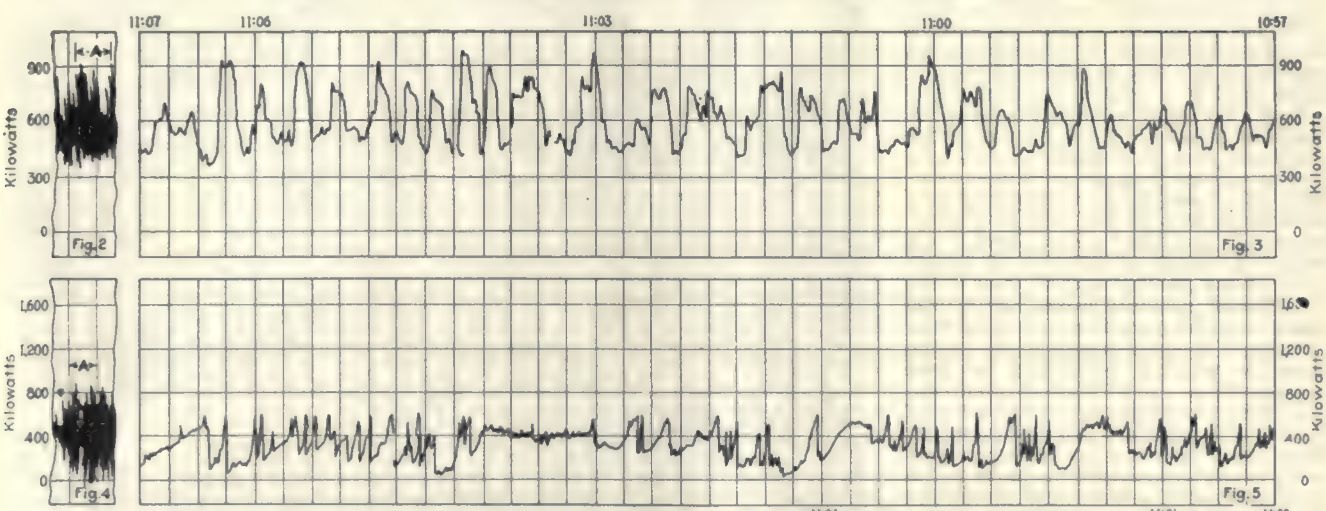
ALTHOUGH theoretically graphic wattmeters will indicate the power passing through them at each instant of time, it is difficult on fluctuating loads to determine accurately the demand over a period of several minutes. This is due to the fact that each successive change in load produces a swing of the graphic pen, with the result that the chart shows a wide jagged band of ink. Such a record, while giving an idea of the use of power, is very difficult to average for any interval of time required in determining a demand. By speeding up the chart and drawing out these swings the impulses of power will show characteristics in themselves. It would appear from the record of a small section on a low-speed chart that the average power for that period would be a line drawn through the center of the wide band. Such a reading would likely be incorrect. A study of a high-speed chart record for the same load would give a better idea of the characteristics of the load and enable one to make a more intelligent and accurate reading. The Puget Sound Power & Light Company has converted an ordinary low-speed graphic wattmeter into a high-speed meter by substituting for the clockwork in the instrument a small series motor as shown in Fig. 1.

FIG. 1—MOTOR USED FOR DRIVING CHART AT SPEEDS VARYING FROM 3 IN. PER HOUR TO 2 IN. PER MINUTE

This motor runs at a very high speed and drives the mechanism of the instrument through a train of gears taken from an ordinary watt-hour meter. The speed is controlled by use of an incandescent lamp and an adjustable resistance in series with the motor, which is energized from a 110-volt circuit. Any number of speeds can be obtained by using gear trains of different ratios. The ratio used on the instrument described was 133⅓, giving a chart speed of 2 in. per minute. Fig. 2 is a chart taken from a low-speed graphic meter on a lumber-mill load. The chart travel is 3 in. per hour. The swings of the pen overlap one another, drawing a very irregular band from which it is difficult to obtain an average reading for any period of time. Fig. 3 is a chart taken at the same time on the high-speed meter. The chart travel in this case was 2 in. per minute. The moving element of the meter was heavily damped to prevent overshooting due to its momentum. The swings of the low-speed meter are here shown drawn out. From this it is evident that each swing represents actual power used by the mill and pictures clearly the power required as cuts are taken from the log by the head-saw.

Since the time of making a cut is longer than that required for the return of the carriage for the next cut, it is clear that the average reading is greater than a line drawn through the center of the irregular band on the low-speed chart. Fig. 3 and Fig. 4 are likewise low-speed and high-speed charts respectively taken on an electric furnace load. The high-speed chart shows that the impulses of power are very sudden and of short duration, causing the low-speed graphic to overshoot. The average power in this case would be less than a line drawn through the center of the wide band on the low-speed chart.

There are instruments on the market which are designed for high chart speeds, but where graphics of the low-speed class are available an arrangement of this kind can easily be made for speeding up the chart. Thus the expense of buying a special instrument, the use of which would be limited, is saved.



FIGS. 2 TO 5—HIGH-SPEED CHARTS GIVE MEANS FOR ANALYZING LOADS THAT FLUCTUATE BETWEEN WIDE LIMITS

Fig. 2—Graphic record from a lumber mill service. Chart speed 3 in. per hour.
Fig. 3—Graphic record from high-speed meter on lumber mill service covering same period shown by A in Fig. 2. Chart speed, 2 in. per minute, or forty times faster than that of low-speed meter, which gives an accurate record of the mill performance.
Fig. 4—Low-speed graphic record from an electric steel furnace load.
Fig. 5—High-speed record covering same period shown by A in Fig. 4.

Proper Inspection of Meter Wiring Important

BY W. C. DEVIN
Meter Department, Chester Valley Electric Company, Coatesville, Pa.

OF ALL the standardization rules of the central station no other is so vital as the one requiring that all wiring be in accordance with the National Electrical Code or at least passed by a competent inspector. A fire from defective electrical apparatus or wiring not only causes a financial loss to the property owner and possibly to his neighbor, but means a loss to the central-station company as well. Damage suits often result and a customer is lost, prospective customers are deterred and a public impression that electric wiring is hazardous is produced. The average person does not appreciate the danger of poor wiring, but every person appreciates the value of the dollar, so it naturally falls to the central station to set the standard for all electrical wiring to be connected to its lines.

Most companies require that a certificate be procured from the Fire Underwriters' Association before supplying service, while others depend upon a municipal inspector whose authority is supported by a city ordinance. With some companies the certificate of standard is not mandatory, a release being signed by the owner of the property instead.

To companies requiring an underwriter's certificate before supplying service many problems present themselves, especially when the rule has been in effect only a few years. Among these are:

1. Has the electric company a right to refuse to supply service to a house whose owner refuses to have the wiring inspected by the proper authorities, although it is not considered hazardous?
2. If additional wiring is done in the building whose original wiring is not standard, should a letter of approval be required on the new job?
3. If an additional outlet is placed in accordance with the code in a building with certified wiring, should the owner of same be required to obtain a certificate on this outlet?
4. What procedure should be followed when it is discovered that the customer has done a small amount of wiring which is safe but which has not been inspected?
5. Will the extra expense of having a small amount of wiring inspected cause the customer to do the work himself, possibly creating a hazard, instead of having a competent electrician do it, who knows a certificate is required on the job, no matter how small?
6. In a case where the electric service has been discontinued, should a certificate be required before reconnecting if the wiring has never been inspected and passed?
7. Is it good policy to give the customer temporary service before the wiring has been inspected and a temporary certificate issued by the inspector?
8. Is it good practice to have the owner sign a release instead of getting a certificate on his wiring? Is it fair to his next-door neighbor?

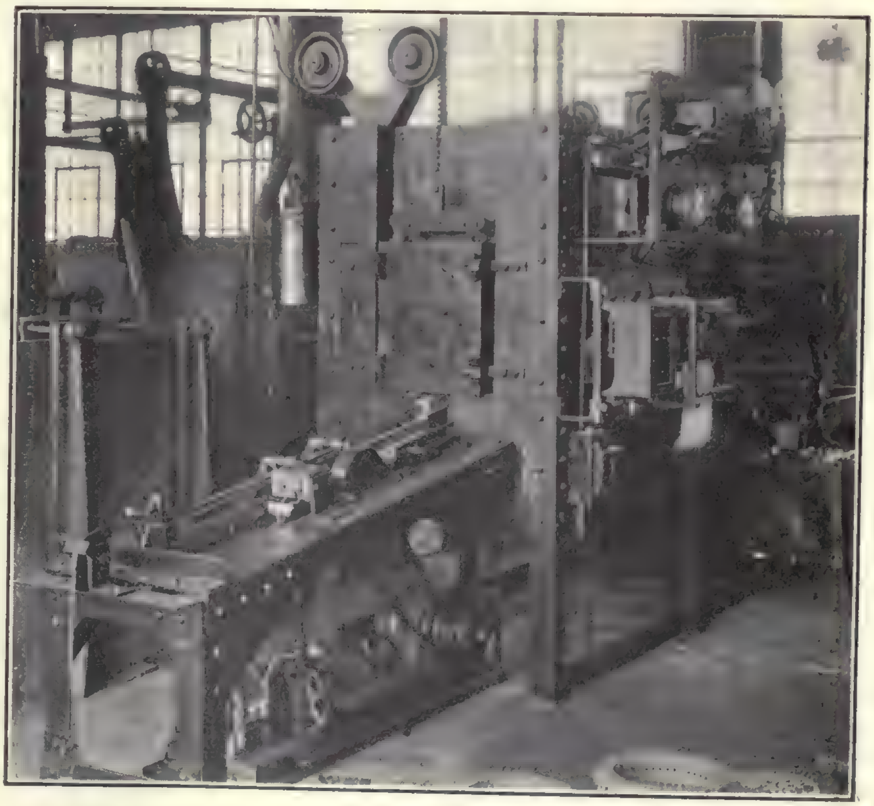
These questions do not concern the companies which have their requirements well established, but those which have lately enforced certain requirements for wiring almost daily confront problems which can be most easily solved when the general policy of other companies is known.

Resistor Furnace Operates at 2,350 Deg. F.

CONFRONTED with the problem of treating high-speed tools for automatic gear-cutting machines, the Gleason Works at Rochester, N. Y., installed a resistance-type furnace capable of heating the parts to a temperature of 2,350 deg. F. This furnace replaced an oil furnace from which the results had not been entirely satisfactory because of the variable heating conditions resulting in non-uniformity in the finished product, especially as to hardness.

Much research work was necessary before a resistor could be developed to withstand this temperature. The first experience with a solid graphite resistor showed that the electrode oxidized very quickly and usually burned out before the desired temperature had been reached. In working on the theory that some method would have to be devised to counteract the effect of oxidation on the heated electrode, F. J. Ryan & Company of Philadelphia, who furnished the furnace for this installation, designed a special low-voltage transformer with which the heat of the electrode could be increased to a much higher temperature. The temperature up to the working conditions of the furnace was reached easily, and it was found that after this temperature was reached the power input could be reduced to the original calculations of necessary input. As a result the high-power input is used only for bringing up the temperature and to overcome oxidizing conditions.

One of the advantages of this furnace is the fact that the tools are conveyed automatically through the furnace and are then extruded directly into the quenching bath. The heat of the tools entering the quenching bath causes fumes to be given off which have proved a direct benefit to both the electrode and the tools. The furnace consists of two chambers, the mean heating chamber in which metallic resistors are used and the final heating chamber in which the graphite resistor is used.



HIGH GRADE OF PRODUCTION POSSIBLE WITH THIS HIGH TEMPERATURE RESISTOR-TYPE FURNACE

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

An Appraisal of Employee Welfare Work

C. L. Edgar Cites Benefits in Accident Prevention, Co-operative Education and Development of Personnel—Value of Policy Demonstrated

ONE of the best estimates of the value of employee welfare activities was made by President C. L. Edgar of the Edison Electric Illuminating Company of Boston, before a thousand employees of that organization at a recent meeting called to celebrate prize awards for new business getting during the past year. The following extracts from Mr. Edgar's remarks indicate the attitude which the chief executive of the Boston company maintains in reference to employee welfare:

In the summer of 1910 the central-station companies took up seriously and systematically the question of relationship between employer and employee. From the very beginning our industry has been guided largely by the National Electric Light Association and its public policy committee, composed of the leading executives of the principal central stations in this country.

It was my good fortune to be chairman of the public policy committee in the year 1910, and we decided to confine our attention that year entirely to the question of relationship between employer and employee. The result was a report submitted at the convention in 1911 which has become an authority on this whole subject.

It was recommended as fundamental, first, that all of these activities should be at the expense of the company rather than at the expense of the individual employee, and second, that they should apply to all company employees from the office boy to the president. As a result of this report, our company made a complete study of the recommendations, and it is interesting to note that we have in force at the present time all of them with one or two exceptions.

Earlier Welfare Work at Boston

The Christmas tree of 1911 which was given to the families of our employees was, I think, the first tangible result of this new policy. It happened that about this time we were considering the construction of our Massachusetts Avenue service property, and the restaurant, recreation building, library building, tennis courts and ball field were also the direct result of this policy.

As soon thereafter as possible we organized our welfare bureau and put into effect our sickness and death benefits and our annuity benefits. In 1912 we held our first Edison field day, and we have kept it up as an annual institution ever since.

We started the Edison Savings Fund five years later, in 1917, and you may be surprised to know that up to date more than $1,000,000 has been deposited in this fund. Of course this does not mean that there is $1,000,000 there at present, as naturally a large percentage of it has been drawn out for various purposes; but it has resulted in our employees being able to save $1,000,000 out of their wages for future investments or expenditures.

Great Importance of Accident Prevention Work

I am not going to attempt to recite all of the welfare activities in which this company has been engaged, but there are two which it seems to me might well be emphasized. The most important of all is, in my opinion, the work of the company's accident prevention committee. This committee has been in existence since 1912. The superintendent of the employment bureau has acted as its permanent chairman, and the personnel has been changed from time to time in order to give all departments and all divisions a chance to become familiar with the work of the committee.

The company has been intensely interested in this subject of safety first from the beginning and has during all these years had a representative on the accident prevention committee of the National Electric Light Association and of the New England Division of the National Electric Light Association. The company is also affiliated with the National Safety Council and its local branch, the Massachusetts Safety Council. It has been represented on the executive committee of the National Safety Council, and one of our employees is at present chairman of the Public Utilities Section of that council, which includes more than two hundred public utilities.

In addition to the accident prevention committee itself, we have this year nearly one hundred departmental safety men appointed by department heads to report on unsafe conditions and unsafe practices. The result of all this is that our accident experience as a whole is considerably better than the average.

Educational Program Expanding

The other matter to which I want to refer specifically is the general question of the education program for the benefit of our own people. We have for many years had a reciprocal arrangement with a number of the educational institutions in our vicinity under which we take students for certain specified times during the year and give them a chance to learn our business. The work which they do while with us is considered a part of their regular college course, and they are rated in accordance with the thoroughness with which they undertake the work. For example, we have at the present time four men from Harvard, twelve from the Massachusetts Institute of Technology and a number from the Northeastern University. This arrangement has worked splendidly and has enabled us to get in touch with college men and be in a position to know something about their qualifications when they graduate. It has, of course, at the same time been of great advantage to the colleges themselves.

For some years our employees have been enabled to take advantage of courses arranged for by the National Electric Light Association. We have now decided that the time has come when we should go one step further and arrange to provide some of these educational advantages ourselves. I have, therefore, within very recent time, appointed an educational committee of representative men and women in the various departments, under the chairmanship of E. S. Mansfield. Plans are now being made, and it is expected that notices will be sent out within the next few weeks offering various educational courses, to start soon after the beginning of the new year.

Employee Welfare Work Its Own Justification

The question may well be asked, what is to be gained by all this? The public policy committee, in making its report, referred specifically to the question whether these activities were justified and whether they would be misunderstood. Our industry is in a little different position from the ordinary commercial corporation. We are a public utility, operating under a virtual monopoly, and our income is derived entirely from our customers. The question as to whether or not we were justified in spending our money for matters of this kind and including it in the cost of service was discussed at considerable length. Fear was expressed that public authorities might think that we were going too far, but it was finally concluded that the justification for all of these activities was so apparent that we had better go ahead and meet the criticism if it arose. Looking back over the last twelve years, we can see that this fear was groundless. While there has been individual criticism both from authorities and from employees, generally speaking, the plans have met with universal commendation.

I think the whole matter hinges very largely upon the spirit in which these things are done. So far as our own company is concerned, we have carried on these activities because we thought they were right and that our employees

were entitled, as men and women, to such consideration as we were able to give them. To my mind the greatest asset any company can possibly have is a satisfied and loyal body of employees. I feel that this condition exists in our company to the fullest extent. I do not want to claim that it is due to these various things which we have done, but at the same time I feel that they undoubtedly have helped.

There has been a lot of discussion as to the problems between employer and employees. These problems undoubtedly exist in certain industries and in certain corporations. If they have ever existed in our company, I have a feeling that we have solved them. We certainly have solved them to the satisfaction of the employer, and we trust also to the satisfaction of the employee.

Appliance Exhibit at Holding Company Offices

BETTER to acquaint members of the executive office staff with the "feel" and characteristics of a variety of modern electrical appliances a three-day exhibit was recently held at the headquarters of Charles H. Tenney & Company in Boston. The plan was devised by Cyrus Barnes, general sales manager of the Tenney organization, in the belief that many employees would be interested to obtain a closer first-hand acquaintance with electrical conveniences than can ordinarily be had in an office in the banking district of a large city. Orders were taken for holiday gift purposes by the purchasing department of the company, and nearly the entire personnel of the home office of this syndicate availed itself of the opportunity.

DISPLAY FAMILIARIZES HOLDING COMPANY EXECUTIVES WITH MERITS OF ELECTRICAL APPLIANCES

Finding a Name for "Convenience Outlet"

Philadelphia Electric Company Holds Competition in Which 2,829 Customers Express Opinion—Advertising Value Capitalized

BY CLARA H. ZILLESSEN

THE electrical industry wants a better name for what is pretty generally called a "convenience outlet." The name was adopted and has been extensively advertised, but somehow or other it has not taken hold as universally and wholeheartedly among electrical people as might be desired. It has been pushed more or less sporadically here and there, but to the public generally it has little significance. It is generally felt that the name is inadequate and that some term should be devised that will indicate clearly the conventional places where electrical appliances may be connected so that the public will understand and use the name and the whole industry will adopt it.

It occurred to us here in Philadelphia recently to put this question of a proper name up to our customers and get their response. To be perfectly frank, we did not set out with the expectation of getting a name which would immediately take the industry and nation by storm; but we did feel that it would be a good thing to "feel out" the public and see by what term they were calling this nameless orphan of the electrical industry. Moreover, we felt it would be good local advertising, and that it would stir up an interest in more outlets per house.

It was rather a difficult matter to put before our public. On thinking it over we decided to run a couple of pages in our quarterly house organ for residential customers, explain the situation, offer prizes for the best names, and then sit back and wait for the returns. It was a wide-open contest with no limiting rules—each contestant could send in as many name suggestions as desired. The closing date was the only limitation.

We offered three prizes—First, a lamp valued at $25; second, a waffle iron; third, a grill or percolator. Then, to sustain the interest, we offered as "extra special prizes" for the ten next best names ten double-duty plugs. We expected to receive several hundred replies and thought it would be a simple matter to pick the prize winners from them.

As a matter of fact, the replies actually totaled 2,829. A lot of them were valueless, of course—humorous, "near-humorous," foolish and impossible. Out of the whole lot we picked fifty names which might be considered as coming somewhere near hitting the mark. It is interesting to note that of the total number only fourteen replies suggested the term "convenience outlet." The word "socket" seemed to be much better known than "outlet," as is evidenced by the fact that 468 individuals used the word "socket" and only 235 used "outlet."

Another interesting point is that seventy-five suggestions coupled the word "utility" with either "socket" or "outlet," and 54 suggestions coupled "service" with the same two terms. It is well to consider this, because when the word "utility" was suggested at one time as a proper term a number of people in the industry claimed that the public would confuse the adjective "utility" with "public utility" or "public service." This apparently does not seem to be the case.

We sent these names to a number of people in the electrical industry who have been working for the best nomenclature and to a number of men and women—not connected with the electrical business in any way—

who might be expected to make reasonably intelligent selections. We gathered together their replies and finally selected the winning names, making the last choice somewhat on the same principle as that on which the All-American football team is selected. Here is the final result: First prize, "plug-in"; second prize, "electro tap"; third prize, "convenience socket"; ten extra prize-winning names, "handiplug," "service plug-in," "service socket," "handisocket," "service tap," "utility socket," "walsocket," "utility outlet," "appliance connection," "plug-in socket."

When the returns were all in we found that seven persons had won the first prize, five persons the second and eight persons the third. In addition, the ten extra prizes had been won by 143 people. There was nothing to do, however, but to give seven first prizes, five second prizes and eight third prizes, plus 143 extra prizes for the ten next best names.

So we wrote personal letters to each prize winner, telling them about the unexpectedly large returns and that we would give each prize winner a prize as advertised. In order to make capital out of this unforeseen circumstance, we have advertised the whole thing in the newspapers, first, to bring this extra-outlet proposition before the public in a new way; second, to build up additional good will; finally, to give as much publicity as possible to the new term.

Milwaukee Has High Appliance Saturation

Survey by Newspaper Indicates Widespread Use of Electrical Devices—Electric Washers Owned by 27 per Cent of City Families

AN APPLIANCE survey of Milwaukee just published, which was made under the direction of the Milwaukee *Journal*, indicates some interesting particulars concerning electrical appliance saturation in that city. The survey was conducted in conjunction with an analysis of other household utensils and accessories. More than 9,000 questionnaires were answered of the 40,000 distributed. This 22.5 per cent return served as the basis for estimating the saturation of the entire city. As an inducement to answer the questionnaires sent out a shopping bag filled with food and other household merchandise was given to each person who presented the questionnaire personally or by messenger to the merchandising service bureau of the Milwaukee *Journal*. The work was started in January, 1923, and it took ten statisticians four months to complete the survey.

Out of a total population of 539,449, 77.4 per cent of the families are reported as living in electrically wired homes. Of the total Greater Milwaukee families, 66,377, or 54.1 per cent of the 122,694 families investigated, are owners of one of three types of washing machines—electric, water-power and handpower. Of these, 33,250, or 50.1 per cent of all washing machines, are of the electric type. This represents a percentage of 27.1 of the total number of families.

Vacuum cleaners to the number of 62,819 machines are owned by 51.2 per cent of the families, about fifty types of machines being distributed in Milwaukee.

Only 1,840 Milwaukee families own electric ironing machines. This is less than 2 per cent of the total population. Electric flatiron saturation is much greater since 75.7 per cent of families own this appliance. Sixty-four different makes are in use. It was also found that 2,085 families having wired homes do not use electric irons.

The use of toasters is much lower, since only 29.2 per cent saturation is obtained. Products from fifty-two manufacturers were represented. A similar situation was found in the electric heater field, where 20.7 per cent of the population enjoy open-air heaters, twenty-four kinds being used.

Milwaukee has not gone far toward a saturation point for electric ranges, as only 0.86 per cent of the population use them. In the percolator field 12.6 per cent of the Greater Milwaukee families are provided with thirteen types of this appliance. Curling irons have a distribution of 17.1 per cent, twenty-nine varieties being employed. Only 9.1 per cent of the Greater Milwaukee families own electrical vibrators, numbering twenty-seven makes.

Detailed statistics were also developed to show the proportion in use of the devices of various manufacturers to determine the influence of local advertising upon the sale of electrical household appliances.

What Other Companies Are Doing

Boston, Mass.—In the first week of a campaign at Canton, Mass., the Edison Electric Illuminating Company of Boston sold 250 kitchen-lighting units, the total number of residence customers in the town being 800. Nine employee salesmen "worked" the territory under the general direction of Julius Daniels, illuminating engineer of the company. The unit used consists of a 9-in. "daylight" fixture, usually with a 100-watt lamp (a 150-watt lamp is offered as a choice). A thirty-day free trial is given and the unit sells installed for $7.50.

Spokane, Wash.—The Washington Water Power Company is co-operating with the local Electric Service League in the erection of ten illuminated poster boards, showing electrical appliances and bearing the legend "Electric Service for Christmas Gifts." These will be 25 ft. long and will be placed on the principal street-car lines. They will be on display for a month before Christmas. The Electric Service League is composed of jobbers, manufacturers, central-station companies and contractor-dealers.

Illinois. — Motion pictures are to be used in telling the story of the growth and development of the public utility properties under the management of the Illinois Power & Light Corporation. Pictures of the various properties and industries served will be taken in Illinois and Missouri. They will also show the manufacture of electric power and gas, beginning with the coal taken from the mines, and how energy is generated and distributed.

Des Moines, Iowa. — More than thirty women employees of the Des Moines Electric Company met recently to form an organization for the study of public utility problems. The women will assist the organization in efforts constantly being made to improve service and acquaint the public with information regarding electrical service. Miss Celeste Robinson presided at the meeting, and short talks were made by M. C. Linn, general manager of the company; Miss Isabelle Davie, chairman of the women's public information committee of the Middle West Division of the N. E. L. A., and Joe Carmichael, director of the Iowa Committee on Public Utility Information.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Hydro-Electric Development and Steam Equipment

Steam-Turbine Blading.—J. C. READ.—The author first describes the causes and effects of corrosion and erosion and then deals with the form of the blade passage in impulse and reaction machines and with the energy losses occurring in the blading. He then details the stresses in the blades and describes the type of blade fastenings, lacing and shrouding, gives methods for obtaining a large exhaust area, and finally deals with vibration and its causes, showing a method of correcting for the effect of centrifugal force.—*Journal of (British) Institution of Electrical Engineers*, October, 1923.

Power Station at Forshuvudsforsen, Dalälven, Sweden.—CAPT. MAURITZ SERRANDER.—This article is a complete description of the new power station on the Dalälven in Sweden built by Stora Kopparbergs Aktiebolag. The station is arranged for three units, each of 8,000 hp., two of which are already in operation. The waterwheels are constructed for 83⅓ r.p.m., at which they are warranted to have an efficiency of 86 per cent for a water consumption of 60 cu.m. per second. The generators are rated at 6,500 kva., 11,000 volts and 50 cycles.—*Teknisk Tidskrift (Swedish)*, Oct. 27, 1923.

European Development in High-Speed Hydraulic Turbines. — ELOV ENGLESSON.—The Kaplan-type turbines are designed with movable blades to be adjusted for different load conditions, which improve the part-load efficiencies. An 11,200-hp. turbine of this type is being constructed to operate under 21.25 ft. head and run at 62.5 r.p.m. The runner is 19 ft. in diameter and weighs 62.5 tons.—*Power*, Nov. 13, 1923.

Sherman Island Hydro-Electric Development.—A 50,000-hp. development on the Hudson River, consisting of five 10,000-hp. vertical Francis turbines to operate under 66-ft. head, has recently been placed in operation. The power house and canal are constructed on sand underlain in many cases with quicksand. The dam rests on glacial deposits and is of special construction and the canal, over 3,500 ft. long, is concrete-lined. Structural-steel framework was used to reinforce draft-tube bells. Provisions have been made for continuously measuring the flow of water to each unit.—*General Electric Review*, December, 1923.

Determination of the Fineness of Powdered Coal.—W. A. SELVIG and W. L. PARKER.—Coal being usually pulverized so that 70 per cent or more passes through a 200-mesh sieve, it presents difficulties in sieving as the finely divided material tends to clog the meshes. Recognizing this condition the Bureau of Mines, through co-operation with the committee D-5 on coal and coke of the American Society for Testing Materials, conducted sieving tests on two standard samples of powdered coal, the tests being described in this paper. As a result of this work a method for making fineness tests, by hand sieving, is recommended as a standard method, while a rapid method, by machine sieving, is given for routine tests.—*Report of Investigations, No. 2545, Bureau of Mines.*

Generation, Control, Switching and Protection

Overloads and Short-Time Ratings.—R. O. KAPP.—In connection with the generation of energy a problem often arises as to what period of time under given conditions a plant will safely stand a given overload. If sufficient design data of the plant are known, the problem may be solved and a result can be arrived at by calculation, but the calculation involves expensive mathematical studies and is generally too complicated to be found worth while. A simple graphical solution in this case would be of help. Such a graphical solution is given applicable to transformers and cables.—*Electrical Review (England)*, Nov. 2, 1923.

Outdoor Oil Breakers for 44,000 Volts.—A short article on the design and important characteristics of an oil circuit breaker recently developed in England. The breaker is of very rugged construction, making it suitable for very heavy-duty service.—*Electrician (England)*, Nov. 9, 1923.

Overload Protective Relay.—A. B. CAMPBELL.—Several types of thermal and temperature overload relays recently developed are described. After a few remarks on the general principles involved, the author describes the construction and operations of these relays.—*General Electric Review*, December, 1923.

Transmission, Substations and Distribution

Inter-Scandinavian Power Distribution.—A. ANGELO.—This paper, read at the Electrotechnical Congress in Gothenburg, Sweden, in 1923, gives the results of the work of a Scandinavian committee appointed in 1921 to investigate the project. The author discusses the financial and technical problems in connection with a superpower system extending over Sweden, Norway and Denmark. The main problem is the transmission of power from Norway and Sweden to Denmark. The different possibilities of undersea cables between Norway and Denmark and between Sweden and Denmark are considered. Alternating current cannot be considered for the former project on account of the extensive net of telephone and telegraph cables in Skagerrak. The committee has established four main alternatives for the superpower system, and gives a detailed description of each. These alternatives are: (1) Direct-current power carried in undersea cables under Skagerrak between Norway and Denmark; (2) direct-current power carried in overground lines through Sweden and across Oresund; (3) alternating-current power carried in overground lines through Sweden and through an undersea cable across Oresund; (4) alternating-current power carried in overground lines through Sweden and an overground line across Oresund.—*Teknisk Tidskrift (Swedish), Elektroteknik*, Oct. 6, 1923.

Effect of Shearing Stress on the Span Calculations of a Suspended Cable.—T. OHTSUKI.—The paper presents the complete equation of a suspended cable, taking into account its density, elasticity and rigidity, and determines the extent to which the effect of shearing stress should be considered for practical span calculations. — *Journal of (British) Institution of Electrical Engineers*, October, 1923.

Mechanical-Electrical Construction of Modern Power Transmission Lines.—C. B. CARLSON and W. R. BATTEY.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. fall convention, Oct. 20, 1923, on page 801. — *Journal of A. I. E. E.*, November, 1923.

Units, Measurements and Instruments

Temperature Measurement with the Einthoven Galvanometer. — F. ADCOCK and E. H. WELLS.—The object of this investigation is to study the relationship between the temperature of the gas in which the thermometer is situated and the thermometric record obtained. Attention has been devoted primarily to the platinum-resistance thermometer. As it is required to obtain a continuous record of temperature throughout a single cycle, the method adopted is to measure the out-of-balance current in the Wheatstone bridge by means of an Einthoven galvanometer. The forces on the fiber of the Einthoven galvanometer are considered and the suitability of various types of fiber are compared. The apparatus designed to investigate the problem is described. Experimental results are given and discussed.—*Journal of (British) Institution of Electrical Engineers*, October, 1923.

Measuring Small Currents.—An instrument is described for use in connection with the compensation method of measuring currents of 10^{-9} amp. or less. It consists essentially of a current divider, which divides a variable current in a ratio very large compared

with unity. The small current is used for compensating the unknown current, the large current is read on a relatively insensitive instrument. The device consists of a thermionic cathode and an anode pierced by a small hole. The large current is that received by the anode; the small current is the fraction passing through the small hole in the anode.—*Journal of Scientific Instruments* (*England*), November, 1923.

Illumination

Railway Car Lighting.—G. E. HULSE. —The author discusses the limitations encountered in supplying illumination to cars. The amount of energy available is limited owing to the car being on the move. The position of lighting fixtures is determined by car construction, preventing flexibility in placing units. Maintenance of reflecting and transmitting surfaces is more difficult than in most other situations. Arrangements of fixtures for various types of cars, the resulting illumination, the type of glassware used and the efficiency of installation with this glassware are considered. — *Transactions of I. E. S.*, October, 1923.

Illumination by Light Projectors at Coal Mines.—EDGAR GEALY.—Hazards of poor lighting, the function of reflectors and methods of focusing the headlights of mine locomotives are discussed. Present practice shows that there is a great need for the application of the advanced principles in correct illumination in coal mines.—*Coal Age*, Nov. 29, 1923.

Motors and Control

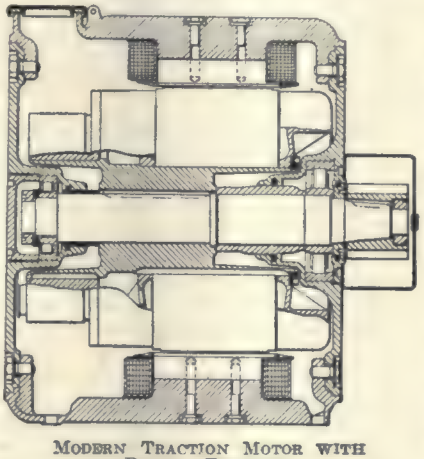
Power and Electrification in Finland.—G. M. NORDENSVAN.—This paper was read at the Electrotechnical Congress in Gothenburg, Sweden, 1923. The author gives the consumption of power, both electrical and mechanical, in Finland and shows how it is distributed throughout the domestic, industrial and railway fields. The available water power is able to generate an average of 2,500,000 hp. The electrification of railroads has been considered from time to time by several committees, but nothing has been done as yet. The total length of railroads in Finland amounts to about 4,000 km., of which about 350 km. is being considered for electrification. The total consumption of energy for this electrification would amount to about 30,000,000 kw.-hr. per year.—*Teknisk Tidskrift* (*Swedish*), *Elektroteknik*, Oct. 6, 1923.

Calculation of Air-Space Flux.—W. CRAMP.—With the increase of alternating-current apparatus and the spread of wireless telegraphy, the calculation of air-space flux, whether electromagnetic or electrostatic, becomes daily of greater importance. At present the formulas of Forbes are used, supplemented by certain cases developed by Maxwell, Thompson, Carter and others. The author extends the number of these cases and develops therefrom close approximations in forms of immediate use to the designer. The results thus obtained are compared with the older formulas by means of examples.—*Journal of* (*British*) *Institution of Electrical Engineers*, October, 1923.

Speed Regulation of Strip and Bar Mills.—In addition to the usual characteristics required for mill motors generally, it is essential also with motors for these mills that when adjusted for any definite speed throughout the range of control the speed should be only slightly affected by wide variations in load. The motors should also be able to carry high overloads throughout the full speed range. This article discusses the essentials of alternating-current motor design, rating of mill motors, function of regulating set, ohmic drop exciter, necessary control equipment and speed-control arrangements.—*Electrician* (*England*), Nov. 30, 1923.

Traction

Roller Bearings for Traction Motors. —H. MECKE.—The author shows some of the latest bearing constructions which have been found successful on railway motors. Where 20-kw. motor rating is not exceeded ball bearings are recommended. Above this size smaller dimensions and more competitive cost will result from the use of roller bearings. For motors which are to be installed in cramped places, as on narrow-gage cars or in mine locomotives, well-designed roller bearings, extending on both sides deeply into the hollowed-out armature body, give the designer a chance to compress a comparatively large-size motor into the smallest available width, as, for example, in the design shown here.—*A. E. G. Mitteilungen*, September, 1923.



MODERN TRACTION MOTOR WITH ROLLER BEARINGS

Heat Applications and Material Handling

Electric Furnace Progress.—W. S. GIFFORD.—The total capacity of the electric furnaces in Sheffield, England, at the end of the war was about 150,000 tons per annum. Since that time several new installations have been placed in operation. One of the important questions raised by the author is how developments in the iron and steel industry can be aided by the use of the electric furnace. Stainless iron, like stainless steel, should be a useful electric furnace application, especially as electric heating is economically the best method to employ. Another use of the electric furnace is for such processes as hardening, tempering and annealing, while the employment of the induction furnace in brass manufacture is extending.—*Electrician* (*England*), Nov. 30, 1923.

Improved Electric Melting Furnace for Alloys.—T. F. BAILY.—A description is given of the new type of radiant-dome electric furnace recently installed in the plant of the Miller Industries, Canton, Ohio. The furnace requirements of this plant are unusually severe, as its product requires a wide range of metals, running from yellow brass, bronze and red brass to alloys containing 50 per cent nickel. The operation of the furnace for these processes in this plant have been very satisfactory in the time it has been in operation.—*Chemical and Metallurgical Engineering*, Dec. 10, 1923.

Telegraphy, Telephony, Radio and Signals

Generation of Alternating Currents by Means of Triodes.—N. SHUTTLEWORTH.—The author covers the essential features of the subject and endeavors to solve some of the difficulties on original lines. He offers an explanation of the characteristic behavior of triodes in conjunction with generator circuits. After a brief study of the characteristics of a triode or high-vacuum valve provided with three electrodes, the general circuit is considered and the factors determining the frequency of the generated current are established. The design of a circuit to meet a specification is laid out and experimental confirmation is given. Finally a graphical method of analysis is evolved to show in diagrammatic form the conditions under which triodes may and do operate.—*Journal of* (*British*) *Institution of Electrical Engineers*, October, 1923.

European Long-Distance Telephony. —The problem of international long-distance telephony has become a subject of universal interest, to the study of which telephone engineers and executives throughout the world are giving their closest attention. The solution of this problem has been materially advanced by the work of the delegates composing the Preliminary Technical Committee for European Long-Distance Telephony at a meeting in Paris on March 12-20, 1923. Their recommendations, unanimously adopted, have been approved by the administration of the six countries involved, which are Belgium, Spain, France, Great Britain, Italy and Switzerland. Recommendations for transmission, aërial lines, cables, composite lines and traffic regulations are included in this report, which has been translated from the original French.—*Electrical Communication*, Vol. 2, No. 2.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

New Niagara Unit Cut In

Niagara Falls Power Company Starts Up "World's Biggest" Hydro Turbo-Generator

THIRTY-SEVEN prominent hydraulic and electrical engineers and central-station executives, as well as representatives of the federal government, assembled at the new power plant of the Niagara Falls Power Company on Tuesday, Dec. 18, to see Jacob F. Schoellkopf of Buffalo, chairman of the company's board of directors, start up what is so far the largest hydro-electric unit in the world.

This giant unit weighs more than 1,750 tons. It consists of a 70,000-hp. single-runner, vertical-shaft hydraulic turbine attached to an electric generator delivering 65,000 kva. at 12,000 volts. This is the first of three such units being installed in the new twelve-million-dollar project at Niagara. When completed this station will house units with a total rated capacity of 454,000 hp. The company has two other stations with rated capacities of more than 200,000 hp. The annual output of the American Niagara system is in excess of 2,500,000,000 kw.-hr. and represents about one-third of the electricity sold in New York State.

The new unit uses 3,200 cu.ft. of water per second with an efficiency of at least 93 per cent. It does not increase the company's diversion of water in any way, but does materially increase the efficiency of conversion into power. It uses the same amount of water formerly used by seven 5,000-hp. units and delivers energy equivalent to the output of fourteen such units. Each of the three new 70,000-hp. units will produce electricity which if generated through the use of coal would require 700,000 tons annually. The new installation will produce an increase of 100,000 hp. of electricity.

Biggest Waterwheel Ever Built

The turbine of this unit is the biggest waterwheel in power capacity ever built. It is a product of the I. P. Morris Division of the Cramp Ship & Engine Building Company of Philadelphia. The runner is a single-piece s el casting weighing 105,000 lb. The turbine casing and control valve required thirty-two carloads of parts. The stator of the generator weighs 228 tons. The rotor with its twenty-eight 8-ton poles measures 21 ft. in diameter and weighs 399 tons. The revolving elements, consisting of rotor, shaft and runner, total approximately 500 tons and are suspended from the top of the unit by a Kingsbury thrust bearing. The generator was manufactured at the Schenectady works of the General Electric Company, where a companion machine is approaching completion. One hundred and ten cars were required to transport the machinery and equipment composing this unit.

The Pressure Tunnel

The three new hydro-electric units will receive their supply of water through a new hydraulic pressure tunnel. This tube, which is 32 ft. by 32 ft. in diameter and 4,300 ft. in length, carries the water from the head of the rapids above the falls under the city of Niagara Falls to the edge of the high cliff below the falls. It was excavated through solid rock. The tunnel discharges into a great forebay from which the water is conducted to the turbines by means of three 21-ft.-slope tunnel penstocks cut through the limestone cliff.

"Two million people will share in the increased power produced by this project," said Paul A. Schoellkopf, president of the Niagara Falls Power Company. "It means more power for Buffalo and for all on the Niagara frontier. However, in spite of the additional energy from this new unit, as well as the energy to be produced by the other two big machines which go into service during the coming year, the demand for cheap, constant hydro-electric power from Niagara outruns the supply. We cannot augment our output, after the completion of this project, until present restrictions on the use of the waters of the Niagara River are modified."

Bill Leasing Muscle Shoals to Ford Strongly Backed

Much significance is attached at Washington to the Muscle Shoals bill which has been introduced by Representative Dickinson of Iowa. It is understood that the bill was drafted in official quarters and that it has powerful support in Congress. It proposes to lease the government's Muscle Shoals properties to Henry Ford under conditions which would bring the entire operations under the provisions of the water-power act. The measure provides that the government is to receive an annual return of 6 per cent on its actual expense of constructing the dam and other project works, exclusive of navigation facilities, with the proviso that only 3 per cent need be paid for that proportion of the facilities used in the production of commercial fertilizers.

New Station in Des Moines

Illinois Power & Light Plans to Build Steam Plant with Ultimate Rating of 200,000 Hp.

PLANS for the building of a steam generating electric power station for the Des Moines (Iowa) Electric Company, with an ultimate capacity of more than 200,000 hp. and to cost more than $16,000,000, were announced at Chicago this week by the Illinois Power & Light Corporation. This is the largest improvement announced by that company since its organization last summer. It will be, the company's officials say, one of the many to be made from time to time in the corporation's plans for betterments and expansion of service.

Work on the first section of the plant, consisting of two units of 33,500 hp. each, to cost together $6,000,000, will begin at once and will be pushed to completion as rapidly as possible. The power house, which will be built on 63 acres of land near the southeast city limits of Des Moines, below the junction of the Des Moines and Raccoon Rivers, will be thoroughly modern in construction. When it is finished the old power house will be used as a standby station.

Hartford Company Will Manage Connecticut Power

Effective Jan. 1, 1924, the Hartford (Conn.) Electric Light Company will take over the management of the various divisions of the Connecticut Power Company from Stone & Webster, Inc., Boston. The Hartford company purchased a controlling interest in the Connecticut Power Company a few years ago. Under the new arrangement a closer co-ordination of the systems involved will probably take place along both engineering and commercial lines. No present changes in executive personnel are contemplated. V. E. Bird is general manager of the Connecticut Power Company, with headquarters at New London.

Commonwealth Edison Sells $15,000,000 of Bonds

An issue of $15,000,000 of first mortgage collateral 5 per cent gold bonds of the Commonwealth Edison Company of Chicago, series A, due in 1953, was made this week by Halsey, Stuart & Company. When the books were opened on Wednesday it was found that advance subscriptions received had exceeded the amount of bonds offered.

The bonds are priced at 92½, to yield more than 5.50 per cent. These bonds constitute the initial issue under a mortgage of July 1, 1923.

Big Mine Electrification

Susquehanna Company's Four Anthracite Collieries in Pennsylvania to Be Converted

THE Susquehanna Collieries Company has under way an extensive electrification program which will, it expects, be completed within a year. According to the company's plans, all its four mines in the Shamokin district will be operated with electric power. This will go far to revolutionize the coal industry in the anthracite region of Pennsylvania. The Richards and Pennsylvania collieries will be operated by electricity within six months, and within a year the Cameron and Luke Fidler collieries will have the same motive power, insuring both greater efficiency and better and safer working conditions.

The Richards Colliery is already being operated electrically so far as the shafts, pumps and compressors are concerned. At this colliery there are eleven slopes, the breaker, the compressor and two fans, all of which will be driven by electricity. At the Cameron and Luke Fidler collieries there are one shaft, more than five slopes and two larger breakers to be electrified, and at the Pennsylvania Colliery six slopes, three inside and three outside, will be operated by electricity.

It was rumored that the power plant, erected at cost of approximately $1,200,000, would be abandoned because of the proximity of the new substation of the Pennsylvania Power & Light Company at Harwood, but this statement is unfounded. With the new system of operating the collieries, the coal company will save enough within ten years to pay for the construction of the power plant.

With only half of the generating capacity in operation, the monthly output of the plant is 1,500,000 kw. When the four collieries are electrified the services of more than a hundred men in boiler houses will be dispensed with, thereby saving $5,500 on the monthly payroll. Only thirty-two men will be required to operate the electric power plant. One boiler will continue to be operated at each of the collieries for heating purposes.

Effect of Home Rule Amendment in New York State

The effect on public utility companies of the home rule amendment to the New York State Constitution passed in November is the subject of some speculation at Albany, and it is predicted that the cities which do not now have the right to own and operate public utilities will endeavor to get this right from the Legislature so that all municipalities in the state may be placed on an equal footing.

The cities which, either by a provision in their charter or by special law, now have the right to own and operate municipal electric light plants, supplying their citizens as well as furnishing lighting for the streets and public buildings, are Binghamton, Jamestown, Watertown, Oswego, Dunkirk, Batavia, North Tonawanda, Tonawanda, Port Jervis, Rome, Salamanca, Long Beach and Oneida. Of these only Long Beach, Jamestown, Salamanca and Dunkirk are taking advantage of the right. Batavia did operate a plant for some time and then accepted service from the Niagara Falls Power Company at a lower rate. The city can resume operation of its own plant at any time. All villages can by present law own and operate their own lighting plants, and seven or eight do so. The larger cities in the state have the right to own and operate plants for municipal lighting only, and the Legislature would have to act before they could engage in selling light and power.

Twelve Big Power Plants Are Under Way in One State

It is probable that Pennsylvania leads all the other states in the amount of steam generating capacity now being installed. Nine large steam plants, as well as three hydro-electric plants, are listed by the Pennsylvania Public Service Information Bureau as under construction or almost completed in that state. Nearly all of them are designed to be in operation by the end of 1924.

The nine steam plants include the 25,000-kva. station of the Penn Central Light & Power Company at Saxton, whose opening was noticed in these columns last week; the 50,000-kva. station of the Counties Gas & Electric Company at Norristown, the 70,000-kva. extension of the Duquesne Light Company at Colfax, the East Penn Electric Company's 50,000-kva. plant at Pine Grove, the Metropolitan Edison Company's 30,000-kva. station at Middletown, the West Penn Power Company's extensions at Springdale, bringing its initial output to 70,000 kva., and the three big installations of the Philadelphia Electric Company—the new station to be built at Erie Avenue with an initial rating of 200,000 kva., the nearly finished station at Penn Treaty Park, to begin with 60,000 kva., and next year to add another 30,000 kva. and the Chester station extension of 60,000 kva.

The three hydro-electric plants are the Hawley plant of the Pennsylvania Power & Light Company, rated at 50,000 kva.; the Clarion River station of the Pennsylvania Public Service Corporation, rated initially at 25,000 kva., and the Pennsylvania Water & Power Company's extensions at Holtwood, rated at 40,000 kva.

The Pennsylvania Public Service Information Bureau puts the ultimate capacity of these twelve installations at 2,120,000 kva.

To Enter Latin-American Field

Electric Bond & Share Company Organizes the American & Foreign Power Company to Carry on Electrical Utilities in Cuba, Central and South America

WITH an authorized capital of 400,000 shares of preferred stock, 120,000 shares of second preferred and 1,500,000 shares of common, all without par value—the capitalization totaling, however, not less than $50,000,000—the American & Foreign Power Company has been incorporated in Maine to enter the public utility field in Cuba, Central America and South America. This organization has been formed by the Electric Bond & Share Company, the common stock of which is owned by the General Electric Company. It marks the entrance for the first time on a large scale of American capital and enterprise into the field open to the electrical industry in Latin America.

The American & Foreign Power Company, Inc., will immediately take over the important public utility properties in Cuba, Panama and Central America now owned by the Electric Bond & Share Company and will acquire additional foreign public utility properties which for some time have been under investigation and study. It is planned to have the new company carry on the same program in foreign countries as the Electric Bond & Share Company has carried on in this country and which has resulted in the success of such companies as the American Power & Light Company, the American Gas & Electric Company, the Carolina Power & Light Company and other associated companies.

The president of the new company will be Sidney Z. Mitchell, who is also president of the Electric Bond & Share Company, and the following will be directors: Owen D. Young, chairman of the directors of the General Electric Company; Anson W. Burchard, president of the International General Electric Company; Clarence Dillon of Dillon, Read & Company, and Charles E. Mitchell, president National City Bank.

Financing of the project, it is understood, will entail the selling of substantial amounts of stock in the European markets, although the major amount will be raised in New York. As a start it was announced that the Electric Bond & Share Company would purchase for cash the 120,000 second preferred shares and a majority interest in the common.

There are now associated with the Electric Bond & Share Company more than 100 public utility companies in the United States, which serve a total population of about 7,200,000. These associated companies represent an invested capital in excess of $650,000,000. The transfer of the foreign properties now owned will put the American & Foreign Power Company, Inc., into im-

mediate operation and give it a substantial return.

Larger Profits Possible

The announcement was accompanied by the following statement prepared by E. B. Lee, statistician of the Electric Bond & Share Company: "It is interesting to note that while Canadian, British, German and South American capital has been heretofore heavily invested in public utility properties in foreign fields practically no American capital, except that represented by the investments of the Electric Bond & Share Company, has been invested in such enterprises. This is true notwithstanding that public utilities have been developed to a much higher degree in the United States than in any other country, and accordingly operators of public utility properties in America should have the experience to make them highly successful in foreign fields.

"The present is considered a most opportune time for the formation of an enterprise such as the American Foreign Power Company, Inc., as many foreign exchanges are depreciated, making it possible for the new company, with its large available capital, to acquire properties at low prices.

"It is understood that financial returns obtainable from public utility companies in foreign countries are much larger than in the United States. In fact the Electric Bond & Share Company expects these foreign utility investments to yield an average return perhaps twice as much as is possible in this country."

Two Stone & Webster Utilities to Expend $1,845,000

Contracts have been awarded by Stone & Webster, Inc., Boston, for important enlargements of central-station generating plant and allied facilities on the systems of the Edison Electric Illuminating Company of Brockton, Mass., and of the Puget Sound Power & Light Company, Seattle. At the East Bridgewater steam plant of the Brockton company two 588-hp. boilers will be installed, with oil-burning equipment adequate for six boilers; a 10,000-bbl. oil-storage tank, concrete service tank, pumping equipment and heaters. The contract also includes the rearrangement of the present switching equipment. A 13,200-volt line 4 miles long is to be built from the station to Dupont Circle, Brockton, where a two-story switch house, transformer and switching equipment will be installed to tie the system into the transmission lines to be built to the Montaup Electric Company's plant at Fall River, Mass. The estimated cost of this work is $785,000.

On the Puget Sound system a fourth unit, consisting of a 20,000-kva. generator and a 23,000-hp. waterwheel to operate under 440-ft. head, is to be installed, with a new steel penstock 1,800 ft. long, building extension, transformer and switching equipment, at an estimated cost of $1,060,000.

Coolidge Appoints Young

Chairman of General Electric Board to Be One of American Experts to Serve in Germany

In receiving from President Coolidge an appointment, in association with General Charles G. Dawes and a third expert still to be named, to represent the United States on the two international committees designated by the Reparations Commission to investigate the German financial and economic problem, Owen D. Young, chairman of the board of the General Electric Company, has become a figure of worldwide importance. As the successor of Charles A. Coffin in the great manufacturing company that the latter had done so much to build up Mr. Young was already a conspicuous figure in American financial and industrial circles. He is one of a very few men who may be said to dominate electrical manufacture in the United States. Though his education and training were those of a lawyer, his great ability in corporate organization has had its best manifestation in the industry that has been built up on Edison's invention of the incandescent lamp.

O. D. Young

For ten years previous to his elevation to the head of the board Mr. Young was a vice-president of the General Electric Company and at the head of its legal department. Previously he had numbered among his clients Stone & Webster, the Boston engineering firm so largely interested in electrical undertakings, and in their interest had traveled over a great part of the country. His rapid advancement in his chosen profession and the placing of the General Electric's legal department in his hands when he was thirty-eight years of age establish his legal ability on an unquestionable foundation which needs no further words.

Radio Corporation His Work

To him is ascribed the creation of the Radio Corporation of America, of which he became and is chairman of the board. Whatever view may be held of the monopolistic features of this body, no one can deny the acumen and ability displayed in reconciling conflicting interests and manufacturing rivalries and in thus building up an organization that has placed America in the van in the development not only of national but of international radio. Marconi will ever remain the pioneer of wireless transmission of signals and speech, but the fact that in the United States this epoch-making discovery has within a comparatively few years added to the pleasures of the whole population and is in increasing degree rendering it invaluable service as well is due perhaps to Mr. Young's brains and enterprise as much as to any other single factor.

Owen D. Young was born in Vanhornesville, in northern New York, on Oct. 27, 1874, being therefore still under fifty. He was graduated from St. Lawrence University, at Canton, N. Y., in 1894 and received his bachelor-of-laws degree from Boston University in 1896. He started practice at once, soon becoming a member of the Boston firm of Tyler & Young, a connection he retained until 1913. He is a member of the executive committees of the Electric Bond & Share Company and of the Adirondack Power & Light Corporation and a director of the Bankers' Trust Company, the Dallas Electric Company, the Buffalo General Electric Company, the General Motors Corporation and the International General Electric Company, as well as of the International Chamber of Commerce. During the war he was a member of President Wilson's second industrial conference and worked to bring and keep capital and labor in harmonious relations. He still retains his home at Vanhornesville, his birthplace.

Mercury-Turbine Saving Is More than 50 per Cent

Although the initial mercury-turbine installation made by the Hartford (Conn.) Electric Light Company has been in operation less than four months, the indicated fuel saving per kilowatt-hour exceeds 50 per cent as compared with high-grade central-station practice, Samuel Ferguson, vice-president of the Hartford company, asserted on Dec. 10 at a luncheon to press representatives who viewed the equipment at the Dutch Point generating station. Declaring that the mercury boiler and turbine development constituted a revolution in the production of electrical energy from fuel. Mr. Ferguson emphasized the future possibilities of such equipment in enabling energy to be sold to the public at lower rates and pointed out that the development appears likely to be along the line of greatly increased capacity in the not distant future.

Among those present on behalf of the company were T. H. Soren, vice-president, who is in immediate charge of the development for the Hartford organization; James Orr, superintendent of power, and for the General Electric Company, H. N. Hackett and C. D. Wagoner.

Edison Medal to Go to John W. Lieb

Vice-President of New York Edison Company Is Made Its Recipient for 1923—A Recognition of the Part Played by Central Stations in the Electrical Art

ANNOUNCEMENT was made last Saturday of the award of the Edison medal for 1923 to John William Lieb of New York City, vice-president of the New York Edison Company. As ELECTRICAL WORLD readers are aware, this medal is bestowed annually for "meritorious achievement in electrical science, electrical engineering or the electrical arts." In awarding it to Mr. Lieb the committee gives as his outstanding achievement "the development and operation of electric central stations for illumination and power," thus recognizing the tremendous part played in electrical progress by the great light and power companies of the United States and those responsible for their upbuilding and successful operation.

MR. LIEB'S CAREER

To Mr. Lieb in the course of his long connection with the electrical industry three unusual distinctions have fallen. He was an associate of Edison's in the pioneer days of electric lighting and was in at the birth of the central station. He took a prominent part in introducing the new art in its practical phases to a foreign country. He has been instrumental in developing to its present state the light and power service of the greatest city of the country—indeed, electrically speaking at any rate, the greatest city of the world.

Born in Newark, N. J., in 1860, he attended the Stevens Institute of Technology in Hoboken, which gave him the degree of mechanical engineer in 1880. Two years ago his alma mater supplemented this with an honorary degree of doctor of engineering. After his graduation Mr. Lieb entered the employ of the Brush Electric Company of Cleveland as a draftsman. In 1881 he was made an assistant in the engineering department of the Edison Electric Light Company, just organized at New York, and in 1882, as an assistant to Thomas A. Edison, he devoted himself to experimental research. In this year Mr. Edison made him electrician in charge of the installation and operation of the pioneer Pearl Street plant of the Edison Electric Illuminating Company of New York. A description of this famous undertaking, regarded then by most engineers as an experiment, but destined to be crowned by such enormous success, appeared under Mr. Lieb's name in the ELECTRICAL WORLD for Sept. 9, 1922, the fortieth anniversary of the opening of the power house.

Mr. Lieb's foreign experience was gained in Italy, where he went in November, 1882, to represent Mr. Edison in the design, installation and operation of a central station for Milan. He remained twelve years in Italy. From 1883 to 1894 he was engaged with the Milan company in power-station work and in the manufacture of lamps, dynamos, motors and other apparatus. It was under his direction that some of the earliest experiments were made in parallel operation of direct-driven alternators, the operation of large synchronous motors and long-distance transmission of high-tension alternating current by underground cables. While he was in Italy he was made technical director of the Società Generale Italiana di Elettricita Sistema Edison.

When Mr. Lieb returned to New York in 1894 he did so as assistant to the vice-president of the Edison Electric Illuminating Company, becoming vice-president and general manager. On the organization of the New York Edison Company he was made associate general manager and then appointed to

J. W. LIEB

his present position of vice-president, in general charge of operating also for the affiliated electric companies in the metropolitan district. Since 1900 Mr. Lieb has also been president of the Electrical Testing Laboratories.

ACTIVITIES AND HONORS

Mr. Lieb has taken a prominent part in the work of many of the organizations in the electrical and allied fields. He is a fellow of the American Institute of Electrical Engineers, of which he was president in 1904-05, and has served on many Institute committees, notably those on the Edison medal, public policy and code of principles of professional conduct. He is also a past-president of the National Electric Light Association, the Edison Pioneers and the New York Electrical Society. He is a fellow of the New York Academy of Sciences and member of the American Society of Military Engineers, the American Association for the Advancement of Science and the American Society for the Promotion of Engineering Education. He has been manager and vice-president of the American Society of Mechanical Engineers.

Mr. Lieb's work has been recognized by many foreign societies. He is an honorary member of the Association of Italian Engineers and Architects and of the Association of Italian Railway Engineers and has been decorated by the King of Italy. He is a member of the Institution of Electrical Engineers of Great Britain and of the Associazione Elettrotecnica Italiana. During the war Mr. Lieb served as chairman of the National Committee on Gas and Electric Service, as adviser to the federal, New York State and metropolitan fuel administrations and as chairman of the joint fuel committee representing the national public utility associations.

Mountain Island Finished

Southern Power Company's New North Carolina Power House Goes Into Service

THE Southern Power Company has just put into operation its Mountain Island hydro-electric plant, completed after two years of constant and strenuous work. This is the tenth hydro-electric plant to be put into service by the Southern Power Company, nine of them being on the Catawba River. Its addition to the generating system gives the company a total of 451,000 hp. in hydro-electric stations. Adding 105,000 hp. installed in steam plants, a total generating capacity of 556,000 hp. is obtained. It is estimated that the new plant will produce 120,000,000 kw.-hr. of electricity a year, or enough to drive approximately one-quarter of the cotton mills in North Carolina today.

The total generating capacity of the Mountain Island plant is 80,000 hp., the generating equipment consisting of four 20,000-hp. units. The dam and power house were constructed under contract by Whitehardt & Dennis. The waterwheels and governors were supplied and installed by S. Morgan Smith of York, Pa. The Allis-Chalmers Manufacturing Company of Milwaukee manufactured and supervised the installation of the huge generators. The switchboards, transformers and oil switches were manufactured by the General Electric Company and were installed by the engineers and experts of the Southern Power Company.

The dam is about half a mile long, the spillway itself being 1,000 ft. long. The spillway is on the Mecklenburg side and the power house on the Gaston County side of the river, Mountain Island itself being between the two. The power house is an integral part of the dam. The dam is more than 100 ft. high, it being estimated that there will be a head of 85 ft. of water. This dam will back water up 6 or 7 miles.

Three 100,000-volt transmission lines extend from the new Mountain Island plant and tie in with the transmission and distribution system of the Southern Power Company at Charlotte, Gastonia and Salisbury. The distribution of the product of the new plant in this manner is designed to bring about the best balanced distribution possible of the entire load on the network of the power company.

London Bankers Sue Henry L. Doherty & Company

Sperling & Company, a London banking firm, have filed a suit in the Federal District Court at New York against Henry L. Doherty & Company, demanding an accounting of profits accruing to them under an agreement of 1911, whereby the London banking house agreed to finance the formation of various public utility holding corporations. Sperling & Company claim they advanced more than $12,850,000 to the Doherty firm before the formation of the Consolidated Cities Light, Power & Traction Company and the Utilities Improvement Company. Both of these companies were merged into the Cities Service Company in December, 1913.

Sperling & Company allege that between 1911 and 1913 they advanced $10,850,000 to acquire the necessary stock and securities in these corporations, and they claim that they also advanced $2,000,000 to the Doherty firm to carry out the general plan of gaining control of the various utilities. They charge that after the formation of the Cities Service Company the defendant secured options on common stock in the Cities Service Company exceeding $2,000,000 par value and on other stock of the company. After learning of this transaction, the bankers say, they asked for an accounting and the delivery of their share in the stock. They state that these requests, made in May, 1917, were refused. They do not state the amount of their claim, but say that according to their 1911 agreement they were to share equally in the profits.

The ELECTRICAL WORLD was unable to get in touch with Mr. Doherty, who was not in New York. In his absence a statement from his attorney was given out at the offices of the company to the effect that no liability was admitted, that the plaintiffs had been fully compensated for their services and that it was thought Henry L. Doherty & Company would welcome the opportunity to present counter-claims against Sperling & Company for damages incurred in some of the transactions concerned.

Resolutions of Paris High-Tension Conference

As a result of the conference held in the last days of November in Paris the International High-Tension Electrical Transmission Committee passed the following resolution, which has just been received by the ELECTRICAL WORLD:

Considering that in all countries there is a distinctly marked tendency to simplify installations on high-tension lines, resolved, that profound study and research should be given to achieve security and permanency of such installations as well as a prevention of waste.

The following motion was submitted by the Italian delegation:

Resolved, that the remarkable contributions of the various delegations to this congress should be developed with all possible attention to detail on such fundamental bases as will bring about an international association and application of ideas, bearing in mind the always necessary variations called for in different countries by reason of local conditions and customs. When these principles have been analyzed there should be a further collaboration toward unifying on a definite basis such as are susceptible of application.

The Dutch-Belgian motions were as follows:

Resolved, that it is desirable that high-tension lines should follow as far as possible along straight lines, reducing thus the number of posts and towers required, following where possible the shortest route between two points by paralleling either the highways, rivers or railways; also, that such installations be able to secure right-of-way privileges either on public or private lands and to cross roads, rivers and railways at whatever angle may be deemed desirable.

Resolved, that it be recognized that the right is granted to establish whatever coefficient of uniform security may be decided upon as sufficient; the privilege also to be granted of crossing telegraph or telephone lines at will, once proper suspension and insulation precautions have been taken.

Resolved, that the exploiters of transmission lines shall have constant communication through telephone central stations at hours when the service may not be open to the general public, and that severe penalties be enacted against all who may commit depredations against transmission lines or plants generating energy therefor.

The congress voted unanimously a motion to the effect that the next congress shall have reports and papers in the hands of the secretary-general four months in advance if they are written in a single language, but if in two languages (of which one shall be French) the period shall be but two months, and a further motion asking that each country inscribed for each congress appoint a committee whose business it shall be to group the various papers and send them to the secretary within the prescribed time.

It was decided that the next congress shall be held in Paris in May or June, 1925.

Electrified Christmas Tree on White House Grounds

There will be a national electrified community Christmas tree this year on the "Ellipse," just south of the White House yard, in Washington. This tree, which was supplied as a gift to the President from Middlebury (Vt.) College, from whose forest preserve it was cut, has already been installed. It will be lighted first on Dec. 23 by about 2,000 lamps, about 400 ft. of 6,600-volt cable being required to connect it to the transformer. On Christmas Eve a celebration will take place, the Marine Corps band furnishing music and a chorus of 3,000 children singing carols, which will, if possible, be broadcast by radio. The tree will remain lighted throughout Christmas week from sunset to sunrise.

The White House outdoor Christmas tree is the outcome of a suggestion from the Society for Electrical Development. The idea was quickly taken up by electrical and other bodies in Washington. As a result of such combined activities there will, it is expected, be a large number of electrified Christmas trees this year on state capitol grounds as well.

Joint Plants Planned for Delaware Tributary

The Shohola Water Power Company, the Bingman Water Power Company and the Blooming Grove Water Power Company have declared their intention jointly to construct two projects on Shohola Creek, a tributary of the Delaware River, in the northeastern corner of Pennsylvania. The declarants propose to construct a 60-ft. dam at the head of Shohola Falls. They plan to run a pipe line from the dam so as to develop a head of 270 ft. at a power house in which two 4,000-hp. units are to be installed. A second dam at Cold Springs Lake is to be 60 ft. high. A second pipe line will develop a head of 290 ft., and three 4,500-hp. units are to be installed. The project will store 2,500,000,000 cu.ft. of water. It is probable that the Federal Power Commission will take jurisdiction over this project because that amount of storage would affect navigation on the river.

Schuchardt on "Engineers as Public Advisers"

R. F. Schuchardt, electrical engineer for the Commonwealth Edison Company, Chicago, addressed the Milwaukee Section of the A. I. E. E. and the Milwaukee Engineering Society lately on a subject the importance of which he has been endeavoring to impress upon engineers in various parts of the country. This is the obligation and responsibility resting upon engineers to serve voluntarily as public advisers on economic engineering questions even when advice is not sought. He emphasized the point that engineers are too often prone to overlook the economic side of engineering problems, and that until they inform themselves on this phase of various subjects of public interest the public cannot be expected to recognize the economic limitations to certain engineering proposals which are being made every day.

The first thing for the engineer to do, Mr. Schuchardt maintained, is to acquaint the public with the close relation that electric power production and utilization bears to individual and industrial welfare—the absolute dependence of present-day civilization upon the utilization of electric power. The public must be impressed with the fact that economic salvation lies in greater production per man and that this will come only from more extensive substitution of power for labor, in which the application of electricity will be most influential. Engineers should, the speaker said, inform the public on the economic problems involved in electrifying steam railroads, conserving water supply and saving coal, the relative merits of electric service from the public utilities and of isolated plants, and similar questions. It is the total economic saving, not the saving in just one process or part of an undertaking, that is important.

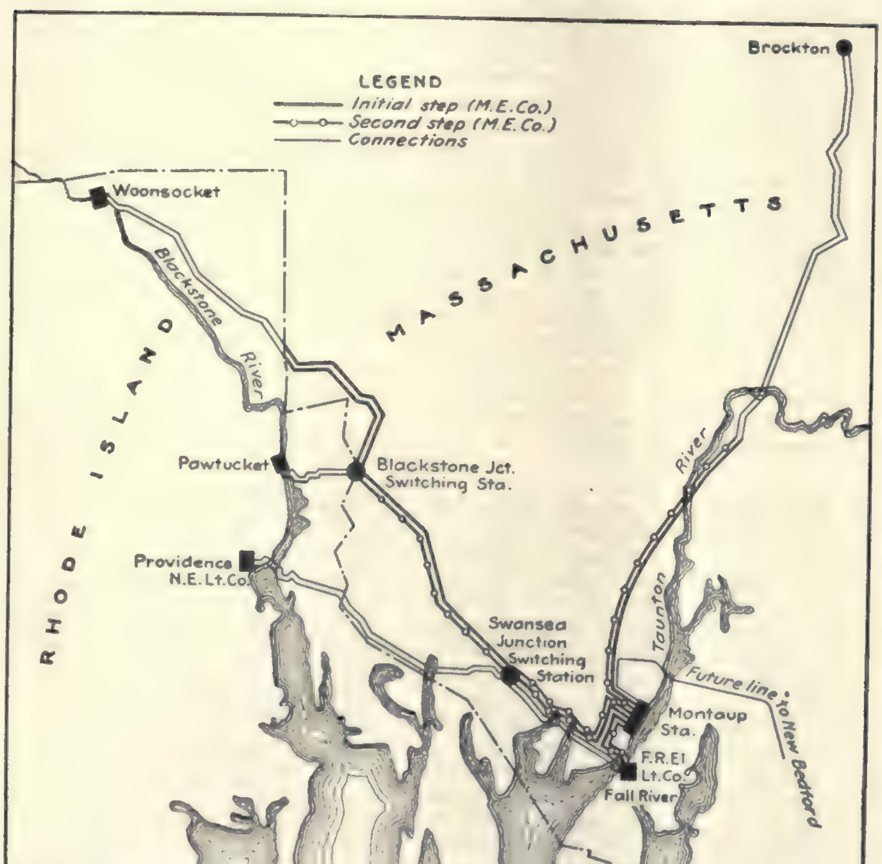
Montaup Plans Made Public

One 32,000-Kw. Unit in First Installation—Initial Voltage of 66,000, Afterward 115,000

PRELIMINARY plans for the Montaup Electric Company's tidewater steam generating station to be built by Stone & Webster, Inc., on Mount Hope Bay, near Fall River, Mass., were submitted to the Massachusetts Department of Public Utilities on Dec. 4 by R. F. Whitney, president Fall River Electric Light Company and general manager of the Montaup company, and A. Stuart Pratt, vice-president Edison Electric Illuminating Company of Brockton, Mass.

As already reported, the Montaup station will be interconnected with the Fall River, Brockton and Blackstone Valley Gas & Electric Company's systems as indicated in the accompanying map, and the estimated cost to the Montaup company of the initial installation, including transmission lines and switching stations, is $7,037,436. One 32,000-kw. unit and three boilers will constitute the first installation in the Montaup plant, which will be built at Somerset and designed for burning fuel oil at present, with a building sufficiently large to house two 32,000-kw. units.

Three 1,500-hp. boilers designed for 400 lb. working pressure are proposed. It is planned to build the high-tension switching for 115,000-volt operation, but the initial operating voltage contemplated is 66,000. A line to New Bedford will eventually be built.



THREE MAJOR CENTRAL-STATION SYSTEMS WILL BE SERVED BY THIS INTERCONNECTION

Brief News Notes

Long Beach Plant to Be Enlarged by 60,000 Kva.—The Southern California Edison Company has retained Stone & Webster, Boston, to build an extension to its Long Beach steam plant to house two 30,000-kva. turbo-generators on order from the General Electric Company.

Iowa Southern Utilities Buys Eight Iowa Plants.—The Iowa Southern Utilities Company of Centerville has announced the purchase of the Iowa utility properties formerly owned by the Union Power & Light Company of Omaha, Neb. These are Chariton, Osceola, Lucas, Woodburn, Murray, Russell, Oakley and Lacona. All of the Union Power & Light holdings in Nebraska, Iowa and South Dakota were sold to the Albert Emanuel Company of New York City, which in turn sold the Iowa properties to the Iowa Southern Utilities Company.

Electric Truck Business Consistently Growing.—During the first eleven months of this year 854 electric trucks have been sold, according to the Society for Electrical Development. To the central stations of the country, the society points out, this means an off-peak load of approximately 5,200,000 kw.-hr. annually, which in round figures represents a yearly income of $260,000. In New York City alone 438 "electrics" were sold during the period named as compared with 326 during the first eleven months of 1922—an increase of 34 per cent. In Boston the sale of electric trucks has increase 76 per cent.

Kentucky Public Service Company to Change Name.—The Kentucky Public Service Company, which manufactures electricity at Bowling Green, Frankfort and Hopkinsville, Ky., and Clarksville, Tenn., desires to change its name to the Kentucky-Tennessee Light & Power Company. It has obtained the approval of the Kentucky authorities, and when that of the Tennessee commission is given the change will be made.

Lighting of Horseshoe Falls to Be Extended.—Extensions to the illumination of the Horseshoe Falls at Niagara are planned by the Queen Victoria Park Commission. Two batteries of light will be put in, one on the ledge near Table Rock and the other on the roof of the power house of the Ontario Power Company. The lighting system will also be extended to Dufferin Islands. The work will be started and completed in the spring.

Commission Rejects Floor-Area Rates for Lafayette.—The Indiana Public Service Commission has rejected a proposal by the Northern Indiana Gas & Electric Company to change the basis for electric service charges at Lafayette to that previously authorized for East Chicago, Whiting and Hammond, based on floor area. Objection is said to have sprung up in the commission since its previous order, which was made on Nov. 9, and the majority of that body ordered, instead of the floor-area system, a reduction of the regular schedule rates in Lafayette amounting to about $31,000.

Long Lake Plant of Washington Water Power Company Nearly Completed.—The fourth unit to be installed in the Long Lake plant of the Washington Water Power Company, which has been built in a narrow gorge of the Spokane River, 35 miles from the city of that name, is to be ready by the first of the new year. It is rated at 22,500 hp. and will bring the capacity of the plant up to 90,000 hp., the figure for which it was constructed. This plant has been built under unusual engineering difficulties at a total cost of about $6,000,000. The spillway is one of the largest in the world.

Bolivian Promoters See Great Electrical Output from Extinct Volcano.—Among the "trade opportunities" reported recently to the Department of Commerce is an extinct volcano which no longer emits fire and smoke but through vents in its sides releases vast quantities of superheated steam, which, promoters claim, can be converted into electric power capable of producing 400,000,000 kw.-hr. per annum. The

volcano, called "Tatio," is on the Chilean-Bolivian frontier. It is asserted that the Bolivian government could be induced to take the electricity produced for the use of electrified state railways and that power could be sold to mining companies. A Bolivian company has a concession for sale for £1,000,000.

South Dakota Company Sold.—The Aberdeen Light & Power Company, with plants in Aberdeen, Watertown, and Yankton, S. D., and in Nebraska and Iowa, has been sold by the Union Power & Light Company of Omaha, for $935,500, to the Northwestern Public Service Company. The general offices of the new company are to be maintained at Aberdeen with the organization of a new company to be incorporated in Delaware. The transfer, it is understood, includes the public utilities of the Omaha company at North Platte, Neb. The new company is a subsidiary of the Albert Emanuel Company of New York City.

Electricity for Moffat Tunnel.—Work on the 6-mile Moffat Tunnel through the Continental Divide, 50 miles west of Denver, with which the Denver & Salt Lake Railroad will replace the open Summit Pass, has begun in earnest, and on Dec. 1 the east heading of the pilot tunnel, designed to carry water to Denver, was 370 ft. under ground and the west heading 630 ft. under ground. The construction company has contracted with the Colorado Power Company for 1,000 hp. of 44,000-volt energy delivered at the east portal, and a 30-mile transmission line will be built to convey this power, which will be used for lighting and for operating machines and tools.

Water and Power Act Indorsed by San Francisco Labor Council.—The San Francisco Labor Council indorsed the water and power act at a meeting on Dec. 7 and pledged its support to the public ownership measure which was defeated at the last state election. All unions affiliated with the council will be asked to contribute to the campaign fund for the act, which is designed to put the state into the business of developing hydro-electric power. Those who put the matter before the council asserted that the future control of industry, labor and government in California was involved in the issue of private as opposed to public power development. It is understood that the proponents of the original water and power act are now redrafting the measure for submission to the people at the 1924 election.

California Railroad Commission's Report.—In transmitting to the Governor of California its annual report for 1922-23 the California Railroad Commission dwells on the continued improvement in the financial condition of utility companies. It claims that the rates of gas and electric utilities were reduced more than $5,000,000 during the fiscal year by direct action of the commission, and that the reductions in the rates of the Pacific Gas & Electric Company and the Great Western Power Company alone amount to $3,000,000. The work of the engineering department is referred to at length, with allusion to the rapid march of hydro-electric development and the enforcement of standards for transmission-line construction.

Long Island Railroad Preparing for Electrification Within New York City Boundaries.—The Long Island Railroad Company is completing plans for the electrification of its facilities within the limits of Greater New York and will submit them to the Transit Commission within a few weeks. It will contend, however, that it is impossible to complete the work by 1926, as the law requires. The Long Island Railroad will have to electrify considerable stretches of its track in Queens Borough to obey the law, although a large part of its line there is already electrified. It is unofficially estimated in railroad circles that the company will have to expend more than $25,000,000 should it desire to install the same modern facilities that the New York Central proposes on the west side of the city.

Applications to New York Public Service Commission. — The Niagara, Lockport & Ontario Power Company of Lockport, N. Y., which develops electricity on the Oswego and Salmon Rivers in Oswego County, has applied to the Public Service Commission for permission to acquire by condemnation certain additional water and riparian rights below its present developments. The Saranac Company of Plattsburg has asked permission to acquire the Saranac River Power Corporation, which is building a new power plant and dam about 4 miles west of Plattsburg. The energy generated at this plant will be transmitted to the new paper mill of the Saranac Company in Plattsburg. The Kanes Falls Electric Company, operating in Fort Ann, Washington County, and the adjoining towns of Granville, Kingsbury and Queensbury, has made application to the commission for authority to sell part of its property to the Adirondack Power & Light Corporation, from which it has been buying energy.

Utah Copper Company Turns to Electric Shovels.—The first of two electrically operated shovels to be installed by the Utah Copper Company for test purposes in its open pit mine is now operating, marking an important departure in operations at the company's Bingham property. The one now operating is a direct-current type, made by the General Electric Company. The other one to be installed and operating in a short time will be the alternating-current type made by the Westinghouse Electric & Manufacturing Company. These shovels will be pitted against each other to determine which type is best adapted to the company's needs. The company plans gradually to substitute electrical shovels for those propelled by steam and hopes to effect a saving of 10 cents a ton in the mining of its ore.

Associations and Societies

New York Electrical Society.—"Why Electric Heat Is Preferable" was the subject of an address by J. C. Woodson of the Westinghouse Electric & Manufacturing Company before the New York Electrical Society on Tuesday, Dec. 18.

Kentucky Association of Public Utilities.—This organization will gather at the Seelbach Hotel, Louisville, on Jan. 10, when a "get-together" dinner will be held. On Jan. 11 a program will be presented of which one feature will be a talk on "Electrical Development" by W. W. Freeman, president Union Gas & Electric Company, Cincinnati. J. R. Downing, vice-president Citizens' Union National Bank, Louisville, will speak on finance, F. F. Gilmore, Jr., on safety, and representatives of the railway, gas and telephone industries will be heard.

National Association of Lighting Equipment Dealers.—This body will hold a convention at the Hotel Sherman, Chicago, on Jan. 21-26 in connection with the fifth annual "lighting equipment market" of the Associated Lighting Industries, all the exhibits and meetings to be under the one roof. Addresses on "Period Design," "Extension of Credit," "Slogan Results for 1923," "Results in Detroit from Talking and Advertising 'Three per Cent for Fixtures,'" "Shop and Selling Costs" and "Methods Used by Dealers for Remunerating Salesmen" will be given, and there will be discussions of a practical nature and "questions and answers."

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

American Physical Society—University of Cincinnati, Cincinnati, Dec. 27-29. H. W. Webb, Columbia University, New York City.

American Engineering Council (F. A. E. S.) —Washington, Jan. 10-11. L. W. Wallace, 26 Jackson Place, Washington.

Kentucky Association of Public Utilities—Seelbach Hotel, Louisville, Jan. 10-11. E. F. Kelly, Louisville Railway Company.

Wisconsin State Association of Electrical Contractors and Dealers—Pfister Hotel, Milwaukee, Jan. 17-19. H. M. Northrup, 23 Erie Street, Milwaukee.

Technical National Section, N. E. L. A.—Birmingham, Jan. 28-Feb. 1.

Western Association of Electrical Inspectors—Hotel Fontenelle, Omaha, Jan. 29-31. W. S. Boyd, 175 West Jackson Blvd., Chicago.

American Institute of Electrical Engineers —Midwinter convention, Bellevue-Stratford Hotel, Philadelphia, Feb. 4-8. F. L. Hutchinson, 33 West 39th St., New York.

Commercial National Section, N. E. L. A.—St. Louis, Feb. 27-28.

Commission Rulings

Operation at a Loss.—All authorities agree, said the Indiana Public Service Commission in granting increased water rates to the Montpelier Utilities Company, that no utility company can be required to continue operation when under its existing rate schedules such operation must necessarily be conducted at a loss. A utility is entitled to earn some return upon the value of its property or to be authorized to abandon its operation. The commission dwelt upon the difficulty of a situation where rates to private consumers could not be raised without actually decreasing revenue.

Management — Income Tax — Donations—Penalizing Paying Customers for Delinquents' Fault.—In setting rates for the Red River Power Company the North Dakota Board of Railroad Commissioners made decisions on several points. It claimed the power to determine whether the policy adopted by the management of a utility company is efficient, as this has a bearing on the reasonableness of the rates. It ordered that federal income taxes be considered as an operating expense. It barred from that account donations, presents to employees and club dues outside the state, which, it said, should come out of net earnings. A retaining fee to a local attorney was also barred, there being no reason, in the commission's opinion, why legal advice should not be furnished by the management in another state. The commission further asserted that consumers who pay their bills promptly should not be penalized by requiring them to bear excessive charges because of uncollectible accounts when the utility was permitted to file meter deposit rules as a protection against such accounts.

Compensation to Be Spread Over Long Period Must Not Be Based on Present-Day Cost.—In disapproving the original application of the Union Electric Light & Power Company of St. Louis to lease the new Cahokia plant from the Union Electric Light & Power Company of Illinois (see ELECTRICAL WORLD, Nov. 17, page 1036), the Missouri Public Service Commission said: "The new plant in Illinois is being constructed at the peak of high prices. The terms of the lease as proposed fix the present-day high prices as the foundation of the charges of percentages for depreciation and return thereon, the same to be made a part of the operating cost of the Union company of Missouri and reflected in the rates charged to its patrons. The lease in effect makes investment cost of the plant in Illinois the basis for calculating rates for thirty-five years. The approval of the proposed lease would, in substance, bind the commission to the investment cost of the new plant at the present high prices for a long period, and such a course would be inconsistent with the rulings of the courts to the effect that the fair value of property for rate making must reflect the prevailing cost at the time the valuation of the property is made. Thus it appears that advantages to the company to be derived from the lease as now offered are outweighed by the disadvantages thereof to the public in fixing the present-day investment cost of the property as a charge to be paid by the public for a long term of years. The commission is loth to approve an agreement which fixes operating costs on a basis of valuation inconsistent with the legal rules for measuring fair value for rate making. The door should not be closed as proposed by this contract upon the right of the public to have the benefit of lower construction costs and a lower rate of return as future business conditions may justify in the application of the rule now established for a reasonable return upon present fair value of property devoted to public use. Therefore the commission should refuse to approve the lease as offered."

Interconnection Authorized Against Protest of Institution.—On the ground that an interconnection between the Laconia Gas & Electric Company and the Utilities Power Company, Bristol, will be of great public interest, the New Hampshire Public Service Commission has issued a finding against the Laconia School for Feeble-Minded Children, which sought to prevent the construction of the necessary transmission line across its grounds. Energy from a new hydro-electric plant under construction at Bristol will better enable the Laconia company to serve the local public. The commission recommends a nominal rental for the transmission-line right-of-way, that the wood and timber resulting from the removal of trees by the company be supplied to the institution and that the line be properly safeguarded against trespass.

Federal Income Tax and Rate of Return.—In a case involving the steam-heating rates of the Pacific Gas & Electric Company in the cities of Oakland and San Francisco, the California Railroad Commission had this to say on the federal income tax and its relation to the rate of return: "Under the recent decision fixing electric rates a return of 8 per cent on the rate base for the electric properties was found reasonable, but the federal income tax of 12½ per cent of net corporate income was excluded from operating expenses. The United States Supreme Court has since definitely ruled that this tax should be included as an operating expense. (Georgia Railway & Power Company vs. Railroad Commission of Georgia, decided June 11, 1923.) In the same decision the court also points out in the following language the close relationship between the inclusion and exclusion of this tax from operating expenses and the rate of return which may be deemed fair and reasonable: 'It must be borne in mind, as pointed out in Galveston Electrical Company vs. Galveston, that since dividends from the corporation are not included in the income on which the normal federal tax is payable by stockholders, the tax exemption is, in effect, an additional return on the investment.' As was indicated in the decision in the electric rate proceeding, a return of 8 per cent from which this tax must be paid was equivalent to a net return after payment of the tax of 7.6 per cent. Such a return was held to be sufficient to attract the new capital that must be continuously invested if the system is to keep pace with the demands of the consuming public. In keeping with the decision of the Supreme Court, federal income tax has been considered herein as an operating expense, and in harmony with the electric rate decision a net return after the payment of this tax of 7.6 per cent on the estimated historical cost of the property is found to be reasonable."

Recent Court Decisions

California Railroad Commission May Classify Consumers.—In a suit brought by the Live Oak Water Users' Association against the California Railroad Commission on the ground of discrimination between and classification of consumers, the California Supreme Court held that such discrimination when based upon logic and justice is within the powers of the commission and not subject to annulment by the court. (219 Pac. 65.)*

Hydro-Electric Company Must So Build Dam as Not to Interfere with Operation of Grist Mill.—A case that has attracted unusual attention in Iowa has just been heard a second time in the District Court after being remanded by State Supreme Court two years ago for retrial. In this case (Harp vs. Iowa Falls Electric Company) the plaintiff sought to restrain the electric company from maintaining a dam across the Iowa River which he asserted interfered with the operation of his grist mill, one long ago built and for which prior rights were claimed. The court now finds that the company has the right to maintain a dam across the river, but that it must be of a height that will not interfere with the successful operation of the plaintiff's mill property. The electric company will have until August, 1924, to construct such a dam.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Richard S. Shoemaker New President of A. I. and S. E. E.

Richard S. Shoemaker, who was elected president of the Association of Iron and Steel Electrical Engineers at its convention in Buffalo, has been associated with the American Rolling Mill Company since 1916, when he became superintendent of maintenance. Mr. Shoemaker is a native of Philadelphia and entered the steel mills early in life. In 1903 he engaged in work connected with the construction of new pipe mills for the National Tube Company of Lorain, Ohio. After the completion of this work he joined Milliken Brothers, Inc., on Staten Island, New York City, in the capacity of electrical engineer, and he had charge of the electrical installation in the Singer Building in New York in 1905-1906. The following year found Mr. Shoemaker out in Cleveland with the Electric Controller & Manufacturing Company, where he specialized on the control of steel-mill apparatus. Subsequently he became identified with the Pittsburgh Steel Company as chief electrical engineer and later served as electrical engineer of the Algoma Steel Company, Sault Ste. Marie, Ontario, Canada, and with George F. Porter, engineer of construction on the St. Lawrence & Dominion Bridge at Quebec. At the present time Mr. Shoemaker is in complete charge of the mechanical, power and electrical departments at the American Rolling Mill Company's plant at Middletown, Ohio.

R. S. SHOEMAKER

W. R. Woodward has recently been made chief engineer of the C. W. Hunt Company of New York and West New Brighton, Staten Island, manufacturers of coal-handling machinery, industrial trucks and conveyors.

H. M. Ross has succeeded Orin Haines as chief engineer of the Barnesboro-Spangler Electric Light Company, Barnesboro, Pa.

H. C. Thuerk, formerly commercial manager of the Keystone Power Corporation, Ridgway, Pa., is now power engineer with the Erie (Pa.) Lighting Company.

A. W. Pride, who has been connected with the Derry (Pa.) office of the Westinghouse Electric & Manufacturing Company, has been transferred to Emeryville, Cal., in charge of a new porcelain section.

J. Lawrence Gilson has been appointed New York manager of Day & Zimmermann, Inc., engineers, whose headquarters are in Philadelphia. Mr. Gilson was formerly connected in the capacity of engineer with E. I. du Pont de Nemours & Company and with the National Lead Company.

S. Z. Mitchell, president of the Electric Bond & Share Company, has been made president of the American & Foreign Power Company, Inc., recently incorporated in Maine to enter the public utility field of Cuba, Central America and South America. The organization of the new company was effected by the Electric Bond & Share Company.

Frederick N. Dodge, formerly sales manager of George W. Smith & Company, Inc., Philadelphia, has joined the staff of the Society for Electrical Development. At one time sales promotion manager of the Fairbanks Company, New York, Mr. Dodge was more recently connected with the Dort Motor Car Company of Flint, Mich., first as assistant advertising manager with the factory organization and afterward as sales manager at Cleveland and later at Philadelphia.

S. R. Inch, whose duties D. C. Green is assuming, has resigned from the Utah Power & Light Company to join the Electric Bond & Share Company in New York. Mr. Inch's connection with Utah will not be severed since he remains a vice-president and director of both the Utah Power & Light Company and the Utah Light & Traction Company. He became associated with the Utah Power & Light Company as general superintendent in 1913. Prior to that time he had been stationed in Montana, managing public utility properties owned by W. A. Clark. He was made operating manager of the company in May, 1915, and less than three years later he succeeded C. E. Groesbeck as vice-president and general manager of the Utah Power & Light Company and vice-president of the Utah Light & Traction Company.

D. C. Green Made Vice-President of Utah Companies

D. C. Green, formerly vice-president and general manager of the Fort Smith (Ark.) Light & Traction Company, has been named vice-president and general manager of the Utah Power & Light Company and vice-president of the Utah Light & Traction Company, succeeding S. R. Inch. Mr. Green has had a wide experience in the management of electric and gas utilities. After being graduated from Purdue University in 1908 he became associated with the San Diego Consolidated Gas & Electric Company and subsequently went to Oregon as manager of the Oregon Power Company at Albany and Marshfield and of the Everett Gas Company at Everett, Wash. Early in 1915 he went to Salt Lake City as manager of the Salt Lake division of the Utah Power & Light Company, which position he relinquished to become general manager of the Fort Smith properties. In addition to the ability gained through wide experience in the management of utilities, Mr. Green is particularly well qualified to handle the duties of his new position owing to his former association with the Utah Power & Light Company and his consequent familiarity with that company's operations and policies.

D. C. GREEN

J. J. Cagney has been appointed valuation and rate engineer of the General Engineering & Management Corporation, New York. Mr. Cagney has had a wide and varied experience in the electrical industry as commercial manager, secretary, treasurer, and general manager of a number of companies, covering a period of twenty-five years.

W. M. Sawdon, professor of experimental engineering at Cornell, has been elected Mayor of Ithaca, N. Y. Professor Sawdon was associated with Prof. R. C. Carpenter for many years in experimental and consulting engineering work. His participation in the civic activities of Ithaca is a source of gratification to his engineering associates as well as to others.

John E. Magnusson has become assistant to the electrical engineer of the Phoenix Utility Company, Duluth.

H. M. Outhwaite is now secretary and treasurer of the municipal electric lighting and power system, West Selkirk, Manitoba, succeeding D. J. Black.

Charles Taylor has been made manager and chief engineer of the municipal electric lighting and power system, West Selkirk, Manitoba, succeeding Donald G. Sutherland.

J. B. Harvey has been made general manager of the Brandon (Manitoba) Gas & Electric Company, succeeding F. H. Brooks.

T. J. Carley is now secretary and treasurer of the municipal water, light and power plant at Fenelon Falls, Ontario, succeeding J. L. Arnold.

T. V. K. Swift, who has been connected with the engineering department of the Central Hudson Gas & Electric Company, has recently been transferred to the operating department (electric).

Donald Steinet, formerly connected with the accounting department of the Central Hudson Gas & Electric Company, has been transferred to the electric operating department to succeed J. Haulenbeck, who is now illumination engineer in the commercial department.

Charles E. Glassner, formerly associated with the General Electric Company, has recently become sales engineer for the National Carbon Company, New York.

W. H. Haines, formerly chief inspector of the Schenectady works of the General Electric Company, has retired, according to an announcement made by C. E. Eveleth, works manager. Mr. Haines has been succeeded by W. W. Wagner.

Oliver B. Capelle, who has been connected with the Apex Electrical Distributing Company's publicity department for three years, has been appointed advertising manager of the company. Mr. Capelle was formerly with the United Publishers' Corporation, New York, and the Penton Publishing Company, Cleveland.

W. M. Goodrich has been made manager of the electrical division of the Lindsay Light Company, Chicago, after spending twelve years in charge of the lighting equipment division of the Western Electric Company, Chicago. Mr. Goodrich allied himself with the Western Electric Company in 1906, after leaving Washington University, St. Louis.

J. W. Lewis, assistant comptroller of the General Electric Company, has been appointed assistant to President Gerard Swope. Mr. Lewis has been assistant comptroller, with headquarters in New York, since April 1, 1921. Previous to that time he was chief statistician of the company, having been appointed to that position April 1, 1911. He entered the service of the company June 1, 1910, in the general accounting department, statistical division, having previously been connected with the American Locomotive Company.

Sir Charles Bright, Engineer and Author

Sir Charles Bright, consulting engineer and well-known author of scientific and engineering books, was educated at Lancing College and King's College, London. During his professional career Sir Charles, following in the footsteps of his father, the late Sir Charles Tilston Bright, who laid the first Atlantic cable, has been engaged in the construction, laying and repairing of some 25,000 miles of submarine and land telegraphs. He has acted as engineer and electrician on a number of cable expeditions in various parts of the world, as well as in preliminary submarine surveys. He was associated with the Interdepartment Cable Communications Committee, the House of Commons radio-telegraphic committee, the Dominions Royal Commission, and represented the Australian Commonwealth at the international radio-telegraphic conference in 1912. In addition to the very many scientific and engineering books which Sir Charles has to his credit are contributions to the leading quarterly and monthly reviews as well as to the *Times*, the Encyclopædia Britannica, the Statesman's Year Book and various standard works of reference. Sir Charles has given numerous lectures to the Royal United Service Institution, Royal Naval War College, Navy League, London Chamber of Commerce, Cambridge University and Eton College, besides contributing papers to the Institution of Electrical Engineers, the Institute of Civil Engineers (of both of which he is a member), the Royal Geographical Society and the Royal Aëronautical Society.

SIR CHARLES BRIGHT

David Sonkin has recently become affiliated with F. A. D. Andrea, Inc., New York, as radio engineer.

Blaine Archer, for seven years assistant manager of the Maryville (Mo.) Electric Light & Power Company, has been appointed district manager for the Iowa Service Company at Shenandoah. Mr. Archer is succeeding R. J. Ritchie.

A. G. Steinmayer, formerly assistant chief engineer with the Electrical Engineers' Equipment Company of Chicago, has resigned to become electrical engineer with the Line Material Company of South Milwaukee, Wis.

Obituary

Charles Frankel, president of the Frankel Solderless Connector Company, New York, died suddenly on Dec. 18. Mr. Frankel was sixty-one years of age.

William H. Williams, district superintendent of the Central Maine Power Company, Augusta, died at his home in that city on Dec. 5 after an illness of two weeks. Mr. Williams had long been identified with electrical enterprises in New England. When the Kennebec Light & Heat Company was chartered in 1887 he was made superintendent and continued in that capacity until it was reorganized in 1910 as the Central Maine Power Company. Mr. Williams, who was seventy-three years of age, was the father of George S. Williams, the present general superintendent of the company.

Walter E. McCoy, formerly chief electrical engineer of the United Electric Light & Power Company, New York City, died at Stamford, Conn., Dec. 16, at the age of fifty-two years, after an illness of more than two years. Mr. McCoy was well known and well liked by members of the electrical profession. He was born at Pittsburgh on July 30, 1871. At an early age he entered the employ of the Westinghouse Electric & Manufacturing Company, where he remained until May 1, 1895, when he became connected with the United Electric Light & Power Company, remaining with that company up to the time he was stricken with the illness which proved fatal. He was a fellow of the American Institute of Electrical Engineers and active for many years in the affairs of the National Electric Light Association.

Ralph E. Gilman, special engineer in charge of turbo-generator engineering of the Westinghouse Electric & Manufacturing Company, died in the Methodist Hospital, Los Angeles, Dec. 5. Mr. Gilman, on account of illness, had been granted a leave of absence from his duties in East Pittsburgh, Pa., to go to the Pacific Coast in an effort to improve his health. Mr. Gilman entered the employ of the Westinghouse company immediately after his graduation from Leland Stanford University in 1898 and completed the apprentice course of the company in January, 1901. For the next two years he was in the engineering department. In 1903 he was transferred to the British Westinghouse Company, and he spent the next five years in London, England. In 1908 Mr. Gilman was recalled to East Pittsburgh and assigned to special duties in the power engineering department, with which he was continuously connected until the time of his death.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

A Problem in the Glassware Industry

A Tremendous Waiting Market for Residence Glassware Blocked by a Demoralized Distribution—What Is Needed to Set the Situation Right

BY EARL E. WHITEHORNE
Commercial Editor ELECTRICAL WORLD

THE illuminating glassware industry is confronted with a difficult problem. Something like nine million homes are wired and using electric light in these United States and only about half the lamps in service in these homes have shades on them. It is estimated, therefore, that there is today a potential market for close on to 90,937,000 shades needed merely to equip bare lamps now waiting in the wired houses of America. A proportion of these lamps, of course, would be shaded with silk or parchment, but this does not consider the additional market for replacement shades in these same homes, the new and more artistic shades that can be sold to take the place of old, unattractive glassware that owners are already tired of. Nor does it embrace the shades that can be sold to equip the fixtures that go into the million or more homes that every year are now being newly wired.

A Tremendous Market

Clearly the market is tremendous, but very little actual progress is being made in getting the job done. Distribution in the residence illuminating glassware field is demoralized. The electrical jobber will not touch the line. The contractor-dealer is not making any effort to sell it. The manufacturers, with all this opportunity staring them in the face, have a moribund market on their hands and cannot agree as to what to do about it.

Commercial lighting glassware, of course, is quite another matter. Here great progress has been made; for the rapid development of new types of store, window and office lighting units in support of the active work that has been done by central-station companies all over the country to build up the commercial lighting load has resulted in volume production and standardization of glassware, and created a very prosperous business. Commercial globes and shades are being manufactured in large quantities and sold largely by campaign methods, and the jobber finds it profitable to stock such a unit and actively sell it to the central station companies and contractor-dealers that his salesmen call on. Business in the commercial glassware field is good, and nobody is worrying about it.

The Three Approaches

There are three directions from which the residence glassware market will ultimately be approached:

1. Glassware can be sold to already-wired houses to shade their lamps just as soap and scissors are sold, by creating a demand through advertising and the merchandising of the goods to the home. Local hardware, department, specialty and electric stores will sell this way.

2. Central-station companies for some years have been preaching to the public against glare, yet half the lamps in the homes today are bare. The central station can be interested to promote this idea and to take up the active merchandising of glassware to get these lamps shaded to prevent glare, raise the standard of household illumination and induce the use of larger lamps by shading all lights.

3. Glassware can be sold by contractor-dealers to newly wired houses to complete installations properly.

Some effort has been made by individual manufacturers to develop this business by the first method, but the movement has never gone very far. Glass shades are not very easy to sell to a household that has never been educated to the value of shades. Shades in use are not easily displaced, and no pressure has ever been put upon the dealer to do this.

The second method has never been seriously attempted. The third method obviously presents the most direct means of approach and the most immediate opportunity, since probably one-third of the electrical contractors are already selling glassware today in an indifferent way, and most of them are sending customers whose homes are wired to some fixture store with a card that wins them a commission on the sale.

Residence Glass Not Being Sold

The contractor is the accepted medium of distribution today in the glassware field and the present set-up as to distribution comprises a variety of manufacturers, the leaders being affiliated in a group known as the Illuminating Glassware Guild; a certain number of glassware and fixture jobbers; the electrical jobbers who sell commercial and residence glass, and then the dealer, who may be a fixture store, a wiring contractor, an electric shop or a department, hardware or non-electrical specialty store. Over-the-counter sales from retail stores are small. The contractor moves most of the goods when he wires homes. But even he is making no creative effort to develop the market. So residence glassware is not being sold.

The electrical jobber offers the natural direct approach to the electrical contractor and dealer because he is selling them the major part of their other purchases. A large number of jobbers are now selling fixtures. Glassware is needed to equip these fixtures and complete the installation. But the electrical jobber today looks upon glassware as an impossible thing for him to sell. He knows that the glassware people have for years been fighting among themselves and cutting prices right and left. He knows that there is no stability to type, design or price—in short, that glass does not present a jobbing proposition at the present time. He believes that there are three things fundamentally wrong with the glassware situation which must be corrected before he can become seriously interested.

In order to interest him in resi-

dence glassware the jobber feels that the glassware manufacturer should:

First—Package the line in such shape that the jobber and the dealer can handle it profitably. That would mean putting up say six, twelve or eighteen shades in a package that could be distributed and retailed with a minimum of breakage, in cartons that would advertise the line and assist in the selling.

Second—Develop a sufficient number of standard shades that would be distinctive, perhaps "guild designs," produced by all members of the group already affiliated, and supported, naturally, by the collective advertising of the group as well as that of the individual members, so that the designs would become known to the public and a sufficient market would be established to give the jobber a volume of business that would justify him putting real effort behind the line. A sufficient diversity could be introduced into this "guild line" to permit personal preference in selection, yet the manufacturer would enjoy the economic benefits of mass production and the jobber would also enjoy a volume that would make it a jobbing line.

Third—Support residence glassware with a policy based on ethical and economical principles. The electrical jobber will never sell this line until he can be sure of his profits, and he never will feel sure until the glassware manufacturers stop cutting prices, copying one another's designs, extending jobbers' discounts to retailers and consumers and in other ways indulging in destructive competition. Without protection on prices no line can be sold successfully by the jobber, and the jobber knows that it would be utter folly to devote time to developing the market for glassware as long as he is in danger of having his customers stolen away by price competition from his own supplier and from other prominent manufacturers. He believes that he should have a liberal profit if he is to push glassware, to cover breakage and the costs of market creation.

As one jobber expressed it recently, if he should decide to take up glassware, it would be necessary for him to call in all his salesmen and absolutely convince them that these three essentials had been satisfactorily met. He would have to sell them this new basis for confidence in glassware before he could expect to get the slightest bit of additional support from his salesmen for the sale of glassware. Such is the general feeling. In fact, glassware and fixture salesmen themselves frankly admit that it is hopeless for the electrical jobber to try to do anything in the residence glassware field until such a policy is established.

PRECEDENT IN FIXTURES

There is no question that a strong and practical market can be built up for residence glassware. Here is a vital element necessary for the completion of every installation. The job is not done until a fixture is installed; the fixture is not complete until it is equipped with glassware. The present trend toward ball lamps without shades is simply a reflection of the demoralized situation in the glassware industry. Fixture manufacturers, dealers and jobbers are despairing of securing glassware on a profitable and commercial basis and, rather than struggle with these conditions, are selling more and more fixtures with unshaded ball lamps, although they know the unshaded lamp produces glare and that glare is not good lighting and therefore should be avoided.

The American public is willing to buy glassware, just as it is willing to buy any other meritorious article that renders a service. The electrical jobber for years has had the same general attitude toward fixtures that he has today toward glassware, but the fixture industry has begun to recognize this and a number of manufacturers are now offering a line of fixtures that the jobber can handle, supported by a policy that makes their distribution profitable. If the glassware manufacturers will follow suit and establish glassware on an economic basis, the jobber will take up the sale of residence glassware eagerly. So will the retailer. It will be a specialty requiring very little interpretation, and that can be easily sold.

PRODUCT OF TRADING

This trouble in which the glassware manufacturers find themselves is a product of an era of trade. For many years they have devoted themselves very largely to selling glassware on a "catch-as-catch-can" basis, and they have never co-operated to any extent for the establishment of a substantial market for standardized products that could be supported by policy and publicity and would build up an enduring demand. The hardest job will probably be for these manufacturers to get together and agree on uniform policies to be followed.

Yet there have been some notable examples in the fixture business where a manufacturer has deliberately established a price and a policy on his own line and has himself developed a degree of standardization and volume that has made good business both for him and his distributors. It can be done.

The principal thing is that here are these millions of unshaded lamps in use and this tremendous growing need for glassware in newly wired homes. It presents an opportunity so big that the mind does not follow the figures. But in spite of this residence glassware is not being sold in a volume that pays either the producer or the distributor. It would seem to be important to the entire industry that these underlying causes be faced and readjusted so that this important piece of market development can be speedily and well done.

Department of Commerce and Selling Combinations

Japanese Market Brings Discussion of Webb-Pomerene Act and Export Situation

ALTHOUGH it is too early to predict what concrete action will be taken by industry following the discussion at the Department of Commerce of selling combinations, much interest is being manifested in the general question. Definite steps are expected shortly because of the need for prompt action if economies are to be effected in handling reconstruction sales in Japan. The time also is opportune to secure an amendment to the Webb-Pomerene act, if it should be found desirable to organize under that statute.

The agitation at this time of joint sales organizations or selling corporations composed of non-competing units is more than an effort to handle Japanese business in the most efficient way. It is being considered in connection with the movement to expand all American export activities. It is recognized that advantage must be taken of all possible economies if we are to compete in the world markets.

Joint sales organizations can be established by non-competing industries without legislation. There are some who believe, however, that advantages would accrue were it possible to organize non-competing activities into Webb law corporations. It is known that the Webb act is to be taken up for amendment at this session of Congress. The principal amendment which will be proposed is to permit of combinations for import purposes. These combinations doubtless will be limited to commodities produced entirely or in great part abroad in the handling of which artificial price levels are maintained.

The first definite step is likely to be taken by the manufacturers of construction materials. It is evident

that very important economies could be effected were sales of lumber, steel, sash, doors, plumbing, glass and paint and other building materials handled through the same agency. If organization along those lines expedites and makes more efficient the handling of the Japanese orders at this time, it is argued that it should be equally useful in handling other export business.

In the export trade American manufacturers are having to meet competition from countries where it is entirely legal to combine. The depression in Great Britain is forcing large - scale combinations, which mean reduced overhead charges and the elimination of the less efficient production units. One of the principal savings is in selling costs. Some middlemen are eliminated and distribution costs are reduced greatly. Knowledge and experience in manufacture can be pooled. Research can be undertaken on a more ambitious scale.

While American manufacturers may not take advantage generally of many of these economies by reason of our anti-trust statutes, some of them can be secured in the handling of exports. It is believed that Congress is disposed to consider sympathetically various amendments to the Webb-Pomerene act.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

THIS week sees the practical completion of the Christmas selling. It has been a bumper market generally throughout the country. Along the Eastern Coast and through the Middle West sales of holiday goods have reached a volume beyond any previous Christmas season in the history of the electrical industry's participation.

A conspicuous feature of the week in trade is the great volume of business being done in the New England States. Electrical supplies are moving at record-breaking rates with a very diversified demand. Lamp orders are taxing the factories nearly to the limit of normal output. Sales of motors have increased, prices of wire, flexible armored conductor and loom have gained especially, and prices generally are firm throughout this section of the country.

In the New York district business continues evenly. Ranges are selling stronger, also the larger appliances. Business is very good in the Southeast, where jobbers are low in stocks and construction is active, with a strong demand for materials both for housewiring and for power-line extensions. The Middle West is experiencing a very heavy demand for radio equipment and heating appliances, but prices are unaltered on most commodities and the week has been rather quiet except for the Christmas selling. General business on the Coast has been entirely satisfactory, but without any spectacular developments.

Washington Actively Discussing Business Statistics Problem

IN VIEW of the consent decree formulated by the Department of Justice, in connection with the case against the Tile Manufacturers' Association, some thought has been given to action which would force a showdown in the whole matter of the legality of the collection of statistics by trade associations. The fear is that if that were done it inevitably would bring about a period of uncertainty, during which the whole statistical foundation of American business might be lost. The stability which has characterized business in this country for more than a year is attributed in some quarters to the better statistical information available. Business is depending more and more upon statistics. It is the one shield of the business world against booms and slumps.

Were the federal government to undertake the gathering of all statistics now collected by trade associations, it would involve a very large expenditure. The principal objection to it, however, would be the unavoidable delays in making the figures available. If the Department of Justice feels disposed to recommend to all trade associations the prescription which it forced upon the tile manufacturers, it might be necessary for the government to undertake the work. It is not thought probable that American industry would attempt to go forward with any statistical program of its own—bootlegging of statistics as some have suggested—in the face of Department of Justice disapproval.

There is some sentiment in favor of compulsory collection of basic statistics by the government, particularly in those industries where statistics are rendered almost valueless through the refusal of important units within the industry to submit figures. For instance, a large unit in the woolen industry refuses to contribute to the statistics of the trade. As a result, many of these statistics are valueless to manufacturers other than the one who holds out against them. He can add the published statistics to the figures which he withholds, and thus he alone is in a position to secure the benefit of the figures. This is so unfair to the other concerns engaged in woolen manufacture that it has stimulated the thought that the solution may be in collection of the statistics by the government under compulsory statutes. In that connection the suggestion has been made that the government should undertake the work when 60 per cent of those engaged in the trade should require it.

Lamp Sales Running Above Normal

UNPRECEDENTED demands for lamps characterize the rapid approach of the holiday season, and representative distributors and retailers report an exceptionally fine trade in fixtures, with increased activity in electric sign and billboard lighting. In the East the open season has permitted later motoring than was the case last year, and this has stimulated the demand for headlight lamps. An increase amounting to about 15 per cent in the price of miniature type C headlight lamps has been announced effective Jan. 1.

The sale of portable lamps is very active, and the demand for round-bulb lamps for use in bracket and other fixture lighting in homes has risen to such totals that factory stocks cannot be built up to any extent, even though high-pressure production is resorted to. Twenty thousand of these lamps are being turned out daily in a single New England factory.

A leading distributor of fixtures informed a representative of the ELECTRICAL WORLD on Monday that the public is steadily growing in appreciation of higher-quality fixtures in its purchases. The demand for kitchen-lighting units has stimulated sales of 100-watt gas-filled lamps in many parts of the country. In representative cases fixture sales are running 20 to 25 per cent above last year's figures, and this has its effect on lamp purchases as well as the increased consumption due to central-station development.

Japan's Increasing Importance as an Electrical Customer

JAPAN'S position as a purchaser of electrical machinery and the fundamental conditions of our expanding markets there certainly justify the expenditure of real sales effort on the part of American electrical interests, in the opinion of Walter Rastall, chief of the industrial machinery division of the Bureau of Foreign and Domestic Commerce. It is estimated by the bureau that more than 18,000,000 yen in electrical machinery, equipment and materials was destroyed during the recent earthquake. The bureau also estimates that an additional 4,000,000 yen in electrical appliances was lost.

Since 1915 there has been a marked expansion in the electrical machinery import trade of Japan and an especially gratifying increase in the volume of such imports from this country, and

conditions have now reached a point where the competition for this business lies between British and American manufacturers.

In the machinery industry as a whole the average American factory exports perhaps 20 per cent of its production, according to the bureau. The average English shop exports perhaps 60 per cent of its production, and the prosperity of these companies depends in greater or less degree upon this export ration.

New England Trade Mounts Higher in Volume

ELECTRICAL supplies are moving at record-breaking rates in the New England area. The demand is so diversified that the slump in cotton textile production has had little effect on the jobbers' total sales increase over last year. During the past fortnight wire, flexible armored conductor and loom orders have gained substantially; appliance sales are mounting to gratifying totals, and lamp orders are taxing the factories nearly to the limit of normal output. Sales of motors under 10 hp. rating have also quickened perceptibly this month. Non-metallic flexible conduit is in more diversified demand as regards regional distribution. Prices are firm, and miniature lamps for headlight service are scheduled for a general advance Jan. 1.

Building contracts in New England totaled $8,104,900 for the week ended Dec. 11, compared with $6,452,600 a year ago. Interest in street-lighting betterment is more active in many interior municipalities. Retail trade is brisker, and no shortage of commodities was threatened Monday, although there is some probability of being obliged to call upon factory stocks for the final rush just before Christmas, and there is every prospect of extremely low inventories in both manufacturers' and jobbers' hands at the turn of the year. Central-station business is increasing enormously. In some cases jobbing salesmen have been called off the road to help handle recent orders at the home office.

New York's Wiring Line Steady; Ranges and Cleaners Pick Up

NEW YORK'S electrical market continues at the even level held during the past two weeks, the wiring supplies market is bravely holding its own in face of heavy appliance buying in the retail market, and sales of conduit, rubber-covered wire, armored cable and lamps are said to be far above those of last year at this time. A general disposition among the jobbers is to mark time and wait until the holidays have passed again before concentrating too much on the building equipment market. Second-hand motors during the week received added attention, with some heavy purchases reported in the industrial districts to New Jersey.

Holiday buying is said to have exceeded that of any previous season in the history of the electrical industry. Sales are diversified, with very firm prices throughout the retail trade. A feature of the present appliance market is the noticeable increase in the intelligence of buyers in that they are well versed in the ultimate value of quality and are not merely seeking cheaper prices.

During the week range sales have increased in those sections where reduced cooking rates are in effect, in Westchester County and Connecticut. Sales of washers and cleaners also have picked up during the week, jobbers report, although there are some few reductions being made by the manufacturers at the first of the year.

Holiday Sales Records Broken in the South—Construction Active

ALL electrical retailers in the Southeast report that business so far is beyond expectations. Jobbers find themselves in many cases with stocks wiped out and all lines of heating devices and radio badly depleted. Dealers' stocks are so low that they are calling on the jobbers to fill orders for immediate delivery to ultimate consumers, in an effort to hold down pre-inventory stocks. Approximately $250,000 in Christmas savings accounts has been withdrawn from various Atlanta banks since the first of December and the holiday buying is now under full swing.

Sales of electrical constuction materials have fallen off slightly on account of inclement weather, but this lull is only temporary. Construction in the South in November, 1923, was almost 50 per cent in excess of the same month in 1922. Several of the larger central stations have under consideration and will undertake the construction of high-tension lines within the next thirty days. Much of this construction will be in south Georgia, which is practically virgin territory. This, of course, will stimulate the demand for materials going into the work.

A new ruling in Atlanta calls for the use of conduit or armored conductor from the eaves of the house to meter location and the installation of safety switches with meter trim on all wiring in that city. This ruling becomes effective Jan. 1, 1924.

Christmas Buying Continues to Take All Attention in Chicago

WITH the exception of holiday purchasing, the week of electrical trade for Chicago has been rather dull and uninteresting. But the Christmas trade is steadily reaching a volume which dealers say will far outreach that of any previous holiday season. The cold weather during the past few days has retarded building construction in some cases. Buildings now in the course of erection are being rushed to rapid completion before winter actually sets in. Prices remain the same on most commodities, the only exception being armored cable. This was reduced $1 per 1,000 ft., making the price $40 Pittsburgh on the No. 14 two-conductor size.

Sales of radio equipment and heating appliances of all kinds are increasing continually. The popular demand for radio is equal to that of two years ago. Jobbers are limiting their purchases even in holiday merchandise to quantities which they will be able to sell without carrying them over in their inventories.

Central-station purchases for construction work have been fairly good. Numerous orders for conduit, with deliveries specified the first of the year, have been booked by conduit manufacturers. While there is a feeling that conduit is likely to advance, nothing definite has been announced to date.

Season Successful on the Coast; Building and Railroad Markets Strong

BAD weather has interfered with the holiday season in some sections of the Far West, and there is fear that some dealers will be left overloaded with stocks after Christmas. On the whole, however, the market has been exceedingly good and the season a wholly successful one. The demand for heating devices, for instance, has been better distributed throughout the Coast than ever before. Vacuum cleaners have been selling exceptionally well and have apparently firmly established themselves as holiday merchandise

There has been no marked trend in general prices or stock conditions. Building continues good except in the San Joaquin Valley, where low grape prices and mildew have cut business to about one-third of its normal volume. Recent rains came in the nick of time along the Coast to save pasturage and the winter grain crop.

Bare copper wire has receded slightly, and other commodities are firmer than they have been since the temporary equilibrium in June. Railroad buying is exceedingly good in such lines as bare iron wire, strand and telephone cable. The Pacific Fruit Express announces that it has purchased more than 3,000 new fruit cars, valued at $10,000,000, for delivery before the peak of the 1924 season, and is enlarging its icing and yardage facilities. These are optimistic forecasts for the 1921 crop, and therefore for prosperity on the Pacific Coast.

The Metal Market

METALS during the week were very quiet, but, contrary to usual experience during a dull period, copper prices have held firmly at 13.50 cents, delivered. This strength of prices has been due to the surprisingly good statistics shown for November, which revealed a decrease in surplus of 10,000,000 lb., and also to the heavy sales in November, which put producers in a very comfortable position. Prices of finished products have been un-

changed for several weeks, although the American Brass Company last week increased extras for tinning sheet copper, making prices net list without discount because of the sharp advance in tin prices.

The surplus of refined copper is no more than 264,000,000 lb., which is little more than a month's consumption, based on November shipments. It seems very evident that prices will advance once a buying movement is resumed, and many are confident that the level will be established at 14 cents a pound early in January.

NEW YORK METAL MARKET PRICES

	Dec. 12, 1923 Cents per Pound	Dec. 20, 1923 Cents per Pound
Copper, electrolytic...	13.25	13.50
Lead, Am. S. & R. price	7.00	7.00
Antimony............	9.00	9.00
Nickel, ingot.........	27.00 to 30.00	27.00 to 30.00
Zinc, spot............	6.35	6.35
Tin, Straits..........	45.00	45.00
Aluminum, 98 to 99 per cent..........	26.00 to 27.00	26.00 to 27.00

Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Westinghouse's Growing Orders

The Westinghouse Electric & Manufacturing Company is experiencing a resumption of business activity, approaching spring and early summer levels, which is keeping plant operations at capacity. Unfilled orders now approximate $75,000,000. In the effort to reach a basis where it can promise earlier delivery on contracts and take care of more business offered, the company is striving to reduce unfilled orders. The Pittsburgh and Philadelphia plants are operating day and night.

The company's radio business has proved substantial, and activity in that field has reached record proportions. The company is pushing operations at the East Springfield plant in an effort to supply the growing shortage of radio sets. The outlook for business continues satisfactory, and the sales department announces that there is no indication of slackening of forward business. Bookings in November were larger than those in October, which in turn exceeded the September total of $10,600,000. Indications are that the total of the year will probably be as large as the $152,328,564 received last year.

Habirshaw Booked to Capacity Until March, 1924

The reorganization committee of the Habirshaw Electric Cable Company, whose initial plan for reorganization was set aside recently by federal court order, has prepared an amended plan which will soon be submitted to the court, according to testimony by counsel for the committee before Judge Knox last week. It was also brought out in the testimony that the Habirshaw company is booked to capacity until March 1, 1924.

Maxwell Brandene, counsel representing a small minority of the bond and claim holders, introduced a motion before the court for an order to permit creditors and bondholders to withdraw claims that they had deposited with the reorganization committee. Mr. Brandene suggested that he had a better and more conclusive plan for reorganization of the companies and intimated that many of the creditors whose claims were now filed with the reorganization committee would favor this new plan.

The counsel for the reorganization committee objected to any action before the introduction of an amended plan, which would be completed next week. Judge Knox reserved decision pending introduction of further evidence from both groups.

Elect Marathon Battery Officers

Walter H. Thorn was elected president of the recently organized Marathon Battery Company at Wausau, Wis., at the company's first meeting, held for the purpose of electing officers and discussing future operations. E. J. MacEachron, former mechanical engineer of the French Battery & Carbon Company, Madison, Wis., was elected to the post of vice-president and general manager. L. H. Wheeler will be secretary and Eugene Fuller, Madison, treasurer and sales manager. The company is capitalized at $150,000 and all of the stock has been reported sold.

Manufacturing operations will not begin at once owing to the fact that the company must have its equipment designed and made as there is no company putting out the special machinery necessary for this type of work. It is expected that the work of equipping the plant will be completed in about three months.

O. L. Perkins Joins Pettingell

Oscar L. Perkins, formerly associated with E. H. Carpenter in the Perkins-Carpenter Electric Supply Company, Boston, has joined the sales organization of the R. V. Pettingell Electric Supply Company, Boston, with headquarters at 51 High Street. He will devote his attention chiefly to central-station and mill trade. Wilbur Perkins, who was also employed by the Perkins-Carpenter Company, has entered the sales department of the Pettingell company. The Perkins-Carpenter organization has been dissolved.

E. H. Carpenter, formerly a member of the Perkins-Carpenter Electric Supply Company, Boston, has joined the sales staff of the Lewis Electrical Supply Company, Boston.

General Electric May Show $18 on Capital Stock

The General Electric Company is rounding out one of the most satisfactory years in its history, in which production has been at top speed and orders close to a record. On the basis of eleven months' operations, the net amount available for dividends should reach about $33,000,000, equal to $18 a share on the $180,000,000 outstanding capital stock. Earnings last year were $14.86 a share on $175,624,746 capital stock; in 1919 they were $20.80 on $120,000,000 stock, and in 1917, the record year, $26.50 on $101,500,000 stock. Inventory adjustment and depreciation charges at the close of the year will probably be about the same as in 1922.

Since the close of the company's fiscal year the company's capital stock has been swelled over $5,000,000 by distribution to employees of additional shares early in the year, while the new $10 par-value special stock has been increased to $17,000,000 by declaration in October of the second annual 5 per cent stock dividend. This stock is preferred as to dividends, and in the above computation the full year's dividends of 60 cents a share are taken on the $8,717,000 stock outstanding up to October. Aggregate dividend requirements for this year approximated $15,000,000.

Organize to Represent Makers of Power Plant Equipment

Announcement is made that Frank H. Schubert, district manager of the Wheeler Condenser & Engineering Company, and William G. Christy, secretary of the St. Louis Section, American Society of Mechanical Engineers, and formerly with the St. Louis Boat & Engineering Company, St. Louis, have organized the Schubert-Christy Construction & Machinery Company, with offices in the Railway Exchange Building, St. Louis. In addition to representing manufacturers of power-plant equipment, the company will render general construction engineering service, specializing in the design and construction of water-cooling equipment.

Apex Appliances Reduced

On Jan. 1, 1924, the price of the vacuum cleaner manufactured by the Apex Electrical Distributing Company, Cleveland, will be reduced to $47.50 from $57.50. In addition the company will make a new "trade-in" allowance of $10 for old vacuum cleaners. The

price of $10 for attachments will remain the same.

The "Rotarex" copper washer, which now sells for $167.50, will be reduced to $155, and the galvanized washer, which sells for $152.50, will be reduced to $137.50.

Electric Storage Battery Company to Have New Building in St. Louis

The Electric Storage Battery Company has recently purchased the property at 1026 South Vandeventer Avenue, St. Louis, and is erecting a building. The present location at Twenty-first and Walnut Streets will be given up when this builiing is completed. This company has outgrown its quarters, and the building now under construction will give it considerably more space. The plans are so arranged that additions may readily be made to the new building as the business grows.

The service station at 3408 Lindell Avenue will be retained, but all battery charging for the service station will be done at 1026 South Vandeventer Avenue. It is expected that the new building will be ready for occupancy by Feb. 1, 1924.

Just & Hanaman and Langmuir Patents Again Sustained

A decision was handed down this week in the United States District Court for the Southern District of New York in favor of the General Electric Company in a suit against P. R. Mallory & Company and a similar suit against Save Electric Corporation for infringement of the Just & Hanaman and Langmuir patents. Circuit Judge Julius M. Mayer sustained the validity of these patents for incandescent lamps, both tungsten and gas-filled, and found infringement by the defendants. These two cases were tried together in the spring of this year and were argued at the final hearing early in October. These patents have been sustained several times by the federal courts in prior suits.

Benjamin Announces Winners of Hallowe'en Window Contest

The Pacific Coast carried off first prize in the Hallowe'en two-way-plug prize-window contest which the Benjamin Electric Manufacturing Co., 847 West Jackson Boulevard, Chicago, put on toward the end of October, when the Stubbs Electric Company of Portland, Ore., won the first prize of $100.

The interest shown by jobbers and electrical dealers in co-operating with the manufacturers in obtaining material for window trims may be taken from the fact that more than 1,600 window trims were furnished. Both the second and third prizes went to Ohio jobbers—the Electric Sales Company of Columbus and the P. & A. Electric Supply Company at Mansfield, respectively. The fourth prize was awarded to the Seger Electric Company, Chicago.

Blaw-Knox Christmas Dividend

The Blaw-Knox Company, Farmers' Bank Building, Pittsburgh, manufacturer of transmission towers, has declared an extra Christmas dividend of 2 per cent on its common stock, payable Dec. 24, to stockholders of record Dec. 14. This will make a total dividend disbursement on this stock for this year of 10 per cent. President A. C. Lehman reports that earnings for 1923 will be equal to about 28 per cent on the common stock after allowance for depreciation and taxes and the payment of the dividends on the preferred stock, of which a 7 per cent cumulative issue of $1,400,000 is outstanding at present.

The outstanding common stock amounts to $3,750,000 (150,000 shares of a par value of $25). Indicated net earnings after taxes, depreciation and preferred dividend requirements for the year therefore are $1,050,000, or $7 per share, which would meet the stock dividend, at the recent regular rate of 8 per cent, for three and one-half years.

L. R. Brown Made Manager of G. E. Transformer Sales

L. R. Brown has been appointed manager of the transformer division of the new central-station department of the General Electric Company, according to a recent announcement. He was one of the company's first transformer specialists and has a wide personal acquaintance in the central-station industry.

Mr. Brown is a graduate of the University of Wisconsin, class of 1903. Following early work with the Oshkosk Electric Light & Power Company he entered the General Electric test course at Schenectady. He later took up duties in the switchboard department there, working on station layout engineering. With the establishment of the transformer sales department in 1906 he joined this division and in 1911 he was made head of the distribution section of transformer sales. In 1913 he established the first transformer commercial offices at Pittsfield.

In connection with the reorganization following this and other changes in the central-station department G. G. Jeter, H. F. McRell and Clinton Jones are to be sales managers in this division. Mr. Jeter will have charge of transformer accessories, advertising and publicity; Mr. Jones will have supervision of power transformers, and Mr. McRell of distribution transformers.

The Hoppes Water Wheel Company, Springfield, Ohio, has been organized to take over the plant and business of the Trump Manufacturing Company, manufacturer of waterwheels. The company will manufacture, in addition to waterwheels, a new hydro-electric unit designed by John J. Hoppes for use by small stream owners and for auxiliary light and power in large plants. Capt. John Lund, Washington, is financially interested in the new company, which will be headed by John J. Hoppes as president; Captain Lund, vice-president and general manager, and R. P. Henderson, chief engineer.

The Atlanta Electrical Association has appointed a committee of engineers, contractors and central-station representatives to co-operate with the Superintendent of Electrical Affairs in the revision of the Atlanta electrical code to conform with the new National Electric Code. This revised code will doubtless be adopted about Jan. 1.

The Boyer Manufacturing Company, Military Avenue, Detroit, has been organized with $50,000 capital stock to manufacture electric appliances, specializing in an electric motor-driven brush vacuum cleaner. The company has factory and equipment and is already producing. S. J. Boyer is president of the firm.

The Empire Miniature Lamp Corporation, 20 Clinton Street, Newark, N. J., recently organized with $50,000 capital stock, will manufacture electric lamps and kindred products. It has taken over the business formerly operated as the Empire Glass Bulb Company.

The Sanitat Manufacturing Company, Newark, N. J., recently organized with a capital of $250,000, to manufacture electrical appliances and equipment, has leased space in the building at 22 Green Street and will equip for its initial plant. The company has its registered office at 78 Clinton Street and is headed by Max Tischler.

The Litlude Battery Company, Morgantown, W. Va., will commence the construction of a one-story building at Connellsville, Pa., to cost $20,000 with machinery.

The Standard Electric Novelty Company, 324 Lafayette Street, New York, electrical specialties, has leased four floors in the building at 19 Bond Street for a new local plant and will take possession at an early date.

The Standard Electric Stove Company, Toledo, Ohio, manufacturer of electric fireless cookers, will move its manufacturing plant to combine with that of the Engman Matthews Range Company at Goshen, Ind., in the near future. Electric, wood, coal and oil stoves will be manufactured by the merged concern.

Paul A. Douden, formerly of the sales staff of the Western Electric Company in Denver, has organized a manufacturers' agency in that city under the name of the Globe Electric Supply Company, with headquarters at 1620 Wazee Street. Accounts already scheduled by the new firm are those of the Federal Electric Company, Redtop Electric Company, Strait & Richards, Walker-Pratt Manufacturing Company, Standard Electric Stove Company, Betts & Betts and the Joslyn Manufacturing & Supply Company of Chicago. Complete stocks of the last named company will be warehoused in Denver and Salt Lake City. The Douden organization plans to cover all of Colorado, Utah, Wyoming and New Mexico.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Port Said, Egypt (No. 8,536), of electric bulbs, wire, cords, small table lamps, wall fixtures and sockets and appurtenances.

An agency is desired in Upper Hut, New Zealand (No. 8,509), for electrical appliances.

Purchase and agency is desired in Christiania Norway (No. 8,552), for electrical equipment and appliances.

Purchase is desired in Havana, Cuba (No. 8,503), of storage-battery parts.

Purchase and agency is desired in Vienna, Austria (No. 8,514), for electrolytic copper in "wire bars" and "rolling cakes."

TENDERS ASKED FOR McLAREN FALLS (NEW ZEALAND) POWER SCHEME.—Tenders are being asked by the Town Council of Tauramga, New Zealand, until Feb. 19, for Sections 15, 16, 17, and 18, in connection with the McLaren Falls development scheme.

The following inquiries have been received by the Philadelphia Commercial Museum, which will furnish names and addresses of inquirers to any desiring them and mentioning the number given: Parties in Gorakund-Indore, India (No. 41,485), would like to get in touch with manufacturers of electric lamps, etc. A party in Havana, Cuba (No. 41,506), would like to communicate with manufacturers who desire to introduce radio apparatus in Cuba. Parties in Foochow, China (No. 41,541), would like to correspond with manufacturers of electric batteries, electric motors, marine engines, telephone and telegraph materials, etc.

ELECTRIC POWER PLANT CONTEMPLATED FOR ARGENTINA OIL FIELDS. —The Argentine State Oil Fields Administration, Buenos Aires, Argentina, it is reported, will receive tenders until Feb. 14, 1924, for the construction and equipment of a 11,250-kw. electric power plant.

New Apparatus and Publications

AUXILIARY RELAY.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has developed a long-time-limit auxiliary relay, known as type "GK."

TEMPERATURE CONTROLLER.—The Foxboro Company, Inc., Foxboro, Mass., is distributing a folder describing the "Foxboro" temperature recorder-controller.

ELECTRIC COOKER. — The Durham Manufacturing Company, Muncie, Ind., has added an electric cooker to its line of fireless cookers.

DUPLEX BRACKETS.—A series of duplex brackets for carrying duplex street-lighting cable down the pole has been brought out by the Line Material Company, South Milwaukee, Wis.

ELECTRIC IRONER.—An open-end electric ironer, "Bilt Rite", with a roll 43 in. long, has been brought out by the Russ Manufacturing Company, West Fifty-eighth and Walworth Avenues, Cleveland.

ELECTRIC HEATER.—Electrahot Appliances, Inc., 301 Fifth Avenue, South Minneapolis, Minn., has placed a glow heater on the market.

GRIDDLE AND PLATE WARMER.—A new "Universal" pancake griddle, which can also be used to fry eggs, bacon, etc., has been brought out by Landers, Frary & Clark, New Britain, Conn. The company has also placed on the market a plate warmer for use in homes and restaurants.

GROUND CLAMP.—A ground clamp made of aluminum is being manufactured by the Gillette-Vibber Company, New London, Conn.

LAMP BRACKETS FOR TROLLEY POLES. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has designed a lamp bracket to be attached to a steel trolley pole, known as the "Columbia Trolleylite" bracket.

LAMP MAINTENANCE HANGERS. — The Thompson Electric Company, 226 St. Clair Avenue, N. E., Cleveland, is distributing a supplement to catalog B-21, covering "Thompson" lamp maintenance hangers.

DIRECTION SIGNAL.—An illuminated direction signal, "Wig-Wag," has been developed by the Kay Bee Manufacturing Company, 3508 South Park Avenue, Los Angeles.

TERMINAL FOR RESISTOR UNITS.—A new terminal support for resistor units has been developed by the Ward Leonard Electric Company, Mount Vernon, N. Y.

New Corporations

THE TRI-CITIES POWER COMPANY, Bolivar, Mo., has been incorporated by J. F. Bryant, J. B. Stewart and others. The company is capitalized at $150,000.

THE COLUMBUS DEVELOPMENT & POWER COMPANY, San Antonio, Tex., has been incorporated by Dr. W. S. McDaniel, O. A. Zumwalt and others. The company is capitalized at $100,000 and proposes to build a large power plant.

THE LINNVILLE CREEK LIGHT & POWER COMPANY, Edom, Va., has been chartered with a capital stock of $9,000. The officers are: A. S. Armentrout, Linville, president, and David Wenger, Edom, secretary.

THE AMERICAN SUPERPOWER CORPORATION, Indianapolis, Ind., has been incorporated with a capital stock of $5,000 to operate electric power stations, transmission systems, etc.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

MILLINOCKET, ME. — The East Millinocket Light Company has purchased the property of the Millinocket Light Company and plans extensions and improvements.

BOSTON, MASS.—The Edison Electric Illuminating Company has completed plans for an addition to its substation at 1207 Commonwealth Avenue.

LOWELL, MASS.—The installation of an ornamental lighting system in Merrimack Street from Cabot to Pawtucket Street is under consideration by the Public Service Board.

EAST HARTFORD, CONN. — The New York, New Haven & Hartford Railroad Company, New Haven, plans to build a power house at its local yards, to cost about $50,000, including an oil-storage building.

TORRINGTON, CONN.—Plans are being prepared by the Torrington Electric Light Company for the construction of a dam.

Middle Atlantic States

ADAMS BASIN, N. Y. — The Adams Basin Electric Light & Power Company plans to extend its electric system into the town of Parma and erect a distributing system along the Pine Hill Road to Parma to serve the residents in that section.

ALBANY, N. Y.—Bids, it is understood, will soon be asked for paving, laying sidewalks, curbing and lighting Madison Avenue (a distance of 2.9 miles), to cost about $300,000. J. G. Brennan, City Hall, is engineer.

BEACON, N. Y.—The Verplanck Brick Company plans to install electric power equipment in connection with plant extensions.

COHOES, N. Y. — The Mohawk Paper Makers, Inc., contemplates building a power plant to cost about $100,000.

NEW YORK, N. Y.—Plans for the proposed motion-picture plant to be erected by the Distinctive Pictures Corporation, 366 Madison Avenue, in Queens Borough, to cost about $300,000, include a power plant. William O. Hurst is architect.

POLAND, N. Y.—Permission has been granted to the Western New York Electric Company, Jamestown, to extend its electric system into Poland Township.

ROXBURY, N. Y.—The New York State Gas & Electric Corporation, Ithaca, has applied to the Public Service Commission for authority to serve electricity in the town of Roxbury under a franchise granted by the Town Board.

SYRACUSE, N. Y.—The Board of Trustees, St. Joseph's Hospital, contemplates the construction of a power house at a proposed institutional building on Prospect Avenue, to cost about $100,000.

HIGHTSTOWN, N. J.—Work has started on the construction of an electric power plant at the Peddie Institute, in connection with additional buildings, to cost about $400,000.

NEWARK, N. J.—Bids will be received by the Board of Education, Department of Supplies, City Hall, until Dec. 27 for electrical supplies and other equipment for local schools.

CORRY, PA.—The Penn Public Service Corporation, Johnstown, has acquired the property of the Corry Electric Light Company and will consolidate with its system. Extensions in transmission lines are contemplated.

CRESSON, PA. — The Penn Cress Ice Cream Company contemplates the construction of an ice and refrigerating plant with power plant in connection with a new factory, to cost about $150,000.

ERIE, PA.—The Pennsylvania Railroad Company plans to install electric power equipment and other machinery in connection with proposed extensions at its local ore docks, to cost about $500,000.

JUNIATA, PA.—Officials of the Juniata Public Service Company are organizing two subsidiaries, to be known as the Mifflin and Berrysburg Electric Service companies, to erect transmission lines in Mifflin Township and Berrysburg Borough respectively.

PHILADELPHIA, PA.—Plans are being prepared by the Philadelphia Electric Company for a substation at 106-12 North Eleventh Street.

PHILADELPHIA, PA.—The Wilmington (Del.) Bleachery Company will build a power house at its proposed mill in the Holmesburg section, to cost about $130,000.

READING, PA.—The Metropolitan Edison Company contemplates extensions in transmission lines and additional generating plants involving an expenditure of about $20,000,000. The work includes two stations now in course of construction at Middletown, Pa., and Holland, N. J., respectively, to cost about $4,000,000 each.

SCRANTON, PA.—The Scranton Electric Company plans to install additional equipment at its power plant, including a turbo-generator and auxiliary apparatus.

TITUSVILLE, PA.—The Municipal Service Company, Philadelphia, has purchased the system of the Titusville Light & Power Company and contemplates extensions, including new equipment.

WILLIAMSBURG, PA. — The Williamsburg, Saltillo, Saxton and Three Springs power companies are being organized by F. E. Harshaw and C. A. McClure, to construct transmission lines and substations in the above-named districts. James C. Jones, Bullitt Building, Philadelphia, is representative.

WHITEFORD, MD.—The Stasco Milling Company, care of the Industrial Bureau, Board of Trade, Baltimore, plans to build a power house at its proposed local roofing slate plant, to cost about $250,000.

FAIRMONT, W. VA.—The Monongahela West Penn Public Service Company contemplates an issue of $1,000,000 in capital stock, the proceeds to be used for proposed improvements in the upper Monongahela Valley.

NARROWS, VA.—The Virginian Railway Company, Norfolk, plans to build an electric plant at Narrows in connection with the electrification of its system in this vicinity.

LOUISA, VA.—The Council is planning to rebuild the light and water plant, recently daamged by fire.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Dec. 26 for 400 switches, 1,000 cords and 200 switchboard plugs. (Proposal C. P. 15264-1.)

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Jan. 8 for wire and cable for Eastern and Western navy yards. (Schedule 1700 and 1701.)

WASHINGTON, D. C.—Bids will be received by the purchasing agent, Panama Canal, until Jan. 2 for electric motor, etc. (Circular 1580.)

North Central States

AKRON, OHIO.—Bids will be received at the office of the Board of County Commissioners, Akron, until Dec. 26 for the installation of an underground electric light and

power service to run from the present power plant at the Springfield Lake Sanatorium to the children's building now being erected on the same grounds. Good & Wagner, Akron, are architects.

ELYRIA, OHIO. — The Columbia-Elyria Power Company has engaged B. R. Shorover, Oliver Building, Pittsburgh, Pa., as engineer in connection with constructing a new power house to have a capacity of about 4,000 kw. The cost is estimated at about $250,000.

MIDDLETOWN, OHIO.—The W. B. Oglesby Paper Company will install electric power equipment at its proposed mill addition, to cost about $90,000.

PLATTSBURG, OHIO.—Plans have been completed for the construction of a municipal electric system in Plattsburg. Electricity for operating the system will be obtained from the Indiana, Columbus & Eastern Traction Company, Cincinnati. The village will erect a transmission line (about 3 miles) to connect with the lines of the company.

COVINGTON, KY.—An ordinance providing for the installation of fifty-four ornamental lamps on Scott has been adopted by the City Commissioners.

LOUISVILLE, KY.—The Highway Iron Products Company, Columbia Building, will install a substation and electric power equipment at its proposed plant at Magnolia and Seventeenth Streets, to cost about $100,000. Joseph & Joseph, Francis Building, are architects.

ANDERSON, IND.—The Board of Public Works is considering the installation of additional equipment at the municipal power plant, including a 5,000-kw. turbo-generator and auxiliary apparatus.

GOSHEN, IND. — Extensions and improvements to the municipal electric light plant, to cost about $50,000, are under consideration.

URBANA, ILL.—Bids, it is understood, will be asked early in February for the installation of an ornamental lighting system on South East Street, to cost about $60,000.

EAU CLAIRE, WIS. — The Wisconsin-Minnesota Light & Power Company contemplates the construction of a warehouse, and garage, to cost about $50,000.

FENNIMORE, WIS. — The Council has approved an expenditure of $2,430 for improvements to the street-lighting system during 1924. Provision has also been made in the 1924 budget for improvements to the municipal electric light and power system.

FOND DU LAC, WIS.—An appropriation of $22,000 in 1924 budget has been approved by the City Council to be used exclusively for extensions and improvements to the street-lighting system in the downtown and residential section of the city.

KEWAUNEE, WIS. — The Council has recommended in the 1924 budget an expenditure of $2,400 for extensions and improvements to the street-lighting system.

OCONTO, WIS.—Arrangements have been made by the Northeastern Power & Light Company for the right-of-way for its proposed transmission line to Manitowoc Rapids.

PORTAGE, WIS. — Bids will soon be asked for extensions to the waterworks, including a new pumping station, water purification plant, etc., to cost about $100,000. Pearse, Greeley & Hansen, 39 West Adams Street, Chicago, are engineers.

RICHLAND CENTER, WIS.—The City Council is considering securing electricity from the high-tension transmission line of the Wisconsin River Power Company, Madison.

SHEBOYGAN, WIS.—Details have been completed by the South and West Side Advancement Association for extensions of the ornamental street-lighting system on North Eighth Street, Indiana Avenue, and on Thirteenth Street, covering five blocks on each street.

WEST ALLIS, WIS.—The installation of ornamental lamps on Sixty-eighth Avenue, National Avenue and on Greenfield Avenue is under consideration by the City Council.

BRAINERD, MINN.—Plans for the proposed municipal power plant at the city pumping station have been temporarily abandoned.

WINTHROP, MINN. — Plans are being considered for improvements to the municipal electric plant, to cost about $100,000.

BEDFORD, IOWA.—The Council is considering the construction of an electric light plant, to cost $40,000, and a distribution system, to cost $25,000. The Prince-Nixon Engineering Company, Peters Trust Building, Omaha, Neb., is engineer.

CENTERVILLE, IOWA. — The Iowa Southern Utilities Company contemplates extending its transmission lines to Unionville and Udell.

DAVENPORT, IOWA.—The United Light & Railways Company is disposing of a bond issue of $1,000,000, part of the proceeds to be used for extensions.

DUBUQUE, IOWA.—The Globe Portland Cement Company, McKnight Building, Minneapolis, plans to build a power house at its local cement mill, to cost about $200,000. The Charles S. Pillsbury Company, 1200 Second Avenue, South, Minneapolis, is engineer.

LEEDS, IOWA.—Plans are under consideration by the Leeds Improvement Association for extensions and improvements in the municipal lighting system.

UDELL, IOWA.—The proposal to issue bonds for the installation of an electric lighting system in the town will be submitted to the voters at an election to be held Jan. 3. It is proposed to secure electricity from the Iowa Southern Utilities Company, Centerville.

UNIONVILLE, IOWA.—At an election to be held Jan. 3 the proposal to issue bonds for the installation of an electric lighting system in Unionville will be submitted to the voters. Electricity will be obtained from the Iowa Southern Utilities Company, Centerville.

WATERLOO, IOWA.—The Citizens' Gas & Electric Company contemplates building a power house on the East River in the near future near the dam recently completed.

FESTUS, MO.—The City Council is considering the installation of electrically operated pumps in connection with the proposed municipal waterworks and sewerage systems, for which $175,000 in bonds have been voted.

HANNIBAL, MO.—Bonds to the amount of $400,000 have been voted for improvements to waterworks, including pumps, motors, filtration plant, reservoir, etc. D. H. Maury, 304 South Dearborn Street, Chicago, is engineer.

ST. JOSEPH, MO.—The City Council is considering calling a special election in January to vote on the proposal to issue $500,000 in bonds for a municipal lighting system. W. K. Seitz is city engineer.

ST. LOUIS, MO.—An issue of $500,000 in bonds for a power plant and also an issue of $500,000 in bonds for street lamps have been approved by the Board of Public Service and the Citizens' Bond Issue Supervisory Commission.

MANDAN, N. D.—The Northern Pacific Railroad Company, St. Paul, contemplates building a power plant in Mandan.

ALMA, NEB.—New equipment, including an oil engine, will be installed at the municipal power plant.

BEEMER, NEB.—The Continental Gas & Electric Company, Omaha, has been granted permission to erect a transmission line to Beemer.

Southern States

SALISBURY, N. C.—The installation of an ornamental lighting system in the business district is under consideration by the Council.

THOMASVILLE, N. C.—The Council is considering the installation of an ornamental lighting system.

FLORENCE, S. C.—The City Council is considering the installation of electrically operated pumps in connection with the waterworks and sewerage systems, to cost about $350,000.

LAKELAND, FLA.—The Municipal Light & Power Department plans to install electric pumping machinery at the city waterworks, to cost about $150,000.

MARIANNA, FLA.—The construction of a municipal hydro-electric power plant on the Chipola River, to cost about $100,000, is under consideration.

MIAMI, FLA.—The Miami Electric Light & Power Company is reported to be considering doubling the output of its plant.

SANFORD, FLA.—The City Commissioners are considering calling an election to submit the proposal to issue $800,000 in bonds to establish electric, gas and water plants.

TAMPA, FLA. — Plans have been prepared by Lockwood, Green & Company, Healey Building, Atlanta, Ga., for a warehouse and mill building, including cold-storage plant, office, etc., to cost about $750,000, for the Swann Terminal Company, 314 Madison Street.

AUSTELL, GA. — The Austell Cabinet Company plans to build a power house at its proposed local plant, to cost about $100,000.

CHATTANOOGA, TENN.—The Tennessee Electric Power Company contemplates new developments during 1924 involving an expenditure of about $5,000,000. Work on the proposed hydro-electric plant on Ocoee River will start as soon as the Hales Bar steam plant and the Rock Island developments are completed. The Ocoee River plant will have a capacity of about 24,000 hp.

CUMBERLAND, TENN.—The Nashville, Chattanooga & St. Louis Railway Company, Nashville, plans to install electric equipment at its proposed local rock-crushing plant.

SHELBYVILLE, TENN. — The Public Light & Power Company plans extensions in its hydro-electric power plant, including the installation of new equipment.

GREENWOOD, MISS. — The installation of an ornamental lighting system to be maintained by underground wires, to cost about $30,000, is under consideration. W. H. Hawkins is city engineer.

HARRISON, ARK.—The Carroll County Utility Company, Eureka Springs, has acquired the property of the Harrison Electric Company. The new company plans to rebuild the local plant and to erect an ice and cold-storage plant, to cost about $100,000.

NEW ORLEANS, LA.—Petitions have been presented to the City Council for the installation of ornamental lighting systems on Magazine Street and Ursuline Avenue.

BRONTE, TEX.—C. C. Holder is reported to be considering installing an electric light plant here.

COLUMBUS, TEX.—The Columbus Development & Power Company, recently organized, has tentative plans for a hydro-electric power plant on the Colorado River, to cost about $200,000.

El PASO, TEX.—Steps have been taken by property owners on Texas Street for the installation of an ornamental lighting system, to cost about $70,000.

FORT WORTH, TEX.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Jan. 8 for twenty-seven flood-lighting projectors for the local navy station, and also, twenty-seven for the San Diego, navy yard. (Schedule 1684.)

HOUSTON, TEX.—The Blodgett Development Company plans to install a lighting system on a tract of land now being developed. J. Stuart Boyles is engineer.

MARLIN, TEX.—The Community Power & Light Company has issued $1,718,000, in bonds, part of the proceeds to be used to acquire the properties of the Central Texas Ice, Light & Water Company and the Central Texas Ice & Light Company, and for extensions to the transmission lines in this section.

PORT ARTHUR, TEX.—The Port Arthur Ice & Refrigerating Company contemplates the construction of a new plant, to cost about $325,000. Stone & Webster, Inc., 147 Milk Street, Boston, is engineer.

Pacific and Mountain States

ABERDEEN, WASH. — Bonds to the amount of $2,000,000 have been voted for a municipal hydro-electric plant on the Wynooche River, to develop 25,000 hp.

BELLINGHAM, WASH. — The Puget Sound Power & Light Company is planning to erect a terminal station at Elk and Magnolia Street, to cost about $200,000.

TACOMA, WASH.—Plans are being arranged for the installation of an ornamental street-lighting system on North Nineteenth Street and on Junett Streets.

PORTLAND, ORE. — The Oregon Land Company has applied for permission to construct a hydro-electric power plant on Miller Creek.

PORTLAND, ORE.—J. R. Keep has been granted a permit to utilize water from Lost Creek for a power development. The project includes two conduits, one 7 miles long and the other 10 miles.

PRINEVILLE, ORE.—Work is under way on extensions to the Cove power plant, to cost about $90,000. The work includes a new power house with sufficient space to house the present unit of 400 kw., the new unit of 1,200 hp., and a third unit of 1,225 hp., to be installed at some future time and a new substation (outdoor type), to be equipped with three 400-kva., 2,300/22,000-volt transformers. Bert L. Sivyer is secretary and manager.

SALEM, ORE.—Plans are being prepared by the Lyons-California Glace Fruit Com-

pany for an ice-manufacturing and cold-storage plant, to cost about $450,000.

BAKERSFIELD, CAL.—Plans are being considered for the installation of an ornamental lighting system on Chester, Baker, Nineteenth and other streets, consisting of about 150 standards. W. D. Clarke is city engineer.

COLTON, CAL.—The Southern California Edison Company will build an addition to its local substation to cost about $250,000.

GRASS VALLEY, CAL.—Plans are under consideration for the installation of an improved street-lighting system.

HANFORD, CAL.—The Southern California Edison Company plans to construct a substation on Fifth Street, to cost about $25,000.

HERMOSA BEACH, CAL.—Plans for the proposed local mill to be built by the Golden State Silk Mill, Inc., to cost about $400,000, include a power house.

HUNTINGTON BEACH CAL.—The California-Pacific Textiles, Inc., care J. W. Purinton, engineer, San Fernando Building, Los Angeles, is having preliminary plans prepared for a factory building, storage building, boiler house, transformer station, etc., at Huntington Beach.

LONG BEACH, CAL. — The Southern California Edison Company has retained Stone & Webster, Inc., 147 Milk Street, Boston, to build a 60,000-kw. extension to its Long Beach steam plant.

LOS ANGELES, CAL.—The Pacific Electric Railway Company plans to build at once two additional power stations to cost about $245,000. One will be erected at Second and Toluca Streets and the other at North Long Beach.

MARYSVILLE, CAL. — Steps are being taken for the installation of an ornamental lighting system on D Street.

MARYSVILLE, CAL. — Plans are being prepared by the Yuba Development Company, Hobart Building, San Francisco, for the Narrows project on Yuba River, including a storage dam, a 1-700-ft. pressure tunnel, a 300-ft. steel penstock and power plant to develop 1,700 hp. The Constant Angle Arch Dam Company, Hobart Building, San Francisco, is engineer.

OAKLAND, CAL.—Steps have been taken by the Uptown Association for the installation of an ornamental lighting system on Broadway from Fourteenth to Twenty-fourth Street, to cost about $50,000.

SAN DIEGO, CAL.—Plans are being prepared for the installation of an ornamental lighting system on Seventh, Eighth, Tenth, Eleventh, B and other streets and on the La Jolla Boulevard, consisting of about 177 standards.

SAN DIEGO, CAL. — Preparations are being made by the San Diego Consolidated Gas & Electric Company for the erection of its transmission system into the Imperial Valley through Escondido and Rincon (to cost about $200,000) to connect with a 100-mile high-tension line which will be erected by the Southern Sierras Power Company, Riverside, between El Centro and Rincon.

SAN FRANCISCO, CAL. — Steps have been taken by the Divisadero Merchants' Association to secure a better lighting system on that thoroughfare.

WILLITS, CAL.—The Central Mendocino County Power Company has been granted permission to erect a transmission line from Willits to Potter Valley and from the Dutch Flat Dam to Willits, to cost about $70,000.

FRANKLIN, IDAHO. — The installation of a new street-lighting system is under consideration.

RICHMOND, UTAH.—The installation of a new street-lighting system is under consideration.

LEWISTON, MONT. — The Montana Power Company will install a local street-lighting system, to cost about $13,000.

Canada

GODHUE, QUE.—The St. Regis Paper Company of Canada, Ltd., Montreal, has awarded a general contract to the Canadian Comstock Company, Montreal, in connection with a local hydro-electric development, to cost about $100,000. The installation of waterwheels, generators, penstock, pumps and motors and erection of transmission line and electrical distributors are included in the contract.

QUEBEC, QUE. — Plans are being prepared by the Quebec Harbor Commission for the construction of a cold-storage plant on the waterfront with power plant, to cost about $600,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued Nov. 27, 1923)

1,475,878. MULTIPLE WIRE CABLE FOR HIGH-FREQUENCY TELEPHONY AND TELEGRAPHY; L. Rellstab, Berlin-Nikolasse, Germany. App. filed March 6, 1923. Reducing induction between wires.

1,475,880. CONTROLLING AND REGULATING SYSTEM FOR DYNAMOS; W. J. Rickets, London, England. App. filed May 21, 1920. Variable-speed generator voltage controlled by thermionic tube.

1,475,885. FIXTURE DEVICE; D. A. Rose, Berkeley, Cal. App. filed March 4, 1922. Attaching chandelier to ordinary outlet.

1,475,894. BEARING HOUSING FOR ELECTRIC MOTORS; C. W. Starker, Pittsburgh, Pa. App. filed Oct. 13, 1917. For ball or roller bearings and reduction gearing.

1,475,900. PANEL CUT-OUT BLOCK; G. B. Thomas, Bridgeport, Conn. App. filed Nov. 29, 1921. Means for indicating the branch circuit connections.

1,475,918. GENERATOR; A. E. Bucnenberg, Toledo, Ohio. App. filed July 14, 1917. Automatic means for regulating output of automobile generator.

(Issued Dec. 4, 1923)

1,475,933. DERECTIFYING SYSTEM; L. W. Carroll, Riverside, Ill. App. filed Nov. 3, 1919. Obtaining 110 volts from 32-volt farm-lighting units.

1,475,937. PHONOGRAPH RECORD MATRIX AND METHOD AND APPARATUS FOR PRODUCING SAME; J. T. Daniels, Newark, N. J. App. filed Sept. 30, 1919. Refinements in electrolytic process.

1,475,942. ELECTRIC RESISTANCE ELEMENT; F. A. Fahrenwald, Cleveland Heights, Ohio. App. filed Feb. 6, 1922. Composed of iron, chromium and manganese.

1,475,946. SIGNAL; H. Hafer, St. Louis, Mo. App. filed March 14, 1921. Automobile rear direction signal.

1,475,951. ELECTROMAGNETIC CONTROL; B. W. Jones, Schenectady, N. Y. App. filed March 5, 1921. Starting arrangements for motors.

1,475,968. ALTERNATING-CURRENT LINE; R. Rüdenberg, Berlin-Grunewald, Germany. App. filed Dec. 2, 1920. Compensating charging current by choke coils.

1,475,970. CONTROL MEANS FOR ELECTRICALLY DRIVEN MECHANISM; L. J. Stephenson, Chicago, Ill. App. filed Feb. 20, 1920. Operating vehicles propelled by motors.

1,475,973. PROCESS OF ELECTRODEPOSITION; B. S. Summers, Port Huron, Mich. App. filed Dec. 9, 1922. Depositing a protecting coating of lead on iron.

1,475,987. SINGLE-TRANSMISSION TELEGRAPH SYSTEM; W. A. Cushing, Newburgh Heights, Ohio. App. filed Jan. 27, 1919. Arrangements for transmitting and receiving signals over same line.

1,475,995. CHEMICAL CONVERSION OF SUBSTANCES; L. Heis and H. Jezler, Zurich, Switzerland. App. filed March 21, 1923. By means of electric discharge.

1,475,997. NETWORK FOR NEUTRALIZING THE SUSCEPTANCE OF A LOADED LINE; R. S. Hoyt, Brooklyn, N. Y. App. filed July 9, 1919. Relates to telephone line.

1,476,003. RADIO-SIGNALING CALL SYSTEM; De L. K. Martin, Orange, N. J. App. filed Aug. 18, 1922. Central radio station with number of remote stations.

1,476,005. MOTOR; J. C. Osher, Anaheim, Cal. App. filed Aug. 28, 1919. Motor for operating dental tools, hair clippers, etc.

1,476,028. ELECTRICAL CONNECTOR FOR SPARK PLUGS; J. Berge and L. B. Berge, Flint, Mich. App. filed April 11, 1919.

1,476,048. GRID FOR PROTECTING RÖNTGEN IMAGES AGAINST SECONDARY RAYS; G. Bucky, Berlin, Germany. App. filed May 17, 1923.

1,476,052. OVERHEAD CATENARY SUSPENSION CONSTRUCTION FOR TRANSMITTING ELECTRICITY TO VEHICLES; J. I. Comly, Harrisburg, Pa. App. filed Oct. 7, 1916. For trackless trolleys.

1,476,059. METHOD OF ELECTRIC DRIVING; P. P. Deutschmann, Berlin-Charlottenburg, Germany. App. filed Nov. 23, 1920. Method of determining acceleration of alternating-current hoist motors.

1,476,073. ELECTRIC BED WARMER; H. Guggenbühl, Ruschlikon, Switzerland. App. filed Aug. 16, 1921.

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1,476,586. ELECTRICAL PLUG AND SOCKET EXTENSION UNIT; G. H. Bowen, Boston, Mass. App. filed Jan. 30, 1920. Extension plug for attaching appliances to overhead fixtures.

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Men Who Create

MANY men "build better than they know." Comparatively few who do great work along pioneering lines realize or even dream in the beginning what results may come. To most men each act, each accomplishment, has significance only in relation to the problem of the moment. Thus those who have a practical vision of the future and how to build for that future stand out strongly in contrast with their fellow men. The advance of society and industry is measured by the sum total of the contributions of all, but this advance is both accelerated and directed by those who through technical ability or through genius for leadership work with the fundamental idea of building for the future. And those who through the exercise of rare creative genius or through perseverance in investigation and infinite patience make possible entirely new achievements rightly rank first. However much others may add, their contribution alone is indispensable.

The electrical industry and the electrical art provide the most outstanding example of the results obtained through the combination of inventive genius and sound business development. The early engineers had a real vision of what their work might accomplish, though their vision fell far short of the realization. Others who came into the industry and associated themselves with the engineers to help build upon their technical achievements have shown marvelous courage and foresight in their work. There has thus come to be a class of men whom the electrical industry recognizes as primarily responsible for its present success and future opportunities. Their records stand as encouragement and inspiration to others already in the industry and to the younger generation as it grows into its own responsibilities.

It is for this reason that the ELECTRICAL WORLD for the past three years has published photographs of such men accompanied by short appreciations of their individual contributions to the industry. Some have been overmodest and have refused the use of their portraits, but the long list presented, with more to come from time to time, will form a fitting tribute to the genius and ability which have been responsible for the upbuilding of the electrical art and industry in America. Believing that it will be an enterprise well worth while, and indeed in response to numerous requests, the ELECTRICAL WORLD plans to publish as a book this series of personal photographs and appreciations. Such a collection will undoubtedly find a welcome as a permanent record of the relation of the men who create and build to the industry which their vision and their labor has called into being.

Sidney Borden Paine

A pioneer and foremost authority in the application of electricity to the textile industry.

FOR thirty years Sidney B. Paine, manager of the mill-power department of the General Electric Company, has rendered distinguished service as a liaison officer between the electrical and the textile manufacturing industries. As a boy in Fall River, Mass., he grew up in the atmosphere of cotton-mill activities, and after a comparatively short term of service in Edison central-station development in New England the opportunity came to undertake the pioneer cotton-mill electrification of the world at the Columbia Mills Company plant in Columbia, S. C. The motors (polyphase induction type) went into service in 1894 in 65-hp. units and are still in operation. Upward of 1,500,000 hp. in motors is today at work in the textile industry, and the adoption of electric drive has become a foregone conclusion in every new installation, while the electrification of old plants is proceeding very fast.

Mr. Paine was born in 1856 and was educated at the Brooklyn Polytechnic Institute and abroad. His earlier work in the electrical industry was in association with W. H. Francis, another Edison pioneer, in introducing Edison central-station equipment and service into New England. When the General Electric Company and the Thomson-Houston Electric Company joined hands, Mr. Paine was appointed manager of the power and mining department, with headquarters at Boston, and in 1903, in recognition of his vision of electrical possibilities in the textile industry, he was made manager of the mill-power department.

At all times Mr. Paine has worked in close contact with the designing engineers at the factory, and many of his ideas have been embodied in the equipment which has been developed to meet the expanding needs of the great textile industry, the four-frame drive of spinning machinery being conspicuous among these. Mr. Paine's knowledge of the textile industry includes a profound understanding of the service requirements of its branches from the standpoint of electrical engineering, and he has constantly striven to convince mill owners and operators of the wisdom of installing motors of adequate rating in relation to prospective future developments in character of product, volume of output and arrangement of manufacturing processes. He has made several trips to investigate the textile industry in Europe. In his analytic power, constructive understanding of industry needs and sales ability he stands among the foremost authorities in the world of textile power application.

Editorial Comment

Electrical World, December 29, 1923
Volume 82 Number 26

Human Relations

NO GROWTH in the size of central-station systems, no increase in the complexity of operations or in the organizations of personnel, can affect the humanness of human relations. Customers will continue to be men and women, employees will be no less individuals, and both will go on until the end regarding the chief executive of the utility company as a neighbor or a stranger who is frank, fair and friendly or otherwise, as the case may be. It is a capital idea, therefore, to pause during this week of the holidays to think about these things. Christmas carries an inspiration toward good will to men; New Year's Day prompts us all toward introspection and a candid scrutiny of our affairs. Let it be asked, therefore, what are the fundamental concerns of the utility executive, the manufacturer, the jobber, any business man who heads an organization?

The vital elements in any business, after all, are three —employees, customers and stockholders—the men and women for whom the business is really run. These are the chief interests. Policies, traditions, ambitions, rules, regulations, personal privileges, all should be secondary to the loyal, helpful service of these three groups. Presidents, general managers, department heads, all executives are merely skilled men employed and authorized to carry forward these great personal interests in behalf of the many who intrust this business to their direction. They expect good stewardship and are entitled to it, freely given. It is a wise executive who sees this all clearly and keeps the thought of it ever forward in his mind. He inevitably profits in three very practical ways. His employees are more contented and therefore more efficient. His customers are more appreciative and therefore easier to sell to and to serve. His stockholders are more interested, more satisfied and therefore more responsive to new needs for capital. Good stewardship adds immeasurably to the possibilities for achievement and to the joy of living.

The Christmas Tree at the White House

AN ELECTRICALLY lighted outdoor tree has this year become a feature of the Christmas celebration at the White House. Middlebury College cut a great tree and presented it to President Coolidge as a gift from his native state. It was installed in the "White Lot" and decorated with many electric lights. Appropriate ceremonies were held on Christmas Eve, with carols by children and music by the Marine Band. The President turned on the lights. The growing popularity of the electrically lighted outdoor tree as a modern symbol of the Christmas festival thus receives new impetus that will carry to the farthest parts of the country.

This tree at the White House, with its national significance, comes as the indirect outgrowth of the original "tree of light," with its attendant ceremonies, that first marked the Christmas services in Madison Square, New York City, several years ago. The idea has since spread across the country. The suggestion for the White House tree originated with the Society for Electrical Development and was carried through by the co-operation of a number of electrical men in Washington.

The electrical industry may well feel pride in the part that it is playing—through the use of electric light and radio—in this new expression of the spirit of Christmas. It deserves the most enthusiastic support from electrical men and women in every city in order that some day the electrically lighted tree may come to stand before the world as the symbol of symbols of Christmas and all it means to young and old.

Corporate Interference with Freedom of Teaching

SOME members of the American Association of University Professors appear to be alarmed over the real or supposed interference of industrial and financial corporations with the freedom of teaching. Influence, mostly in the form of suggestions, they claim, has been brought to bear on them in the teaching of economics, in courses on corporations and finance, public utility courses, public speaking and composition, and even in purely technical subjects involving machinery or chemical process. Why a university instructor, even one most imbued with the idea of academic freedom, should want a Chinese wall between himself and the practical side of the subject he is teaching is not quite understandable. Certainly, a corporation or industry interested in any policy has a right to keep teachers informed on the reasons for that policy and, through representatives, literature, apparatus, or in some other way, to manifest an interest in the education of young men some of whom it expects to employ.

The ELECTRICAL WORLD has little sympathy with the oversensitive teacher who sees in an innocent suggestion a big stick, even though it is possible that some overzealous representative of industry has at times not exercised much discretion in dealing with departments of applied science in our universities. Speaking of the big groups in our own industry, it is hard to imagine any attempt at coercion, for the simple reason that we need broad-minded men who can think independently and reach logical conclusions. The leaders in the electrical industry, if given their choice, are not likely to choose passive young men "stuffed" with information and policies, but independent young men trained to get all

the facts in a given case and who can analyze them carefully, draw impartial conclusions and adopt a logical course of action. Effort toward that end is a scholastic contribution and not interference.

Publishing Operating Results Stimulates Economy

IF OPERATING records of electrical generating stations could be published each year in such form as to give a real indication of station performance, there is reason to believe that operating economies would result from the spirit of rivalry that would be engendered by the published figures. In this country no really informative data are published on station operation, nor, as a matter of fact, is there much privately circulated, and the tables showing the performance of stations here and there that appear spasmodically are usually not of sufficient thoroughness to give the information necessary for exact comparison. As a general thing some important data are lacking and costs may well be questioned as to their general application.

The greatest drawback to the publication of station production data is removed when direct costs are eliminated. Costs are not essential to performance comparisons on a thermal basis, and it would seem feasible to draw up a standard form of data sheet by the use of which the desired results could be obtained. The N. E. L. A., the A. I. E. E. or the A. S. M. E. could do much in formulating a co-operative solution to this problem, for the material thus obtained would undoubtedly be of great benefit to the industry.

Only Unbalanced Circuits Introduce Appreciable Reactive Metering Errors

WITH the very large kilowatt-hour outputs of modern electrical systems, metering accuracy becomes of great economic importance. The money involved as a result of errors in metering is so large that adherence to an accuracy of at least one-half of 1 per cent is warranted on large kilowatt-hour meters, and fortunately the development of this type of meter has kept pace with the economic demands in the art of measurement. For energy measurements on any scale, meters of simplicity, reliability and accuracy are available for service.

But in that class of measurement involving "investment metering" it has been stated that there is not the same degree of development or of precision in measurement and that meters nearly all measure approximate values only and are subject to errors when the voltage or power factor varies or the circuit becomes unbalanced. Questions and statements of this character are to be expected, because this class of metering is of comparatively recent origin and requires the application of more complex electrical principles to insure accurate results. The motor or energy principle must give way to the capacity or wattless principle in many cases, and the available mechanisms become complicated and expensive.

Particularly in reactive metering does this condition hold true, and those confronted with this phase of metering problem will be very much interested in the article in this issue by Prof. A. E. Knowlton of Yale University, who is also electrical engineer of the Public Utilities Commission of Connecticut and who brings to his study a great deal of experience with metering practice. This article analyzes thoroughly the theoretical and practical limitations of the art and defines the degree of accuracy to be expected under different conditions of operation. The study shows that errors are introduced by unbalanced circuit conditions with all cross-connected metering schemes applied to usual types of meters and that inherently these errors cannot be eliminated except by a redesign of meters so as to bring the potential flux in phase with the potential.

On the other hand, the error introduced by unbalance favors the consumer, is small in magnitude and occurs only in those few commercial installations where unbalanced conditions prevail. And it is encouraging to note that the degree of accuracy required in this type of measurement, which seeks to measure values proportional to investment, is fulfilled in the general case, so that an understanding of the points indicated in the article should serve to help meter engineers adapt their meters to the special conditions that are encountered.

Short Cuts in Rural Rates Are Based on Error

CENTRAL-STATION men in several localities in the United States are courting future trouble in the formation of their rural-service rates through a failure to recognize the fact that there is not enough information available on the character of the business, nor is the business itself well enough developed, to allow the formation of a new "class of business" rate. Because the present state of the business points to the conclusion that it will be a new class and that allowances must be made for new conditions to be met, some are apparently jumping to the conclusion that existing conditions are final and are attempting to solve the rate question by short-cut methods.

It is important to differentiate between the "rural charge" as used in any of the present forms of rural-service rules and a "fixed charge" in the sense that the term is used in other rate schedules—power, for example—where there is some degree of stabilization in costs of service. In the Wisconsin rural-rate development it was recognized that the problem was largely made up of unknowns. Certain class rates established under commission rule and therefore legally adequate were available as a starting point. As a measure to be used until the problem is better understood an "excess charge" under the name of "rural charge" was added to the urban rates. The committee of the Wisconsin Utilities Association and the commission recognized the temporary nature of the rules and carefully tried to bring into the method of computation all the factors covering costs and revenue. It then provided for yearly adjustments under which the excess charge can be wiped out and the farm consumer put on the same basis as his urban neighbor if his energy use justifies the change. From this it can be seen that the rural charge in Wisconsin is purely an excess-cost charge and not what is implied in the ordinary use of the term "fixed charge." In the final development of the business the charge now used may not have any relation whatever to the fixed charge that the business will justify. On the other hand, it may be the final answer. Until the answer is known the customer is in position to receive whatever advantage his increase in business justifies and wipe out the excess cost if he can.

Almost every other effort to simplify the computation of rates has been based on the assumption that the present condition is a permanent one. The fact that the method used in Wisconsin has been to take an established rate and add an excess charge to it, which can be wiped out by increases in the use of energy, is forgotten, and the resulting short cuts tend to establish the excess charges on present conditions with no opportunity for adjustments as these developments occur.

Committees working on the subject should travel slowly and leave methods of adjustment that will keep the rates on a par with growth, be it much or little. In this connection it will be interesting to watch the rural electrification research work in Minnesota. Here the rates are based on a fixed charge covering all items of investment, maintenance and operation so far as the utility makes the investment. Energy charges are made at a low rate, and the average rate becomes what the customer's use of energy makes it. While computations like these or like those employed in the Wisconsin method may be cumbersome, they have the merit of showing up the conditions as they are and leave no chance for self-deception. They do not encourage slipshod guesswork or the building of poor and improper rate schedules, such as have already characterized some rural-line developments, to be a bugbear to the industry in the future.

Arizona Still Spikes Colorado River Projects

THE sovereign state of Arizona has become ambitious. Not that ambition is unpraiseworthy; but Arizona is animated by the kind of ambition that Wolsey charged Cromwell to fling away and for which Brutus slew Cæsar—an ambition which upon analysis proves to be covetousness. The Colorado River is rich in potential water power, and by the gift of nature some of the finest water-power sites are in the canyons of Arizona. Hence Arizoná, with an eye single to her own advantage, seeks to exact tribute on all Colorado River power developments within her borders. That is the reason why she refuses to sign the seven-state treaty proposed by Herbert Hoover and ratified by all the other states through which the Colorado and its tributaries flow.

State development of water power by Arizona as suggested by her Governor is merely a gesture. Any one development would cost more millions than Arizona can raise, and where Arizona expects to get the money her Governor does not say; nor does he say where she expects to sell the electricity, granted it is ever generated. Nor does it reflect any credit on commission regulation to have Governor Hunt intimate that the entire cost of development be saddled on the users of power, when flood control and irrigation are such important features. Covetousness, however, cannot prevail, although it will serve to delay development in the lower states of the Colorado Valley. Had private enterprise, under the law, been permitted to carry out its plans, work on at least two major developments would now be under way, even though it might involve $150,000,000. Since political interference, however, has asserted itself, another decade will probably pass before the canyons of Arizona echo and re-echo the sound of the air drill and explosives.

Capacity Factor Is a Measure of Utilization of Capital

THE analyses of turbo-generator service records which have been presented by the prime movers committee of the National Electric Light Association in recent years, and which it is hoped will be continued in the future reports, are very enlightening regarding the extent of useful service obtained from different installations in this country, but more important still is the use a company can make of its own equipment, since a unit may be operated at less than its rated load or may be held off the line entirely for a considerable period of each year at certain times during the day. According to some records which have been made of capacity factor (that is, the ratio of actual kilowatt-hours developed by each unit to the total that could be developed if the unit were in operation all the while), it is only 30 to 40 per cent on the average. This indicates a relatively small use of capital investment. Of course, the capacity factor is influenced by the load factor of the plant and by the amount of reserve capacity carried for emergencies, but it is also dependent to a great extent upon obsolescence of equipment. In fact, out of 268 units observed in this country only five are seventeen years old, all of the others having replaced older units because they were more modern and more economical.

When it is considered how much turbo-generators with condensers and auxiliaries cost, most companies will not have to be told how important it is to have records of the extent to which this investment is being used. Some companies are already keeping them as a guide to operation, and blank records which the N. E. L. A. prime movers committee has sent to various companies for filling in should stimulate more extensive compilation of these data. It is to be hoped that every company will co-operate with the committee in this laudable undertaking. Such a record is not difficult to keep where kilowatt-hour meters are connected with each generator. The yearly or monthly kilowatt-hour output of each machine can be divided by the energy which it could develop if operated continuously at full load throughout the entire period. Many such records are kept, but unfortunately some of them are not interpreted. When they are the chief engineer will be in a better position to ascertain why the units are not being used to a fuller degree. If they are being held off the line because they are obsolete and uneconomical, it may pay to ascertain whether they can be disposed of at a desirable price before they lose all save junk value. In some cases, however, it may be that their availability for emergencies is worth more than the price which could be obtained for them. Sometimes it is even possible to modify them, to adapt them to new operating conditions. If obsolescence is not the cause of their low capacity factor, this is probably due to the low load factor of the station. In this case it is a problem either for the commercial department to improve the load or for the engineering department to divide the load differently so that maximum capital utilization consistent with reliable service can be obtained.

In any event, a greater consideration of the use factor of expensive equipment like turbo-generators is advisable, and easily kept records will serve as a very excellent guide for increasing the utilization of the capital represented.

Amsteg Station Supplies Gotthard Railway

DURING the summer the Amsteg station supplies energy for the railway while the Ritom station on the Italian side lies idle. In winter the Ritom station will be used and the Amsteg station will be idle. This is an example of the diversity to be found on two sides of a high chain of mountains which makes interconnection profitable and convenient. Two Pelton waterwheels, with a combined rating of 13,600 hp., drive each of the ten generators to be installed in the Amsteg station. The head is 725 feet and the speed of the waterwheels 333 r.p.m. When not used for traction purposes the Amsteg station output will be used on the lines of the Swiss Power Transmission Company for industrial purposes.

Tests on Accuracy of Reactive Metering

The Method of Metering and the Degree of Unbalance of Voltages and Currents Enter Into the Question—Analytical Study and Experimental Results

By ARCHER E. KNOWLTON
Assistant Professor of Electrical Engineering, Yale University

> THE subject of reactive metering is important in connection with the commercial application of demand and power-factor clauses. The experimental and theoretical analyses of Professor Knowlton as given in this article should clearly indicate the possibilities, limitations and accuracy of present methods of reactive metering.—*Editors.*

REACTIVE metering has assumed its place in the field of electrical measurements only because the previous metering of energy did not permit the power service to be vended at a rate commensurate with the cost of rendering it. Reactive metering aims to recover in an equitable way for the cost of plant capacity devoted to a given service as well as for the costs associated with generating the kilowatt-hours consumed. Much progress has been made in convincing power users that it is equally appropriate to be charged for the power they take from the line and *retain* and for the power they take during one portion of the cycle and *return* during some other portion of the cycle. They have derived benefit from the "borrowed" power by way of excitation in transformers, induction motors, etc., and are persuaded to pay accordingly.

Loads of abnormal power factor are primarily the ones necessitating reactive metering, and not infrequently these loads become unbalanced as to line currents or phase voltages or both. It is important, therefore, to determine the degree of inaccuracy, if any, that may result in the various types of reactive metering when conditions of unbalance occur. Some reactive metering schemes are seriously in error when ordinary unbalance occurs; others are of sufficient accuracy to be commercially acceptable even with a large degree of unbalance. It will be seen from the tests and analysis that the degree of accuracy is dependent on the relation between the current and voltage unbalance. Unbalance is hardly a desirable condition; it would therefore be viewed as fortunate if any error of reactive metering, and therefore of power factor, proved to be in such a direction as to penalize the power user who occasioned the unbalance. It would also appear to be equitable if the error resulted in an apparent power factor better than the actual power factor of the customer whose load is of such a nature as to neutralize in part the voltage unbalance occasioned by the loads of other customers. This will be found to be the case with certain of the tests here reported. (See the fifteenth to twentieth sets of readings in Table II.)

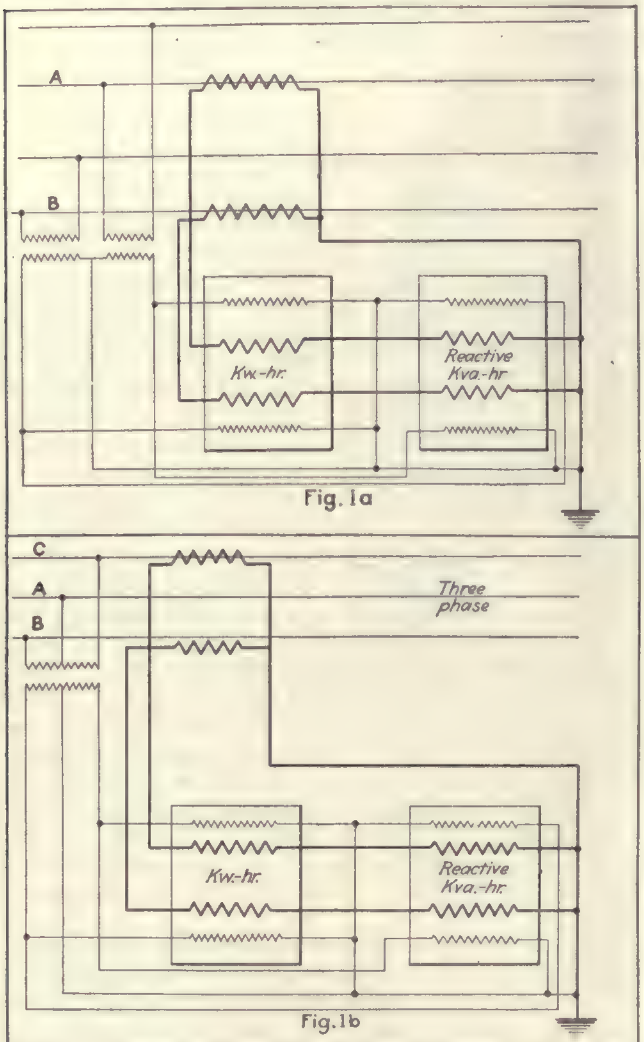
Another fortunate aspect of the situation is that the errors are relatively small with ordinarily existing conditions of unbalance; also that the errors in the more common schemes exist only when both current and voltage are unbalanced at the same time.

TABLE I—ERRORS IN METERING REACTIVE COMPONENTS

(Method (*b*), potentials interchanged), connections as in Fig. 1 (*b*)

	Load Connected Between — CA Kva.	CA P.F.	BC Kva.	BC P.F.	AB Kva.	AB P.F.	Total Kw.	Total Reactive Component — True	Indicated A	Indicated C	Indicated Total	Error, per Cent	Total Kva. — True	Indicated	Error, per Cent	Power Factor — True	Indicated	Error, per Cent
Balanced non-inductive	100	100	100	100	100	100	300	0	0	0	0	0	300	300	0	100	100	0
Two-phase non-inductive	100	100	0	...	100	100	200	0	43.3	—43.3	0	0	200	200	0	100	100	0
	0	...	100	100	100	100	200	0	0	43.3	43.3	00	200	204	2	100	97.8 lg	—2.2
	100	100	100	100	0	0	200	0	43.3	0	43.3	00	200	204	2	100	91.7 ld	—8.3
Single-phase non-inductive	0	...	0	...	100	100	100	0	43.3	0	43.3	00	100	109	9	100	91.7 lg	—8.3
	100	100	0	...	0	...	100	0	0	—43.3	—43.3	00	100	109	9	100	91.7 ld	—8.3
	0	...	100	100	0	...	100	0	.....	......	......	0	100	100	0	100	100	0
Balanced inductive	100	50	100	50	100	50	150	259.8	129.9	129.9	259.8	0	300	300	0	50	50	0
Two-phase inductive	100	50	0	...	100	50	100	173.2	86.6	43.3	129.9	—25	200	164	—18	50	61	22
	0	...	100	50	100	50	100	173.2	129.9	86.6	216.5	25	200	238	19	50	42	—16
	100	50	100	50	0	...	100	173.2	43.3	129.9	173.2	0	200	200	0	50	50	0
Single-phase inductive	0	...	0	...	100	50	50	86.6	86.6	0	86.6	0	100	100	0	50	50	0
	100	50	0	...	0	0	50	86.6	0	43.3	43.3	—50	100	66	—34	50	75.6	51.2
	0	...	100	50	0	0	50	86.6	43.3	86.6	129.9	50	100	139	39	50	35.9	—28.2
Mixed	100	100	100	50	100	100	250	86.6	86.6	43.3	129.9	50	265	282	6	94.5	88.7	—6.1
	100	50	100	100	100	100	250	86.6	0	86.6	86.6	0	265	265	0	94.5	94.5	0
	100	100	100	100	100	50	250	86.6	43.3	0	43.3	—50	265	253	1	94.5	98.7	4.5
Mixed	100	50	100	50	100	100	200	173.2	86.6	129.9	216.5	25	265	295	11	75.6	67.9	—10
	100	100	100	50	100	50	200	173.2	129.9	43.3	173.2	0	265	265	0	75.6	75.6	0
	100	50	100	100	100	50	200	173.2	43.3	86.6	129.9	—25	265	238	—10	75.6	83.9	11

The subject of reactive metering has been discussed to a considerable extent in the ELECTRICAL WORLD and elsewhere, and several different schemes are in common use. One of the schemes which is not in common use avoids the error mentioned by employing a watt-hour meter that has been modified in its potential circuit so as to bring the potential flux into phase with the potential (a power meter is regularly lagged so as to bring the potential flux into quadrature with the potential). A meter so modified or designed will experience no torque when potential and current are in phase (100 per cent power factor) because there will then be no time-phase difference of fluxes in current and potential poles of the meter. It will, as it should, indicate zero reactive component. With the other extreme of zero power factor it will experience torque and register only the reactive component. This scheme of reactive metering has not come into extensive use largely because the other schemes employ standard watt-hour meters without modification, and this is considered essential, partly to simplify meter administration and partly to avoid an unfavorable effect on the consumer. This type of reactive metering has the additional advantage that it is independent of the phase rotation; the reactive meter will not register negatively if two of the service leads happen to become interchanged.



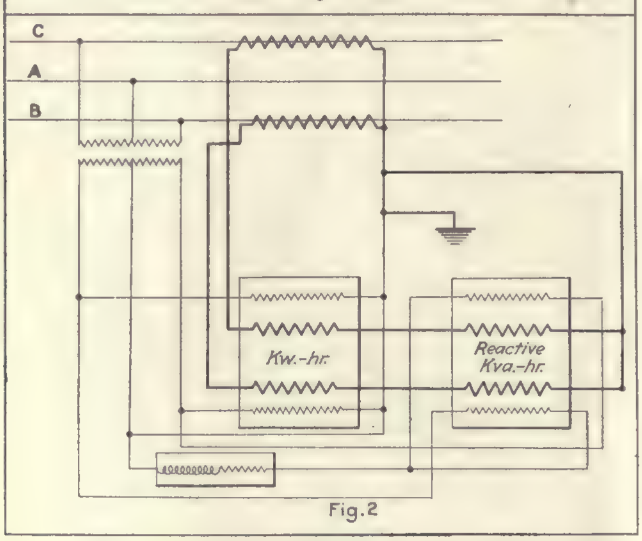


FIG. 1 (A) AND (B)—SPECIAL CONNECTIONS AND THEIR ERRORS

(a) With this connection an error occurs if both the currents and the voltages are unbalanced. (b) A two-element meter with connections so as to interchange phases produces errors when either currents or voltage are unbalanced.

FIG. 2—ARTIFICIAL NEUTRAL REQUIRES A SPECIAL METER

In addition to normal unbalance errors a serious error is introduced if the neutral is displaced because of differences in the three star impedances.

TABLE II—METER TORQUES
(Determined from vector diagrams shown in Figs. 8 and 9)

		Watt-Hour Meter			Reactive Meter		
Element	System	Voltage	Current	Torque	Voltage	Current	Torque
Upper	Positive	${}_pE_{ba}$	${}_pI_b$	+	M	${}_pI_b$	—
Upper	Negative	${}_nE_{ba}$	${}_nI_b$	—	${}_nM'_b$	I	+
Lower	Positive	${}_pE_{ca}$	${}_pI_c$	+	N	${}_pI_c$	+
Lower	Negative	${}_nE_{ca}$	${}_nI_c$	—	N'	${}_nI_c$	+
Combined	Positive			+			+
Combined	Negative			—			+
Resultant	Both			+			+

This discussion is not intended to apply so much to two-phase as to three-phase conditions, but for the sake of a measure of completeness in classification one common two-phase scheme will be included.

INDIVIDUAL METHODS OUTLINED

(a) *Two-Phase, Phases Interchanged.*—An ordinary two-element polyphase watt-hour meter will integrate the reactive component if connected with a current coil of each element in each phase but with potential impressed on each element from the other phase than that from which the current was taken. If the phase voltages are equal and in quadrature, the registration is correct for any power factor or for any degree of current unbalance between phases. If both currents and voltages are unbalanced (or if phase voltages are not in quadrature) there will be an error of the same sort as will be demonstrated for three-phase schemes. The connections are shown in Fig. 1a.

(b) *Three-Phase, Two-Element Meter, Phases Interchanged.*—This is the three-phase equivalent of the above. The two current coils are connected respectively into two line wires and then the potential coil of each element is connected across the two line wires not connected to the current coil of that element (Fig. 1b).

Definite polarities must be observed, and these can be verified by test. Each element should run forward when the load is known to be inductive. It should be noted, however, that the relative polarities of the elements will be correct when the service side of one potential coil and the load side of the other are connected to that line wire not connected to either current coil.

This method is correct when voltages and currents

are strictly balanced; it is inherently incorrect when both are unbalanced and even when only currents or only voltages are unbalanced. In this respect it is more to be avoided than several of the other "cross-connected" schemes. The errors may be quite serious even with ordinary conditions of unbalance—it even makes a difference in registration whether a single-phase load comes on in such a way as to have that current pass through both or but one of the current elements. To show the extent to which this simple but unreliable scheme may be in error, the true and apparent reactive component, power factor and total kva. have been computed for several combinations of non-inductive load and inductive load (Table I). It is evident that this scheme is unreliable to an extent that should materially restrict its application.

(c) *Two-Element Meter, Artificial Neutral.*—The potential coils in this scheme have voltages impressed upon them from a star connection built up of the two potential coils and a supplementary coil identical with them in impedance and power factor. The cross-phase connections are shown in Fig. 2.

The star voltage is only 63.6 when the line voltage is 110, and therefore a special watt-hour meter must be employed unless the voltage applied to the meters is boosted to 110 by auto-transformers or two-coil transformers.

This method is subject to the inherent error coming from cross-phase connections, but an additional adverse factor is the fact that even a slight displacement of the neutral arising from slight discrepancies among the three star impedances will result in a relatively large error in registration. The displacement of the neutral may be minimized by using two-coil transformers and connecting their secondaries in delta for application to the meter potential elements.

USING PHASING TRANSFORMERS

(d) *Two-Element Meter.*—Middle taps on two open-delta-connected potential transformers will make possible the application to the watt-hour meter (which is to be employed as a reactive meter) of potentials in quadrature with those applied to the corresponding elements of the power meter. Auto-transformers can be employed as in Fig. 3 to bring the voltage to the normal rated value for the meter. This method has the same inherent error under unbalanced conditions as all the other cross-connected schemes.

To exhibit the degree of this error readings of various types of load were taken in the laboratory. The input in watts and volt-amperes was measured by single-phase instruments on each of the controlled single-phase loads; also by a polyphase wattmeter and a polyphase reactive meter connected in the three-phase line according to the open-delta potential connection of

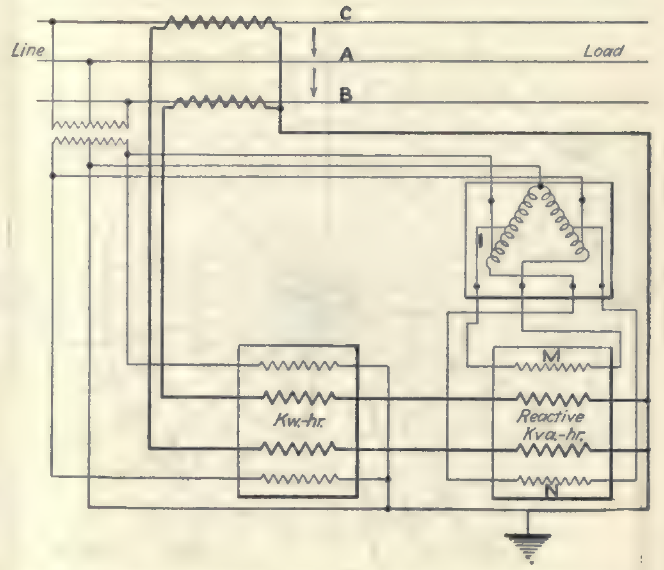


FIG. 3—PHASING TRANSFORMER PRODUCES ERROR

The use of phasing transformers introduces the same error as is inherent in all cross-connected schemes under unbalanced conditions.

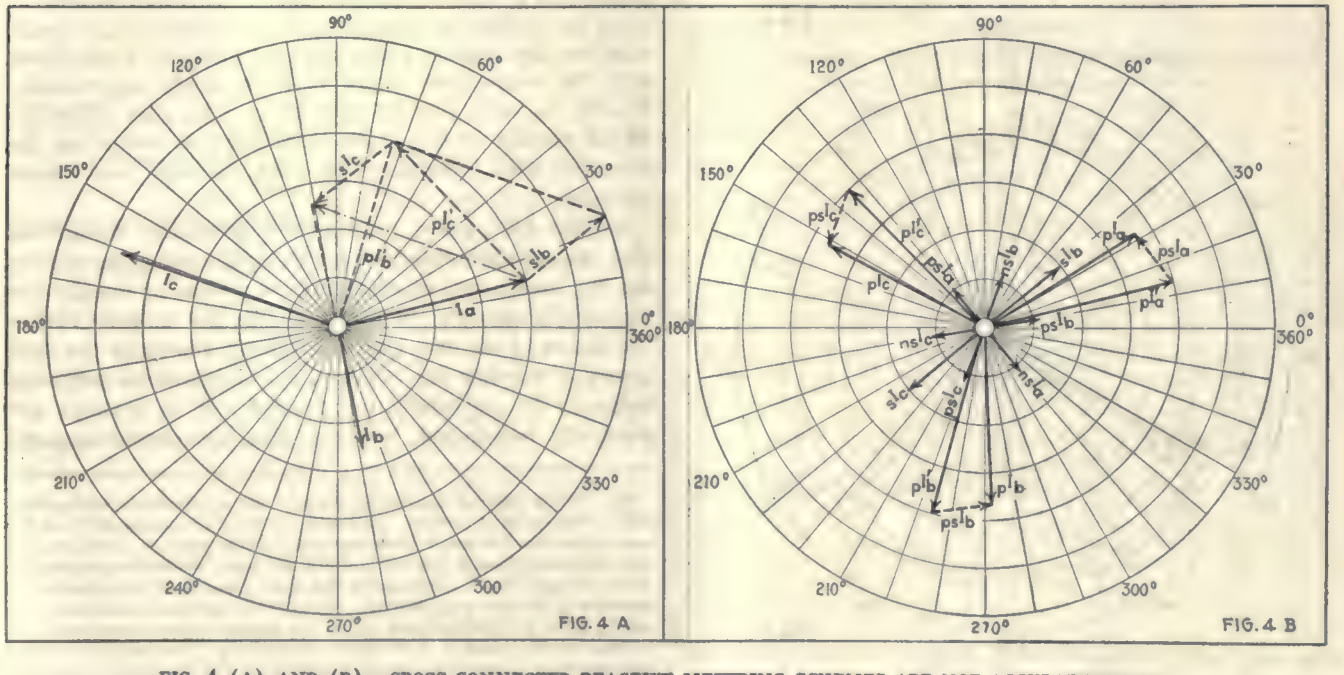
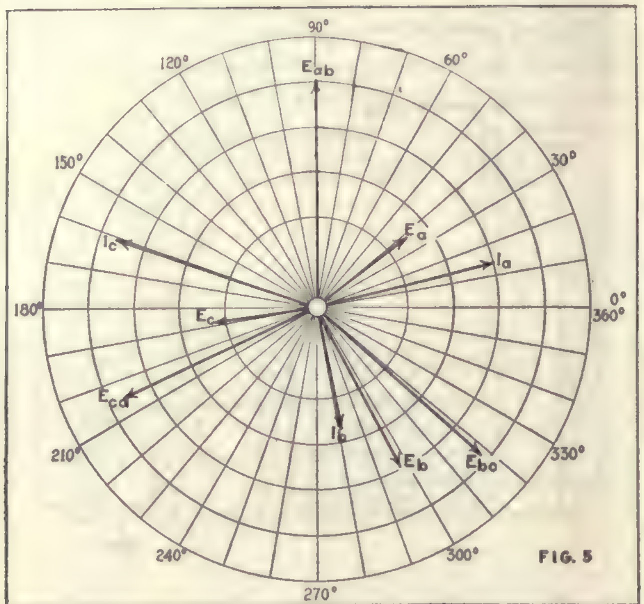
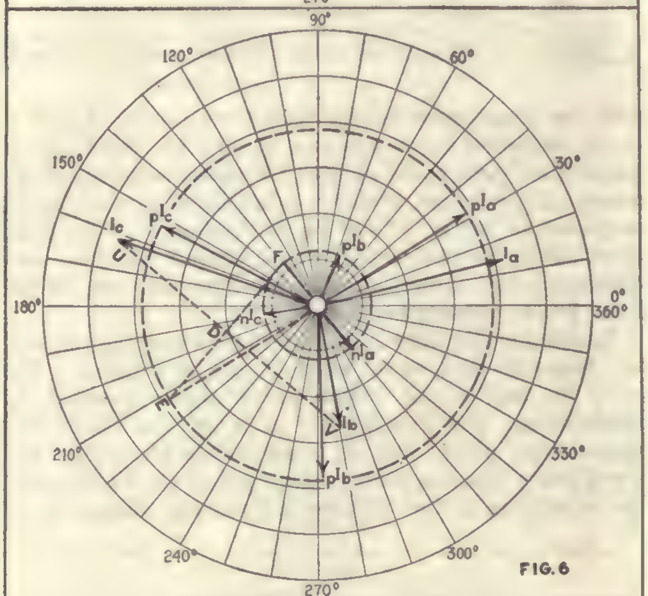
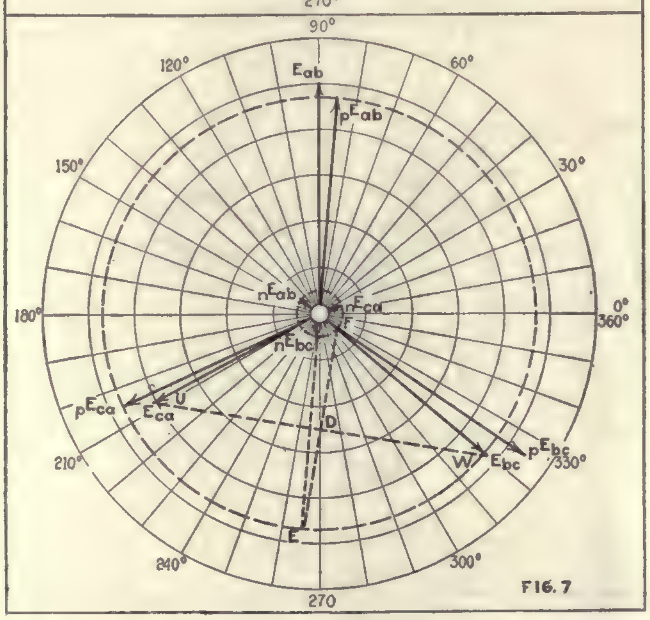


FIG. 4 (A) AND (B)—CROSS-CONNECTED REACTIVE METERING SCHEMES ARE NOT ACCURATE UNDER UNBALANCED CONDITIONS

(a) Vector analysis by resolving an unbalanced three-phase system into a balanced three-phase group of positive sequence and a single-phase current, after which (b) the single-phase current is resolved into two balanced systems of opposite phase sequence, and these are then added to form a single positive balanced system.







FIGS. 5, 6 AND 7—RESOLUTION OF UNBALANCED THREE-PHASE SYSTEM BY PHASE-SEQUENCE METHOD DEVELOPED BY FORTESCUE

method (d), Fig. 3. The experimentally determined error differs slightly from the computed error because of slight meter errors and uncompensated losses in meters. The artificially imposed voltage unbalance, it will be noticed, in certain cases was made to agree in direction with what would result from line and winding impedances subjected to the unbalanced currents.

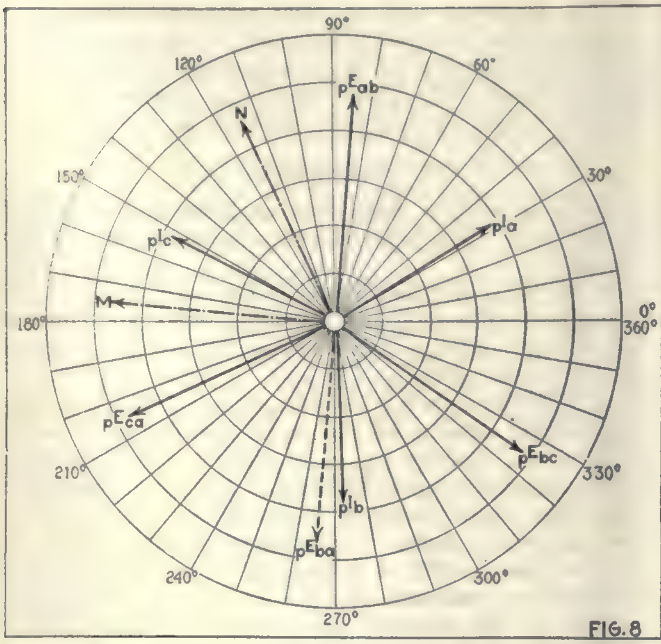
(e) *Three-Meter Elements, Delta Connection.*—Three single-phase meters or a three-element, three-phase meter may be used in a scheme similar to (b) and at the same time materially improve the reliability. Each element has applied to it a potential taken from two wires and its current from the third. The load side of one potential coil should be connected to the line side of the next, thus forming a closed delta, in order that the relative polarity of the elements shall be correct. Under certain conditions (unbalanced load of high power factor) one or more of the meters will be inclined to rotate backward. The registration of those meters will be short, because the light load compensation will work to add to the friction as a disk load instead of compensating for that friction. A three-element polyphase meter will obviate that difficulty. The elements as a whole will overregister the reactive component to an extent that requires the introduction of the multiplier 0.577. After this multiplier has been applied the registration will still be in error on unbalanced loads because that error is inherent with cross-connected schemes.

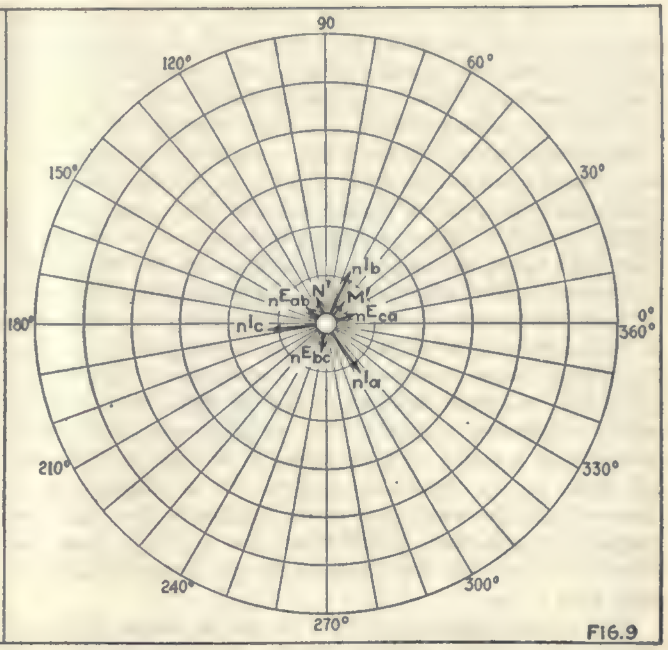
PHASE SEQUENCE MUST BE CONSIDERED

All of the above methods require that phase sequence be taken into account in making connections. The reason is, of course, that if the meter is to register "forward" instead of "backward" on an inductive load, the potential applied to it must lag 90 deg. from that applied to the corresponding element of a power meter. If the load is of a condensive character, "forward" registration would result only in case the applied potential is advanced 90 deg. in phase ahead of that applied to a power-meter element. In other words, it must be decided at the time the connections are made whether the load is primarily inductive or condensive, and the connections must then be made accordingly. It will be seen shortly that it is this very situation which results in the error mentioned as occurring inherently with unbalance of load currents and phase voltages.

In the first place, it is pretty generally recognized that the common standard methods of connecting meters for the measurement of polyphase power or energy are technically correct; in other words, the meter (within the limits of its own characteristics) registers the true quantity whether the voltages and currents are perfectly balanced or materially unbalanced. It is perhaps not generally recognized, however, that the cross-connected

Fig. 5—The assumed unbalanced system. Fig. 6—Resolution of currents. Fig. 7—Resolution of voltages. Following the current resolution in Fig. 6, the construction is as follows: Find the centroids (centers of gravity) E and F of the two equilateral triangles constructed on UV as a base. With O as a center draw circles through E and F. The positive sequence component of Ia is found as the extension of EO and is marked pI_a. The positive sequence components of I_b and I_c follow as shown (pI_b and pI_c). The negative sequence compont of I_a is found as the extension of FO and is marked nI_a. The negative sequence components of I_b and I_c are symmetrically placed with respect to nI_a, but the cyclic order is opposite to that of the assumed system of unbalanced currents o which they are components. It is readily seen that pI_a and nI_a combine to give the original I_a, and likewise for the components of I_b and I_c.





FIGS. 8 AND 9—VECTOR ANALYSIS FOR OBTAINING BASIS FOR TABLE II

Fig. 8—Positive-sequence components of system illustrated inFig. 5 are obtained from Figs. 6 and 7, while in Fig. 9 the negative-sequence components are assembled.

reactive metering schemes are not similarly precise under conditions of unbalance. In analyzing this difference between power metering and reactive metering it is in many respects advantageous to resort to the principle that a system of unbalanced three-phase quantities can be resolved into two independent balanced systems which are of opposite phase sequence. One way of visualizing this principle is to assume such an unbalanced system of currents, separate them into a balanced three-phase group of positive sequence and a single-phase current; next resolve the single-phase current into two equal systems of balanced currents of opposite phase sequence; next add the two resulting positive balanced systems to form a single positive balanced system. The final result is therefore a positive and a negative system, each balanced. This process has been carried out in Fig. 4, where each step may be distinguished. The same system of currents is dealt with by another method of analysis, and the results will be seen to be the same. (Fig. 4 A and B.)

There is a method developed by Fortescue (see *A. I. E. E. Transactions*, 1918, page 1,114) which is more direct if less obvious, and this is employed in Figs. 5, 6 and 7 to demonstrate the errors cited.

TABLE III—EXPERIMENTAL DETERMINATION OF ERRORS IN METHOD (*d*)

(Using phasing transformers with connections as in Fig. 3.)

	Single-Phase Loads															
	CA			AB			BC									
Type of Load	*E*	*I*	*W*	*E*	*I*	*W*	*E*	*I*	*W*	Total Watts	Total Volt-Amperes	Reactive Volt-Amperes	Polyphase Wattmeter Reading	Reactive Meter Reading	True Power Factor	Apparent Power Factor
Balanced non-inductive	99.7	3.74	374	107.9	3.85	410	101.1	3.93	395	1,179	1,190	...	1,192	2	100	100
Two-phase non-inductive	100.0	3.75	374	108.7	0	0	101.1	3.93	395	769	772	...	782	—5	100	100
	99.5	3.74	372	108.2	3.85	413	102.5	0	0	785	[illegible]	...	794	40	100	99.9
	100.8	0	0	108.0	3.84	412	101.8	3.95	400	812	817	...	824	—21	100	100
Single-phase non-inductive	99.3	3.72	369	112.9	0	0	109.8	0	0	369	369	...	370	13	100	99.9
	101.0	0	0	112.7	0	0	108.8	4.20	457	457	457	...	458	—50	100	99.4 ldg
	109.7	0	0	112.0	3.98	442	110.0	0	0	442	446	...	442	40	100	99.6
Balanced inductive	110.5	2.87	175	110.9	2.80	165	110.6	2.94	165	505	953	810	505	811	53.0	52.5
Two-phase inductive	100.0	2.60	144	109.7	0	0	102.5	2.72	143	287	539	456	283	480	53.2	50.8
	100.5	2.62	146	108.6	2.75	159	102.8	0	0	305	562	472	303	482	54.3	53.2
	101.0	0	0	109.3	2.75	162	102.0	2.70	140	302	575	489	303	467	52.4	54.4
Single-phase inductive	100.7	2.63	146	113.4	0	0	111.0	0	0	146	265	221	143	260	55.2	48.1
	100.7	0	0	113.9	0	0	109.8	2.91	160	160	320	277	162	243	50.0	55.5
	101.4	0	0	112.5	2.85	169	110.0	0	0	169	321	273	166	261	52.6	53.7
Single-phase inductive	100.7	2.63	1.46	113.4	0	0	111.0	0	0	146	265	221	143	[illegible]	55.2	48.1
	110.5	0	0	100.3	2.56	138	113.0	0	0	138	257	217	141	252	53.7	48.8
	10.85	0	0	107.4	0	0	99.5	2.65	135	135	264	227	127	253	51.1	44.9
Two-phase inductive	100.2	260	144	109.7	0	0	102.5	2.72	143	287	539	456	283	480	53.2	50.8
	102.3	2.67	151	101.4	2.91	194	113.0	0	0	345	[illegible]	451	345	488	60.[illegible]	57.7
	109.5	0	0	102.3	2.94	202	100.3	2.66	137	339	568	456	333	460	59.7	58.6
Single-phase non-inductive	99.3	3.72	369	112.9	0	0	108.8	0	0	369	369	...	370	13	100	99.9
	109.0	0	0	108.9	0	0	98.5	3.42	337	337	337	...	333	0	100	100
	109.5	0	0	98.2	3.53	346	110.5	0	0	346	346	...	343	0	100	100
Two-phase non-inductive	100.0	3.75	374	108.7	0	0	101.1	3.93	395	772	772	...	782	—5	100	100
	101.4	2.93	297	99.9	3.57	355	100.9	0	0	657	657	...	656	0	100	100
	109.0	0	0	101.1	3.59	363	100.5	3.48	350	713	713	...	717	0	100	100
Single-phase non-inductive 25 per cent unbalance	.....	....	....	.....	....	....	.....	....	....	....	279	...	279	12	100	99.9
	108.9	0	0	87.7	3.18	276	113.0	0	0	276	426	...	424	75	100	98.5
	110.1	0	0	89.5	0	0	111.5	3.82	425	425	.....	...	.....	....	.....	....

The next ruling principle is that in the metering elements only the positive system of voltages reacts with the positive system of currents to produce meter torque and only the negative systems react with one another; in other words, a negative-sequence current component does not react with a positive-sequence voltage component to produce torque in either the watt-hour-meter element or in the reactive-volt-ampere-hour-meter element. The resultant torque in one of these elements is, of course, the algebraic sum of the torque produced by the two systems of opposite phase sequence. It is the point of this paper to emphasize the fact that it is inherent in all of the methods aiming so to connect watt-hour meter elements by "cross-phase" taps as to integrate reactive-volt-ampere-hours that *the reactive meter elements register the negative-sequence components in a sense directly opposite to the registration of them in the watt-hour meter.* If in integrating a proper total the watt-hour meter subtracts the negative-sequence component power from the positive, then the reactive meter will add them to the positive components, and vice versa.

The simple reason for this is that a phase displacement which takes place in such a direction as to be a lead for the positive-sequence system will inherently be a lag for the negative-sequence system. In metering the reactive component of an inductive load the potentials applied to the meter will have to lag behind those applied to the corresponding element of the power meter. This lag is, of course, referred to the original system, and this system was conventionally called a positive-sequence system. But the unbalance, if any, can be attributed to a negative-sequence component and what was lag for the positive will be lead for the negative. The very meter which was installed to register the lagging component will therefore tend to record it in the wrong sense. The negative-sequence component, incidentally, can be taken as the measure of the unbalance.

Assemble in one diagram (Fig. 8) the positive-sequence components of the originally assumed unbalanced system of voltages and the corresponding positive-sequence current components, from Figs. 6 and 7 respectively; and assemble in a second diagram (Fig. 9) the negative-sequence current and voltage components.

If the voltage p^Ea and current p^Ia are applied to the upper element of the watt-hour meter, and also if the connections of Fig. 3 are employed for the reactive meter, then voltage and current for the upper element of the reactive meter will be M and p^Ia respectively; for the lower reactive element they will be N and p^Ib, respectively. The corresponding negative-sequence components of these quantities will produce total torque in the watt-hour meter in the direction opposite to the positives; in the reactive meter, however, the negative-sequence components of currents and voltages will react to produce total torque the same in direction as that produced by the positive-sequence components. The signs of these torques have been determined from the vector diagrams (Figs. 8 and 9) and arranged in Table II. The registration of the reactive meter is, therefore, in error to an extent determined by twice the magnitude of the torque of the negative-sequence components.

In this case the true power is the algebraic sum (and arithmetical difference) of the powers in the two systems. The true reactive component should similarly be the algebraic sum of (and arithmetical difference between) the reactive components in the two systems, but it is registered by the reactive meter as the arithmetical sum. The power factor in this case is thus made to appear poorer than it really is.

CONCLUSIONS

In view of the foregoing analysis and results it would seem that the following conclusions are supported:

1. If freedom from error is the only factor to be considered, then for loads that will remain well balanced as to both currents and voltages any of the methods outlined will suffice.

2. If either currents or voltages are likely to become appreciably unbalanced, the mere interchange of potentials at the reactive meter results in errors too great to be tolerated in most instances. Even the errors with the other cross-connected schemes may be prohibitive for important loads. Any method which obtains the desired phase shift of potential flux by adjustment of conductance, reactance and condensance in the potential circuit of the reactive meter element rather than by admixture of line potentials will avoid the error.

3. If, however, the cost of meters, the cost of meter administration and the proficiency of metermen in installing, reading and testing meters are to be given due consideration along with the accuracy of registration, there is a question whether any—except method (b)—of the methods outlined can be wholly condemned as too inaccurate for use with the majority of loads.

4. The situation seems to point to the desirability of developing a reactive metering scheme which will be more generally precise for large and important loads than those now commonly employed.

Coal Handling at Zilwaukee

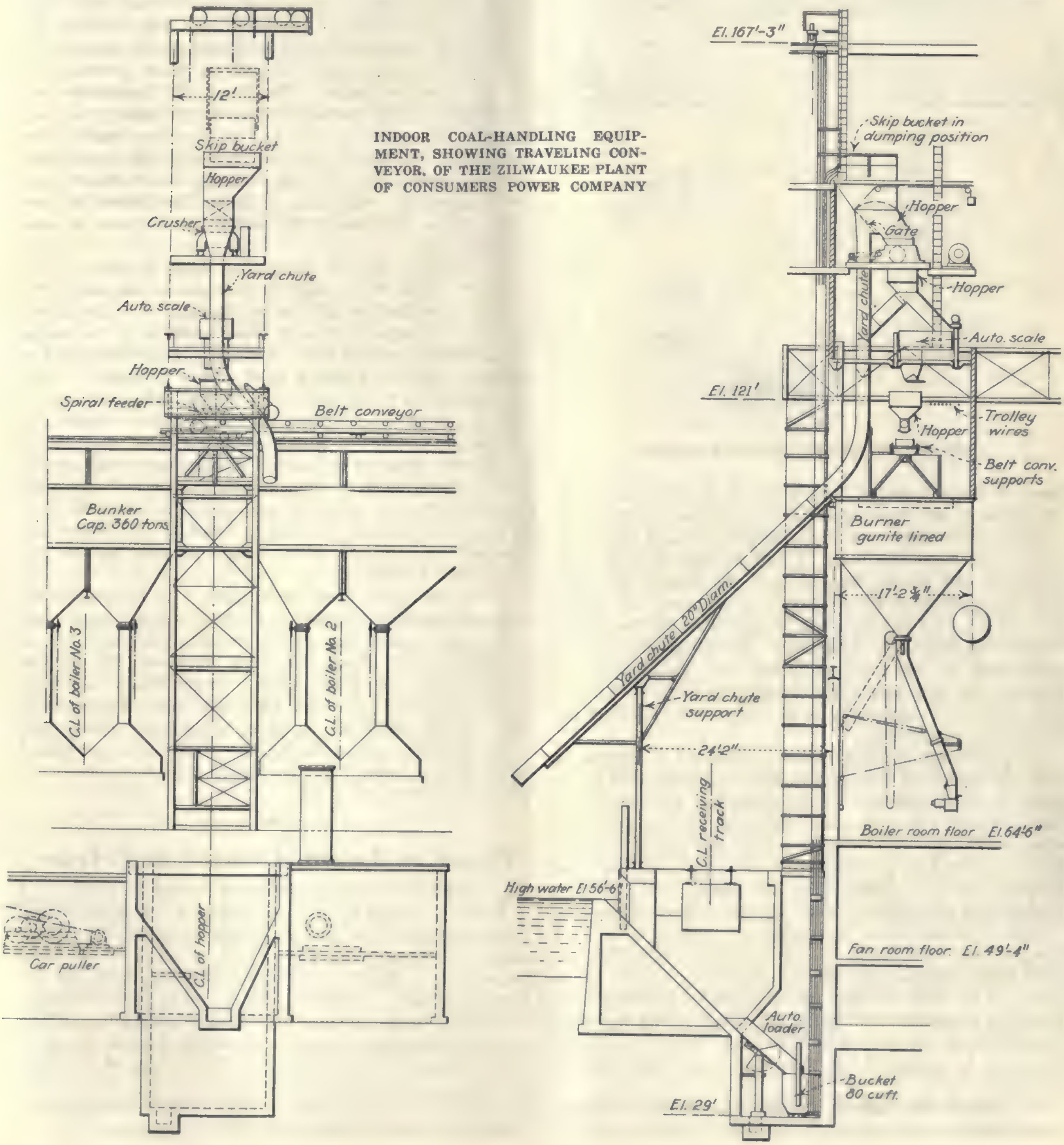
Avoidance of Great Investment and Costly Attendance Governed the Selection and Arrangement of Coal-Handling Equipment

BY H. F. EDDY
Mechanical Engineer Consumers' Power Company, Jackson, Mich.

A RATHER unusual system for handling coal and ash has been employed by the Consumers' Power Company in its new Zilwaukee steam generating station on the Saginaw River. The design was influenced chiefly by the desire to handle all coal during the daytime, including coal for storage, and by the fact that there are large areas on the property to be filled which can be utilized for disposal of ashes for several years to come. All of the equipment was selected with a view to minimizing the amount of labor required and to insure reliable continuous operation without great investment or skilled operators to run complicated machinery.

Coal is received in drop-bottom cars on an elevated track next to the boiler room and is dropped through the trestle into a concrete pit, which delivers its contents to a skip bucket loader that fills automatically. This loader elevates the coal 125 ft. in an 80-cu.ft. bucket to a hopper, from which coal can be delivered either to the overhead bunkers through a coal crusher and an automatic scale or to a spout that leads to the yard storage system. From the crusher the coal can

be delivered to the automatic scale or to the yard storage spout. The scale is intended to weigh only coal that is to be delivered to the coal bunkers so that coal intended for yard storage can be crushed and delivered to yard storage, or if crushed when received, it can be delivered to yard storage without passing through the crusher. From the automatic scale coal is delivered to a shuttle-belt conveyor set directly over the coal bunkers. This belt is mounted on a steel frame, which in turn is supported on flanged rollers running on rails over the boiler house. The length of the belt is about one-half that of the boiler house. The scale, which is of the automatic drop type, delivers 1,000 lb. per drop, so that in order to give the shuttle belt an even feed, an automatic feeder is interposed between the automatic scale and the shuttle belt. This feeder consists of a screw conveyor with steep sides but with part of the bottom omitted. The belt on the shuttle conveyor and the frame supporting it are arranged to run both right-hand and left-hand from the center of the building, and coal is discharged over one end of the belt. While the coal is being discharged, the supporting frame moves from one side of the building to the other, thus moving the point of discharge of the coal. When the end of the frame that was near the end of the building reaches a point near the center of the building, it is automatically stopped. If it is desired to fill the bunkers on the opposite side of the center from that on which it was working, the direction of travel for both the belt and the frame is reversed and the operation



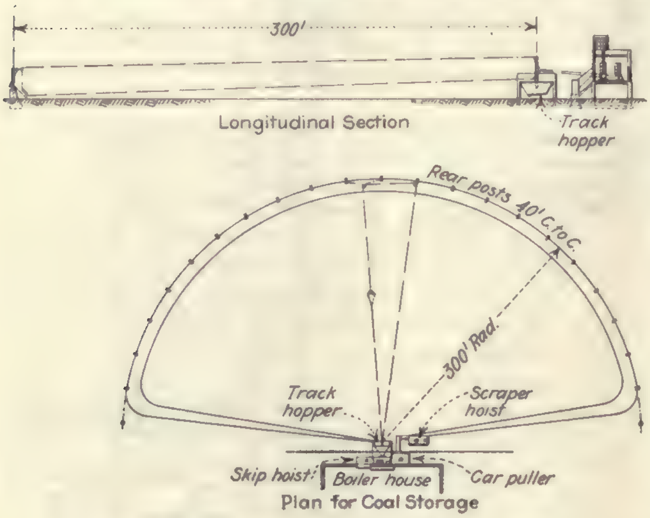
INDOOR COAL-HANDLING EQUIPMENT, SHOWING TRAVELING CONVEYOR, OF THE ZILWAUKEE PLANT OF CONSUMERS POWER COMPANY

continued as before. If desired, the shuttle belt can be set stationary over any point for filling a single bunker.

There is a coal bunker for each boiler made of steel plate tied into the building steel. These are of inverted pyramidal forms and are self-cleaning and lined with $1\frac{1}{2}$-in. Gunite on wire mesh. Each bunker has a capacity of 350 tons, and two outlets are provided for each boiler, fitted with 16-in. cast-iron rack-and-pinion gates operable from the boiler-room level.

The stoker spouts are of steel with flared ends, which facilitate the mixing of the coal before delivery to the stokers and permit the flow of the coal to be seen at all times by the boiler-room attendant. The spouts are pivoted at the top so that they may be swung out through a window in case of fire in the bunkers. The equipment is designed to handle 60 tons per hour.

The various units are electrically interlocked so that in



YARD STORAGE AND RECLAIMING FACILITIES

case of breakdown of any unit, or in case any unit should stop, all equipment that feeds coal to the unit which is shut down will stop. Sequence starting is provided. To start the plant it will be necessary first to start the belt on the shuttle, then the feeder, the scale and the crusher, if the coal is to be crushed; or, if not, to feed the coal through the proper gate in the spouting system and then to the skip. Stopping the plant is performed in the reverse order, and the control is so arranged that starting and stopping must be done in this order. A car puller is provided for handling the loaded and empty cars.

As previously pointed out, it is intended to handle all coal for the plant during the day, arrangements being made so that this can be accomplished with only two men. These men will spot and open the cars, set the shuttle belt and look after the overhead system. Push-button control is provided for the skip and overhead system and is installed near the track level, but the system can be stopped from the upper level if desired.

Coal is distributed to storage by means of a yard scraper equipped with a $\frac{3}{4}$-yd. crescent-type bucket. This yard provides storage for 35,000 tons piled 12 ft. deep. The yard scraper is also used for reclaiming coal, the reclaimed fuel being delivered to the same pit that receives the coal from the cars. The storage system will be operated by the same crew that handles the cars.

At present four 930-hp. boilers equipped with underfeed stokers and designed to operate at 540 per cent of rating are installed. When operating at this rating these boilers will require approximately 400 tons of coal per day. When four additional boilers are installed an automatic car dumper and a double skip with necessary crushers and weighing equipment may be provided. The future skips and their auxiliary equipment may feed a shuttle belt, and the present and future skips may be interconnected by a reversible belt conveyor. When the future units are installed the present skip may be used only for handling storage coal.

Clinker crushers are provided under each stoker which will break the clinkers down to about 2 in. The ash pits are made of steel frames attached to the steel girders supporting the stokers. The space between the frames is filled with concrete applied with a cement gun, and the entire inside surface of the ash pits is lined with a mixture of ground firebrick and refractory cement applied with a cement gun. The concrete inclosure is reinforced with steel bars and wire mesh, and the firebrick lining is held in place by wires set in the concrete walls. Provision for expansion and contraction of the firebrick lining is provided by leaving about $\frac{1}{2}$ in. space at each end of the long walls. The bottom of the pits is formed by heavy cast-iron gates hinged across the pits and arranged so that they can be dropped by operating a large handwheel on one side. Slots in these gates allow air to pass up into the ash pits.

To simplify the ash disposal problem a semi-circular concrete flume 3 ft. wide is provided under each row of ash pits and water forced through it when ashes are being dumped. Under these conditions the water is maintained within 6 in. of the top of the flumes. For flushing out the ashes a part of the condenser water is diverted to the flume. The flumes deliver the ashes and water to a pit at one end of the plant where two dredge pumps, one of which is a spare, raise the mixture to a point about 20 ft. above the ground level, whence it is distributed by wooden launders over the surrounding property for grading purposes. A bar grizzly is provided between the discharge end of the flume and the receiving pit on which large clinkers can be collected and broken up.

Under ordinary load conditions it is expected that the ash-handling operation in twenty-four hours will not require more than ten man-hours. Each ash pit has a capacity of about 10 tons between the clinker grinders and the dump gates. Under heavy load conditions and with poor coal, ashes will have to be dumped once during each of the three eight-hour shifts, and possibly twice on the day shift. It has been estimated that the ash-handling capacity of this system will be at least 25 tons per hour.

Power an Essential Factor in Defense

A POWER survey to determine what resources are available and by what means they can be increased when necessary for war purposes is, according to Assistant Secretary of War Davis, a work of extreme importance. Such a survey is being carried out by army engineers. Said Mr. Davis: "The part played by electricity in the great war was but an inkling of the possibilities which it can demonstrate should the need arise for another call to arms. Knowledge of the vast resources in the hands of America is one of the best arguments for peace—and it is one that a belligerently disposed country could most easily understand."

Reproduction and Investment Costs as Rate Bases*

Effe ctof Price Trends Upon Each—Reproduction Cost Cannot Be Ignored Whether Greater or Less than Investment Cost—Commissions Still Adhere to Investment as Basis of Return

By L. R. NASH
Stone & Webster, Inc., Boston, Mass.

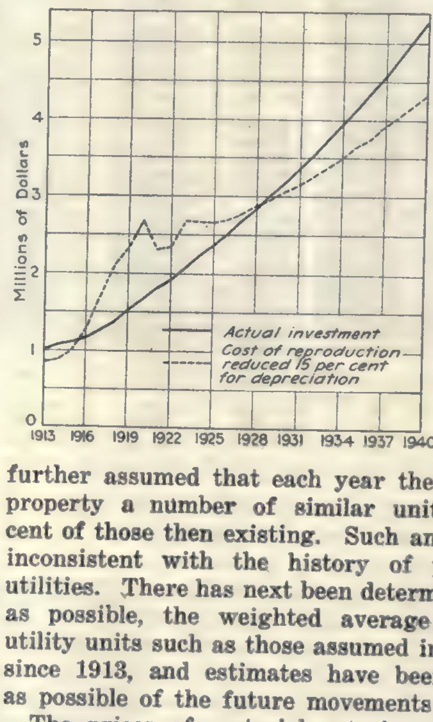
IT IS not without significance that increasing recognition is being given to the present cost of reproduction as a rate base, in view of the attitude of the courts, to which rate cases are appealed. Obviously, when seeking the protection of the courts, the methods which they adopt must be followed whether or not they appear most appropriate under existing circumstances.

In spite of the unbroken line of court decisions so far on record on this subject, it does not necessarily follow that some change with respect to public utilities may not some time be made because of special regulatory practices affecting them but not other industries subject to competitive influences. The recent Southwestern Bell Telephone case occasioned a sharp division among the justices, disclosed in a dissenting opinion which presented in an able and forceful manner the advantages of prudent investment as a rate base. Although this basis was rejected in that case and in more recent Supreme Court cases, the actual recognition given in leading cases to present cost of reproduction as compared with investment has not been wholly encouraging up to this time. In no decision of last resort has present cost of reproduction been the sole measure of value, and in many cases fair value has been so scaled down by averaging unit prices over a period of years, or by deductions for depreciation, or both, that the final finding of value has been but slightly higher than actual investment.

COMMISSIONS FAVOR PRUDENT INVESTMENT BASE

Regulatory commissions are still more strongly inclined to adhere to investment as the basis of return in rate cases. It is possible that a sufficient number of further decisions of our leading courts reversing this practice of the commissions would lead to their general adoption of the reproduction method as controlling. This process, however, would require a considerable period of years, during which, it is to be expected, there will be some decline from the present level of prices to a level much below the maximum prevailing in the post-war period, during which a large amount of public utility construction was necessary. If a few years hence construction prices have fallen to a level 50 per cent above the pre-war level, they will still be at least 33⅓ per cent below the peak prices prevailing in 1920. It is therefore conceivable that actual investment may not only approach consistency with reproduction cost, but that it may materially exceed it after a period of years. A strict adherence to cost of reproduction might, therefore, in time work to the disadvantage of at least some utilities and holders of their securities.

It is of interest to make certain assumptions as to the future level of prices affecting public utility properties and the growth of these properties to determine when, if at all, the cost-of-reproduction method will cease to yield a value higher than the actual investment. For this purpose a public utility has been assumed having, in 1913, 10,000 units of property, each with a value of $100 and, therefore, representing a total value (assumed to coincide with investment) of $1,000,000. It is further assumed that each year there is added to the property a number of similar units equal to 5 per cent of those then existing. Such an assumption is not inconsistent with the history of progressive public utilities. There has next been determined, as accurately as possible, the weighted average prices of public utility units such as those assumed in each of the years since 1913, and estimates have been made as closely as possible of the future movements of these prices.



The prices of material entering into public utility properties are now substantially higher than the average of all commodities. While the reasons for the discrepancy will in part continue, it is to be expected that there will be some tendency toward greater consistency within the next few years, after which, it is assumed, a decline in public utility and other prices will continue at about the same rate as the increase which occurred during the period from 1896 to 1913 and the decrease during the preceding period, which began about 1878. The rate of change in these periods was about 2 per cent per annum. It may appear inconsistent to assume a reduction in public utility construction costs continuing after they have come into accord with general prices, but such reduction is, nevertheless, anticipated by many well-informed people, and it is at least permissible to determine the results of such possible reduction.

The above assumptions are all embodied in an accompanying table which shows for a series of years from

*From a discussion of the 1923 report of the American Electric Railway Association valuation committee.

1913 to 1940 the number of units in the property, the current costs of these units and the actual investment, starting at $1,000,000 and increasing from year to year by the current costs of the added units. There has then been computed the cost of reproduction of the entire existing units in each year at the prices then prevailing. The figures shown are not exact, being obtained by slide-rule computations.

An examination of the columns of total investment and cost of reproduction shows a steady increase in the former but a far less regular change in the latter. The cost of reproduction increases rapidly up to 1920, after which there is an actual decline in spite of the annual

PUBLIC UTILITY VALUATION—RELATION OF COST OF REPRODUCTION TO INVESTMENT

(5 per cent increase in property units per annum)

	Units		Current	Investment		
Year	Total	Annual Additions	Unit Costs	Total	Annual Additions	Cost of Reproduction
1913	10,000	500	$100	$1,000,000	$49,000	$1,000,000
1914	10,500	525	98	1,049,000	56,000	1,029,000
1915	11,025	550	107	1,105,000	72,000	1,180,000
1916	11,575	580	130	1,177,000	96,000	1,505,000
1917	12,155	605	165	1,273,000	118,000	2,006,000
1918	12,760	640	195	1,391,000	131,000	2,488,000
1919	13,400	670	205	1,522,000	151,000	2,748,000
1920	14,070	705	225	1,673,000	131,000	3,166,000
1921	14,755	740	185	1,804,000	133,000	2,734,000
1922	15,515	775	180	1,937,000	151,000	2,794,000
1923	16,290	815	195	2,088,000	151,000	3,178,000
1924	17,105	855	185	2,239,000	150,000	3,165,000
1925	17,960	895	175	2,389,000	152,000	3,144,000
1926	18,855	945	170	2,541,000	157,000	3,206,000
1927	19,800	990	166	2,698,000	161,000	3,287,000
1928	20,890	1,045	163	2,859,000	167,000	3,405,000
1929	21,935	1,095	160	3,026,000	172,000	3,510,000
1930	23,030	1,150	157	3,198,000	177,000	3,616,000
1931	24,180	1,210	154	3,375,000	184,000	3,723,000
1932	25,390	1,270	152	3,559,000	191,000	3,859,000
1933	26,660	1,335	150	3,750,000	198,000	3,999,000
1934	27,995	1,400	148	3,948,000	204,000	4,143,000
1935	29,395	1,470	146	4,152,000	212,000	4,291,000
1936	30,865	1,545	144	4,364,000	219,000	4,444,000
1937	32,410	1,620	142	4,583,000	227,000	4,600,000
1938	34,030	1,700	140	4,810,000	235,000	4,764,000
1939	35,730	1,790	138	5,045,000	243,000	4,940,000
1940	37,520	.....	136	5,288,000	....	5,103,000

increase in number of property units, which decline is not overcome for several years. It appears that in 1938 the investment begins to exceed the cost of reproduction, the excess increasing from year to year. It follows under the assumptions made that if public utilities, either voluntarily or through unreversed regulatory action, are limited to return on the investment for the next fifteen years, it would thereafter be to their advantage to have this basis of value continue instead of changing to cost of reproduction.

If other assumptions are made as to rate of growth or the trend of future prices, different comparative results would be obtained. It goes without saying that a property without any growth since 1913 would continue to gain advantage through the cost-of-reproduction method as long as current prices remained higher than those prevailing in 1913. On the other hand, if the rate of growth was more rapid than that assumed in the accompanying table, the investment would overtake the cost of reproduction at an earlier date. If, for example, the property units increased at the rate of 10 per cent per annum instead of 5 per cent, the investment would exceed the cost of reproduction within ten years.

If the prices of public utility materials fail to decline materially during the coming years, the investment would not equal cost of reproduction until a later date, if at all, depending upon the trend of prices. If, on the other hand, the decline is sharper than that assumed, the investment would overtake the cost of reproduction more promptly. Computations in which prices are assumed to have fallen to 150 in 1930 instead of 1933, as in the accompanying table, show investment overtaking cost of reproduction within ten years from now instead of fifteen years.

The uniformity in rate of growth assumed in the table does not represent the facts, particularly during the period of most rapid price fluctuations. Prior to and during our participation in the world war there was an enforced curtailment of construction except where required for war purposes. During the following years of continued business activity and also of maximum commodity prices it was necessary for many public utilities to undertake an exceptionally large amount of construction, and so the effect of peak prices upon investment becomes more pronounced than under the assumptions of a uniform growth. It follows that under such circumstances investment will overtake reproduction cost at an earlier date.

It is to be noted also that no deductions have been made for accrued depreciation from any of the figures compared in the accompanying table. A study of rate decisions shows very few cases where deductions have been made from investment for depreciation, but a comparatively large number in which such deductions are made when the reproduction method is used in determining value. If, therefore, it is assumed that cost-of-reproduction figures are generally subject to such deductions and actual costs are not, there is a further tendency for investment to show an earlier advantage. Actual investment overtakes the cost of reproduction, shown in the table, in 1929 if the latter is reduced by 15 per cent for depreciation.

INVESTMENT COST GAINING WITH TIME

It would not be unreasonable, in the light of the above data, to predict that with only partial recognition of present cost of reproduction, which still prevails, and the deductions for depreciation which may be made because of such recognition, this basis of value will yield higher results than actual investment during only a few more years, after which its exclusive use would not be advantageous even if permissible. This discussion, with its accompanying data, is not presented for the purpose of discouraging reasonable attention to cost of reproduction, but to point out that investment should not be ignored. The A. E. R. A. committee report recommends that both these evidences of value should always be presented in rate cases, as has been the general practice in the past. Before the war the simplicity of the investment basis, which did not differ radically from cost of reproduction, had its appeal to both utilities and commissions. During and following the war departure from this basis was necessary to maintain the credit or solvency of many companies. A rate of return within the limits which the commissions felt free to authorize would not, when applied to investment, yield a return attractive to new capital. Other companies, however, passed through the war period with satisfactory rate adjustments without claims for value higher than investment. With return to more stable economic conditions this basis should show increasingly favorable results, but, as the valuation report points out, cost of reproduction cannot safely be ignored whether it be greater or less than the investment in the property.

System Maintenance and Inspection

Periodical Inspections and a Maintenance Crew Reduce Service Interruptions—Details of Organization Equipment and Duties on a Transmission and Distribution System

By JAMES E. JORDAN
Superintendent of Distribution El Paso Electric Railway

EARLY in 1922 a decided innovation was made in connection with the El Paso Electric Railway Company's light and power distribution and transmission systems by putting into effect a maintenance schedule calling for periodic inspection and repairs.

For this purpose the territory served by the company's lines was divided into twelve sections, El Paso being divided into eleven sections, with Juarez, across the Rio Grande, in Mexico, comprising the twelfth section. The blocks in each section are numbered in consecutive order, as are the sections themselves. Work is done starting with Section 1, Block 1, and following through each block in order. The sectional divisions are designated on a large map of the territory served by the company's lines, one map being kept by the distribution engineer and another by the foreman in charge of the maintenance crew. The size of these sectional divisions is governed by the density of the lines rather than by any geographical factors that might enter into the problem.

INVESTIGATION NECESSARY

Prior to starting work on any section, the section is thoroughly gone over by the superintendent of distribution, general line foreman and distribution engineer, any changes or replacements are definitely outlined, and photographs are taken of existing conditions. Work by the maintenance crew, consisting of a foreman, four linemen and three helpers, is then commenced according to the changes outlined by the general line foreman. A light line truck is allotted to this maintenance crew and is kept with that crew on maintenance work entirely.

IMPROVING THE APPEARANCE OF A STREET CORNER BY UP-TO-DATE CONSTRUCTION

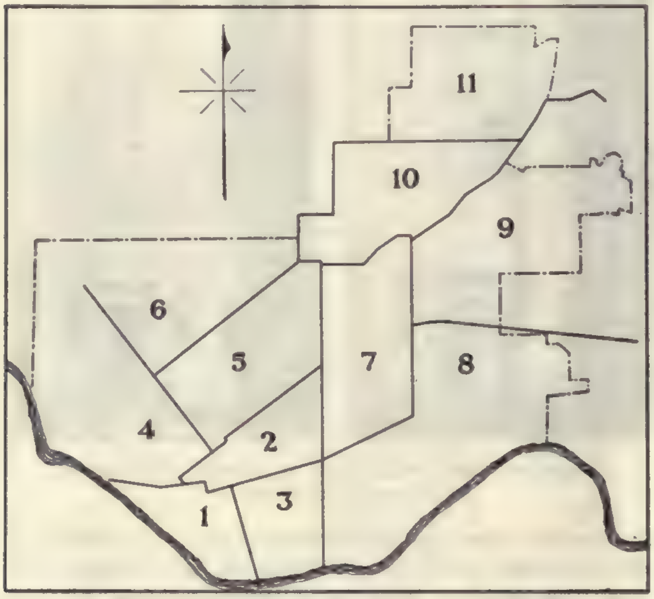
CHANGING THE APPEARANCE OF A STREET CORNER
Left—Old installation on southeast corner. Center—Corner after pole was removed. Right—New installation on northeast corner

The scope of work done by the maintenance crew embraces in general the following:

1. Standardizing construction in so far as possible.
2. Pulling slack out of wires.
3. Removing unnecessary copper.
4. Removing unnecessary poles and cross-arms.
5. Straightening poles and replacing bad ones.
6. Rearranging services and renewing those in bad condition.
7. Replacing bad cross-arms.
8. Relocating transformers.
9. Improving customers' voltage.
10. Checking transformer loads.
11. Filtering transformer oil.
12. Cleaning and repairing transformers.

In preparing the details of the maintenance work to be done in each section, consideration is taken of the probable future expansion and requirements, and alterations are made with such expansion in mind.

It is estimated that the entire distribution system can be gone over in two years. On a pro rata basis, therefore, two months is allotted to each section in which to complete the maintenance work.



FOR MAINTENANCE PURPOSES THE CITY IS DIVIDED INTO SECTIONS

The actual work done by the maintenance crew proper consists primarily of the first ten items enumerated above. After this crew has completed the work on a section, a second or "follow-up" crew, consisting of two men and a helper, goes over the section, inspecting, cleaning and filtering oil in distribution transformers. Any transformer showing evidence of any defect is at once replaced and the faulty transformer brought into the shop, where it is thoroughly tested and overhauled. After repairing, the transformer is again subjected to virtually the same tests as it received in the factory.

As the maintenance crew continues its work through a section, close touch is kept with this crew by the general line foreman, and as the section is completed a thorough inspection of the section is made by the superintendent of distribution, general line foreman and distribution engineer. As the task is finished kodak pictures are taken of the completed work. These, together with those taken before the work was started, give a very accurate idea of the changes which have taken place.

Jan. 16, 1923.

Block 25

Cross-armed two poles.
Removed cross-arms from two poles.

Block 26

Cross-armed three poles.
Removed cross-arms from one pole.
Changed drop wires on one street light.
Removed one transformer.
Changed service wires to 404 South Campbell Street.

Block 27

Removed cross-arms from four poles.
Removed two 30-ft. poles.
Reset one 35-ft. pole.

Jan. 17, 1923.

Block 27

Removed cross-arms from five poles.
Cross-armed two poles.
Put two-wire racks on one pole.
Transferred grounded wire and conduits to new pole.

Block 28

Cross-armed six poles.
Removed cross-arms from four poles.
Moved one transformer.
Guyed one pole.
Transferred two trolley spans to new pole.
Put up two No. 2 wires in two spans of primaries.
Removed two No. 2 wires in two spans of primaries.
Changed five No. 6 wires in two spans of primaries.

Jan. 18, 1923.

Block 27

Removed one 35-ft. pole.
Pulled slack in lighting primaries and secondaries.
Changed service feeding 416 South Campbell Street.

Block 28

Removed one 35-ft. pole.
Removed cross-arms from one pole.
Put three-wire rack on one pole.
Pulled slack in power primaries and lighting primaries and secondaries.
Guyed one pole.
Transferred one trolley span wire.

Lard Refining Substation

Date..................

3. Substations—Monthly.

General inspection of substation, including structure and buildings. Inspection for broken insulators, etc. General appearance.
General appearance good.
No broken insulators.
Cleaned station and transformers.

4. Transformers—Monthly.

Cleaning and inspecting of transformer bushings. Quantity of oil. Temperature of transformers. Inspection for loose connections.
Cleaned transformer bushings.
Plenty of oil. Temperature, 32 deg., 33 deg., 30 deg.
No loose connections.

6. Oxide-Film Lightning Arresters—Monthly.

General inspection for loose connections, etc. Test for bad cells (after electrical storms).
No loose connections.
Tested all cells—found O.K.

9. Grounds—Monthly.

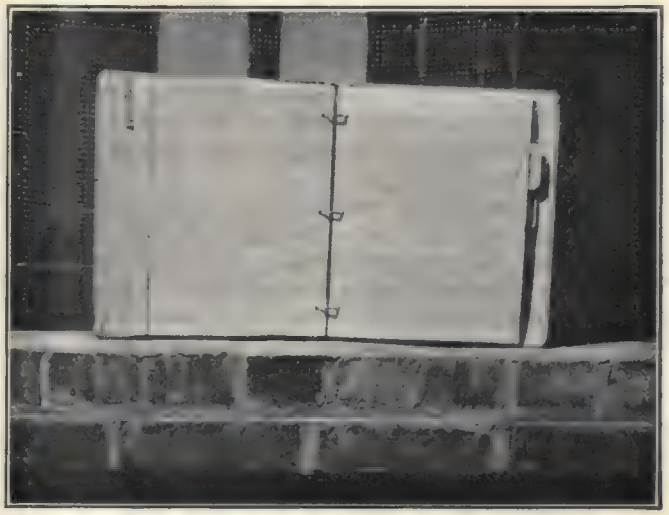
Condition of ground wires. Inspection for loose connections.
Ground connections O.K.
Ground test to water pipe, 34 volts, 8.3 amp.

10. High-Tension Switching Equipment—Monthly.

Inspection for loose connections and defective insulators. Amount of liquid in carbon-tetrachloride fuses. Number of spare fuses. Condition of switch stick.
No broken insulators.
No loose connections.
Fuses O.K.
Three spare 30-amp. link fuses.
Switch stick O.K.

A TYPICAL SUBSTATION REPORT

The records kept in connection with the maintenance work are as simple and yet as complete as possible. Each day the foreman in charge of the maintenance crew hands to the general line foreman an account of the work done for the day and the section and block numbers in which the work is done. This record is written up and filed in a loose-leaf book in the manner shown by the accompanying sheet. In this book is also kept a photographic record of the work done, showing the different locations before and after the changes have been made.

BOTH WRITTEN AND PICTORIAL DAILY RECORDS ARE KEPT ON MAINTENANCE WORK

The above discussion applies to the maintenance schedule in operation on the distribution system. A similar schedule is carried out on the substations and transmission lines. The transmission lines within the city limits are patrolled daily, with a thorough inspection on the first and fifteenth of each month, the line extending from El Paso to Ysleta, Tex., 12 miles distant, being patrolled and inspected the first of each month.

All substations, of which there are thirteen, receive a thorough inspection and repairs once each month. This inspection covers the general appearance of the substation, condition of the transformer bushings, quantity and temperature of transformer oil, condition of lightning arresters, condition of ground connections, with a ground test, and condition of high-tension switching equipment, number of spare fuses, quantity of liquid in carbon tetrachloride fuses, etc. In addition to the above inspection, transformer oil is filtered every two years, lightning arresters are overhauled yearly, oil in oil switches is filtered yearly, and all high-tension pole-top switches are inspected and overhauled semi-annually.

The substation maintenance crew is furnished with neostyled forms showing the inspections to be made at the time. This form is filled out by the foreman in charge of the crew and after being transferred to the permanent record book is filed for reference. Ornamental street lights are also inspected and overhauled every four months.

Since the inauguration of the maintenance schedule in connection with the distribution and transmission systems, the interruptions to service due to line troubles have been very greatly reduced and a great saving in cost of line maintenance has also been accomplished. In direct contrast to the sections which have not been gone over, no serious trouble has been experienced in those sections which have been reworked. As the schedule has been in operation for a very short while, there is considerable deferred maintenance which has to be done the first time through each section. The amount of work will be greatly reduced at the next period. The institution of such a schedule will, therefore, not only decrease the number of line failures but will also decrease the cost incident to maintenance of the transmission and distribution systems.

Taken as a whole, the results obtained are very satisfactory indeed and prove to the company's satisfaction that the best operation of the transmission and distribution systems can be had only as a result of systematic maintenance and inspection.


SHOWING WHAT CAN BE DONE WITH TRANSFORMER MOUNTING


A BEFORE-AND-AFTER VIEW OF AN ALLEY AND STREET INTERSECTION

Governor of Arizona States His Stand on Colorado River Situation

IN A RECENT interview with an editor of the ELECTRICAL WORLD Governor Hunt of Arizona made the following statement defining his position on the Colorado River compact:

"The decision in this matter is the most momentous one Arizona will ever be called upon to make. Her whole future as a state is tied up to this proposition. We cannot afford to make a mistake; consequently we are taking the time to obtain the fullest possible data on the subject.

"The only reason for the compact is the desire of the upper basin states to conserve for their own use sufficient water for their purposes. The authority granted the commission which drew the compact was to allocate the water between the states. This was not done. The water was allocated between the upper and lower basins. This is the first objection to the compact, as it leaves Arizona in the lower basin occupying relatively the same position which caused the upper-basin states to insist on a compact.

"This objection is made all the more important because of the linking together of the propaganda for the adoption of the Colorado River compact and the building of a dam at Boulder Canyon, as is outlined by the United States Reclamation Service and in the Swing-Johnson bill.

"It may be asked, why should there be objection in Arizona to a dam at Boulder Canyon? The answer is that it is starting development of the canyon at the wrong end, and that a dam at that point would limit agricultural development in Arizona from the Colorado River to 280,000 acres of land. The power development at that point would largely benefit California, and Arizona would derive little, if any, benefit from it.

"It is argued that it will be impracticable to irrigate anything in excess of 280,000 acres of land in Arizona from the Colorado River, yet the supplemental report of E. C. LaRue of the United States Geological Survey, as chairman of the Arizona Engineering Commission, is anything but discouraging to those in Arizona who hope to see 2,000,000 or more acres of land irrigated in the state—of course, not in the immediate future, but it is believed that the plan will be possible long before some of the irrigation projects in the upper basin states for which these states are reserving water under the compact are developed. The compact voiding the law of prior appropriation for beneficial use sets up bargain terms allotting to the upper-basin states 7,500,000 acre-feet of water in perpetuity, and to the lower basin 8,500,000 acre-feet, to be distributed on the basis of prior appropriation for beneficial use unless a supplementary compact is made.

"California refuses to sit in a conference of the three lower-basin states to make such a supplemental compact. As California and New Mexico will inevitably develop earlier than Arizona, it is apparent that Arizona cannot accept a bargain allotment in the upper basin and the doctrine of prior appropriation in the lower basin without forfeiting her interests.

"I believe that power is the only agency at this time that can bear the cost of development.

"One of the main arguments being put forth now is for flood control. The alarm over floods, in my opinion, is exaggerated. During my long residence in Arizona the only menacing floods have been caused by the simultaneous run-off in the Colorado and Gila Rivers. The Gila River floods, while not fully checked, have had their volume reduced through several dams which have been constructed so that the flood menace is proportionately relieved.

"If power development can proceed unhampered in a businesslike way, the benefits of flood control and more water for reclamation will be realized in a surprisingly short time as a byproduct. Eighty per cent of all the power developed in the lower basin will be developed wholly within the State of Arizona, and the other 20 per cent will be developed between the States of Arizona and Nevada. I believe that this development can be best undertaken by the State of Arizona, and that the state can derive greater benefit and furnish power at less cost than can be furnished through any other agency. As the power will be developed in this state, Arizona should determine where it shall be developed in order to be of the maximum benefit to her.

"I recently suggested a conference between California, Nevada and Arizona, in order to arrive at an understanding between the states in the lower basin.

"The Governor of California, as I have already said, refused to appoint delegates to such a conference, and the State Engineer of California, who was the California representative at Santa Fé, stated in a letter to the Governor of Nevada that the upper states were entitled to share in the benefits of any power which might be developed in the lower basin because of any moneys spent by the federal government. I believe it to be the almost unanimous sentiment of the people of the State of Arizona that—irrespective of the opinion of the State Engineer of California and whatever may be the opinion in the upper basin—the upper-basin states will not be entitled to derive any revenue from power developed in the lower basin. While these objections exist I do not believe that Arizona will enter into the compact."

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Patenting of Engineering Arrangements

To the Editors of the ELECTRICAL WORLD:

An editorial entitled "Two Interests Involved in Patenting Engineering Arrangements," on page 849 of the Oct. 27 issue of the ELECTRICAL WORLD, has come to my attention. This editorial seems to question the wisdom of granting patents on new and useful combinations of apparatus or machines which the editorial terms "engineering arrangements." No objection seems to be raised to the patenting of the individual apparatus or machines. The basis of the objection seems to be the fear that patenting of the so-called "engineering arrangements" will hamper the development of the industry.

The specific statement of the editorial in question is as follows:

"For example, a patent has been issued on at least one isolated-phase arrangement, and others have been granted on various combinations and arrangements of heat-balancing equipment and boiler arrangements. Any company which has duplicated these specific arrangements has technically infringed a patent."

I am familiar with the first instance referred to,

namely, the isolated-phase arrangement, owing to the fact that I prepared and prosecuted the patent application covering the same. It relates to a new switch house and bus construction and was originated by Bertrand B. Jamieson, engineer of inside plant, Commonwealth Edison Company, Chicago. The invention was embodied in the Calumet station of the Commonwealth Edison Company of Chicago and was described in the ELECTRICAL WORLD of April 2, 1921, page 761.

In general, the patent (No. 1,454,744) which Mr. Jamieson received relates to a structure of buses, switches, connected apparatus and the arrangement thereof in a building to secure, primarily, great freedom from danger of interphase short circuit and, secondarily, certain other advantages, such as greater simplicity of construction, greater accessibility of all parts, more working room, ability to dispose the phases above each other and thus reduce the necessary ground space, and other advantages.

The invention has been widely copied, and the question now raised by the editorial under consideration is, Shall subsequent users pay for the employment of this invention or shall they be permitted to use the invention free?

Independently of the patent laws, would it be fair to Mr. Jamieson and to the Commonwealth Edison Company to have them sustain all the expense and labor and danger of loss by unsuccessful venture which they had to undergo in developing this invention, and then let every one who wishes partake of the benefits of the invention without turning a hand? Would it not be more fair and equitable to let the later users pay at least their proportion of the development cost plus something as a reward for the initiative of the original inventor and builder? If all the cost of the initial conception and development of a new idea is to be saddled entirely upon the one who originates such improvements in the art, it places too much of a tax upon initiative. The tendency naturally would be to coast along behind, for it would cost less to let some one else have the expense and grief of developing new ideas.

I realize that the present case is different from the usual patent on a manufactured article in that in the present case it is the user of the invention who secures the chief benefit of the invention and who pays directly the license fee for its use. This license fee therefore is paid as a direct tax by the user. Ordinarily the license fee on a manufactured article is not paid by the user but is paid by the manufacturer, and the user pays the cost of the license fee only as an indirect tax. The principle, however, is in no wise different.

The attitude of the Commonwealth Edison Company toward its employees is very liberal and is a notable example which may well be carefully considered by other industrial and public service organizations. According to the rules in force, each employee is required to submit to a patent board duly constituted of officers of the organization all ideas, improvements and inventions relating to the business of the employer organization. This patent board passes upon the question of whether the employer organization desires rights under the invention or improvement. If the recommendation is favorable, the inventor is directed to file application for a patent on the improvement at the cost of the employer organization and to execute to the employer organization a license permitting it to use in its business the invention or improvement, and payment of a fixed sum in the nature of a bonus is made to the deviser of the invention or improvement.

I am familiar with another instance of a somewhat similar character. This relates to a scheme for arranging the apparatus of a power station so that higher economy may be obtained by the use of auxiliaries electrically driven from the main generating unit but operable on failure of current from the main unit from a house turbo-generator which is normally driven by current from the main unit. This invention was devised by Allen M. Rossman, one of the members of the well-known firm of consulting engineers Sargent & Lundy of Chicago, and was duly patented (No. 1,456,652). It appears that this scheme which Mr. Rossman patented was adopted by the engineers who designed the Wabash River station of the Indiana Electric Corporation without knowledge that it was patented. In accordance with the practice of Sargent & Lundy, a license has been granted to the manufacturer (Westinghouse Electric & Manufacturing Company) and to the user on a nominal royalty fee to reimburse Sargent & Lundy for developing and patenting the invention and to reward the inventor in a very moderate way for his initiative and ability.

DEVELOPMENT COSTS MONEY

For the purpose of more specific discussion suppose that an inventor has invented and developed at his own expense and effort a new switch house, such as the Jamieson switch house, or a new mode of operating a house turbo-generator set like the Rossman invention, and that the Doe Power Company wishes to erect a station embodying those devices, copying exactly the device of the patent. Why should it not be permitted to do so? Why should it not be permitted to construct for its own use only one or more of the devices of the invention? The Doe Power Company does not plan to sell the station nor to manufacture stations for others.

Let us assume that this were permitted. Then each power company could put up as many of the devices as were necessary for its own use, and the result would be that all the stations in the United States could thus be supplied without the inventor being even consulted. Then who would have to stand the cost and loss of time incidental to its development? It would be the inventor. But he gets no income from the invention. He is not able to use the patent as a means to hire out his services as a consulting engineer, because his price would have to be higher in order to reimburse himself for loss of time and costs incidental to the development. It would be more economical to the inventor to let some one else do the worrying and stand the cost of making an invention, because the inventor would see at once that invention is carried on at a loss. An invention would be an asset to every one except the one who produced it. The result would be that invention would be stifled and would be furtively and secretly produced and carefully guarded from public knowledge. This is exactly contrary to the spirit and purpose of the specific clause in the Constitution covering issuance of patents. It is for the purpose of promoting progress of science and useful arts that patents for inventions are granted.

How are engineering arrangements of a different class from other inventions? The statutes passed by Congress state that patents may be granted for inventions in any of the four classes of "art, machine, manufacture or composition of matter, or any improvement thereon." Some of these engineering arrangements are undoubtedly in the class of "machine" and others no doubt in the class of "manufacture." The Patent Office has held that these inventions come within the statutory

classes, as is obvious from the above particular patents to which I have referred. Furthermore, I know of no case where a court has held that an improvement or invention, such as the Jamieson invention or the Rossman invention, was not protectable under the existing patent law.

As pointed out before, it is true that in this class of inventions the user—i.e., the plant operator—is the chief beneficiary of the advantages of the invention. But the contractor or engineer who erects the device is also the gainer from the construction of the device. And the manufacturer of the apparatus employed also gains by the manufacture and sale of such apparatus. And the public, not least to be considered, benefits most of all.

There is no compulsion upon any one who erects a power plant to use the patented invention. The devices which existed prior to the patented invention are always open to the public and may be used freely. If one deliberately copies the advantageous arrangement devised and perfected by another, he should expect to make fair payment therefor. Where the infringement was inadvertent, as in the case of a later but independent inventor, the equities are not so unequal. But it is an old principle of the law that where equities are equal the law must prevail. The rights of the first inventor should not be impaired by the subsequent act of another.

Your editorial also raises the point that the patent situation will necessitate a patent searcher for each utility company.

Why cannot the public utility men do the same as automobile companies, which buy great numbers of parts, materials and equipment from independent manufacturers? They could not in each instance investigate the patent situation as could one who supplies the particular part, because each man is familiar with patents on his own line of goods. The automobile manufacturer when he places his order specifies:

"By accepting this order the seller hereby agrees to save the buyer harmless against all suits for patent infringement on the parts or material supplied on this order."

Now the utilities are in somewhat the same situation, only the point under consideration is not the question of whether the individual apparatus infringes, but whether the apparatus when assembled and combined constitutes an infringement on some patent covering a so-called engineering arrangement.

Whereas the automobile companies generally buy from manufacturers and dealers of less financial resource and stability than they are, the utilities generally deal with highly responsible manufacturing concerns. The manufacturer who supplies a piece of apparatus knowing that it is to be employed in a certain combination of apparatus is as guilty of patent infringement as is the user, if that combination is patented (on the legal doctrine of contributory infringement). In other words, the manufacturer who sees the plans and specifications of the proposed installation is charged with the duty of investigating the patent situation and is liable for infringement if he then supplies a part of a patented combination. This is well known by most manufacturers.

Since the manufacturer has the facilities for investigating these matters and must do so for his own protection, I can see no good reason why the manufacturers should not give the utilities a guarantee on this point. Let the utility insert a clause in its contracts as follows:

This material is bought for installation and use in erecting a generating station [or substation, or transmission system] known as the.........................., the construction of which is shown and described in the plans and specifications prepared by...................... ...., engineers, and dated ...., a copy of which is on file at the office of the purchaser at........................ ...., open to your inspection. The seller in supplying material on this order hereby agrees to save the purchaser harmless from all claims for patent infringement, primary or contributory, based upon the use of the material so supplied in the construction of such ...., according to the plans and specifications referred to above.

The consulting engineer and contractor may also be liable for patent infringement on the basis of contributory infringement and suitable stipulations may be made in contracts with them, but this is far less effectual as they have not the means to make proper investigation and generally have no invested capital.

By the foregoing suggestions I do not mean to advise the utility operator to dodge the issue. He should make his own investigation and use reasonable caution. An investigation on the main features can readily be made at no great expense, and such investigation is a necessary insurance of the capital invested. But he should put the real burden of the investigation upon the manufacturer, because the manufacturer can distribute the cost of the investigation as overhead on a large number of installations by settling at a single investigation the question for all installations of like character.

The utility operator is not familiar with the individual arts and the patent problems involving the same, and any investigation he would make would be for his own station only. It would, therefore, not be so likely to be thoroughly and intelligently done, and it would involve a relatively large outlay as overhead for a single installation.

I, therefore, suggest as the proper way to handle the situation mentioned in the editorial the following:

1. In making contracts for purchase or installation of apparatus and equipment and the like introduce a clause in the contract for purchase or installation of the character above explained, thereby putting the responsibility for the investigation upon the seller or erector, where it properly belongs.

2. Make an independent investigation on any features known to be new or unusual, where such feature is an important part of the station or installation. Employ competent counsel; otherwise the effort may be wasted.

3. Assist the development of the industry by patenting and thereby revealing to others improvements in apparatus or methods of operation which the utility operator may devise.

4. Adopt a plan of procedure in connection therewith which will serve as a reward and act as a stimulant to employees. (The plan adopted by the Commonwealth Edison Company of Chicago is suggested as a model.)

JOHN A. DIENNER.

Brown, Boettcher & Dienner, Attorneys and Counselors, Chicago, Ill.

[The editorial in question did not depreciate the value of the two patents nor take a stand against the practice in those two cases, but raised the question for discussion how patents on engineering arrangements could be granted so that the utilities and the public would not be handicapped but on the other hand most benefited. The situation as to patents of this kind is not now serious enough to bother any one. But enough companies have raised objection to patents of this sort to indicate that the subject warrants discussion. Mr. Dienner's letter is an able presentation of one aspect of the subject.—EDITORS.]

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

One Tower a Day with Eight Men

Indiana Company Assembles 80-Ft., 8,000 Lb. Towers in Sections on Ground and Brings Them to Erect Position with Steel Gin Pole and Tractor

By Ole Davidson

Assistant Superintendent Construction Department, Indiana Electric Corporation, Indianapolis, Ind.

A COMPROMISE between building towers up from the ground, one member at a time, and assembling the entire tower in sections on the ground and then erecting has been adopted by the Indiana Electric Corporation in building its 132,000-volt line from Terre Haute to Indianapolis, a distance of 74 miles. The towers, which are 80 ft. in height and weigh 9,800 lb., including the foundations, are spaced about 800 ft. apart with a ground clearance of 22 ft. The towers carry six No. 4/0 copper conductors and one $\frac{7}{16}$-in. galvanized ground wire. The insulation consists of one string of nine disks in suspension and eleven disks on each side for dead ends. Right-of-way is being obtained for two tower lines 110 ft. apart.

The line traverses a well-settled farming country with about four property owners to the mile. The problem in surveying the line was to secure a right-of-way that would avoid farm buildings. To do this it was deemed necessary to obtain an option on the right-of-way before detailed surveys were made. Maps of the country were procured from different sources, and from these a general map was made on which the theoretically desirable line was traced. Automobiles with speedometers were used to locate the improvements along this line. To avoid improved sections it was necessary to make slight deviations from the theoretical line, but none the less the right-of-way options were based on this paper location.

After options on a reasonable amount of the right-of-way had been obtained the regular surveys were started, the transit line being the center line of the north tower line, and levels were taken 15 ft. on each side of the transit line. Maps and profiles were plotted to a scale of 200 ft. to the inch horizontally and 20 ft. to the inch vertically, each sheet covering about a mile of line. With an appropriate sag curve, tower locations were made on these profiles. The tower locations in the field varied slightly from this paper location, depending on the local conditions. Setting of the steel footings involved no new features except the use of the "farm level" instead of the customary level board and carpenter's level.

Details of Erection

Tower erection was divided between three crews. One was the assembly crew, consisting of a pusher and three ground men, which assembled the tower parts in six flat sections on the ground, averaging two and a quarter towers per nine-hour day. The second crew, which was an erection crew, consisted of a foreman, a tractor driver, four "high men" and three or four ground men. Their equipment included one 30-ft. built-up steel gin pole, one tractor, and a wagon with a special body to carry the gin pole, rigging and small tools. This crew erected on an average two towers per nine-hour day. The third or finishing crew consisted of a pusher, two "high men" and a ground man. These men followed the erection crew and filled in the members which of necessity had been omitted in erection. This crew completed (placing and tightening all bolts) one and a quarter towers in a nine-hour day.

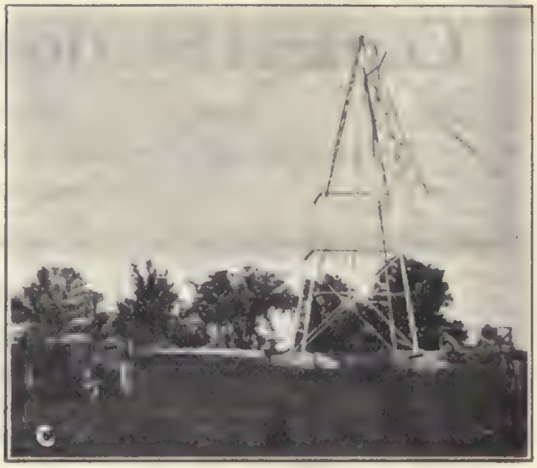
In order to compare the speed of tower erection on various jobs it is necessary to know the weight, number of pieces and number of bolts in a standard tower. The portion above the ground weighed 4 tons and consisted of 166 pieces and 743 bolts.

In some places it was not practicable to use the tractor outfit previously mentioned in erecting towers. In such cases the towers were assembled in the air by building them up one piece at a time. A wooden gin pole (4-in. x 4-in. x 20-ft. yellow pine) was used to raise the heavier pieces. The gin pole was raised from story to story as needed. A foreman, four "high men," two ground men and a team erected five standard towers in six nine-hour days.

Before erecting the towers with the tractor outfit, eight pairs of guy stubs were driven around each tower, 90 ft. from the center at the 90-deg. and 45-deg. points. These stubs consisted of 6-ft. by 2-in. black pipe sharpened on one end. Five of the guys consisted of $\frac{3}{4}$-in. manila rope with 15 ft. of $\frac{3}{8}$-in. cable next to the gin pole. A sixth one, consisting of $\frac{3}{4}$-in. rope with no cable, was used as a safety guy and later was employed to lower the gin pole from the top of the tower. The lower story of each tower was assembled on the ground in two sections, one on the north side and one on the south side of the tower foundations. For the second and third stories the east and west faces were assembled on the east and west sides of the tower foundations, respectively. As much of the side lacing as could be expeditiously handled was fastened to these assembled sections.

Method of Raising Towers

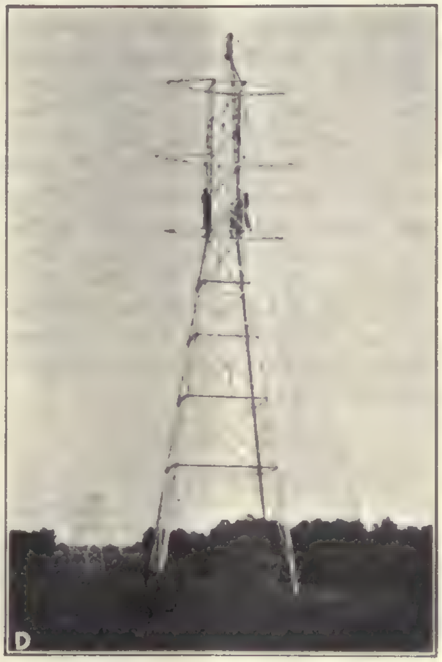
Upon arriving at the tower site the wagon trailer carrying the gin pole was pulled through the center of the tower and stopped at such a place that the base of the gin pole could be landed at the center of the tower without removing it from the wagon. The base of the gin pole rested on a built-up wooden block measuring 2 ft. x 2 ft. x 4 ft. and was bridled to the foundations to keep it from slipping. The guys were then attached and strung out in their proper location, and the regular hoisting line was attached to the tractor which raised the gin pole



on a direct pull. The main hoisting falls consisted of ⅞-in. manila rope and two single 8-in. wood mortise blocks.

After the gin pole and guys had been placed in position, the north and south faces of the tower were pulled up and fastened to the steel foundation and a part of the lacing on the east and west facing was bolted up. The gin was then hoisted to the second story, the foot of the gin riding on a hook over a strut on the tower immediately under the leg joint. After the gin was properly raked and the guys were in position the east face of the second story was raised and the leg joints were full bolted. It was then necessary to slide the foot of the gin along the strut to the opposite side of the tower and raise the west face of the second story as before. The lacing on the north and south faces which was attached to the sections was then bolted up. The gin was then raised a second time and, as before, rested on a hook over a strut to the top of the second story immediately under the leg joint. The west and east faces were pulled up, and the lacing attached to the section on the north and south faces was bolted. The last lift carried the bonnet of the tower, which was christened by the gang the "goat head" as it sometimes "got their goat" to get it in place.

During the process of raising the north, south, east and west guys remained tied to the same guy stubs. The other two guys were shifted from the northeast to the northwest and from the southeast to the southwest stubs as load conditions demanded. After the last section was in place and all side lacing bolted up the five guys were thrown off and the north (safety rope) guy was used to lower the gin. In the meantime the tractor had pulled the trailer under the center of the tower and the gin pole was laid on the top of the trailer body, which was especially designed to carry it. Meanwhile the guy stubs were pulled and the guys coiled and loaded so that the outfit would be ready to move to the next tower.



132,000-VOLT TOWERS USED BY THE INDIANA ELECTRIC CORPORATION BETWEEN TERRE HAUTE AND INDIANAPOLIS

A—Gin pole erecting first section of tower by direct pull from tractor. B—First section of tower completed. C—Gin pole, in place on first section, erecting second section. D—Erection of tower completed except for insertion of minor members.

When the tractor crew left a tower 90 per cent (by weight) of the steel was in place in the air and 65 per cent of the bolts in place and tightened. The remainder of the material left on the ground for the follow-up construction crew to assemble.

Kelsey, Brewer & Company of Grand Rapids, Mich., are the constructing engineers; L. B. Andrus vice-president and chief engineer, F. G. Dana, superintendent.

Fault-Locating Equipment for Lighting Circuits

THE Haverhill (Mass.) Electric Company recently purchased an amplifier from the Lundin Electric & Machine Company, Boston, for use with the latter's fault-locating equipment in overhead maintenance. To avoid using the amplifier with an exploring rod, which is better adapted to transport on an open automobile than in a closed car or on one with the top up, it was found that by connecting the exploring-rod binding post to the metal frame on top of the car and the ground terminal with the frame of the car the amplifier would work. Afterward 25 ft. of fixture wire was placed between the inner and outer tops of a Ford coupé, one end being brought to a binding post inside the car, using this as a collecting agency instead of the frame on top of the car.

As a test the line crew opened an arc circuit by disconnecting the lead to a lamp, taping the end and laying it on top of the lamp and outside the range of vision from the street. The lamp was about 1.5 miles from the station, and in twelve minutes after leaving the latter the "open" was located. This amplifier is similar in construction to equipment for one stage of radio-frequency amplification as ordinarily used in radio receiving outfits.

It is essential when using this outfit that the station operator analyze the open circuit and connect the fault locator on the short wire to obtain the quickest results.

Keeping Operating Charts Readily Available

BY FREDERICK L. RAY
Superintendent Power Plants, Traction, Light & Power Company, Anderson, Ind.

THE value of operating plant charts and records depends upon the condition in which they are kept at the superintendent's office. Unless they are filed in a manner easily accessible they become worse than useless. No detailed checking of plant economy can be accomplished unless the records are complete and in their proper place. The mistake of installing high-grade and expensive instruments without keeping their graphs for study needs no proof.

To facilitate this object the Traction, Light & Power Company constructed a rack to accommodate twelve various-sized charts. Wooden pegs were inserted for holders so as to prevent tearing the charts when they are being mounted. To keep them from flying off the pegs, small round wooden disks were turned out on the company's lathes. The rack is placed on the wall near the left-hand side of the superintendent's desk so that he can stretch out his hand and reach any chart desired.

Compact Storage of Central Station Supplies

AT THE recently completed Melrose service station of the Narragansett Electric Lighting Company, Providence, R. I., provision has been made for storing rigid conduit and reels of cable and rope with minimum occupation of space. Fig. 1 shows a skeleton timber rack layout for holding conduit in vertical or inclined stands. The rack is assembled of 12 in. x 12 in. uprights tied together by a longitudinal stringer of the same cross-section, bays for the reception of different sizes of pipe being formed by 4 in. x 6 in. crosspieces. Stacking conduit in this way enables desired sizes to be withdrawn without interference with other sizes and gives a continuous visual check of the amount of stock on hand.

Reel storage (Fig. 2) is effected by setting the bearing spindles carrying the spools into diagonal slots in fabricated steel T-members ½ in. thick, these members being installed as uprights and tied into horizontal cross-members at top and bottom by bolts. A flexible arrangement meeting the space requirements of different-sized reels is assured by the provision of numerous bolt holes in the horizontal members and by frequently recurring slots in the uprights. Jenks & Ballou, Providence, were engineers and architects of the new service station.

Michigan Rules on Wattmeter Installations*

Sealed Switch Boxes, Safety Cabinets and Suitable Locations Are Made Obligatory by Rule 1692 of Public Utilities Commission

UNDER Rule 1692 of the Michigan Public Utilities Commission, the entrance switch boxes shall be so arranged, sealed or locked that unauthorized persons cannot tamper with either the switch or the main line fuse; provided, however, that in an emergency a consumer may remove this seal from the main fuse compartment if the utility is promptly notified that the seal has been removed. All service wiring passing through or along partitions to entrance switches shall be installed in continuous lengths of approved rigid metal conduit up to the entrance switch and be equipped with proper fittings. No exposed wiring shall be installed between the entrance switches and meters. The entrance switches and cut-outs, except where installed on approved switchboards or panels, shall be inclosed in metal boxes of approved safety inclosed type, so designed that the switch may be operated by a suitable handle on the outside of the switchbox. The covers of such a switchbox shall be so designed that they can be either sealed or locked in a closed position, and the switch handle shall be so designed that it can be locked in the open position, and they must indicate whether they are open or closed.

No utility shall furnish electric supply service to any applicant until the installation of utilization equipment to be served has been approved by a recognized inspection agency or the controlling civil inspection authorities. In case this does not exist, the utility shall make an examination and inspection of the installation, and if there are any evident violations of the rules of the commission governing the installation, the utility shall not furnish service until these violations are corrected. In case of disagreement re-

*An abstract of the meter committee's report, J. C. Langdell, chairman, before the Great Lakes Division, N. E. L. A., Sept. 27, 1923.

FIG. 1 (LEFT)—SKELETON ON TIMBER FRAME SUPPORTS RIGID CONDUIT. FIG. 2 (RIGHT)—STEEL RACK KEEPS REELS OFF THE FLOOR

garding installations the matter shall be referred to the commission for a ruling.

Although the 1922 report of this meter committee showed a varied practice among companies regarding the use of meter safety cabinets, at this time (September, 1923) manufacturers of meter and service equipment have small-sized cabinets well standardized from a standpoint of dimensions. Cabinets with service switch and fuse connection blocks are available in the 30-amp. size. These cabinets take the place of the service switch and meter fitting formerly used. In all cases provision is made for carrying the neutral wire through the cabinet without a fuse, and in some cases also with a disconnecting link instead of the switch blade as approved by the National Electrical Code. Provision is made at the neutral cabinet for connecting the ground wire, which can be brought into the cabinet through a knockout in the bottom.

The connection blocks have a provision for testing the meters without interrupting the customer's load or disturbing any of the permanent wiring connections. This provision consists of a switch blade on the load side of the meter which can be opened only from within the cabinet. All switches are operated from the outside of the cabinet and shut off the current from the meter. For the mutual protection of both consumer and company, all service and meter cabinets should be kept sealed in order to accomplish the full safety designs of the equipment. Consequently, when they are of a fused type, the circuit fuses are to be provided on the load side of the meter, which will be accessible to the customer. Fuses in the meter cabinet should be of a size determined by the capacity of the connection block and should be heavier than the customer's fuses.

During the year the meter committee investigated to find what attention had been given power-factor correction. Out of eleven questionnaires submitted, four companies said that they were measuring power factor for billing purposes. One company reported that in doing this it makes use of two watt-hour meters by employing auto-transformers to determine the reactive kilovolt-ampere hours. Measurements are made of the customer's power factor from time to time, and the customer's demand is increased in the ratio of 90 to the measured power factor when the measured power factor is below 90 per cent. No data as to the frequency of measurement of testing were included.

Another company reported the same method of determining the power factor and the same method of application, with the exception that it used 70 per cent as the standard power factor instead of 90 per cent. Power-factor measurements are made on a given installation every six months.

Another utility follows the same method, except that measurements are made monthly. The power factor is determined from the meter readings in the usual manner, but corresponding to every power factor is a multiplying constant by which the kilowatt-hour consumption is multiplied to give the energy consumed. The standard power factor in this case is 85 per cent. Another company reports two methods of measurement in use. For secondary customers the standard method with two watt-hour meters and auto-transformers is used, while for primary customers the middle tap on the secondary of the potential transformers is used. The method of application to the ratio is the same in both cases. A standard power factor of 80 per cent is adopted.

Electrical Insulating Materials

A COMPARATIVE summary of the properties of hard rubber, vulcanized fiber and laminated and molded phenolic insulated materials, as taken from the Technologic Paper No. 216 of the Bureau of Standards, was published on page 544 of the Sept. 15, 1923, issue of the ELECTRICAL WORLD. This was quoted from a copy of the above paper as first issued, which did not contain some corrections embodied in the corrected reprint subsequently issued. These corrections affect the last three items of the table, which are reproduced herewith. The data regarding the effect of sunlight on these materials, withheld from the first table on account of space limitations, are also included.

COMPARISON OF PROPERTIES OF VARIOUS INSULATING MATERIALS

Properties	Hard Rubber	Vulcanized Fiber	Phenolic Insulating Materials	
			Laminated	Molded
Sunlight	Surface discolors and deteriorates after a few months; the sulphur of the hard rubber is oxidized, forming the equivalent of sulphuric acid; this may take up ammonia from the air or may attack the filling materials forming the various sulphates upon the surface; the surface resistivity is greatly reduced.	No effect.	No visible effect.	After two and one-half years some materials show a slight change, such as discoloration or very fine cracks; other materials show no such change.
Metallic inserts	Cases have been observed in which there is corrosion of copper and brass inserts at the exposed junction of metal and hard rubber; no such corrosion of bronze or tinned inserts has been reported.	No effect.	No effect.	No effect.
Machining qualities	Admits of high polish; machines less accurately than would be supposed, due to great resiliency; the better the grade the more readily it is machined; quality may be judged roughly by color and texture, toughness, color and grain of a shaving; has tendency to warp; can be molded to size within plus or minus 0.002 in.	Admits of a fine finish; may be sawed, punched, drilled, stamped, embossed, turned, planed, bent, tapped; tough, resists shock; cannot be molded.	Admits of a good polish; can be sawed, punched, drilled, stamped, turned, planed, knurled, embossed, milled, tapped either with or against the grain, though not as easily as hard rubber and vulcanized fiber; tough, resists shock; cannot be molded.	Admits of a fine lasting polish; can be machined, cut, filed, sawed with difficulty; can be molded to size within plus or minus 0.001 in.; quite brittle.
Cost	About $0.50 to $1.10 per pound in sheet form.	50-80 cents per pound up to 1 in. in thickness; about $5 per pound for 2 in. in thickness.	About $1 per pound.	Cost varies with complexity of steel molds.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Advance Schedule for Sales and Advertising Gets Results

Central-Station Company Serving Several Small Communities Averages $18.60 Appliance and Lamp Sales per Customer per Year

By H. C. Thuerk
Commercial Manager Keystone Power Corporation, Ridgway, Pa.

FOR the past year a complete advertising and merchandising schedule has been used effectively to increase the sales in the appliance and contracting departments of the Keystone Power Corporation. The scheduling of commercial programs has been comparatively simple in form, but the results attained have demonstrated the wisdom of careful planning ahead.

The company maintains retail stores in the towns of Ridgway, Johnsonburg, Kane and Mount Jewett, in the north central part of Pennsylvania. These towns have populations of 6,200, 6,500, 7,500 and 1,800 respectively and are relatively close to each other. They are connected by good state highways so there is considerable interurban traffic. In addition, the newspaper in each community has a rather large circulation in the other towns.

With these conditions in mind it was decided to operate the four stores as a unit. In carrying out this idea the show windows in each of the stores display the same merchandise and appliances at the same time, newspaper advertising in each town is related definitely to the show-window displays, and in like manner all other forms of advertising and sales efforts are co-ordinated.

The merchandising schedules used are planned ahead to cover a period of four months. This has been found to be the most satisfactory plan, for schedules covering longer periods must be revised often to accommodate special campaigns. Selling or advertising campaigns conducted by manufacturers can usually be anticipated four months in advance if effort is made to secure the necessary information.

The schedule reproduced here covers the period from April 27 to Aug. 29. It will be noted that this schedule is outlined by weeks, so that the salesmen in charge of the stores know exactly what appliance to feature in the windows and what to advertise in the newspapers on the different days of the week. It gives them instructions as to advertising material which should be inclosed with the monthly electric bills and daily appliance invoices, and also indicates under "Remarks" special window displays, special advertising literature, etc. It may be mentioned here that this company does electrical contracting work and that its newspaper advertising on one day of each week concerns housewiring.

It has been found that by using this schedule considerable time has been saved by the salesmen in trimming windows, and windows are trimmed regularly. Previous to the adoption of this plan the windows were trimmed spasmodically, and much time and energy were wasted deciding what should be placed on display. This schedule, however, does not discourage individual initiative, for the arrangement of the windows is left entirely to the local man.

TABLE I—COMBINED GROSS APPLIANCE, MERCHANDISING AND HOUSEWIRING SALES BY MONTHS

	1922	1923	Per Cent Increase
January	$4,829.32	$6,251.57	29.4
February	4,207.13	4,338.80	3.1
March	3,542.80	7,362.07	107.9
April	6,493.61	9,512.25	46.5
May	4,866.78	8,465.38	73.9
June	3,964.90	8,381.67	111.3
July	3,741.33	7,773.20	108.0
August	4,960.89	6,796.80	37.0
September	4,479.81	8,346.84	86.3
October	9,616.73	10,951.22	13.9
Total	$50,703.30	$78,179.80	54.3

The merchandising schedule is tied in as closely as possible with the

SALES AND ADVERTISING SCHEDULE, MAY 1, 1923, TO SEPT. 1, 1923*

		Show Windows		Newspaper Advertising						
Week	Appliance to Push	Right	Left	Fri. and Sat.	Mon., Tues and Wed.	Thurs.	Theater Slides	Inclosure with Lighting Bills	Inclosure with Appliance Invoices	Remarks
April 27–May 3	Cleaners	Lamps	Cleaners	Lamps	Cleaners	Wiring	Cleaners	Cleaners	Fans	Cleaner broadsides
May 4–10		Cleaners	Toasters	Toasters	Cleaners	Wiring	Toasters			
May 11–17		Fixtures	Cleaners	Fixtures	Cleaners	Wiring	Cleaners			
May 18–24		Cleaners	Wiring Supplies	Supplies	Cleaners	Wiring	Cleaners			Decoration Day window
May 25–31		Irons	Washers	Irons	Washers	Wiring	Washers			
June 1–7	Fans	Curlers	Table Appliances	Curlers	Appliances	Wiring	Curlers	Fans	Irons	Wedding gifts
June 8–14		Fans	Ranges	Fans	Ranges	Wiring	Fans			Flag Day, June 12
June 15–21		Cleaners	Fans	Fans	Cleaners	Wiring	Cleaners			Range demonstration
June 22–28		Fans	Lamps	Stoves	Fans	Wiring	Fans			
June 29–July 5	Irons	Washers	Irons	Irons	Washers	Wiring	Washers	Irons	Washers	Fourth of July window, Iron campaign (Special prizes for employees)
July 6–12		Irons	Fans	Fans	Irons	Wiring	Irons			
July 13–19		Fixtures	Irons	Fixtures	Irons	Wiring	Irons			
July 20–26		Irons	Cleaners	Irons	Cleaners	Wiring	Cleaners			
July 27–Aug. 2		Toasters	Irons	Toasters	Irons	Wiring	Irons			
Aug. 2–8	Washers	Percolators	Washers	Percolators	Washers	Wiring	Washers	Washers	Cleaners	
Aug. 9–15		Washers	Table Appliances	Appliances	Washers	Wiring	Appliances			
Aug. 16–22		Cleaners	Lamps	Lamps	Cleaners	Wiring	Cleaners			
Aug. 23–29		Stoves	Washers	Stoves	Washers	Wiring	Washers			

*In using this schedule windows should be trimmed on Fridays. To save time newspaper advertisements for a whole week should be prepared at one time.

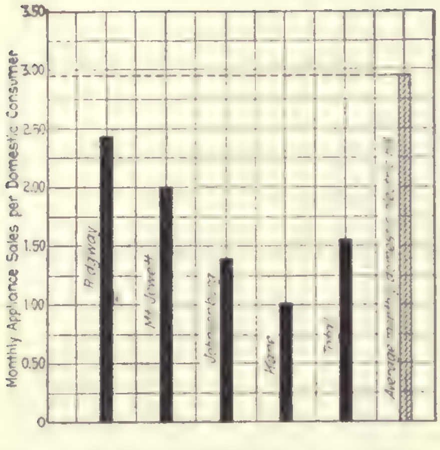


FIG. 1—RELATION BETWEEN APPLIANCE SALES AND DOMESTIC LIGHTING REVENUE

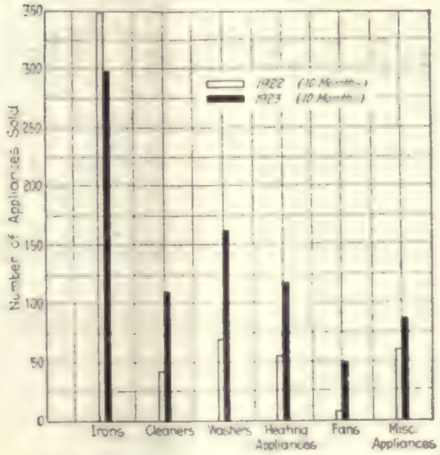


FIG. 2—COMPARISON OF APPLIANCE SALES, 1923 AND 1922

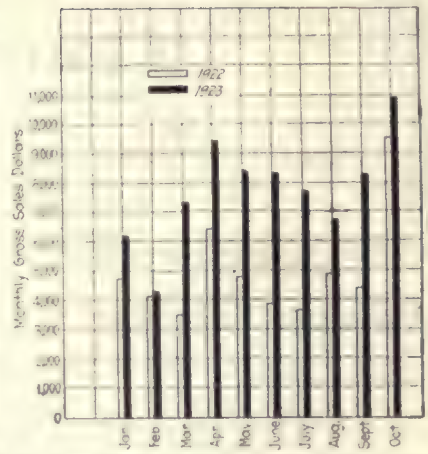


FIG. 3—MERCHANDISE SALES FIRST TEN MONTHS, 1922 AND 1923

national schedule of the manufacturers whose merchandise is sold. The window-display service of one of the largest manufacturers of household appliances is being used and is considered when the schedules are prepared.

Special campaigns are in progress most of the time and are indicated on the schedule. A separate letter of instructions is sent to every manager and salesman for each campaign, and prizes are always given as inducements to the salesmen. It might be well to state at this point that competition is keen in the territory served by this company. In Kane there are two other retail electrical stores, and there is one each in Ridgway and Johnsonburg.

The accompanying tables show how the gross sales of this year compare with the corresponding period in 1922.

Table I shows the gross merchandise, appliance and house-wiring sales by months for the first ten months of the past two years. It can be seen that each month's sales show an increase over the corresponding month of the previous year. The merchandising schedule was first used during September, 1922, so that real results from its adoption could not be expected at once.

The gross sales for the ten months of 1923 showed an increase of 54.3 per cent over the corresponding period of 1922. If we consider only the first seven months of 1923 and compare the gross sales during these months with the corresponding seven months of 1922 (during which no schedule was used), we find the gross sales have increased 67.8 per cent.

Table II shows the relation between appliance sales and domestic consumers in the towns where retail stores are maintained. Gross sales of tungsten lamps have been included under "Appliance Sales" in this table. The lamp sales constitute 5 per cent of the total appliance sales.

The appliance sales per month per residential customer vary from $1.01 to $2.42, with an average for the entire property of $1.55. If we assume that average sales for the seven months represent a fair average for all months, then on a yearly basis these figures vary from $12.12 to $29.02, with an average of $18.60. No separation of appliance sales from all merchandise and jobbing sales was made until April of this year, so that figures are available for comparison purposes from this date only.

The lower showing of the Kane store is due to the fact that from May to September inclusive no outside salesman was employed. The appliance sales per consumer at Kane for April were $2.02 and for October $1.52.

The figures given in this table show that in two of the towns, Ridgway and Mount Jewett, the monthly appliance sales per domestic consumer are very nearly as large as the average domestic electric bill in these towns.

TABLE II—GROSS APPLIANCE SALES FOR APRIL TO OCTOBER, 1923, INCLUSIVE

	Average Monthly Appliance Sales for Seven Months	Number of Domestic Consumers as of July 1, 1923	Appliance Sales per Domestic Consumer Per Month	Appliance Sales per Domestic Consumer Per Year	Average Monthly Domestic Electric Bill for Year Ended Sept. 30, 1923
Ridgway	$1,993.93	823	$2.42	$29.02	$2.96
Johnsonburg	756.51	548	1.38	16.56	2.26
Kane	1,262.12	1,253	1.01	12.12	3.28
Mount Jewett	275.86	140	1.97	23.64	2.40
Total	$4,288.42	2,764	$1.55	$18.60	$2.96

Table III shows how the total number of appliances sold in 1923 has been increased over a corresponding period in 1922. The most important comparison here from the standpoint of the appliance business is the large increase in the number of washers and vacuum cleaners sold. This increase has been due to systematic and carefully planned campaigns carried out with the co-operation of the jobber and manufacturer.

TABLE III—NUMBER OF APPLIANCES SOLD

	First Ten Months, 1922	First Ten Months, 1923	Percentage Increase
Irons	348	297	14.6*
Cleaners	42	109	159.5
Washers	69	162	135.0
Heating appliances	55	117	112.7
Fans	8	50	525.0
Miscellaneous appliances	60	88	46.7
Total	582	823	41.5
Added load in kilowatts	233.2	257.3	10.4
Estimated annual revenue	$2,981.80	$3,489.40	17.0

* Decrease.

The comparisons at the bottom of Table III are of special interest to central stations from the electric revenue standpoint. As a result of the merchandising plans outlined above, the added load in kilowatts due to appliance sales has been increased 10.4 per cent and the estimated annual revenue from appliances has been increased 17 per cent. These figures were obtained by using the average values of wattage and annual kilowatt-hour consumptions of the various appliances, as recommended by the Society for Electrical Development and manufacturers of electrical household appliances.

Rate Reduction Receives Praise from Press

PUBLIC relations and good will were furthered recently by the voluntary reduction of rates on the part of the Northern Connecticut Light & Power Company. A two-part rate based on an initial charge of 12.5 cents per kilowatt-hour for the first 1.5 kw.-hr. per 100 sq.ft. of floor area, with an energy charge of 6 cents per kilowatt-hour for all additional service and a minimum charge of $1 per month, will go into effect Jan. 1 on the system of the company. At the same time the commercial lighting rates will be reduced from 13 cents maximum, net, to 12.5 cents maximum net, on a block plan, with two steps in place of three previous steps, all energy used above the first block to be billed at 9 cents net.

In a full-page advertisement Walter P. Schwabe, vice-president and general manager, announced the reduction as voluntary and due to the increased number of customers and more liberal use of electricity, despite continued high costs of operation. Typical savings by average, large and small customers are cited for the old and new rates. Local editorial comment, which refers to the action of the company as "an oasis in a desert of ascending prices," says:

The announcement of the reduction in its electric lighting rate by the Northern Connecticut Light & Power Company will doubtless be received with no small amount of satisfaction by the customers. It comes like an oasis in a desert of ascending prices. In addition to the material benefit—and in dollars and cents this is no insignificant sum—there is the feeling of gratification that it will give the consumer to know that the act is voluntary on the part of the management of the company. So far as the public was concerned, there was neither demand or agitation for this reduction. Had the lighting company elected to do so it might have gone on indefinitely on the present basis of charges. It apparently prefers the policy of giving the consumers the benefit of anything that accrues over a reasonable return on the investment. That this policy will be well received here is certain. It is an impressive indication of community interest that should have a salutary effect on those who insist that nothing good comes from a public service corporation.

In some respects, of course, it should be remembered that the local concern differs from the average corporation of this character. Considerable of the stock is owned by the local consumers, which gives it a common community status above the average. The general manager, Mr. Schwabe, has gone to no small expense in placing the full details of this reduction before the people in this issue. His statement should be carefully studied by the people, for that is the primary purpose in making it public in this manner. No detail appears to be lacking in this published statement to make the new rate clear, and the reward for the effort will come from the intelligent grasp it is hoped the public will take of it.

Commissioners' Views on Utility Problems

ALTHOUGH there is no industry that requires a better public appreciation of its problems than the public utility business, unfortunately no industry is less understood, Sherman T. Handy, Michigan Public Utilities Commission, declared recently. Hence the utilities' problems and aims should be taught in the public schools so that the younger generation can educate their parents. Regulation will last in its present form, Mr. Handy contended, only so long as commissions have the confidence of the public, and utilities must help maintain this confidence. He expressed an abiding faith in human nature and expressed a belief that the public will allow utilities a fair return if they understand the business. More harm can be done to public relations by improperly conducted office routine than in any other way, Mr. Handy thought.

Consolidation is the order of the day, but there have been some regrettable accompaniments, in the opinion of Lewis E. Gettle, chairman Railroad Commission of Wisconsin. These have been due to the acquisition of properties at excessive prices (1) because too much weight has been given to going value, (2) through the payment of nuisance values, and (3) because of bidding among competing companies. The issuance of securities on such inflated valuations cannot be allowed by the commissions, Mr. Gettle declared. While he expressed recognition of the fact that these conditions do not exist everywhere, he said there were a few cases in Wisconsin which will magnify the seriousness of the problem from the industries' viewpoint if they are not completely eradicated.

He also referred to a case where unnecessary construction work was done by one company having a separate engineering organization, just to get the profit on the work. Expansion should be based on known growth and not on speculation, since nothing stirs up the public more than corporate profligacy and extravagance.

What Other Companies Are Doing

Bangor, Maine.—Plans are being matured for an electric show in the early spring under the auspices of the Bangor Railway & Electric Company and local contractor-dealers. A radio broadcasting license has been secured by the Bangor company and a transmitting station installed at its headquarters offices to be used in creating interest in the progress of show plans. Edward M. Graham is president and general manager. A representative of the ELECTRICAL WORLD gave an informal talk last week upon electric show policies at a joint meeting of local electrical men Dec. 11.

Boston, Mass.—The first month's sale of kitchen-lighting units in five small suburban towns served by the Edison Electric Illuminating Company totaled 1,000 purchases of 100-watt and 150-watt outfits, the former size predominating. Eight salesmen are at work, and up to Nov. 30 only two withdrawals had been reported from the total of sales.

Chicago.—The Central Station Institute of the Commonwealth Edison Company, Chicago, has 813 students enrolled in nineteen different classes. This institute was founded to interpret the central-station industry to its employees and to serve as a training school for college graduates. Sixty-four college graduates are at present taking the regular central-station practice course, while 243 others are engaged in the study of engineering and operating theory. New employees to the number of seventy-five are getting their first contact with the company, and sixteen others are taking the standard N. E. L. A. engineering course.

Fond du Lac, Wis.—Classes of instruction have been established by the Eastern Wisconsin Electric Company in this city and Oshkosh for the purpose of further educating its employees in the matter of public relations so that the spirit of service to customers will be paramount. The company will provide its employees with special courses of reading matter giving suggestions on winning and keeping public good will. Arrangements have been made for a series of monthly meetings at which prominent men of the organization will address the employees along this line. The special courses are provided by the N.E.L.A. and explain various public utility questions.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Hydro-Electric Development and Steam Equipment

Development in Powdered-Fuel Firing. — J. S. ATKINSON. — The author contrasts the turbo-pulverizer unit with the central system, and answers numerous criticisms of powdered-fuel firing. Among the criticisms discussed are the high first cost of plant, high running costs, both for replacements and for power required, danger of complete stoppage and the danger of explosion or slow combustion of the fuel, the ground space taken up by the plant, the noise of the grinding machinery, and the ejection of ash from the chimney top.—*Electrical Times* (*England*), Nov. 8, 1923.

Condenser-Tube Corrosion. — The problem of the corrosion on condenser tubes is primarily a concern of the chemist and metallurgist as a chemical reaction is involved. The possible prevention of corrosion, the importance of minor variations and the physical factors of the tube structure are given.—*Engineering* (*England*), Nov. 12, 1923.

Tests of a Powdered-Coal Plant.—H. KREISINGER, J. BLIZARD, C. E. AUGUSTINE and B. J. CROSS.—The results of tests of the pulverized-coal plant of the St. Joseph Lead Company, at Rivermines, Mo., are given. The boiler tests were made on two Stirling boilers, each having 7,688 sq. ft. of heating surface, and the results are given in the accompanying table.—*Technical Paper* 315 *of the Bureau of Mines.*

STEAMING TESTS ON PULVERIZED-COAL BOILER INSTALLATION

Test number	1	*2	†2
Duration, hours	48	119.22	93.28
Condition of coal when burned	Dried	Dried	Undried
Rating, per cent	202	155	155
CO_2	12.9	13.7	13.6
Temperature of flue gas, deg. F.	666	561	567
Temperature of superheated steam, deg. F.	546	525	534
Over-all efficiency of the boilers	74.4	78.8	78.4

* First five days. † Last four days.

Determining the Economical Interval Between Cleanings of Condenser Tubes.—C. E. COLBORN.—Sediment deposited on condenser tubes by cooling water is frequently a matter of continual daily accumulation. The best vacuum obtainable then steadily decreases. The steam consumption of the prime mover, therefore, is gradually increased, representing a loss in dollars, which is balanced against the cost of cleaning tubes. The most economical period between tube cleanings depends upon how fast the sediment is deposited, the cost of the vacuum loss, which varies with the relative load to a large extent, and the cost of cleaning tubes. Economical operation usually requires a seasonal variation in cleaning schedule.—*Power*, Nov. 20, 1923.

Generation, Control, Switching and Protection

Regulation of Voltage in Alternating-Current Distribution Networks.—F. JACOBSEN.—This paper, read at the Electrotechnical Congress in Gothenburg, Sweden, in 1923, discusses the effects of voltage variations for incandescent lamps, heating appliances and synchronous motors for the conditions that prevail in the electrical industry of Norway. It is maintained that the voltage variations should be limited to 4 per cent or 5 per cent. For this variation there is a reduction of about 12½ per cent in the intensity of the light of an incandescent lamp, and this is considered tolerable. The efficiency and power factor of three-phase synchronous motors are not changed appreciably, and the maximum torque is not changed by more than about 7.5 per cent. The efficiency of heating appliances is not affected, and the time for boiling in cooking apparatus is extended only about 8 per cent. Since the voltage variation of the distribution transformers may amount to 1.5 per cent to 3 per cent, it is necessary to limit the voltage variations in the distribution network to about 2 per cent. The power system should be designed with this limit in view. The author also gives a very simple method for predetermining the voltage variations in the distribution network. It is shown that the ratio of voltages at short circuit and no load depends primarily on the length of the transmission line and is practically independent of cross-section and general arrangement. For example, for a length of line of 650 km. to 800 km. and a copper cross-section of 95 sq. mm. to 240 sq. mm. the error resulting from neglecting these factors amounts to only 1.5 per cent. Convenient graphical methods are given. — *Teknisk Tidskrift* (*Sweden*), *Elektroteknik*, Oct. 6, 1923.

Methods of Voltage Control of Long High-Voltage Lines by the Use of Synchronous Condenser.—J. A. KOONTZ, JR.—Inherent characteristics of high-voltage lines and high-voltage transformers, the effect of low-power-factor load on high-voltage lines as to limiting capacity, the uses of condenser for increasing line output and obtaining good voltage control, and the characteristics which must be met by generators, condensers and regulating equipment in order to control properly voltage over all operating conditions, are considered in this paper.—*Journal of A. I. E. E.*, December, 1923.

Transmission, Substations and Distribution

Alternating Current for 380/220-*Volt Farm Installation.* — V. FAABORG-ANDERSON.—The paper, read at the Electrochemical Congress in Gothenburg, Sweden, 1923, discusses several problems incidental to the introduction of alternating current to three-phase, 380/220-volt farm installations in Denmark. This voltage is used to a considerable extent at the present time. The author gives very extensive statistical information concerning accidents that have occurred in various alternating-current and direct-current installations. This information is of considerable general interest, but it must be reviewed in its entirety if used as a basis for general conclusions. Details of specific installations are given to show the progress that has been made.—*Teknisk Tidskrift* (*Sweden*), *Electrotecknik*, Oct. 6, 1923.

Electrical Apparatus for High-Tension Power Transmission.—S. Q. HAYES.—A general instructive and descriptive article continued from the November issue on the electrical equipment involved in high-tension power transmission. In this issue bushings, oil circuit breakers, disconnecting switches, lightning arresters and arrangements of transformers are considered.—*Electric Journal*, December, 1923.

Leakage Flux Between Parallel Pole Cores of Circular Cross-Section.—B. HAGUE.—Some of the formulas used by designers for the purpose of calculating the leakage flux passing between circular pole cores in salient-pole machines are far from satisfactory, since they cause the flux to be considerably underestimated. The author draws attention to formulas and curves from which the permeance of the leakage paths can be found with high accuracy, the results being derived by simple mathematical methods. A critical comparison of the old with the new formulas is given, illustrated by a numerical example to show the use of the new results in practice.—*Journal of Institution of Electrical Engineers* (*England*), October, 1923.

Units, Measurements and Instruments

Test Results on the Performance of Suspension Insulators in Service.—C. F. BENHAM.—Megger test results on suspension insulators on the lines of the Great Western Power Company, covering records since 1908, giving the percentage of depreciation by districts—that is, mountain, valley and coast conditions—are given. These results also cover various types of insulators.—*Journal of A. I. E. E.*, December, 1923.

Mercury-Vapor Pumps. — H. P. WARAN.—The rapid production of high vacua is becoming increasingly necessary, and the mercury-vapor pump ac-

complishes this efficiency and rapidly. After discussing some of the drawbacks of the mercury-vapor pumps now on the market, the author describes improvements to the Volmer pump, which has proved very satisfactory.—*Journal of Scientific Instruments* (*England*), November, 1923.

Illumination

Temperature and Brightness of Tungsten Lamps.—W. E. FORSYTHE.—After some general remarks on the brightness and temperature of incandescent lamp filaments, the author describes the three different ways of measuring brightness of tungsten. Valuable data are given in four tables in the article.—*General Electric Review*, December, 1923.

Lighting of Large Dry Goods and Department Stores.—The revised issue of this bulletin now includes new illustrations of typical installations conforming to modern standards, a table of desirable intensity of illumination and a discussion of the choice of reflecting and diffusing equipment. Particular emphasis is laid on developments which have taken place in the last two years.—*Bulletin L. D. 132 of the Edison Lamp Works of the General Electric Company.*

Motors and Control

Magnetic Fields of Three-Phase Induction Motors.—F. J. TEAGO.—In dealing with the subject of stator and rotor windings it has been usual to describe a coil in terms of its slot pitch—that is, in terms of the number of slots spanned by the coil. The author feels that a certain amount of confusion arises when it is attempted to describe windings in terms of "pitch," and it is proposed to use the terms "normal distribution" and "super-distribution," which are definite and lend themselves to very simple mathematical representation. A case of normal distribution of the winding is one in which the windings of one phase are put into a number of consecutive slots per pole equal to the actual number of stator slots per pole per phase and where no other phase windings are interwoven with them. It is shown that with one coil side per slot there is little benefit to be derived from a departure from a normal distribution of the winding, but that with two coil sides per slot super-distribution is useful. The changes in the flux density and magnetizing current, with changes in the number of poles, are discussed, together with their bearing upon the phenomenon of crawling.—*Journal of Institution of Electrical Engineers* (*England*), October, 1923.

Starting of Polyphase Squirrel-Cage Motors.—B. F. BAILEY.—The different methods of starting polyphase induction motors are briefly reviewed and the speed-torque curves obtained with various types are considered. The effect of starting current upon line voltages, upon the motor and upon connected apparatus is taken up. It is shown that the performance of the compensator is poorer than ordinarily assumed and that the effect upon the line voltage is less with a resistance starter than with a compensator. It is also shown that the heating of the motor is least when thrown directly on the line. The energy required with the various methods is also considered. In large installations it is shown that the considerations involved are radically different.—*Journal of A. I. E. E.*, November, 1923.

Electrophysics, Electrochemistry and Batteries

Non-Arcing Metals.—H. YAGI and H. OYAMA.—After a brief review of the research that has been made on arcing and non-arcing metals, a description is given of investigations in which the authors made a oscillographic study of instantaneous phenomena and found out the existence of two distinctly different phases of discharge between copper electrodes. The factors which seem to have connection with the non-arcing quality of certain metals are discussed.—*Journal of Institute of Electrical Engineers of Japan*, September-October, 1923.

Electric Storage Battery.—H. E. DANCE.—The paper opens with a reference to the early failure of the electric battery vehicle and to the misconceptions which exist as to its proper duty. The battery is not dealt with in detail, but a table showing the characteristics of the two chief types is included, while the motor is dealt with by a brief reference to the main factors controlling its design. The question of transmission is discussed at length, as is also the subject of control. Under the heading of transmission special circumstances affecting differential action are noted. As information regarding the methods of charging is not readily accessible, it was decided to devote a section to this subject, which is probably of greater interest to the user than is the battery itself. —*Journal of Institution of Electrical Engineers* (*England*), October, 1923.

Traction

Concrete for Electric Railways.—D. A. TOMLINSON.—The author discusses the methods, designs and uses of concrete for conduits, substations, concrete ties, stations and freight terminals, carhouses, subways, tunnels, bridges and trestles.—*Electric Traction*, December, 1923.

Automatic Fault Localizing on Electric Railways.—H. LUTHY.—A new system of fault localizing is described, and it is shown that the difficulty in the application of the simple motor-load relay protection to an intricate network can be easily overcome by this system. The line sections in each station on the network are connected to a bus-bar by means of electrically remote-controlled oil switches, the latter being assembled in separate switching stations. This interconnection permits any section to be isolated without disturbing the rest of the line. The arrangement of the equipment is described on the basis of the electrified section of the Swiss Federal Railways on the line from Sihlbrugg to Zurich, where the system was applied.—*Electrical Review* (*England*), Nov. 16, 1923.

Telegraphy, Telephony, Radio and Signals

Modes of Resonant Vibrations of Telephone Receiver Diaphragms.—J. T. MACGREGOR-MORRIS and E. MALLETT.—The well-known phenomenon of the "howling telephone" is extended by the insertion between the microphone and the receiver of a valve amplifier. The extended phenomenon is used to measure the velocity of sound. An investigation is made as to which member of the complicated mechanical-electrical system determines the pitch of the "howl." Sand figures are obtained of some of the various modes of vibration of a receiver diaphragm. The frequencies of the various modes are compared with those predicted by theory. As a result of these studies the author concludes that the characteristic note is determined by the telephone receiver and that receiver diaphragm overtones are substantially in accordance with the plate theory.—*Journal of Institution of Electrical Engineers* (*England*), October, 1923.

Recent Developments in Telephone Equipment for Train-Dispatching Circuits.—W. H. CAPEN.—This paper presents in detail the recent developments in telephone equipment for train dispatching, including a brief outline of its history up to the present time, the transmission requirements of dispatching circuits, together with the effect of the electrical characteristics of the line, number of sets, etc., on the proper design for maximum efficiency; diagrams showing the circuits for the dispatchers' and way-station sets; the development of the vacuum-tube amplifier with loud speaker for both dispatcher and way-station use; diagrams and photographs illustrative of the apparatus discussed; discussion of the practical application and limitations of the present train-dispatching apparatus. An appendix follows giving in detail the development of certain mathematical formulas used in the design of the apparatus. — *Electrical Communication*, Vol. II, No. 2.

Applications of Long-Distance Telephony on the Pacific Coast.—H. W. HITCHCOCK.—The author deals with the general problem of providing long-distance telephone service on the Pacific Coast. A description of the present toll plant is given and the applications which have been made of recent developments in telephone practice are illustrated. Reference is made to the extensive use which has been made of carrier telephone and telegraph systems, and the many special problems, such as the loading of long-toll entrance cables, which these systems introduce are pointed out.—*Journal of A. I. E. E.*, December, 1923.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Atlantic City Chosen

N. E. L. A. Convention Will Be Held at Famous Resort in the Week Beginning May 19

AT THE recent meeting of the executive committee of the National Electric Light Association in New York it was decided to hold the annual convention of the association for 1924 at Atlantic City during the week beginning Monday, May 19. The convention will be held at Young's Million-Dollar Pier, and the manufacturers have arranged to hold an exhibition at the pier during the week.

For some time it was felt that the convention might possibly be held at Philadelphia, but the convention committee being unable to secure sufficient hotel accommodations in that city, it was eliminated.

Central-Station Christmas Message Put on the Radio

President Charles L. Edgar of the Edison Electric Illuminating Company of Boston broadcasted a Christmas message on Monday, Dec. 24, to central-station executives and their public—arrangements having been made to reach practically all parts of the United States, including Alaska and Hawaii. Advance notices of the time of his talk, which was made at 10 p.m., were sent to about a hundred central-station executives. The co-operation of the Westinghouse and General Electric broadcasting stations and the American Telephone & Telegraph Company made it possible to have the broadcasted message reach so large an audience.

This idea of broadcasting the central station's story, or personality, to the public was strongly urged editorially in the ELECTRICAL WORLD for Dec. 8.

Mr. Edgar said in part:

"When I was told that my message tonight would, within the space of a few moments, be heard throughout our North American Continent, including the farthest reaches of Alaska and Hawaii, it brought home to me with tremendous force how great is our advancement today. This advancement has come almost without our realizing it.

"Forty-five years ago a brightly burning electric arc lamp attracted curious crowds; the incandescent electric lamp was a rare novelty. The telephone as we know it was in its experimental stages. Inventors were feeling their way in the application of this electric force. And since those pioneer days, by rapid stages, have come the improvements, the increasing knowledge of what electricity can do and the working out of wireless and its control until now it is possible for me to stand here in Boston on one edge of the United States and speak to a great audience distributed among 135 millions of people.

"This one remarkable development alone in the use of electricity would make this a merry Christmas—a Christmas filled with inspiration, not only because it is the Christmas time, but because the great mass of eager, earnest, faithful workers in the world have literally taken to heart and put into actual practice the divine privilege granted to man—to rule the world."

Griffith Becomes First Vice-President of N. E. L. A.

Franklin T. Griffith, president of the Portland (Ore.) Railway, Light & Power Company, has been elected first vice-president of the National Electric Light Association to succeed the late John A. Britton of San Francisco. Mr. Griffith was formerly vice-president of the association, but resigned prior to the last convention owing to pressure of work. Mr. Britton was elected to succeed him, and when he died last summer it became necessary to replace him by another vice-president, preferably from the Pacific Coast. Mr. Griffith was chosen again and was finally prevailed on to accept the appointment. Mr. Griffith has always taken an active interest in N. E. L. A. affairs and for many years was chairman of the association's important water-power committee.

F. T. GRIFFITH

New Muscle Shoals Offer

Southern Power Companies May Combine in Bid of $100,000,000 on Fifty-Year Lease

IT IS understood in Washington that a large group of the Southern power companies have concluded an arrangement under which they intend to make an offer to the government to lease the Muscle Shoals developments for a period of fifty years and will pay the government approximately a hundred million dollars.

The negotiations now going on with the government, it is understood, are at the instance of Representative Harry E. Hull of Iowa, who inquired of the Federal Power Commission the money value to the people of the United States of the power to be produced at Muscle Shoals. Mr. Hull, it is said, desired to contrast the amount of the potential power and its possible money value with the offer made last winter by Mr. Ford of $5,000,000 for all of the government's property at Muscle Shoals—an offer made, it will be recalled, before the War Department sold the Gorgas steam plant for $3,500,000. It is understood in Washington that Mr. Hull took the step he did in order to bring out the actual value of the power to come from the Wilson Dam and that he was led to do this by the introduction in the House of Representatives of the so-called Madden and McKenzie bills, which provide for the turning over to Mr. Ford not only of all the government property at Muscle Shoals, but of all the water-power rights at Wilson Dam and other dams in case they should be built.

It is further understood in Washington that the group of Southern power companies which are to offer the hundred million dollars for the fifty-year lease of the Wilson Dam intend also to make an offer to the government to purchase the Sheffield steam plant for approximately $4,500,000 in cash.

The prospective offer of the Southern power companies, it is understood, will reserve 100,000 hp. for the manufacture of nitrates for fertilizer by the use of the Casale process now being established in this country.

Superpower Conference to Be Held in Washington

Secretary Hoover of the Department of Commerce has called another conference on superpower, to be held in Washington on Jan. 5. At this meeting the delegates appointed by the governors of the various states will be in

attendance, as well as those appointed by utility companies. The program for the meeting will be prepared by Secretary Hoover with the aid of the public service commissioners of the ten Northeastern states most interested in superpower.

Record-Breaking "Tie-in" on New York's Systems

On Tuesday, Dec. 11, the 25-cycle and 60-cycle power systems of the New York Edison Company and the United Electric Light & Power Company were tied together at the Hell Gate station of the latter company. This "tie-in" was accomplished by means of a General Electric 35,000-kw. induction synchronous-type frequency converter, establishing a record in frequency-converter ties and representing a total of 727,000 kva. working in synchronism on the two systems.

The kilowatt capacity of this set is nearly three times that of the largest frequency converter previously built and marks a new epoch in the construction of horizontal-shaft alternating-current machines. The induction unit is the largest induction motor in the world and has a continuous rating of 37,000 kva. The synchronous generator, rated at 25,000 kva., is larger than any horizontal-shaft, salient-pole generator previously constructed. The installation, the manufacturer says, includes also the largest air-blast transformer in the world.

Stone & Webster Companies Hold Sales Conference

Executive and sales representatives of the Blackstone Valley Gas & Electric Company, Pawtucket, R. I.: Connecticut Power Company, New London; Edison Electric Illuminating Company of Brockton, Mass.; Electric Light & Power Company of Abington & Rockland, Mass.; the Boston office of Stone & Webster, Inc., and the Lowell Electric Light Corporation, together with New England gas companies operated by Stone & Webster, met recently at New London, Conn., for a sales conference, with headquarters at the Mohican Hotel in that city.

Among the talks of electrical interest on the program were the following: "How to Pick Salesmen," Ralph H. Williams, Boston; "The Management's Viewpoint of the Sales Department," J. L. Alexander, Haverhill, Mass.; "Dealer Co-operation," F. M. Feiker, vice-president Society for Electrical Development, New York; "How to Increase Kilowatt-Hour Consumption per Residential Meter," N. T. Wilcox, Boston; "Sales Promotion," R. R. Johnson, Pawtucket; "Advertising Versus Man Power," S. E. Choquette, Pawtucket, and B. R. Farrand, New London; "Merchandising Electrical Heating and Cooking Devices," A. J. Williams, Brockton; "Public Relations," R. G. Custer, Lowell; "The Value of the Woman's Viewpoint in Our Business," Mrs. M. V. Martin, Pawtucket; "Commercial Lighting Potentialities," F. C. Eteson, Pawtucket. Other speakers were V. E. Bird, manager Connecticut Power Company; H. H. Hunt, H. T. Edgar, M. L. Sperry and A. S. Pratt of the Stone & Webster executive organization, Boston; E. L. Milliken, Roger A. Gordon, F. K. Simmons and E. C. Tuite of the Blackstone Valley company.

Six-Million-Dollar Program of Tennessee Electric Power

The Tennessee Electric Power Company, which has now under construction a 20,000-kw. steam plant at Hales Bar on the Tennessee River, has recently purchased a second unit of the same size to be installed as soon as received. This will give this steam plant a capacity of 60,000 hp. It will operate in conjunction with the 60,000-hp. water station at the same location. The estimated cost of the steam additions is $4,000,000. Plans call for the completion of the first unit about May 1 and the second unit July 1, 1924.

Work is now in progress also on the installation of an additional 22,200-hp. unit at the company's Great Falls hydro-electric station near the town of Rock Island, 75 miles southeast of Nashville. This unit is of the vertical type. In connection with its installation a tunnel 600 ft. long is being built together with a new intake house and duplicate facilities to correspond with the 13,000-hp. unit in operation. The height of the dam at this development is being increased 35 ft., which necessitates building it up with concrete and raising the Taintor gates, which are now on top. The total cost of this work is estimated at $2,000,000. The installation of the new unit is scheduled for completion Nov. 1, 1924, and the dam for May 1, 1925.

The work of constructing a duplicate 120,000-volt line from Cleveland to Knoxville has been practically completed. This work cost approximately $370,000. Work was recently completed on the 15-mile extension of 22,200-volt lines into the town of Tellico Plains, serving a quarry which mines slate. A line has been built from Lenoir City into Friendsville to serve several marble quarries in that vicinity. Construction work has been started on an extension of power lines from Mascot, above Knoxville, into the town of Jefferson City.

Vice-president B. C. Edgar announced very recently that plans for expansion next year called for an expenditure of $5,000,000 or more. He said the proposed hydro-electric plant on the Ocoee River in Polk County would follow the completion of the Hales Bar steam plant and the development under way at Rock Island and that the company fully expected the work on the Ocoee to begin in 1924. This development will mean the building of a 24,000-hp. hydro-electric plant.

New York Commission Adopts Uniform Account System

The Public Service Commission of New York State on Dec. 19 adopted the uniform system of accounts for gas and electric corporations subject to its supervision as recommended by the National Association of Railway and Utilities Commissioners at its meeting in Detroit in November, 1922, with certain modifications necessary to adapt the system to New York State practice. The commission has been considering the adoption of the system for more than a year, and on Oct. 31 a public hearing was held at Albany attended by officials of leading electric and gas companies operating in the state. The new system of accounts will apply to all corporations under jurisdiction of the commission with operating revenues of $10,000 or more.

While the commission is obliged by law to give six months' notice in changing the system of accounts of a public service corporation, and the order of the commission therefore does not require compliance with its terms until July 1, 1924, it is announced at the office of the commission that nearly all of the corporations affected will install the new system of accounts on Jan. 1. The system has been adopted in Illinois, Wisconsin, Utah, Pennsylvania, Michigan and other states, and it is the aim of the National Association of Railway and Utilities Commissioners to have it adopted by all states. Accompanying the order the Public Service Commission of New York has issued a pamphlet of more than 100 pages setting forth in detail the various ramifications of the new system.

Illinois Public Service Valued at $60,759,000

The property value behind the par and no-par common stock of the Public Service Company of Northern Illinois, as of Jan. 1, 1923, was $131 per share, according to a computation just made by the Illinois Commerce Commission relative to the value of the company's properties "used and useful" in the public service and also based upon the value of certain other properties not included in the commission's valuation.

The Commerce Commission, after an exhaustive inquiry, fixed a valuation of $60,759,000 as a basis for rate-making purposes. The commission's valuation did not include certain valuable assets of the company which were not used in the actual rendition of service. Among the properties not included were the Hickory Creek, Jackson Creek and Marseilles water-power sites, securities owned, property represented by expenditures on the new Waukegan generating plant, sinking funds, insurance funds, properties leased to other companies and investments in affiliated companies, including the company's coal properties. These assets are valued by the company at $8,088,255, bringing the total to $68,847,255.

Transportation Midwinter A. I. E. E Theme

Railroad Presidents and National Leaders Will Talk to Nation-Wide Audience—Fortieth Anniversary of Institute to Be Celebrated—The Technical Program

RAILROAD presidents will talk on national transportation problems, railroad operating executives will depict the engineering features of modern transportation systems, the new Moore School of Electrical Engineering at the University of Pennsylvania will be dedicated, the university will confer honorary degrees on several engineers, the Edison medal for 1923 will be presented to John W. Lieb, and, finally, the fortieth anniversary of the American Institute of Electrical Engineers will be commemorated—these will be the outstanding features of the midwinter convention of the Institute in Philadelphia on Feb. 4-8, 1924, and it is confidently expected to be the biggest convention ever held by electrical engineers.

By wire and radio from Chicago, Boston, New York and Washington such men as President Markham of the Illinois Central, President Maher of the Norfolk & Western, President Budd of the Great Northern Railway and Vice-president Buckland of the New York, New Haven & Hartford on the evening of Tuesday, Feb. 5, will address a nation-wide audience in addition to the thousands that will pack the Metropolitan Opera House in Philadelphia. These men and others whose names are known throughout the nation will present the facts about modern transportation and its influence on industrial and social wellbeing, and will outline constructive plans for still greater developments. A Cabinet member and a prominent industrial leader will also contribute constructive views on transportation and its relation to the nation's welfare.

INSTITUTE'S FORTIETH ANNIVERSARY

On Monday evening, Feb. 4, the story of the development of a profession which started only forty years ago and now ranks in accomplishment and influence with any in existence will be told. Members of the small group of electrical engineers who formed the pioneer organization of the Institute will speak. Elmer Sperry, Elihu Thomson, T. C. Martin and J. J. Carty will give inspiration to the younger generation of electrical engineers by addresses illumined by their association with electrical developments since the inception of the present-day art. This will be followed by the presentation of the Edison medal to John W. Lieb.

To add variety to the meetings and to recognize the basic influence of education on engineering developments, the Institute members will be honorary guests of the Moore School of Electrical Engineering at the University of Pennsylvania on the afternoon of Feb. 6. This school is unique in being the only school of electrical engineering handsomely and separately endowed as a part of a great university, and it will be dedicated fittingly by the Institute to the cause of electrical education. To show its appreciation of the accomplishments of electrical engineers the University of Pennsylvania will confer several honorary degrees at this time.

Another interesting event will be the trip planned for Friday afternoon to the works of the Bethlehem Steel Company. After viewing the activities of this great plant the visitors will be entertained at Lehigh University as guests of the Lehigh Valley Section of the Institute.

THE TECHNICAL SESSIONS

Chairman William C. L. Eglin of the convention committee and Chairman L. W. W. Morrow of the meetings and papers committee have not, however, neglected the technical side of electrical engineering in arranging the convention program. In all nine technical sessions will be held, at which more than forty papers will be presented and discussed. These will cover transmission, superpower, industrial applications of electricity, electrical machinery and electrophysical subjects; they will be presented by authorities on the respective topics, and the discussions are sure to be animated, instructive and full.

Card parties, shopping trips, teas, dances and entertainments will be held with the view especially of entertaining the ladies who will accompany the delegates, these social features reaching their climax in the annual dinner-dance on Thursday night. Headquarters will be at the Bellevue-Stratford Hotel.

Program for Midwinter Convention A. I. E. E.

MONDAY, FEB. 4

Morning—Registration and committee meetings.

Afternoon—Technical session: "Economics and Limitations of the Superpower Transmission System," Percy H. Thomas; "Some Theoretical Considerations of Power Transmission," C. L. Fortescue and C. F. Wagner; "Power Transmission, F. C. Hanker; "Power Limitations of Transmission Systems," R. D. Evans and H. K. Sels; "Experimental Analysis of the Stability and Power Limitations of Transmission Systems," R. D. Evans and R. C. Bergvall; "Limitations of Output of a Power System Involving Long Transmission Lines," E. B. Shand.

Evening—Celebration of the fortieth anniversary of the Institute. Speakers: General John J. Carty, Prof. Elihu Thomson, Elmer A. Sperry and T. Commerford Martin; presentation of Edison medal to John W. Lieb.

TUESDAY, FEB. 5

Morning—Technical session: "Gaseous Ionization in Built-up Insulation—II," J. B. Whitehead; "Overdamped Condenser Oscillations," C. P. Steinmetz (deceased); "Free Convection of Heat in Gases and Liquids—II," C. W. Rice; "Magnetic Properties of the Ternary System Fe-Si-C," T. D. Yensen; "Alkali-Vapor Detector Tubes," H. A. Brown and C. T. Knipp.

Afternoon and Evening—Addresses on the operating aspects of railroad transportation, and a "transportation meeting" at Metropolitan Opera House. Among the speakers will be Ralph Budd, president Great Northern Railway Company; N. D. Maher, president Norfolk & Western Railway; C. H. Markham, president Illinois Central Railroad; Edward G. Buckland, vice-president New York, New Haven & Hartford Railroad, and L. G. Coleman, assistant general manager Boston & Maine Railroad. (Other speakers to be announced later.)

WEDNESDAY, FEB. 6

Morning—Technical session (A): "Transient Performance of Electric Elevators," David Lindquist and E. W. Yearsley; "Variable-Voltage Control Systems for Elevators," E. M. Bouton; "A Novel Alternating-Current Voltmeter," L. T. Wilson; "Oscillographic Study of Voltage and Current in Permeameter Circuit," W. B. Kouwenhoven and T. L. Berry, Jr.; "Power-Plant Auxiliaries—Their Relation to Heat Balance," A. L. Penniman, Jr.

Morning—Technical session (B): "Shaft Currents in Electric Machines," P. L. Alger and H. W. Samson; "Eddy-Current Losses in Armature Conductors," R. E. Gilman; "Tooth Pulsations in Rotating Machines," T. Spooner; "Surface Iron Losses, with Reference to Laminated Materials," T. Spooner and I. F. Kinnard.

Afternoon—Dedication of the Moore School of Electrical Engineering at the University of Pennsylvania.

Evening—"Transmission at 220,000 Volts," Frank G. Baum; entertainment and dance.

THURSDAY, FEB. 7

Morning—Technical session (A): "Method of Testing Current Transformers," F. B. Silsbee; "Recent Developments in Kilovolt-Ampere Metering," B. H. Smith and A. R. Rutter; "Automatic Transmission of Power Readings," B. H. Smith and R. T. Pierce; "Quadrant Electrometer for Measurement of Dielectric Loss," D. M. Simons and W. S. Brown.

Morning—Technical session (B): "Recent Advances in the Manufacture and Testing of Static Condensers in Power Sizes," R. Marbury; "Effect of Time and Frequency on Insulation Tests of Transformers," V. M. Montsinger; "Insulation Tests of Transformers as Influenced by Time and Frequency," F. J. Vogel; "Short Circuits of Alternating-Current Generators," C. M. Laffoon.

Afternoon—Technical session: "Economic Development of Step-by-Step Automatic Telephone Equipment," P. G. Andres; "High-Quality Transmission and Reproduction of Speech and Music," W. H. Martin and H. Fletcher; "Function and Design of Horns for Loud Speakers," C. R. Hanna and J. Slepian; "Certain Factors Affecting Telegraph Speed," H. Nyquist.

Evening—Annual dinner dance.

FRIDAY, FEB. 8

Morning—Technical session (A): "Measuring Methods for Maintaining the Transmission Efficiency of Telephone Circuits," F. H. Best; "Radio-Telephone Signaling—Voice Frequency," C. S. Demarest, M. L. Almquist and L. M. Clement; "Telephone Transformers," W. L. Casper; "An Electrical Frequency Analyzer," R. L. Wegel and C. R. Moore.

Morning—Technical session (B): "Multiple System of Cooling Large Turbo-Generators," D. Bratt; "An Experimental Study of Ventilation of Turbo-Alternators," C. J. Fechheimer; "Importance of Brush Mounting," P. C. Jones; "Transformers with Tertiary Windings," A. Boyajian.

Afternoon—Visit to Bethlehem Steel Company's plant.

Evening—Entertainment and visit as guests of Lehigh Valley Section at Lehigh University.

Plans for Spring Convention of A. I. E. E.

Birmingham, Ala., will be the location for the spring convention of the Institute, and the date will be April 7-11. The hearty co-operation of the local committee in Birmingham with the meetings and papers committee has brought about plans for a program which should attract electrical engineers from all parts of the country.

Hydro - electric developments and equipment, high-tension transmission lines and equipment, electric furnaces, oil circuit breakers, operation of interconnected systems, high-tension insulation, lightning arresters and relays are some of the topics which will be treated. It is planned to have authoritative papers presented on these topics by men representing the practices and opinions of all sections of the country, so that very profitable discussion should result.

As a feature of the convention it is planned to hold a meeting on the electrical development of the South—what it has meant and what it will mean. Industrial leaders, legislators and utility executives will talk on various aspects of this topic, and sufficient acceptances have already been received to warrant the promise of a successful meeting.

Local League Organization Committee Begins Work

W. E. Robertson, vice-president of the Robertson Cataract Electric Company, Buffalo, who was chairman of the conference of representatives of local electric leagues held on Association Island last September, has appointed the following committee to develop a plan for a national organization of local electric leagues. Charles A. Collier, Georgia Railway & Power Company, Atlanta; M. A. Curran, manager Western Electric Company, Cincinnati; R. E. Fisher, vice-president Pacific Gas & Electric Company, San Francisco; Joseph Fowler, president Fowler Electric Company, Memphis; J. E. North, commercial agent Cleveland Electric Illuminating Company; L. L. Strauss, New York; Earl E. Whitehorne, commercial editor ELECTRICAL WORLD, New York, chairman.

The committee was authorized by the conference to make a thorough study of existing local electric leagues, their organization and activities, and also of the organization plans of other national affiliations of local associations, such as the Rotary clubs, Kiwanis and the National Federation of Women's Clubs, and develop a plan for the national affiliation of local electric leagues that will provide for organized co-ordination and co-operation to strengthen and promote the league movement and make available to all the experience and achievements of successful leagues. This organization plan will be submitted for their information to all the national group associations of the electrical industry and brought before the next league conference, which is to be held in September, 1924, on Association Island.

American & Foreign Power Stock Quickly Sold

The 400,000 shares of preferred stock with a bonus of the same number of shares of common stock offered by the newly formed American & Foreign Power Company, Inc., last week were very quickly oversubscribed. Allotments, it was announced, will probably range between 15 and 20 per cent of subscriptions. Demand for the securities from abroad was much greater than had been expected by the syndicate offering them. With the sale of this stock the outstanding capitalization will consist of 400,000 shares of $7 cumulative preferred stock, 120,000 shares of $7 cumulative second preferred stock and 920,000 shares of common, of which 520,000 will be held by the Electric Bond & Share Company.

Before the formation of the American & Foreign Power Company, Inc., the Electric Bond & Share Company had acquired operating public utility properties in Cuba, Panama and Guatemala at a purchase price aggregating $13,114,213. These properties are now supplying electric light and power, telephone or other services to over thirty-nine communities in Cuba, Panama and Guatemala. All these properties have been successful, and for the year ended Aug. 31, 1923, earned $2,088,900 net. The American & Foreign Power Company, Inc., will take over and operate these properties.

General Electric to Aid Pure Research in Germany

According to recent announcement by E. W. Rice, Jr., honorary chairman of the board of directors, General Electric Company, Schenectady, N. Y., this company has arranged for the assistance of pure electrophysical research in Germany for one year under a committee consisting of the eminent and well-known scientists Max Planck, Professor Haber, Drs. Nernst, Laue and Franke.

The money is to be employed for the purchase of apparatus and material and must not be used to relieve the government of its duty of properly maintaining a laboratory. It is also to be used for the remuneration of coworkers and assistants. It is not to be used for the solution of problems of direct industrial use, such as specified technical processes.

The company has also arranged to place a small fund at the disposal of Dr. Nernst, who is director of the Technisches Reichsanstalt in Berlin, for a study of the electric phenomena preceding and accompanying the breakdown of insulators. This is a problem on which Dr. Steinmetz was at work, but even had he lived, competition would have been useful in the achievement of the results sought for.

The result of the work of these German scientists is to be made public for the general good of all. Their work, while financed by and to a certain extent in co-operation with the General Electric Company, will not be the property of that concern in any sense, but will be published in full.

Successful Pioneer Illumination of Football Game

BY FLOODING the football gridiron with light from eight 18-in. searchlamps and fifty "L-15" projectors mounted 42 ft. above the ground at the General Electric Company employees' athletic field in Lynn, Mass., Nov. 21, the first thoroughly successful night football game to be played in the world, so far as is known, was enjoyed by a crowd of five thousand enthusiasts who were invited to the contest. The General Electric student engineers' and Tufts College second elevens played a tie game under an illumination varying from about 4 foot-candles in the center of the field to about 1.25 foot-candles at the sides. All the lamps used consumed 1,000 watts each at 110 volts and were of the gas-filled type. Football coaches from many athletic centers attended and were loud in their praise of the installation. Energy was supplied by the Lynn Gas & Electric Company.

Dickinson Bill on Muscle Shoals

Measure Thought to Have the Support of Representative Madden and Other Republican Leaders Sanctions Fifty-Year Lease to Ford—Fertilizer Project Prominent

REPRESENTATIVE MADDEN of Illinois, Republican leader in the House of Representatives, and others influential in the majority party are understood to favor the passage of the bill (H. R. 3222) introduced by Representative Dickinson of Iowa to lease to Henry Ford for fifty years the government nitrate plants and dams at Muscle Shoals, Ala. As stated in the ELECTRICAL WORLD last week, by the terms of this bill the operations at Muscle Shoals would come under the provisions of the water-power act, administered by the Federal Power Commission. The measure provides that the government is to receive an annual return of 6 per cent on its actual expense of constructing the dam and other project works, exclusive of navigation facilities, with the proviso that only 3 per cent need be paid for that portion of the facilities used in the production of commercial fertilizers. A summary of the other chief provisions of the measure follows:

GORGAS PLANT ELIMINATED

The Secretary of War is empowered to accept the offer of Henry Ford, as made on May 31, 1922, with the exception of the part relating to the Gorgas plant and transmission line. Mr. Ford must form a corporation in which $10,000,000 must be paid in in cash, to be controlled by the company. The lease is to run for a period of fifty years from the date when structures and equipment sufficient to generate 100,000 hp. shall have been completed. At the end of that calendar year the first payment of $200,000 must be made. Thereafter $500,000 must be paid annually for a period of five years.

The government is to complete Dam No. 2, acquire necessary lands and flowage rights and install equipment up to a capacity of approximately 600,000 hp. Maintenance of the power house, machinery and other appurtenances is to be at the expense of the company. Maintenance of the dam is to be the responsibility of the United States. Energy not to exceed 200,000 hp. is to be delivered for the operation of the locks. The proposed site for Dam No. 3 is to be held open to the company for a period of three years, during which time it is to have preference in the matter of a water-power license.

For an annual rental of one dollar the company may lease all of the property constituting Nitrate Plant No. 2 and be privileged to use any and all of the patents, processes, methods and designs which the government has acquired, together with the sulphuric-acid units now in storage on the premises. Practically the same conditions apply to Nitrate Plant No. 1, but the company is not to be obligated to operate the No. 1 plant as a nitrogen-fixation plant. Under the dollar-a-year lease are included also the property and appurtenances at the Waco quarry. The company is obligated to manufacture nitrogen and other commercial fertilizers, "mixed or unmixed and with or without filler, according to demand, at Nitrate Plant No. 2 or its equivalent."

FERTILIZER RESEARCH IMPOSED

A further condition is "to determine by research whether by means of electric furnace method and industrial chemistry there may be produced, on a commercial scale, fertilizer compounds of higher grade and at lower prices than farmers and other users of commercial fertilizers have in the past been able to attain, and to determine whether in a broad way the application of electricity and industrial chemistry may accomplish for the agricultural industry of the country what they have economically accomplished for other industries and, if so found and determined, to reasonably employ such improved methods."

The profit on the fertilizer products is not to exceed 8 per cent. The fertilizer production is to be under the supervision of a board of not more than nine voting members to be chosen as follows: The American Farm Bureau Federation, the National Grange and the Farmers' Educational and Co-operative Union of America are each to designate not more than seven candidates, in the first instance, and thereafter, for succession in office, not more than three candidates. From this number the President is to nominate not more than seven. The company is to select two voting members of the board. The members of the board are not to draw compensation from the government. A representative of the Bureau of Markets is to serve the board in an advisory capacity.

To insure equitable distribution of the product, the board is empowered to make regulations for its sale. If the board disagrees, the matter is to be referred to the Federal Trade Commission.

GOVERNMENT REGULATION PROVIDED

The company is to operate the project "so as to produce the fullest practicable output of salable electrical energy and must transmit, distribute and sell all surplus energy not used by it in the manufacture of nitrogen or other commercial fertilizers or must enter into contracts for its distribution. The distribution of the power is to be under state regulation or that of the Federal Power Commission. The Federal Power Commission will determine the proportion of power used in the manufacture of nitrogen or other fertilizers and the practicable output of salable electrical energy. It will determine the adequacy of repairs and the necessity of renewals.

At the end of the fifty years the company is to have a preferred right to negotiate for a renewal of the lease. If the terms of renewal offered by the government are not accepted by the company, the conditions of the contract are to remain in effect until the government shall have disposed of the plants and properties to another under terms no less favorable than those offered to the company.

POINTS OF DIFFERENCE SUMMARIZED

The main points of difference between the provisions of the Dickinson bill and those of the original Ford offer are these:

The offer is amended by providing for the completion of Dam No. 2 by the United States.

The period of the lease is made fifty instead of a hundred years.

The annual charge payable for the use of the government property is to include interest, maintenance and depreciation and to be computed on the government investment exclusive of locks and navigation facilities, and a change is made in the schedule of payments for the first six years, increasing them by $1,500,000. The charge is to be cut from 6 per cent to 3 per cent to the extent to which the power is actually used for the production of fertilizers. The original Ford offer proposed to pay 4 per cent on the government investment. A proposed annual charge of $35,000 to reimburse costs of operation of the dam and gates is eliminated.

The provisions of the Ford offer with respect to the construction of Dam No. 3 have been eliminated. It is proposed in the Dickinson bill that the United States shall reserve for a period of three years the site of Dam No. 3, during which time the company shall have a preference right to apply for it under the federal water-power act if the power which can be produced at Dam No. 2 proves insufficient.

By the Ford offer it was proposed that the company should purchase from the United States the nitrate properties at Muscle Shoals and the steam power plant at Gorgas and its transmission line for the sum of $5,000,000. It is proposed by the Dickinson bill that, instead of selling the nitrate properties, the United States shall lease them for the same period as Dam No. 2, that is fifty years, for a nominal annual rental of $1. This change would relieve the Ford company of the payment of the $5,000,000 as originally proposed. In order to protect any investment which the company may make in original plant or in improvements, provision is made in the bill for reimbursement of such expenditures in the manner provided in the federal water-power act, in the event that the lease is not renewed on termination.

From the Ford offer the words "adjacent or near thereto" have been eliminated, in order that no restrictions may be placed upon the location of plants for the production of fertilizers if it should be found desirable to locate them further from Muscle Shoals.

The expression "annual cost," held to be vague in the Ford offer, is clearly defined in the Dickinson bill. The company is required to operate the power properties to their full capacity and to dispose of all surplus energy not used by it in the manufacture of fertilizers or to contract for such disposal. The transmission, distribution and sale of such power is made subject to regulation by public authority, as provided in the federal water-power act, and the company is required to establish and maintain a system of accounts.

The Federal Power Commission is by the terms of the bill to determine certain questions of fact upon which the annual charges would be based, to determine whether the power project is fully operated, and to supervise the maintenance and renewal of power house and equipment. The provisions of the federal water-power act with respect to recompense for headwater improvements are incorporated.

The company is to have a preference right for renewal of lease at the end of fifty years, and if there is not agreement between the company and the United States at that time, the conditions of the existing offer are to remain in effect until the United States shall find a new lessee under conditions no less favorable than those offered to the company. If the properties are leased to another, the company shall be compensated for the fair value not to exceed actual cost of any properties constructed by itself or for any betterments of or additions to existing government property.

The proposed amendment would frankly subsidize fertilizer production by eliminating the proposed cash payment of $5,000,000 and the annual payments for maintenance and sinking fund, by reducing the rate of interest to 3 per cent, by making no charge for the use of the government nitrate properties, and by protecting any investment the company may itself make. If the company really desires to produce nitrates, say the advocates of the Dickinson bill, the amendment is more favorable than the original offer made by Mr. Ford and embodied in former bills.

President Coolidge Lights White House Christmas Tree

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PRESIDENT COOLIDGE has taken much interest in the electrically lighted outdoor tree which was a feature of the Christmas at the White House and personally turned on the lights on Christmas Eve. As stated in these columns last week, this "national" electric Christmas tree was the result of a suggestion from the Society for Electrical Development. The tree was presented by Middlebury College, Vermont, and installed through the co-operation of various electrical men in Washington. The Potomac Power Company hauled the tree from the station and set it up in the "White Lot" south of the White House. The Washington Electrical League furnished and installed all the equipment and the decorations on the tree itself, consisting of 2,000 multi-colored lamps and a three-foot star illuminated by high-candle-power white lights. The Capital Traction Company and the Washington Railway & Electric Company contributed publicity to the event by carrying announcements on the front of all street cars. The ceremonies at the tree on Christmas Eve, attended by about 4,000 people, consisted of Christmas carols and musical selections by the Marine Band.

The first three figures from left to right in the picture are William L. Goodwin, operating vice-president of the Society for Electrical Development, Senator T. L. Greene of Vermont and J. H. Colbeck, treasurer Washington Electrical League. President Coolidge stands to the right.

Before the Power Board

Grays Harbor Company Will Fight Municipality—Renewability of Three-Year Permits

THE Grays Harbor Light & Power Company of Aberdeen, Wash., a concern operated by Sanderson & Porter of New York, has applied to the Federal Power Commission for a preliminary permit covering a project in the Wynooche River at a point 25 miles above Aberdeen. It is planned to build a dam 150 ft. to 170 ft. high. A conduit is to be run to a power house where 10,000 hp. will be developed. The site of the reservoir is covered with a heavy growth of timber. It will be a number of years before the site will be cleared, but the power company has been forced to put in its application by the action of the municipality of Aberdeen in voting a bond issue of $2,000,000 looking to this very development. The power company expects to contest any effort on the part of the municipality to develop this site.

Walter Cravens of Kansas City has applied for a preliminary permit to construct a dam 100 ft. high on the Osage River 8 miles above Bagnell, Mo. The dam will create a pool 125 miles long. The reservoir will cover 65,000 acres. It is the plan to install machinery capable of developing 50,000 hp. The primary power available is 20,000 hp. The entire cost of the project is expected to be in the neighborhood of $7,500,000.

The city of Tacoma, Wash., has applied to the commission for a license to cover a minor portion of its Skokomish River project. In carrying through this large development nine acres of the Olympia National Forest will be flooded. The remainder of the project, which was described in the ELECTRICAL WORLD for Dec. 8, page 1191, does not come within the purview of the Federal Power Commission. The plans involve the construction of a transmission line 40 miles long to carry energy to Tacoma.

RENEWABILITY OF PERMITS

An announcement on the part of an important interest that it expects to file an application for another preliminary permit under the water-power act after having held a preliminary permit for the full three years allowed by the law has led to a study of that situation by the staff of the commission. The conclusion has been reached that the law does not contemplate allowing any one interest to have priority rights for more than three years. It is probable that the commission will be asked to approve a recommendation that no preliminary permit be granted a second time to the same interest. It would be possible, of course, for the applicant to come in at any time after the expiration of his preliminary permit with an application for a license. This situation is being faced at present on the lower Niagara Gorge project, on a Pit River project and on the Dixie projects. Other projects soon will be in the same situation.

Brief News Notes

Motorboat Show to Be Held Next Month.—The nineteenth annual motorboat show in Grand Central Palace, New York, will be held on Jan. 4-12, with a full display of electrical features, including ignition for the engine, searchlamps, cabin lamps, refrigerating sets, pumps, radio and apparatus for steering and for handling the anchor.

Wewoka Sells Plant to Oklahoma Utility.—The election held at Wewoka, Okla., on Dec. 12 resulted in the sale of the local municipal electric light plant to the Central Oklahoma Light & Power Company, a subsidiary of the Oklahoma Gas & Electric Company. Only four votes were cast against this action.

Sixty-two Municipal Plants in Iowa Given Up.—By a unanimous vote the City Council of Little Sioux, Iowa, has agreed to abandon its municipal plant and to receive service from the high-tension line of the Iowa Service Company. The company will build a line from Mondamin, a distance of 7 miles. Little Sioux is the sixty-second Iowa municipality to abandon its electric light and power plant for private service.

Waterloo Central Station Builds New Dam.—The dam built by the Citizens' Gas & Electric Company across the Cedar River at Waterloo, Iowa, at a cost of $250,000, has been completed. This dam, which took the place of a fifty-year-old structure, was begun in August, 1922. It is the intention of the company to build a hydro-electric plant on the east bank of the river in the near future.

Electrical Progress in Houston, Tex.—Operating revenue of the Houston (Tex.) Lighting & Power Company during its fiscal year just closed amounted to $2,465,835, as compared with $2.028.392 last year. Operating expenses were $913,922 as compared with $830,028. These figures are given in the report of S. R. Bertron, general manager. The city of Houston shares in the company's earnings, and this year it will receive $88,348 as its share. Last year the city received $104,746. The decrease is explained by the greater outlay for improvements and betterments.

Maine Engineers to Compile Water-Power Data.—At a recent meeting of the Portland branch of the Maine Association of Engineers a committee of five was named to look into the water-power situation in the state. Its conclusions will probably be submitted to the Legislature. At this meeting Philip W. Blake a consulting engineer of Portland, said: "I ask any man in the room to tell me one reason why it is bad policy to sell water power developed in the state outside the State of Maine." His challenge, says the report, remained unanswered.

Marysville, Ohio, to Resume Street Lighting.—After two years of dark streets, Marysville, Ohio, with a population of 4,000, is about to resume street lighting as the result of a mayoralty campaign waged around that issue. Marysville gets its electric light and power from the Ohio Edison Company, and a contract with that company for street-lighting service has been negotiated on the following terms: For 600-watt lamps, $60 per lamp a year; 250-watt lamps, $40, and 60-watt lamps, $30. A new domestic service schedule, starting at 11 cents a kilowatt-hour, has also been accepted.

Western States Gas & Electric's El Dorado Development.—The Western States Gas & Electric Company, with headquarters in Stockton, Cal., has been authorized by the California Railroad Commission to issue and sell at not less than 88½ per cent of face value, plus accrued interest, $800,000 of its first and unified mortgage series "A" gold bonds, due March 1, 1947, for the purpose of financing in part the cost of completing the first unit of its El Dorado power development project. The El Dorado project will develop 28,000 hp. and is scheduled for completion early in 1924.

Georgia Company Adds Eight Towns to Distribution System.—The retail distribution systems of the Wofford Shoals Light & Power Company in Cornelia, Clarkesville, Alto, Baldwin, Lula, Mount Airy, Bellton and Hollingsworth have been purchased by the Georgia Railway & Power Company, which will take over the property on Jan. 1 and will operate it thereafter as an integral part of its system. The towns involved are on or near the main line of the Southern Railway and approximately 80 miles from Atlanta. With this acquisition the Georgia Railway & Power Company will operate the retail distribution systems in twenty-one towns besides serving forty on a wholesale basis.

Growth of Public Service Corporation of New Jersey.—The Public Service Corporation of New Jersey, which has rounded out its twentieth year, now serves a population which, according to a historical and statistical booklet just issued by the company, has grown from 1,631,174 to 2,829,604. It supplies 228 municipalities as compared with 115 when it was incorporated. The annual revenues of its electric department have increased more than $26,-000,000 and the individual demand for service from 32 kw.-hr. to 203 kw.-hr. a year (in 1920) per inhabitant. The company's annual tax bill rose to $8,235,736 in 1922. Its kilowatt-hour sales for the current year will reach more than a billion, its experts estimate.

Southern California Edison Company Orders Large Synchronous Condensers.—The Southern California Edison Company has ordered from the Westinghouse Electric & Manufacturing Company three 30,000-kva. synchronous condensers with direct-connected exciters and nine 11,667-kva. step-down transformers with starting taps for the synchronous condensers. The condensers have a maximum capacity of 35,000 kva. and are, the manufacturer says, the largest in the United States.

Opposition to Diversion of San Benito River.—The Federal Power Commission will probably reject the application of W. Neumann and D. Hirstel of San Francisco for a preliminary permit covering a projected diversion of the San Benito River from its natural course into the San Joaquin River. Investigation has revealed that all of the water of the San Benito is needed for irrigating lands along its natural course. Moreover, it is believed that the development of the river in its natural course is more promising and less expensive than the proposed diversion, which would almost certainly result in extensive litigation.

Engineers Oppose City Distribution of Hetch Hetchy Power.—That acquisition by the city of San Francisco of a municipal distribution system at the present time would cripple the water project financially and endanger the city's rights to the use of the water was the gist of a report adopted by the American Association of Engineers at a meeting held in San Francisco recently. Temporary distribution of power through existing agencies was recommended. The report says that 76 per cent of the power used in the Bay region is used by manufacturing and commercial interests which are more interested in reliability of service than in the possibility of slightly lower rates.

Public Ownership Agitation in Washington State.—The Washington Superpower League, organized in Seattle for the purpose of supporting the passage of legislation to permit cities to sell power outside their boundaries, will support an initiative power bill to be submitted to the voters at the 1924 election providing for public ownership of utilities, particularly power plants, and will take into consideration the Erickson and Bone bills, both permitting cities to sell power outside their boundaries. Whether the Washington Superpower League will co-operate with the Seattle Municipal League is uncertain, there being said to be a difference in plans.

One Circuit of Cincinnati-Dayton Line Finished.—One of the two 66,000-volt circuits under construction from Dayton to Cincinnati has been placed in service. This circuit consists of 27 miles of wooden poles and 2 miles of steel towers. Thirty-three consecutive days comprised the total working time

of the wire-stringing gang. A temporary substation at Miller's Ford consists of three single-phase, 8,333-kw. water-cooled transformers. These transformers require 1,925 gal. of oil and weigh 46,400 lb. They have a temperature rating not to exceed 55 deg. C. at a continuous load with circulating water of 27 gal. per minute. The efficiency at full-load rating is 99.05 per cent. Oxide-film arresters totaling 536 cells provide lightning-arrester protection. Three of the legs carry weatherproof spark gaps, which are mounted on top of the stack assembly. Work is rapidly continuing on the second line, which is very nearly completed.

French to Open Wire Service for Drawings and Manuscripts.—Beginning Jan. 1, press dispatches say, drawings, plans, designs and manuscripts will be accepted by the French government telegraph administration and transmitted by wire. These will be called telautographic messages. Their commercial possibility is due to Edouard Belin, an inventor. At the beginning messages will be accepted for transmission only between Paris and Lyons and Paris and Strasbourg. Later the system will be extended to connect all the big centers of France. By the Belin method so exact a reproduction of the original is obtained at the receiving station that transmitted signatures will be valid. The cost of transmission is relatively small, being 10 francs or 20 francs, according to the dimensions of the manuscript or drawing.

California Co-operative Campaign Plans 1924 Work.—The plans of the California Electrical Co-operative Campaign for next year's activities, as announced at the meeting of the executive committee at Del Monte, Dec. 7, were a continuation of the portable window-lighting exhibit, the electrical homes, the work with the architects and builders and the assistance being given contractors and dealers in merchandising methods, window trimming and store arrangement. The portable window-lighting exhibit mounted on a Ford truck has been shown in forty cities and towns of the state during the year with very tangible results in new business obtained. Seven electrical homes have been shown in the last year, with an average attendance of between fifteen and twenty thousand persons per home. An appropriation equal to that of last year is being sought to carry on the work, and indications are that there will be no difficulty in obtaining this.

Utah Company Providing Against Emergencies.—The Jordan River in Utah, which was withdrawn from entry a few years ago, with other main tributaries of the Great Salt Lake, because of the investigation of a reclamation project, has been restored to entry, and the Utah Power & Light Company has filed an application for the use of 75 second-feet of water in its Jordan steam-plant extensions. The power company wishes to supplement its hydro-electric system by enough steam capacity to make Salt Lake City and tributary territory assured of a continuous power supply in event of damage to transmission lines from the north. An order has been placed for a 20,000-kw. steam turbine, which will increase the company's installed capacity at the Jordan River plant to about 45,000 hp. Work has been under way for some time on the enlargement of the plant, and it is expected that the total expenditure will be about $1,500,000.

Ohio Power Company May Build High-Tension Line from South Bend to Lima.—That a 132,000-volt transmission line will be built by the Ohio Power Company through Fort Wayne, Ind., to connect South Bend with Lima, Ohio, provided the present plans of the company mature, became known when a photographer left Fort Wayne in an airplane to make pictures of the topography of the proposed route. Since work on the new power plant at Mishawaka, near South Bend, has started, S. W. Greenland, president and general manager of the Indiana Service Corporation, Fort Wayne, told a correspondent of the ELECTRICAL WORLD he had no doubt the proposed transmission line will be built and that if it is built the Indiana Service Corporation will take supplementary power from this source.

Associations and Societies

Worcester Section, A. I. E. E.—William C. Yates, manager of the industrial control sales department of the General Electric Company, Schenectady, N. Y., addressed this section last week on "Industrial Control and Applications."

Western Association of Electrical Inspectors.—The nineteenth annual meeting of this association will take place at the Hotel Fontenelle, Omaha, Neb., on Jan. 29-31, 1924. The meeting will in large part be devoted to the consideration and interpretation of the 1923 edition of the National Electrical Code. All inspectors in the United States and Canada are invited.

Next Year's Advertising Association Convention.—Lou E. Holland of Kansas City, president of the Associated Advertising Clubs of the World, with which the Public Utilities Advertising Association is amalgamated, has announced that July 14 has been definitely set as the date for the opening of the world convention of advertising in London next summer, and that plans are afoot to take over a delegation of at least two thousand publishers and advertisers from America.

Nebraska Section, N. E. L. A.—Horace M. Davis, secretary of this section, announces that the date of its 1924 convention, to be held at Omaha, will be May 8 and May 9.

Pennsylvania Electric Association.—On Jan. 16 a geographic section meeting of the Pennsylvania Electric Association will be held at the Hotel Adelphia in Philadelphia. There will be an all-day session. Power-station auxiliaries, interconnection and inductive co-ordination will be the topics.

Engineers' Club of Philadelphia.—A conference on economy in the use of fuel will be held by this club on Jan. 15, with morning, afternoon and evening sessions. The treatment of the subject is to be confined strictly to its engineering and financial phases, avoiding the commercial phase of competitive fuel-saving devices, and the program will be arranged approximately on the uses of fuel in the order of relative tonnage of possible fuel saving. Papers will be presented by engineers recognized as authorities in the various phases of the subject, with open discussion.

Technical National Section, N. E. L. A.—Group meetings of this section will be held in Birmingham, Ala., from Jan. 28 to Feb. 1 inclusive. A general meeting of the section is scheduled for Jan. 30 at 8.30 p.m. and a meeting of the executive committee for Jan. 31 at 6 p.m. Committee meetings convene at 9.30 a.m. as follows: Jan. 28, meter; Jan. 28-29, inductive co-ordination, underground systems; Jan. 29-30, electrical apparatus, prime movers, hydraulic power, meter, uniform specifications; Jan. 31, overhead systems, electrical apparatus, prime movers, hydraulic power, accident prevention, uniform specifications; Feb. 1, overhead systems, electrical apparatus, prime movers, accident prevention. Visits to the plants of the Alabama Power Company will be made.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

American Engineering Council (F. A. E. S.)—Washington, Jan. 10-11. L. W. Wallace, 26 Jackson Place, Washington.

Kentucky Association of Public Utilities—Seelbach Hotel, Louisville, Jan. 10-11. E. F. Kelly, Louisville Railway Company.

Wisconsin State Association of Electrical Contractors and Dealers—Pfister Hotel, Milwaukee, Jan. 17-19. H. M. Northrup, 23 Erie Street, Milwaukee.

National Association of Lighting Equipment Dealers — Hotel Sherman, Chicago, Jan. 21-26.

Technical National Section, N. E. L. A.—Birmingham, Jan. 28-Feb. 1.

Western Association of Electrical Inspectors—Hotel Fontenelle, Omaha, Jan. 29-31. W. S. Boyd, 175 West Jackson Blvd., Chicago.

American Institute of Electrical Engineers—Midwinter convention, Bellevue-Stratford Hotel, Philadelphia, Feb. 4-8. F. L. Hutchinson, 33 West 39th St., New York.

American Physical Society — New York, Feb. 23.

Commercial National Section, N. E. L. A.—St. Louis, Feb. 27-28.

Commission Rulings

Evidence of Going Value.—The North Dakota Board of Railroad Commissioners, valuing the property of the Red River Power Company, said that a statement purporting to show the gradual development of the business and the necessary expenditures and forbearance of financial return on the original investment of a utility company is not conclusive evidence of going value where it covers a period of years before commission regulation began and no attempt has been made to determine the reasonableness of the operating expenses for the early years.

Combining Meter Readings Prohibited—Rates to Large Consumers.—In ordering a reduction in the rates of the electric department of the Red River Power Company, the North Dakota Board of Railroad Commissioners condemned the practice of combining the readings of several meters in different locations owned by the same customer in order to reach a total large enough to be entitled to a reduced schedule. Such a practice the commission called unreasonable and discriminatory. On the question of reductions to large consumers it said that a lower rate is justified provided it is sufficiently remunerative to pay the output cost and a part of the fixed cost, but that any special rates which provide for the furnishing of service at less than production cost are unreasonable and discriminatory.

Essential Railroad Construction May Be Included in Rate Base.—In the course of the hearings held by the California Railroad Commission to arrive at a valuation for the Southern California Edison Company objection was raised to the company's total book investment in the San Joaquin & Eastern Railroad being included in the rate base. Representatives of certain consumers contended that the investment in the railroad should be entirely excluded from the rate base for the reason that it is incorporated and operated as a separate unit, that its rates are subject to orders of bodies other than the commission, and that it is engaged in the handling of express matter, excursion trains and passengers, which is an entirely different business from serving electrical energy. The commission, however, pointed out that the railroad was constructed in connection with the installation of the Big Creek power plants, that the bonds were guaranteed by the power company and all of the stock owned by it, that it was incorporated separately and has been operated as a common carrier under the jurisdiction of the Interstate Commerce Commission, that the evidence showed it to be necessary for the construction and operation of these plants, and that it is required for the construction and operation of new plants under way and for plants proposed for the future, and cannot be economically replaced by any other method of transportation. "The railroad therefore," said the commission," appears to be rendering a definite and necessary service in the construction and operation of hydro-electric plants, and for that reason the total investment cannot fairly be deducted from the rate base. The reasonableness of including the railroad investment in the rate base can be shown by considering the conditions if the road had only been useful during the construction period and thereafter removed. The expenditure would have been charged to construction of hydro-electric plants and the cost would have been prorated among the plants installed and would have become in that way a part of the rate base. The objection that the railroad is used in other business than electric does not prohibit it from being included in the electric rate base as these activities are incidental to the electric requirements and the revenues from these sources held pay expenses that would otherwise fall upon the electric consumer were it not operated as a common carrier. Necessarily credit to the electric business should be made for any earnings received from the railroad."

Invasion of Territory and "Gentlemen's Agreements."—In hearing a complaint brought by the Fleetwood & Kutztown Electric Light, Heat & Power Company against the Topton Electric Light & Power Company involving invasion of territory the Pennsylvania Public Service Commission refused to entertain a contention by the owners of the invading company that they were innocent purchasers for value of its stock without notice of an alleged understanding and "gentleman's agreement" not to enter certain territory. The commission held that the operations of the other company at the time of the stock purchase were sufficient to put the stockholders on notice and that upon proper inquiry full knowledge of facts could have been obtained.

Service Must Not Be Discontinued Where Bona Fide Dispute Exist.—Where a bona fide dispute exists between a utility company and a consumer in regard to a bill for service, payment cannot be enforced by shutting off service, according to a reiterated decision of the New Jersey Board of Public Utility Commissioners made in a complaint against a water company (Graves vs. Noteboom). The board said: "This matter has been passed upon formally by this board in the case of Murphy vs. Coast Gas Company. In its conclusions in that case the board said: 'Where gas companies do not require a deposit, the reasonably prompt payment of admittedly due bills for gas may be enforced by a prompt cessation of service. But the payment of back bills bona fide in dispute . . . cannot be enforced by shutting off service. The company still has a remedy in the courts.'"

Recent Court Decisions

Burden of Proof on Utility Company.—Dismissing a bill in equity brought by the Reno Power, Light & Water Company, alleging that rates fixed by the Nevada Public Service Commission for gas were confiscatory, the United States District Court declared that the burden is clearly on a utility company attacking rates fixed by a commission to show that, if enforced, the difference between the gross revenue derived from rates and the necessary ordinary expense of operation is too small to yield a fair return on the reasonable value of its property after paying taxes and a proper depreciation annuity. Reproduction cost, while a highly important fact in valuation, is not necessarily a controlling factor in fixing rates. The reasonable value of public utility property, declared the court, should be gathered from a careful and comprehensive consideration and comparison of its original cost, the cost of reproduction new, depreciation, additions, improvements, present and probable future revenues and expenses, market value of stocks and bonds, and any factor or circumstance which adds to or takes from its value.

Sweeping Limitation Imposed on Powers of Wisconsin Railroad Commission.—The Wisconsin Supreme Court has affrmed the decision handed down recently by the lower court at Madison in State vs. Washburn Waterworks Company, involving the issue of municipal or commission jurisdiction over public utility extensions within municipal boundaries. The Supreme Court in this important finding holds that authority to demand such extensions and to impose fines for failure to construct them is vested in the municipalities and not in the Wisconsin Railroad Commission. This is the case in which the commission had assessed fines against the waterworks company aggregating nearly a million dollars for failure to comply with the commission's order to make extensions requested by city officials and property owners. In a previous decision in the same case the Supreme Court, in the absence of any representative of the water company when the case was called, sustained the original decision of the commission and held the company liable in the amount of the accumulated fines. (See ELECTRICAL WORLD, Nov. 24, page 1087.) This order, however, was later rescinded on proof that officials of the company had not been apprised of the date of the hearing, and the case was restored to the calendar.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

John L. Livers Leaves Charlottesville

John L. Livers, president of the Charlottesville & Albemarle Railway Company and vice-president of the Virginia-Western Power Company, with which the street car and light properties were recently merged, has resigned. Mr. Livers has been connected with the electrical properties at Charlottesville since 1912, and under his management the company has successfully met the requirements for light, power and railway service of the city. He is a native of Gettysburg, Pa., and started his career in the electrical industry as lineman at the age of eighteen. For several years he engaged in construction work and subsequently entered the operating and contracting field. Mr. Livers' resignation, effective Dec. 31, will cause general regret in Charlottesville, where not only the electrical utilities have had the benefit of his valuable services but also every movement that made for civic betterment and progress. Early in January he will leave for Ormond Beach, Fla., where he will spend the winter.

W. H. Young, formerly connected with the operating department (electric) of the Central Hudson Gas & Electric Company, has been transferred to the engineering department of the company.

Andrew G. Betts, who has been connected with the meter department of the Tacoma (Wash.) Railway & Power Company for twelve years, has been appointed superintendent of the Olympia (Wash.) Light & Power Company.

Joseph Gartenman, formerly connected with Dwight P. Robinson, Inc., New York, as electrical designer, has joined the division of construction and engineering of Stone & Webster, Inc., in the capacity of electrical designing engineer.

Philip H. Chase of the Philadelphia Electric Company has been elected chairman of the Technical Section of the Pennsylvania Electric Association. E. C. Stone of the Duquesne Light Company was the chairman during the past year.

W. M. Walsh, for the past twelve years connected with the Adirondack Power & Light Corporation, Schenectady, N. Y., will join the organization of the Connecticut Light & Power Company at the general offices of the company in Waterbury, Conn., on Jan. 1. Mr. Walsh will be general merchandising manager in charge of the company's merchandising activities in Waterbury, Naugatuck, New Britain, Norwalk, Branford and Greenwich. He started with the Adirondack company twelve years ago as clerk and advanced rapidly, to the position of assistant sales manager in 1917 and sales manager in 1919.

Emile Garcke, British Electrical Engineer

Emile Garcke, president of the British Electrical Federation, London, has been associated with the electrical industry since 1883, and during that period of forty years he has devoted much time and energy to the development and progress of electrical enterprises. Mr. Garcke was born in Germany in 1856, but became a naturalized British subject in 1880. He became identified in 1883 with the management of the Brush Electrical Engineering Company, where he spent ten years in active service, and in 1910 he was made its chairman. From 1893 to 1895 he played the rôle of managing director of the Electric Construction Company for the purpose of reorganizing the company, and since that time as managing director of the British Electric Traction Company (and since 1911 as chairman) he has given special attention to promoting the electrification of the railroads in the United Kingdom.

EMILE GARCKE

Mr. Garcke was an original director of the Electric & General Investment Company and of the Electrical & Industrial Investment Company and is at the present time president of the British Electrical Federation. He is a member of the Institution of Electrical Engineers and has served as vice-president of the Tramways & Light Railways Association and as chairman of the electrical section of the London Chamber of Commerce. Mr. Garcke has contributed to the technical press and is the compiler of the "Manual of Electrical Undertakings," published annually.

R. F. Mullin, commercial manager in the Muncie division of the Indiana General Service Company, has been transferred to Elwood as division manager, succeeding Homer E. Gant, who has been made district manager of the North Western Ohio Light Company at Van Wert, Ohio.

Frank B. Jewett, vice-president of the Western Electric Company and past-president of the American Institute of Electrical Engineers, received the decoration of the fourth class of the Imperial Order of the Rising Sun on Monday, Dec. 24, at his office in New York City, by order of the Emperor of Japan. The honor was given in recognition of the assistance which Dr. Jewett and his company are giving to the Japanese government.

Edwin S. Webster, president of Stone & Webster, Inc., Boston, has been appointed honorary Japanese consul at Boston. The appointment was made to promote good will between Japan and the United States. Mr. Webster visited the Far East last year in the interest of hydro-electric and other proposed engineering developments, and he was a member of the citizens' committee in the recent Red Cross drive for Japanese earthquake relief.

Homer E. Gant of the Indiana General Service Company of Elwood, Ind., has been transferred to the North Western Ohio Light Company in the capacity of district manager, with headquarters at Van Wert, Ohio. Both these properties are subsidiaries of the American Gas & Electric Company. Mr. Gant was associated with the Indiana General Service Company at Marion for eighteen years and has been manager of the Elwood division for the past year.

Obituary

John Mustard, who had been associated with the electrical industry almost from its inception, died on Dec. 12 at his home in Philadelphia, at the age of fifty-six. From 1884 to 1887 Mr. Mustard was associated with the Marr Construction Company, Pittsburgh, being a pioneer in the installation of electric light plants. The following year he formed the contracting firm of Kingsbury & Mustard, Baltimore, and in 1891 he joined the Wagner Electric Manufacturing Company, St. Louis, as its Philadelphia representative. This position he held without interruption until the time of his death. For the past ten years Mr. Mustard was an active member of the exhibitors committee of the National Electric Light Association.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Modern Business Tendencies*

Keen Competition Makes Long-Term Commitments Dangerous—Strong Cash Position Determines Safety of Narrow Margins—A New Level of Commodity Prices

By Enoch B. Seitz

Executive Secretary American Washing Machine Manufacturers' Association, Chicago

THE keen competition for the American purchaser's dollar has brought about the conditions that characterize American business today. Striving to get the same dollar has brought about the greatest merchandising cost that has ever existed in America. This cost has been increased because merchandising has been attended with a greater advertising cost which is chargeable to sales expenses. The result is that business has been done at a smaller profit than has been the case in America for several decades. This small margin of profit which has crept into the conduct of business began about a year ago at a time when labor costs and commodity prices began to mount. Economists warned business concerning it ten months ago, and it has become a matter of greatest concern in the conduct of business today. The manufacturer realizes it, and possibly the jobber and dealer appreciate it, but it is doubtful whether the American public has any conception of the narrowness of the margin upon which business is done.

Term Merchandising

Keen competition has brought about the increasing tendency to merchandise upon terms. When there is the slightest buyers' resistance caused by the prevailing excuse that prices are too high, there is a tendency to offset those prices by inducements which are called "terms" —a small payment down and payments forever and a day. American business today is well characterized by the term "merchandising." If continued, this is going to have a most serious effect upon the balance sheets of many stable institutions, because the ordinary dealer is not thoroughly educated to what the use of the deferred plan in merchandising involves.

The average retailer selling on the deferred-payment plan must have, in addition to his working capital, a considerable sum of money to take care of delinquencies. It does not take very long for a modestly capitalized dealer, working on a small margin, to find himself in a stringent financial condition because he has neither capital nor credit to obtain the added amount of working funds that it takes to sell upon deferred payments. This is not said to deprecate legitimately deferred payments, particularly in the sale of electrical appliances. It is inconceivable what the industry would be today if it were not for the deferred-payment plan. Fully 85 per cent of the electric washers sold in the United States are sold on that plan. But there is a limit to the smallness of the cash payment. The length to which the paper should run, the minimum "down" payment and the maximum length of time given should be within sane and bankable limitations.

The smallness of profit that exists in present-day merchandising, after all, brings about a struggle for the survival of the fittest. There are a great many firms which are now pressing their business beyond the point where the increased sales are obtained at an increased cost per unit in selling and at such an additional expense that the narrow margin of profit is entirely wiped out. There are those who are "sitting tight and playing close" until this period of narrow margins is over. When this period ends, when labor and commodity prices again come down so that the narrowness of margin can again be increased, the companies remaining will not be those that have done the greatest amount of business during the preceding year, but those that have given the greater attention to their cash position during these months.

Too much emphasis cannot be placed on what a sound cash position means in present-day business. It involves the avoidance of placing one additional dollar in assets that will not permit rapid liquidation. It involves the turnover of inventories within the shortest possible time. It means keeping away from long-time commitments. One element that contributes much to the stability of the washing-machine industry is that since last March the average length of commitments has been reduced from ninety-seven days to eighty-two days. Those fifteen days saved mean that inventories are being turned over more often.

Cash Discounts

Again, a strong cash position at this time means the ability to take cash discounts. A business that does not take the regular 2 per cent within ten days for cash is neglecting a wonderful opportunity for earning. The business that passes up the rather liberal 5 per cent follows a policy that is nothing short of criminal. A strong cash position embodies the setting up of a reserve to provide for future contingencies. The businesses that sailed best through the slump of 1920 were those that had set aside funds of appreciation, realizing that the added profit of the fat years would be offset by the losses of the lean years. When the deflation came they had the appreciation fund with which to meet it; it had not been dissipated by declaring dividends. It was in liquid form to be used as a buffer against the shock that had to come. So the strong cash position of today is one that takes cognizance of the supreme necessity of building up a very liquid reserve.

*Presented before the twenty-eighth annual convention of the Central Division, N. E. C. A., Chicago, Nov. 21, 1923.

The uppermost question today in the minds of American business executives is, "Are we again facing some kind of a depression?" Commodity prices are still at a very high level as compared with 1913. If business is going to continue comparing present levels with those of another year, say 1913, there will always be the feeling that a deflation is due. But it is not unlike another period. In 1890 American business men were continually saying, "Oh, if we could just get back to normal, if we could just get back to the level of 1879, everything would then be fine."

They kept on talking about getting back to the good old days of eleven years before when levels stayed "put," but they never *did* get back to that level. And yet there came in time the most prosperous quarter of a century in history. Again, ten years after 1913, there are those who are continually yearning for the return to the price level of 1913. It is doubtful whether business will ever come down to it! Labor prices reached their peak last April and have declined slightly since—lowering only when and where non-employment increased. Some decline in commodity prices is due during the first half of 1924. With these natural downward tendencies in labor and commodity prices bringing them closer to agricultural prices, a new level should be established which should again be "normalcy."

Another very apparent tendency in business today is the evolution of an improved method of distribution. Distribution costs are too high. They have more than kept pace with the mounting cost of production. This is a recognized fact in almost all lines of business. Business can be had, but at a cost of getting that is greater than ever experienced before. Heroic efforts are being made to find new channels of distribution, to revamp old ones, to cut corners, to do something that will lighten the load of distribution costs.

Out of this endeavor must come one of two things—either there must be an appreciation on the part of the buying public that the purchase price of an article includes justifiable charges for services performed in bringing that article from the place of fabrication to the consumer's home, or there must be a shortening of the route—moving merchandise much more directly.

With all of the great merchandising brains of our country busy on this problem a solution will be forthcoming. The philosopher of New England wrote many years ago that he who does things better than another will have a path beaten to his door; but he who can bring out of the costly tangle and expensive maze of modern business an orderly, usable, efficient and economic method of distribution will have countless thousands of American business executives arising to call him blessed.

The Market Situation in Coal

An Abstract of a Statement Recently Presented Before the Association of Edison Illuminating Companies that Has a Distinct Interest for Electrical Manufacturers

BY EUGENE MCAULIFFE
President Union Pacific Coal Company

FOR some years the coal industry has, because of its irregularities, caused all consumers, all business, much embarrassment and expense. It has added heavily to the burden of a sorely taxed transportation machine, and it is quite safe to say that it has caused manufacturers and the managers and executives of the great public utility companies more sleepless hours than all other domestic disturbances combined. Gradually this condition has grown to be looked upon as definitely unbearable.

Today the industry is managed by operators divided between two schools of medicine. The one school administers the properties in its charge as directed by a definitely militant labor organization, an organization which has its genesis in the abuses inflicted on mine labor a generation ago, abuses which still rankle in the minds of the older men, and which again make good material for the thunder of the paid leaders. The other school comprises the so-called open-shop or non-union operators, who write their own prescriptions, which in late years have been made palatable by better housing, sanitation, amusement and educational facilities.

EXCESS MINE COST

The result is that the excess mine cost, the excess tax put on transportation, the deflection in quality and other less material losses have added to the nation's fuel bill at least $1 per ton in the form of direct expense, and when the waste of man power is computed a further great indirect loss, but one difficult of measurement, has been suffered by the nation. To the public utilities, on whom a demand for service is made which cannot be flouted, the loss has fallen ton for ton the heaviest, and upon the steam transportation service of the nation immeasurable losses have been inflicted. The recent anthracite wage settlement, which is beginning rapidly to be looked upon as the result of political expediency, does not promise much in the way of example to be followed when the union bituminous wage scale covering mines north of the Ohio River expires March 31 next. It is, therefore, on the reaction of the public to the Coal Commission's recent report that we shall have to depend for betterment. I will attempt to suggest the changes that may happen to the industry between 1923 and 1930.

WHAT MUST BE DONE

The coal strike must go as a method of settling industrial disputes within industries basic and fundamental, such as the coal industry. The operator and the mine worker must take on a new "attitude of mind." The rights of the man who pays the bills must be brought definitely to the front. To accomplish this few changes need be made in the existing order of affairs. These, however, must be well-foundationed changes and they must include:

(a) There must be fullest publicity regarding every affair of the industry and the labor employed therein, its costs, profits or losses, the rate of wages paid, the opportunity for employment afforded the worker, and the extent to which the worker avails himself of the opportunity. Employers who tenaciously opposed the theory of reporting facts during the periods of high earnings now for the second time express a willingness to submit facts. The facts referred to must be collected by the federal government and by men who can and will place correct and fearless interpretation on them. This department, wholly educational, will give expression to the most valuable function of government, the informative.

(b) The wasteful expenditure of new capital, coal reserves and man power which is still taking place must be checked by governmental regulation, which can be of a simple, direct char-

acter that will effect correction without destruction of property rights.

(c) The status of the mine worker must be defined, not through any system of certification such as now exists in certain states and which gives the union the power to dispense to the individual the right to seek employment, but by the full and prompt publication of the facts covering earnings and living conditions, thereby automatically putting the force of public opinion behind such corrective measures as are necessary to bring the slacker up to his proper place in the march of progress.

(d) Recognition must come of the principle that any labor-saving machine which is capable of transmuting the toiler into a machine operator or semiskilled mechanic represents human betterment and should not alone be encouraged but enforced.

(e) There must be such revision of the present "master and man" relationship as will create mutual confidence and respect between the operator and the mine worker, and this will come when there is full publicity of governing conditions. The present attitude of militant belligerency is due very largely to the lack of knowledge concerning the facts under which the present uncertain relation is maintained.

The changes set forth above will take place between now and 1930, and the result will be a stabilized industry, with a livable load factor—an industry whose capacity expressed in mines and man power will fit better the load it must bear.

Material reductions in wages will not be made. I am prepared to say that, with publicity and the advent of mechanical loading machines and perhaps a conveyor form of haulage, largely displacing the many small cars now used underground, an even higher unit wage will be paid in certain districts, a combination of day wage and bonus paid on a tonnage basis perhaps best fitting the new mechanical order. The item of personal safety, now much disregarded, with its resultant social losses, will receive growing attention, but with added expense to the producer, a situation with which we will not quarrel.

The net gain flowing from increased efficiency will tend to effect reductions in cost of production, however, and as an offset definite weight must be given to the rapid exhaustion, largely through waste, of our more accessible and readily removable coal acreage, a situation of which the American people are sadly ignorant. Too many statements regarding the billions of tons of coal in reserve have been fed to the public, these statements being seldom qualified by the facts relating to remoteness from industrial centers and areas of dense population, to the quality of the coal, the thickness of the overburden and the seam itself, the angle at which it lies, and the possible absence of the certain other conditions which are necessary to removal, except at great expense.

The gradual exhaustion of the anthracite reserves, with the definite knowledge that the portion yet in reserve will cost more to remove and prepare than did that which has been mined, plus the recent increase in mining wages granted, will cause a tightening there, perhaps slow to evidence itself; and the profligate waste of our national oil reserves, now also taking place, is another factor that eventually will militate against cheaper fuel.

I can see little in the way of cheaper fuel from mines or oil fields. Doubtless, the maximum measure of relief that will be made possible will, as heretofore, take the path already blazed and followed—an extension of the present hydro-electric power resources and the greater efficiency to be obtained with the fuel used.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

THE electrical trade is closing out the year with a high degree of satisfaction. The tremendous volume of building construction has brought a large market for electrical material throughout the year. The Christmas season apparently has pretty generally exceeded expectations. The month of December goes out with stocks low and the promise of good business to follow the inventory-taking period.

New England continues this week the bright spot on the map. Mild weather there has permitted the work on central-station lines to continue. Appliance sales have been extremely heavy. Lamp and fixture business continues strong in the New York district with credit conditions very good. Prices are holding firm. In the Southwest wholesalers' and retailers' stocks are very low and lamp sales are running 25 per cent better than last year. In and around Chicago building continues, though work on the power lines has stopped. Manufacturers are sold out on cable. The market is generally firm.

There have been a number of reductions in price affecting pole-line hardware, flexible armored conductors and connectors in the East and lamp cord in the Middle West. Tape is expected to advance somewhat after Jan. 1. The Pacific Coast reports a strong business situation.

Wire Makers' Bookings Running to March—1924 Promises Well

RUBBER-COVERED and weatherproof wire manufacturers are running at top production as the year closes, and some of these report future orders as far ahead as May. Present production schedules are mostly filled until three months into the new year. It is the opinion of the leading wire manufacturers that an excellent year of buying by the industrials and central-station companies is in order and that placements are guided to those mills that can supply sufficient quantities in reasonable time.

During 1923 interconnection work and the building of new trunk lines between new generating plants and load centers have had a fair effect in orders for bare wire. In addition, a considerable amount of replacement business came from the electric railways.

Fluctuations in the copper market during the past two months have not been so often reflected in the wholesale market, owing to the practice of the manufacturers who are keeping large stocks of all sizes in the distributors' warehouses. Moreover, there is evidence in the market that manufacturers are shipping these stocks in larger quantities so as to reduce freight costs to a minimum. In turn raw materials are being bought in larger quantities to insure against shortages and the possibility of a rising market at the beginning of the year after inventories are taken. During last week wholesale prices on rubber-covered wire gained approximately 5 per cent in leading market centers of the East and Middle West.

Wooden-Pole Producers Anticipate Greater Sales in 1924

WITH wooden-pole purchases for this year actually completed, the producing companies are reviewing the events of the last twelve months in order to advance their production schedules as near as possible to the estimated purchase requirements of central-station and telephone systems for 1924. This year's business has been far above that obtained in 1922, and many of the wooden-pole producers are anticipating that the sales for their products will be equally good during the next twelve months. Accordingly it is known that certain of the larger interests are laying plans for big contracts in forest lands and labor.

The recent scarcity of certain sizes of wooden poles no longer exists because improved transportation and better cutting programs in the woods have offset the unusual demand for poles in the Middle Western and Eastern States. Orders during the last two months have been somewhat lower, however,

than during the summer months. A falling off of particular import has developed in the Southern States, where a great number of steel poles have been sold. Authorities in the field state that this reduction has been largely seasonal, and this statement is borne out by open knowledge in the industry that the market as a whole is very stable with no change in prices over a considerable period of time.

Another development in present business which will have much to do with an increase in 1924 sales is the matter of the rehabilitation of the devastated sections in Japan. Already this influence in the market is causing considerable buying up of the whole American lumber market. A conservative estimate of the number of feet of timber required for the rebuilding of Japan's transmission lines and houses will run between two billion and four billion feet. Pole producers are calculating how to obtain contracts for this Japanese business to the best advantage of both countries. It is thought that much timber of central-station size but which does not meet in all respects the standard specifications of the central stations of this country can be sold to Japanese buyers.

An element of growing importance in the market of the cedar-pole producers is the sale of the Southern yellow-pine poles. Whether the market will favor Southern yellow-pine poles in place of Western red cedar because of the difference in price levels and available stocks is yet to be seen, and it is a factor which is being closely watched by the pole-producing interests at this time. An important consideration is that Southern yellow pine takes less time to attain its full maturity than does Northern white cedar or Western red cedar. With pole prices about 30 per cent higher than they were in 1921, there are indications that prices may be shaded slightly during this period of the year to induce the central stations to do their purchasing now.

Building Material Selling Strong in Middle West—Lamp-Cord Price Revision

THE continued mild weather has helped the building program in the Middle West and the electrical trade is deriving more benefit from this business than in former years. Good purchases of most electrical construction commodities are in sight, being limited, however, or scheduled for delivery the first of the year.

The demand for pole-line hardware has fallen off this month, but this is perhaps merely a seasonal occurrence. Deliveries are being made promptly on all standard lines of hardware, while specialties are being turned out in good time. Prices remain firm. While there are no indications at present of higher prices, it is thought there will be no reductions in prices.

The cable situation is unchanged. Most manufacturers are sold up to capacity, and new business is not particularly welcome where immediate delivery is required. Single-conductor paper - cable deliveries run about twenty-eight to thirty weeks, while multiple-conductor deliveries run about fifty weeks.

The price of lamp cords was revised on Dec. 17. Single-conductor prices declined a trifle and twisted pair prices advanced. Pure silk lamp cord is apparently being closed out in this district, and another manufacturer has announced that as soon as present stocks are exhausted he will make silk only.

Switchboard accessories sales have been good this week. One manufacturer reports the placing of orders for a considerable quantity of this class of merchandise for delivery the first quarter of next year. Prices remain firm, with no increase anticipated. Stocks are apparently adequate, as deliveries are being made within a reasonable period.

Indications are that friction tape should advance after Jan. 1. During the last ninety days cotton has advanced from 22 cents a pound to 37 cents a pound. With one exception during 1920, this is the highest point reached in fifty-eight years. Cotton sheeting, an essential in the manufacture of all friction tape, has undergone a rapid advance; but, even so, it has not kept up with the advance in cotton. This means that sheeting should advance.

Line Material Selling Fast in New England

PROTRACTED open weather has led to unusually large sales of pole-line material for central-station service, and the movement of this class of supplies continued extremely active to the end of last week. Pole-line hardware eased off about 5 per cent in price and flexible armored conductor weakened about 5 per cent before the holidays. Other prices held fairly firm, but the usual retail reductions were anticipated for the post-Christmas trade and considerable deferred buying of radio apparatus was in sight at Boston when the Christmas closing occurred. Little complaint as to shortages was heard before Christmas among jobbers, although storage batteries of exceptionally high grade were reported scarce in some circles owing to the demand for radio service and a spurt of automobile battery-renewal buying resulting from the mild weather.

Every indication points to a superb electrical appliance business this year, many merchandisers running 40 per cent or more above 1922 totals. General business in New England shows uneven streaks in textiles with the usual pre-inventory losses of manufacturing production. Underlying conditions are sound, and in the electrical industry the demand is widespread that substantial tax reduction shall be accomplished at the present congressional session.

Conditions Quiet in the New York District—Outlook Optimistic

ELECTRICAL business in New York City for last week was without important change except for those lines which included the large volume of holiday purchasing. There was apparently no let-up in the demand for lamps, fixtures and the general line of heating and cleaning apparatus. Prices of connectors for Nos. 12 and 14 armored cable have been reduced from $29.50 to $27. This cut is said to have been made in order to gather in some of the important orders which are floating around the market after severe reductions by smaller interests during the last month.

Although most of the jobbers, industrials and dealers are now preparing for inventory taking, sales books show higher volumes than one year ago and better credit conditions are reported for the New York territory. According to the National Electrical Credit Association, the November situation showed an improvement of $30 in the average delinquent account. In November, 1922, 389 delinquent accounts, totaling $84,743 and averaging $218 apiece, were reported, in comparison with last month's total of 344, which were valued at $50,725 and averaged $145 a piece.

The electrical trade is keeping in general run, with prosperous conditions reported in commodities affected by the greater purchasing power of the industrials and central stations. An estimated gain of about 12 per cent in the value of the year's crops implies an increased buying power in the farming communities, while labor is still well employed at most manufacturing centers of New York State and New Jersey. More building construction is being done than is usual because of the warmer weather at this period. It is said that this month's purchases by the industrials and central stations have been close to the November rate, with railroads and automobile makers active in the market.

The firm undertone of prices in the electrical industry is being generally maintained. A more optimistic spirit prevails in the jobbing houses, and men in the field express optimism concerning January and February business.

Easier Market Ahead on the Coast —Collections Improving

THE electrical fraternity on the Pacific Coast is well pleased with the results of the year just closed and looks forward confidently to 1924. Except in isolated cases where low crop prices or unfavorable weather has cut the profits of the farmer and depressed local business, the electrical industry has run very close to the sales totals of the bumper year of 1920.

Building permits for Los Angeles will total nearly $190,000,000, as compared with $121,000,000 for last year; in San Francisco about $45,000,000, which is close to last year, and in Oakland nearly $28,000,000, as against

$24,500,000 for 1922. This activity has been directly reflected in the demand for wiring materials. Very favorable indications of easier markets are seen in the large and well-assorted stock orders which are now being received. Collections are steadily improving and are now averaging below fifty days.

Some very definite improvements are seen in background conditions in the industry. Better merchandising methods are distinctly in evidence. Accounting is on a far better basis among small electrical contractors and dealers. Meanwhile new industrial markets are being made in the Los Angeles and San Francisco Bay regions. Lack of employment is almost non-existent, and it is difficult to be other than highly optimistic. The only possible upset would apparently have to come through factors which are now indiscernible.

All Stocks Low in the Southeast with Excellent Business in Sight

A RECORD-BREAKING holiday trade is reported in the Southeast, the increase over last Christmas ranging from 20 to 35 per cent, and there will be little or no carry-over of Christmas specialties. While the seasonal lines are, of course, moving best, jobbers state that staple lines are holding up well and that inventory time will find stocks generally low in the territory. Retailers are jubilant over the business they have enjoyed, and as a result their stocks are also low.

Heating devices and radio equipment have gone like wildfire, and practically no stocks will be carried over to the first of the year. Lamp sales are at a peak and show an increase of approximately 25 per cent over last December. Retailers handling portables report a very substantial business on the more expensive types, and are more than satisfied over having been able to discard the cheaper type. The portable business as a whole is excellent, and this is very satisfying from the central-station point of view. All in all, 1923 has been a wonderful year in the electrical industry in the Southeast, and as conditions are improving steadily, the new year starts with enthusiasm and optimism.

November Delinquent Electrical Accounts Lower

FOUR of the five divisions reporting to the National Electrical Credit Association for November have lowered their number of accounts as compared with October, 1923. The other territory, New England, remains the same. However, the average amount for the Central, Philadelphia and New England divisions increased over October, 1923. For the Central Division territory the average account for October, 1923, listed $109.74, while in November it was $160.43.

Conditions in the New York territory are improving, since the average account for November, 1923, was $30 lower than in October. Although the accounts for November, 1923, in Philadelphia decreased, the average amount increased from $99.84 to $133.82. The total number of accounts for the Pacific Coast for November, 1923, were less by five than in October, and the average amount now stands at $236.25.

DELINQUENT ACCOUNTS IN NOVEMBER

Branch and Month	Number of Delinquent Accounts Reported	Total Amount	Average Amount
Central Division:			
Oct., 1922	872	$102,465.52	$117.50
Oct., 1923	981	117,653.05	109.74
Nov., 1922	813	141,482.10	174.02
Nov., 1923	912	146,308.04	160.43
New York:			
Oct., 1922	517	59,602.00	115.00
Oct., 1923	442	77,479.00	175.00
Nov., 1922	389	84,743.00	218.00
Nov., 1923	344	50,725.00	145.00
Philadelphia:			
Oct., 1922	262	24,609.19	93.93
Oct., 1923	326	32,537.96	99.84
Nov., 1922	215	24,703.46	114.90
Nov., 1923	222	29,708.60	133.82
New England:			
Oct., 1922	80	11,223.14	140.29
Oct., 1923	51	3,808.88	74.68
Nov., 1922	47	6,130.29	130.43
Nov., 1923	51	6,018.34	118.01
Pacific Coast:			
Oct., 1922	22	3,980.61	180.50
Oct., 1923	23	5,804.78	252.38
Nov., 1922	24	4,117.10	171.54
Nov., 1923	18	4,252.62	236.25

The Metal Market

COPPER eased off a trifle last week, when outsiders and two or three small producers offered the metal at 13 cents, delivered, to the Connecticut Valley. In fact, offers were as low as 12.95 cents, delivered. The lower offerings revealed a little anxiety to dispose of small tonnages, and it is probable that had large inquiries come along the sellers would have strengthened up to 13.75 cents, which is still the theoretical quotation of the large producers.

Business was fair in the aggregate, especially considering the season of the year, and there are no indications that the market will go below 13 cents. Producers are still well sold ahead from the heavy purchasing in November, and the influence of this on the market is still felt. Last week's threats of the disbanding of the copper export association by no means created a panic in prices, and they held well considering the situation.

The official contract price of lead, as quoted by the American Smelting & Refining Company, was increased from 7.25 cents to 7.40 cents, delivered, New York. The lead market is substantially unchanged from last week, except that even higher prices are being asked for nearby deliveries. One of the producers is quoting as high as 8.12½ cents, New York, although no sales have been reported at that figure. A fair tonnage of lead for late January and early February shipment was sold during the week. The slab zinc market is weaker in tone.

NEW YORK METAL MARKET PRICES

	Dec. 20, 1923 Cents per Pound	Dec. 27, 1923 Cents per Pound
Copper, electrolytic...	13.50	13.00
Lead, Am. S. & R. price	7.00	7.40
Antimony...........	9.00	9.00
Nickel, ingot........	27.00 to 30.00	27.00 to 30.00
Zinc, spot............	6.35	6.35
Tin, Straits..........	45.00	46.00
Aluminum, 98 to 99 per cent...........	26.00 to 27.00	27.00

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

New Factory in St. Louis for Electric Storage Battery

Work is well under way on the new building of the Electric Storage Battery Company at Vandeventer and Choteau Avenues, St. Louis. This is the third building that the company has occupied since a branch was opened in that city in 1907. At that time one floor, occupying approximately 1,000 sq.ft., was sufficient. Seven years later larger quarters were secured in Walnut Street, where the company had 15,000 sq.ft. available.

With the steady growth of business it became apparent that still larger quarters were necessary to enable the St. Louis branch to handle its business in an efficient manner, and hence the new building, with 32,000 sq.ft. of floor space. This building is on the Missouri-Pacific railroad line. In it will be housed the administration offices of the St. Louis branch, from which orders from Missouri, southern Illinois, Arkansas, Louisiana, Oklahoma and Texas will be cared for.

Wakefield Brass Official Gives Optimistic Viewpoint for 1924

A. F. Wakefield, vice-president of the Wakefield Brass Company, in a statement made last week said: "Owing to the popularity of the kitchen lighting idea and the fact that central stations are campaigning for this class of business, we feel that the first half of 1924 will be a busy season for our company. There is no indication to us that 1924 will be a boom year, but it will be, we feel sure, a comfortably prosperous year.

"We have recently built additions to our factory and have added substantially to our equipment; likewise we have increased our sales and advertising programs to an optimistic but

reasonable extent. We expect to have to work hard for every dollar in 1924, but we also expect that a satisfactory number of dollars will accrue from our hard work."

P. A. Geier Will Double Space

"The fact that we have just started construction upon two new factory units which will approximately double our manufacturing space indicates that we look forward to 1924 with considerable optimism," said F. J. Gottron, general manager of P. A. Geier Company, Cleveland, manufacturer of domestic electric appliances, in a statement last week.

"We believe that operations in the coming year must be conducted upon a basis of strict economy and high efficiency, but these are ideals toward which sensible business men struggle in good times instead of waiting for hard times to enforce them. The coming year promises reasonable increases in both volume and net profits, and we have set our manufacturing and sales quotas accordingly."

Industrial Electric Heating Organization Changes Hands

The electric heating apparatus business of the Boston Last Company, Boston, which has been conducted for many years at 44 Biford Street, has been purchased by Donald Heath, Winthrop, Mass., and Charles Lowell and Harold L. Spooner, Whitman, Mass., and the new owners will soon begin business at Whitman under the firm name of the Boston Electric Heating Corporation.

Manufacturing space has been leased at the G. G. Roberts Corporation factory on South Avenue. As in the past, the company will specialize in electric heating equipment for manufacturing purposes. In the new organization Mr. Heath will have charge of production, Mr. Lowell of sales and Mr. Spooner of finances.

American Brass Company Joins Copper and Brass Association

At a meeting of the Copper & Brass Research Association held last week at the offices of the association, 25 Broadway, New York City, the American Brass Company was unanimously elected a member. The American Brass Company, which is affiliated with the Anaconda Copper Mining Company, is one of the largest fabricating and manufacturing units in the industry.

The association now numbers in its membership the leading copper and brass fabricating and distributing companies in the United States, representing approximately 80 per cent of the brass and copper facilities of the country. The producer members total twenty-five and represent the preponderance of the country's copper production.

Westinghouse Acquires New Building in Cleveland

The Cleveland branches of the Westinghouse Electric & Manufacturing Company and the Westinghouse Lamp Company have consolidated in one building their sales and service departments and their warehouses. The new five-story building, which is called the Westinghouse Electric Building, has 115 front feet on Ashland Road and is 130 ft. deep. The executive sales and clerical divisions have their offices on the top floor. Two floors are given over to the service department and two to warehousing facilities.

The building is in every way equipped for complete and efficient service to the electrical trade. In the service department the latest types of equipment are installed for repairing and rebuilding electrical apparatus of all kinds. In addition to a large stock of industrial equipment, supplies and merchandising items, a supply of renewal parts will be carried in the warehouses.

Adequate transportation facilities are available for the shipment and receipt of material. A private siding from the Pennsylvania Railroad has been provided for carload shipments. A platform that will accommodate three trucks at a time serves for the shipment of express and freight in less-than-carload lots.

Triumph Electric Holds Sales Convention in Cincinnati

Salesmen of the Triumph Electric Company, Cincinnati, have just returned to their various district headquarters after a two-day convention held at the home office. In order to finish the program for the convention in two days, various group meetings were held. The important features of the company's motors were discussed for the benefit of the new members of the sales force. This was followed by a trip through the factory, during which refinements and advanced mechanical features of the line for 1924 were explained and demonstrated.

The expanded facilities for manufacturing large-sized motors up to 200 hp. were also inspected, as well as the service department, which has been organized to insure the firm's customers prompt and efficient service during rush periods.

Columbus Jobbers Ship Appliances by Airplane

An aërial precedent was recently established in Columbus, Ohio, when the Hughes-Peters Electric Corporation delivered electrical merchandise a distance of 47 miles by airplane.

The Hughes-Peters firm, Columbus jobbers for the Westinghouse Electric & Manufacturing Company, received a rush order for electrical appliances from the Knecht-Feeney Electric Company, at Mount Vernon, Ohio, and immediately sent the order to a nearby flying field by truck. It was then loaded in a plane and carried to Mount Vernon, traveling the 47 miles in thirty-nine minutes. The trip would have required at least two hours had the goods been sent the entire distance by fast trucks.

Mine & Smelter Appointment

Announcement is made that Arthur E. Bacon has been appointed manager of the electrical department of the Mine & Smelter Supply Company, which does a jobbing business in Denver. Mr. Bacon was formerly with the Western Electric Company in the supply department and went to the Mine & Smelter firm as a salesman. On the recent resignation of James W. Ryall as the manager of the electrical department, Mr. Bacon was promoted to that position.

Mr. Bacon is a specialist in signal systems for mines and railroads.

The Uehling Instrument Company, Paterson, N. J., manufacturer of CO_2 recorders and other power-plant instruments, has recently appointed J. R. Williams, 2028 Jefferson County Bank Building, Birmingham, as its representative in Alabama. The Sheffield Company, Sheffield, Ala., has just purchased a representative installation of CO_2 recording and indicating equipment through Mr. Williams.

R. G. Chamberlain, district manager of the Hurley Machine Company, is in Spokane, Wash., co-operating in the campaign now being conducted by the Washington Water Power Company in the sale of Thor washing machines and of the new Hurley "Superior Oscillator." He says that general conditions are better than they have been for the past five years and on the basis of the results already obtained predicts success for the campaign, which is the largest ever organized by the Washington Water Power Company.

The Stewart Storage Battery Company, previously at Marshfield, Wis., has leased 10,000 sq.ft. of floor space on the third floor of the building at 361 West Superior Street, Chicago, where its manufacturing operations are now being conducted.

The American Brass Company, Kenosha, Wis., subsidiary of the Anaconda Copper Company, has placed the general contract for erecting a new copper wire mill, 220 ft x 540 ft., two stories of brick and concrete.

The General Electric Company, Philadelphia, will commence the construction of the second unit of its new plant on local property at Elmwood Avenue and Sixty-eighth Street, recently acquired. It will be one-story, 119 ft. x 254 ft., estimated to cost approximately $300,000, with equipment. The White Construction Company, New York, is the general contractor, and Harris & Richards, Drexel Building, Philadelphia, are architects.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Glasgow, Scotland (No. 8,678), for advertising signs and electrical tools and for electric heating and cooking equipment. Purchase and agency is also desired (No. 8,600) for electric advertising specialties for window display.

Purchase is desired in Port Said, Egypt (No. 8,603), for cooking utensils, flatirons, etc.

Purchase and agency is desired in Algiers, Algeria (No. 8,602), for electrical accessories, including heating, lighting, power, telephone and wireless apparatus; also (No. 8,601) for electrical supplies.

Purchase and agency is desired in London, England (No. 8,598), for electrical goods and for radio apparatus and parts.

An agency is desired in Oran, Algeria (No. 8,601), for electric lamps, radiators, irons and fixtures.

Purchase and agency is desired in Christchurch, New Zealand (No. 8,604), for small fractional-horsepower motors.

Purchase and agency is desired in Bienne, Switzerland (No. 8,667), for small motors for drilling, perforating, sharpening, etc.

Purchase is desired in Mexico City, Mexico (No. 8,608), for telephone equipment.

Purchase and agency is desired in Birmingham, England (No. 8,599), for tungsten or tungsten alloy.

An agency is desired in Auckland, New Zealand (No. 8,620), for radio apparatus and parts.

Purchase and agency is desired in Adelaide, Australia (No. 8,597), for radio apparatus and parts.

Purchase is desired in Johannesburg, South Africa (No. 8,609), for radio apparatus and parts.

An agency is desired in Vienna, Austria (No. 8,650), for machinery and apparatus for power plants, mines and the metallurgical industry.

PROPOSED TELEPHONE SYSTEM AT SMYRNA.—The Turkish government, *Commerce Reports* states, has given the officials at Smyrna permission to ask for bids for the installation of a telephone service.

New Apparatus and Publications

ELECTRIC SPECIALTIES.—Catalog No. 12 issued by the G. & W. Electric Company, 7440 South Chicago Avenue, Chicago, contains bulletin No. 231, covering its potheads and accessories, and bulletin No. 232, describing its underground boxes.

ELECTRIC WASHING MACHINES.—The Altorfer Brothers Company, Peoria, Ill., has issued a booklet entitled "How 437 Dealers Brought Customers to Their Stores," which describes its method of selling electric washing machines which has been tested by the "A B C" dealers throughout the United States.

AIR FILTERS.—The Midwest Air Filters, Inc., 100 East Forty-fifth Street, New York City, is distributing a folder calling attention to the use of the "Midwest Unit" air filters for power plants, factories, pneumatic tools, pneumatic water systems, ice-manufacturing plants, cleaning and drying spray paints, etc.

BASE ADAPTER.—The Ward Leonard Electric Company, Mount Vernon, N. Y., has developed a "Vitrohm" resistor unit with an "Edi-Swan" (bayonet lock) base.

RESISTANCE MATERIAL.—The Wireless Resistor Company of America, Milwaukee, is distributing a leaflet calling attention to its "Globar" resistance material (non-metallic, bar-shaped) for industrial and domestic heat.

RECORDING INSTRUMENT.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has developed a new portable recording instrument, known as type R.

FIRE-FIGHTING APPARATUS. — "The Essentials of Self-Protection Against Fire" is the title of a booklet published by the Foamite-Childs Corporation, Utica, N. Y., describing the various types of its fire-fighting devices.

ELECTRIC GRILL AND TOASTER.—An electric grill and toaster, consisting of two cooking pans and a toaster, has been placed on the market by the National Stamping & Electric Works, 3212 West Lake Street, Chicago.

PORTABLE LAMP.—A portable lamp of the pedestal type for use in garages, machine shops, etc., has been developed by the Universal Electric Bracket Company, 1,109 Pine Street, St. Louis, Mo.

New Incorporations

THE UNITED LIGHT & POWER COMPANY, 101 East Fayette Street, Baltimore, has been incorporated by George S. Newcomer, Douglas H. Rose and others.

THE KANAWHA VALLEY POWER COMPANY has been chartered with a capital stock of $100,000 by J. E. Harsh, W. D. Payne and others.

THE INTERSTATE POWER COMPANY, Kansas City, Kan., has been incorporated with a capital stock of $2,000 by W. D. Pratt, Fredonia; W. J. Breidenthal, R. J. Higgins, Stanley G. Stewart and O. P. Allee, all of Kansas City.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

FARMINGTON, ME. — The Franklin Light & Power Company has purchased all the power rights in the Carabasset stream at North Anson. The company plans to build a concrete dam and develop 3,000 hp.

BOSTON, MASS.—Bids, it is reported, are being asked by the Edison Electric Illuminating Company of Boston for an addition to the substation on Glenville Terminal, Allston, and for a substation at Dedham. Bigelow & Wadsworth, 120 Tremont Street, are architects.

BROCKTON, MASS.—Contract has been awarded to Stone & Webster, Inc., 147 Milk Street, Boston, by the Edison Electric Illuminating Company of Brockton for extensions at the East Bridgewater plant. The work will include two 588-hp. boilers, with oil-burning equipment for six boilers, a 10,000-bbl. oil-storage tank, concrete service tank, pumping equipment and heaters. The contract also includes the rearrangement of the present switching equipment, a 13,200-volt transmission line (4 miles long) to be erected from the station to Dupont Circle, where a switch house, transformer and switching equipment will be installed to tie the system into the transmission lines to be built to the Montaup Electric Company's plant at Fall River, Mass. The cost of the work is estimated at $785,000.

GARDINER, MASS. — Steps have been taken by the Chamber of Commerce for an improved lighting system in the business district.

HOPEDALE, R. I.—Plans are being prepared by John A. Stevens, Lowell, engineer, for a new power plant for the Draper Corporation.

WOONSOCKET, R. I.—The City Council has adopted a resolution authorizing the Blackstone Valley Gas & Electric Company to install forty-one lamps of 1,000 cp., twenty-two of 600 cp. and eighteen of 100 cp., on Blackstone, Arnold, Social and Clinton Streets.

Middle Atlantic States

ALBANY, N. Y.—The Rochester (N. Y.) Packing Company is planning to install an ice and refrigerating plant at its proposed new factory to be erected on Exchange Street, to cost about $500,000. Henschein & McLaren, 1637 Prairie Avenue, Chicago, are architects.

BATAVIA, N. Y.—The installation of an ornamental lighting system on Main and Jackson Streets, to cost about $15,000, is under consideration.

BROOKLYN, N. Y.—Plans for the ten-story warehouse to be erected by the St. Mark's Holding Corporation on the Eastern Parkway, to cost about $700,000, include elevating, conveying and other material-handling machinery. Charles B. Meyers, 31 Union Square, New York City, is architect.

BUFFALO, N. Y.—The Board of Education is considering the construction of a high and vocational school, to cost about $2,500,000. Associated Architects, 235 Delaware Avenue, are architects.

BUFFALO, N. Y.—The Niagara, Lockport & Ontario Power Company has applied to the Public Service Commission for permission to extend the development of water power on the Salmon River and for the right to condemn property along the stream regarded as necessary in connection with the project. The plans provide for the construction of six dams between the present power house and the village of Pulaski.

FISHKILL, N. Y.—The Wappingers Elec. Light Company, Wappingers Falls, has applied to the Town Council for a franchise to supply electricity for lamps and motors in Fishkill.

HORNELL, N. Y.—The New York Central Electric Corporation has been authorized to issue $3,489,500 in capital stock, the proceeds to be used to acquire the following properties, including proposed extensions in plants and transmission lines: The Hornell (N. Y.) Electric Company; Wayne Power Company, Sodus; Yates Electric Light & Power Company, Penn Yan; Dansville (N. Y.) Gas & Electric Company; Perryville (N. Y.) Electric Light Company and the Warsaw (N. Y.) Gas & Electric Company.

SCHENECTADY, N. Y.—The City Council is considering an ordinance providing for a uniform system of lighting throughout the city.

TROY, N. Y.—Van Zandt, Inc., River and Rensselaer Streets, is planning to install a coal conveyor with elevating machinery at its power house.

VALATIE, N. Y.—Plans are being considered by the Centennial Paper Mills, Inc., for the installation of equipment in its power plant, including a 200-kw. generator, directly connected to steam turbine, with switchboard, etc.

YORKTOWN, N. Y.—Plans are under consideration by the Town Boards of Cortlandt and Yorktown for organizing a lighting district. The proposed district would also include the villages of Mohegan, Shrub Oak, Jefferson Valley and many outlying sections.

BRIDGETON, N. J.—The Electric Company of New Jersey plans to issue $107,000 in bonds and $445,200, in capital, part of the proceeds to be used for extensions in its system in Camden and Gloucester Counties.

DOVER, N. J.—Plans are being prepared by the New Jersey Power & Light Company for extensions to its system.

HAMMONTON, N. J.—The installation of two electrically driven pumps with auxiliary apparatus in the municipal waterworks is under consideration.

EAST GREENVILLE, PA.—The Pennsylvania Power & Light Company has taken over the property of the East Greenville Electric Light Company and will consolidate it with its system.

HARRISBURG, PA.—Appropriations are being arranged for extensions in the park lighting system and also for additional street lamps in the Market Street and Bellevue district.

NORRISTOWN, PA.—The Counties Gas & Electric Company proposes to increase the capacity of its 60,000-hp. steam-power plant now in course of construction at Barbadoes Island to 150,000 hp.

PITTSBURGH, PA.—The Duquesne Light Company is preparing plans for four substations, to be erected at Second, Third and Winthrop Avenues, Pittsburgh, and at Beaver Falls, respectively, to cost about $400,000.

WILLIAMSPORT, PA. — Electrically operated machinery will be installed in the proposed new factory, to cost about $150,000, of the Vallamont Planing Mill Company.

WILLIAMSTOWN, PA.—The East Penn Electric Company is perfecting plans to take over and consolidate the Lykens Valley Light & Power and the Washington

Township Electric Light, Heat & Power companies. Extensions will be made in transmission lines and a power generating plant built on the Juniata River, near Iroquois.

ABERDEEN, MD.—The Puritan Brick Company plans to construct a power house at its proposed local plant, to cost about $100,000.

BALTIMORE, MD.—The City Council contemplates replacing the gas lamps on York Road, between Thirty-fifth and Forty-second Street, with electric lamps and also on the Thirty-third Street Boulevard and Alameda Street. William A. Parr is superintendent of lamps and lighting.

CLARKSBURG, W. VA.—The Clarksburg Wholesale Company, recently organized, is considering the construction of an ice and cold-storage plant, to cost about $85,000.

HUNTINGTON, W. VA.—Bids will be received by the Board of Education of Huntington Independent School District until Jan. 11, 1924, for plumbing, electric wiring, and a clock and program system for the Lincoln Junior High School. Richard M. Bates, Jr., 414 Eleventh Street, is architect.

FREDERICKSBURG, VA. — Plans are being considered by the Spottylvania Power Company for the construction of two large hydro-electric plants on the Rappahannock River above the present development of the company. A large portion of the energy generated at the proposed plant will be transmitted to Richmond.

HAMPTON ROADS, VA.—Bids will be received by the United States Marine Corps, Quartermaster Department, Washington, D. C., until Jan. 3, for one light plant complete, at Hampton Roads. (Schedule 271.)

WASHINGTON, D. C.—Bids will be received by the Board of District Commissioners, District Building, until Jan. 9, for 28,372 ft. telephone and signal cable.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Jan. 8, for 20,000 ft. of two-conductor cable, for the local naval station. (Schedule 1707.)

WASHINGTON, D. C.—Bids will be received by the purchasing agent, Panama Canal, until Jan. 11, for switchboards, electric motor, insulated cable, lamp cord transformers, etc. (Circular 1581.)

North Central States

DETROIT, MICH.—Plans are being prepared by Malcomson, Higginbotham & Palmer, 1219 Griswold Street, for twelve new buildings for the University of Detroit, including administration, general science, gymnasium, engineering, library, chapel, power house, etc., at Livernois Avenue and Six Mile Road.

MENOMINEE, MICH.—The City Council has approved the installation of electrically operated pumps in the municipal waterworks, to replace present steam equipment.

EAST LIVERPOOL, OHIO.—The Ohio Power Company has plans to erect a substation at Chester Avenue and Twentieth Street for power service for the Pennsylvania Railroad and industrial interests in the western section of the city.

LOUISVILLE, KY.—Plans are being prepared by the Louisville Hydro-Electric Company for the construction of a power house in Louisville. D. McDonald is engineer.

HUNTINGTON, IND. — The Northern Indiana Power Company plans to increase its capital stock by $1,500,000, part of the proceeds to be used for the purchase of local light and power properties and for expansion.

INDIANAPOLIS, IND.—The Indianapolis & Cincinnati Traction Company plans to make line extensions and improvements, including the installation of automatic substation equipment, for central-station service. It is proposed to discontinue operations at its Rushville power plant.

MARION, IND.—The Indiana General Service Company contemplates installing new equipment at its local power plant to replace the machinery recently damaged by fire, causing a loss of about $25,000.

TERRE HAUTE, IND.—Bids, it is understood, will soon be asked by the Terre Haute, Indianapolis & Eastern Traction Company for the construction of new shops and car barns.

CHICAGO, ILL.—Electric power equipment will be installed in the initial unit of the proposed plant to be erected by the Williamson Candy Company, 1038 North Ashland Avenue, to cost about $500,000.

CHICAGO, ILL. — The Public Service Company of Northern Illinois has issued $10,000,000 in bonds, the proceeds to be used for further expansion, including the construction of a new power plant at Waukegan.

GRAND TOWER, ILL.—The Central Illinois Public Service Company has petitioned the Public Service Commission for permission to erect a 66,000-volt transmission line from Grand Tower to Wolf Lake and an electric distributing system in Grand Tower.

KANEVILLE, ILL. — Plans are under consideration by the village officials to obtain electric service for the village. Electricity may be secured from the municipal electric plant at Elburn. At present the town is without electrical service.

CHILTON, WIS.—Plans have been prepared by the Wisconsin Public Service Corporation, Green Bay, for the erection of a transmission line to furnish electrical service in Jericho near here.

COON VALLEY, WIS.—Plans are under consideration for rebuilding the electric plant of the Coon Valley Electric Company, recently destroyed by fire. The loss is estimated at about $20,000.

GREEN BAY, WIS.—Plans are under consideration by the Council for the installation of additional pumping equipment at the waterworks, to be operated by electric or steam power.

MILWAUKEE, WIS. — The Board of Estimates has approved a bond issue of $150,000 in the 1924 budget of the city, the proceeds to be used for extensions and improvements to the ornamental and other street-lighting systems in various parts of the city. Electricity for maintaining the lamps is purchased from the Milwaukee Electric Railway & Light Company.

OCONOMOWOC, WIS.—Plans are being prepared for the installation of ornamental lamps on West Avenue, Milwaukee, North and South Main Streets. About 100 standards will be required, to cost about $25,000.

BEMIDJI, MINN.—Steps are being taken for the installation of a new street-lighting system. The work will be carried out by the Minnesota Electric Light & Power Company.

DULUTH, MINN.—Steps have been taken by the Hillisde Improvement Club for the installation of a new lighting system on the Becker and Huntington highways.

NEW PRAGUE, MINN.—Plans, it is reported, are under consideration for the construction of a power plant, in New Prague, to cost about $70,000, during the coming year.

WINONA, MINN.—The Wisconsin Railway, Light & Power Company plans improvements to its local plant, to cost about $35,000.

DES MOINES, IOWA—Work will start at once on the construction of a new steam-electric generating plant for the Des Moines Electric Company, a subsidiary of the Illinois Power & Light Corporation, at Des Moines, which will have an ultimate capacity of 200,000 kw. and will cost about $16,000,000. The first section will develop 35,000 hp. and will cost about $6,000,000.

GUTHRIE CENTER, IOWA.—The Iowa Electric Company is planning to make extensions and improvements to its local system.

STATE CENTER, IOWA — The Town Council is considering the purchase of forty ornamental lamps standards for lighting the town. Frank D. Paine, Ames, is engineer.

BOLIVAR, MO.—The Tri-Cities Power Company, recently incorporated, has awarded contract for construction of power house, to cost $40,000, and will erect about 28 miles of transmission line. M. B. Messler is chief engineer.

KANSAS CITY, MO.—Plans are being prepared by the Kansas City Cold Storage & Warehouse Company for the construction of a new plant, to cost about $1,250,000. The equipment will include ice-manufacturing and cold-storage apparatus.

RUSH TOWER, MO. — The Missouri Marble Quarries, Inc., Boatmen's Bank Building, St. Louis, contemplates building a power house at its proposed local plant, to cost about $150,000.

KANSAS CITY, KAN. — The Interstate Power Company, recently incorporated, plans to build a superpower plant to serve the territory bounded by Kansas City, Atchison and Topeka. W. D. Pratt of Fredonia, W. J. Breidenthal of Kansas City and others are interested in the company.

TOPEKA, KAN.—Petitions are being circulated requesting the installation of an ornamental lighting system, covering thirteen blocks in the business district (not now lighted), to cost about $11,700.

Southern States

HAYESVILLE, N. C.—The Hayesville Power Company, recently reorganized, contemplates extensions in its system.

STATE COLLEGE, N. C. — Plans are under way for the construction of a power house at the North Carolina State College, to cost about $65,000.

SPARTANBURG, S. C.—The Southern Power Company, Charlotte, N. C., has obtained options on property near Spartanburg, where it proposes to build an auxiliary steam-driven electric plant.

LUDOWICI, GA.—The installation of an electric light system in Ludowici is under consideration.

QUITMAN, GA.—The City Council has entered into a contract with the Valdosta (Ga.) Lighting Company to supply electricity here. The company plans to erect a transmission line from Valdosta to Quitman.

SAVANNAH, GA.—James Imbrie of Imbrie & Co., Ltd., 61 Broadway, New York, is reported to be planning to build a power house in connection with a proposed local fuel briquette plant, to cost about $1,000,000.

MARIANNA, FLA.—The Marianna Light & Power Company, which is planning to build a hydro-electric plant on the Chipola River, also contemplates erecting about 70 miles of transmission lines connecting Marianna, Blountstown, Altha, Cottondale, etc. The Southern Engineering Corporation, Albany, Ga., is engineer.

SOUTH JACKSONVILLE, FLA. — The Florida Paper Mills Company, a subsidiary of the Grass Fibre Pulp & Paper Company, Leedsburg, will soon begin work on the first unit of its proposed local mill, to cost about $250,000. The project includes a power house.

ARKANSAS CITY, ARK.—The Lambe & Denmark Light & Water Company plans to install additional equipment at its power house.

DUMAS, ARK. — The Stimson Lumber Company, Memphis, Tenn., contemplates the building of a power house at its proposed local mill, to cost about $125,000.

LITTLE ROCK, ARK.—The Arkansas Central Power Company contemplates extensions to its power plant on Arch Street, including switchboard, etc., to cost about $100,000.

MALVERN, ARK. — The Van Veneer Company is planning to purchase a 150-kw. generator and auxiliary equipment for its proposed local plant.

CHILDRESS, TEX.—The Texas Central Power Company plans to build a new power house here in the spring.

DALLAS, TEX.—Plans are under consideration for the installation of an ornamental lighting system on Ervay Street and on Young Street.

DALLAS, TEX.—The Texas & Pacific Railroad Company contemplates the construction of a power house at its proposed shops at Belt Junction, near Dallas, to cost about $500,000.

HILLSBORO, TEX.—The installation of electrically driven pumps to replace the present steam equipment at the municipal waterworks system has been authorized by the City Council.

PORT ARTHUR, TEX.—Electric power equipment will be installed by the Kansas City Southern Railway Company, Kansas City, Mo., at its proposed local grain elevator, to cost about $500,000. A. N. Reese, Port Arthur, is engineer.

SALADO, TEX.—Plans are being prepared by the Harrington Company, Houston Building, San Antonio, for the construction of a power plant, pumping plant, crusher, elevators, washer screens and bins, for which, it is understood, bids will soon be asked for. Owner's name is withheld.

Pacific and Mountain States

EVERETT, WASH. — Negotiations are under way with the Puget Sound Light & Power Company for extensions in the ornamental lighting system in the downtown section, totaling about 250 lamp clusters and poles.

NOOKSACK, WASH. — The Glen Echo Power Company has been granted a permit to build a power plant on Breckenridge Creek.

OKANOGAN, WASH.—The Washington Water Power Company will install additional equipment at its Similkameen power station to increase the output to 4,300 hp.

SEATTLE, WASH.—The Puget Sound Power & Light Company has awarded a contract to Stone & Webster, Inc., 147 Milk Street, Boston, for the installation of a fourth unit, consisting of a 20,000-kva. generator and a 23,000-hp. waterwheel, to operate under 440-ft. head, with a new steel penstock 1,800 ft. long, extension to power house, transformer and switching equipment. The cost is estimated at $1,060,000.

SPOKANE, WASH.—The Stevens County Light & Power Company plans to erect a 33,000-volt transmission line to the Old Dominion mining section, about 7 miles.

YAKIMA, WASH.—Plans are being revised and new bids will soon be asked for the installation of an ornamental lighting system in the downtown section.

GARIBALDI, ORE.—The Coast Power Company, Tillamook, has been granted a franchise to build a transmission line to Manhattan. A franchise has been secured.

MADRAS, ORE.—The Columbia Valley Power Company has tentative plans for the construction of a hydro-electric power plant in Deschutes County, with total capacity of 175,000 hp., to cost about $500,000.

LOS ANGELES, CAL.—Plans are under way for the installation of an ornamental lighting system on Cahuenga Avenue from Hollywood to Sunset Boulevards, pressed-steel standards to be used.

LOS ANGELES, CAL.—Bids will be received by Thomas Oughton, city purchasing agent, until Jan. 3, for electric cable. (Specification 806.)

LOS ANGELES, CAL. — The National Paper Products Company, 1789 Montgomery Street, San Francisco, plans to build a power house at its proposed local mills, to cost about $1,000,000.

LOS ANGELES, CAL.—The Los Angeles Concrete Tire Company, I. W. Hellman Building, has acquired a site at Mission Road and Fremont Avenue for its proposed new plant, to cost about $75,000. The plans provide for a power house.

MERCED, CAL.—The San Joaquin Light & Power Company has made arrangements with the Merced Irrigation District for the construction of a hydro-electric power plant at the proposed Exchequer dam.

NEWPORT BEACH, CAL.—The Orange County Box & Lumber Company, recently organized, contemplates the construction of a power house at its proposed mill in the Newport Harbor section, to cost about $100,000. The company was organized recently. C. S. Chapman and James Irvine, Jr., are heads.

REDLANDS, CAL.—Plans have been authorized for the installation of an ornamental lighting system on East State Street, for which bids will soon be asked.

RIVERSIDE, CAL.—The Southern Sierras Power Company is planning to build a hydro-electric power plant on the Owens River Gorge, Mono County, with an initial capacity of 13,500 hp., estimated to cost $500,000.

SAN DIEGO, CAL.—Steps have been taken by the Imperial Heights Club for extensions in the street-lighting system in the Imperial Heights section.

SAN FRANCISCO, CAL.—Bids will be received by the Board of Public Works until Jan. 9 for furnishing steel towers for transmission line for the Mocassin Creek power plant of the Hetch Hetchy project, to include 394 standard towers, 98 heavy-duty towers and 12 transmission towers with foundation steel and 60,000-lb. tower extension steel. The cost is estimated at $500,000.

NAMPA, IDAHO.—Plans are being considered for the construction of a municipal power plant to cost about $90,000.

Canada

NIAGARA FALLS, ONT.—The installation of a lighting system on the Niagara River Parkway, to cost about $30,000, is under consideration by the Queen Victoria Niagara Falls Park Commissioners.

PORT ELGIN, ONT.—The installation of electrically driven auxiliary pumps at the waterworks is under consideration. The cost is estimated at $25,000.

TORONTO, ONT.—The location of the proposed new tower line and the station for the Port Credit division of the Hydro radials is under consideration by the Mayor and Board of Control and the Hydro-Electric Power Commission of Ontario.

HAWARDEN, SASK.—The installation of an electric light plant in Hawarden is under consideration

Electrical Patents

Announced by U. S. Patent Office

(Issued Dec. 11, 1923)

1,476,678. DEMODULATING APPARATUS. H. A. Affel, Brooklyn, N. Y. App. filed Dec. 31, 1920. Signaling by means of carrier currents.

1,476,686. MULTIPLE-UNIT SYSTEM OF ENGINE-DRIVEN GENERATORS; A. F. Brotz, Kohler, Wis. App. filed Jan. 6, 1922. Circuit connections for self-starting engine-driven generators.

1,476,689. ELECTRICAL TESTING SYSTEM; A. G. Chapman, East Orange, N. J. App. filed Dec. 6, 1921. For determining magnitude of cross-talk between two adjacent circuits.

1,476,691. ELECTRICAL SIGNALING; L. Cohen and J. O. Mauborgne, Washington, D. C. App. filed Jan. 26, 1921. Elimination of static.

1,476,721. FREQUENCY-CONTROL SYSTEM; De L. K. Martin, Orange, N. J. App. filed Nov. 23, 1921. Control of carrier frequency used for signaling by different stations.

1,476,725. IGNITER FOR GASEOUS-FUEL BURNERS; H. C. Pope and J. H. Fieldhouse, Los Angeles, Cal. App. filed Nov. 16, 1921. By electric spark apparatus.

1,476,733. ELECTRIC-CURRENT GENERATOR; J. A. Smith, Syracuse, N. Y. App. filed July 28, 1922. Magneto built into flywheel of gas engine.

1,476,790. CENTRIFUGALLY OPERATED CIRCUIT-CONTROLLING DEVICE; M. W. Bartmess, Cleveland, Ohio. App. filed Feb. 18, 1922. For repulsion-type induction motors.

1,476,940. COMMUTATOR-COOLING APPARATUS; N. Wilkinson, Wauwatosa, Wis. App. filed April 28, 1921.

1,476,941. ELECTRIC CABLE-WINDING MECHANISM; W. A. Young and F. Brill, Milwaukee, Wis. App. filed Jan. 15, 1923. Taking up and paying out cable of hoisting apparatus.

1,476,947. WINDING SECURING MEANS FOR DYNAMO-ELECTRIC MACHINES; A. J. Brown, Milwaukee, Wis. App. filed July 18, 1921.

1,476,953. TELEPHONE APPARATUS; W. L. Davis, Chicago, Ill. App. filed Dec. 6, 1920. Company telephone system.

1,476,978. SYSTEM OF CONTROL; F. Jeffrey, Milwaukee, Wis. App. filed Sept. 20, 1919. Motor-generator set for electric furnaces to reduce peak loads.

1,476,982. ADAPTER; T. J. Kerwin, Chicago, Ill. App. filed July 16, 1921. Standard screw plug with Ediswan type socket.

1,476,986. VENTILATING-DUCT CONSTRUCTION FOR DYNAMO-ELECTRIC MACHINES; W. W. Kusterman, Cincinnati, Ohio. App. filed Sept. 22, 1919.

1,476,997. SPEED-CONTROL SYSTEM; W. N. Motter, Milwaukee, Wis. App. filed Nov. 3, 1919. For steel, paper or sugar mill motors.

1,477,009. DEVICE FOR HEATING FORGING PIECES BY ELECTRIC RESISTANCE HEATING; E. Schröder, Berlin, Germany. App. filed July 6, 1921. Similar to butt-welding machines.

1,477,017. CURRENT-CONTROLLING AND STATIC REDUCING SYSTEM; C. A. Sprague, East Orange, N. J. App. filed May 2, 1919. Receiving weak signals in presence of static.

1,477,057. ARC LAMP FOR PHOTOGRAPHIC AND OTHER PURPOSES; B. J. Hall, Fieldend, Eastcote, and C. F. G. Thorkelin, London, England. App. filed April 1, 1920.

1,477,086. PROCESS FOR THE ELECTROLYTIC PRODUCTION OF POTASSIUM BICARBONATE FROM POTASSIUM-CHLORIDE SOLUTION; R. Suchy, Griesheim-on-the-Main, Germany. App. filed Aug. 24, 1921. By diaphragm process.

1,477,088. APPARATUS FOR PURIFYING LIQUIDS; R. C. Turner, Columbus, Ohio. App. filed May 19, 1919. By electric current.

1,477,099. ANODE FOR FORMING PERCOMPOUNDS; J. Baum, Carinthia, Austria. App. filed Aug. 22, 1922. Consists of tantalum partly coated with platinum.

1,477,109. PROCESS FOR THE MANUFACTURE OF ZINC CYLINDERS FOR PRIMARY BATTERIES; S. O. Copwer-Coles, Sunbury-on-Thames, England. App. filed May 11, 1920. For flashlight batteries.

1,477,149. CONTROL PANEL FOR HEATING EQUIPMENT; O. G. Pouch, New York, N. Y. App. filed March 22, 1921. Thermostat control apparatus to maintain constant temperature.

1,477,174. VULCANIZER; J. C. Heintz, Lakewood, Ohio. App. filed Sept. 9, 1920. Electric heating element.

1,477,197. STORAGE-BATTERY SYSTEM; R. H. Sullivan, Rochester, N. Y. App. filed July 26, 1922. System for charging battery from automobile generator.

1,477,271. MULTI-FREQUENCY GENERATOR; F. Lowenstein, Brooklyn, N. Y. App. filed Dec. 9, 1918. For wireless-telegraph apparatus.

1,477,285. COMBINED STOP LIGHT AND TAIL LAMP; H. A. Rippner, Cleveland, Ohio. App. filed March 14, 1923.

1,477,303 to 1,477,306. PROTECTIVE DEVICE; C. T. Allcutt, Wilkinsburg, Pa. App. filed Feb. 8, 1918. Lightning-arrester gap.

1,477,308. GAP IONIZER; Q. A. Brackett, Pittsburgh, Pa. App. filed Jan. 16, 1919. Horn gap of electrolytic lightning arrester made of film-forming metal.

1,477,309. SPEED-REGULATOR SYSTEM; W. M. Bradshaw, Wilkinsburg, and C. A. Boddie, Pittsburgh, Pa. App. filed April 9, 1919. Maintaining generator speed constant.

1,477,313. ELECTRIC FURNACE; O. A. Colby, Irwin, Pa. App. filed Sept. 23, 1921. Removable resistor type.

1,477,314. ELECTRIC FLATIRON CUT-OUT; O. A. Colby, Irwin, Pa. App. filed Sept. 28, 1921.

1,477,316. RADIO-MODULATION SYSTEM; F. Conrad, Pittsburgh, Pa. App. filed July 11, 1922. Telephone transmitting apparatus.

1,477,326. ELECTRIC IRON; H. S. Dodd, Toronto, Ontario, Canada. App. filed June 13, 1921. Cut-out switch closed when handle is clasped.

1,477,339. IMMERSION WATER HEATER; F. F. Forshee, Flint, Mich. App. filed Dec. 7, 1920. Circuit can only be closed when heater is in liquid.

1,477,340. ELECTRIC COFFEE PERCOLATOR; F. F. Forshee, Flint, Mich. App. filed Dec. 17, 1921.

1,477,343. ROTARY-TOASTER STOVE; G. B. Griffin, Springfield, Mass. App. filed Dec. 16, 1920. To toast bread evenly.

1,477,347. RESISTOR SUPPORTING MEANS FOR ELECTRIC RESISTANCE FURNACES; H. A. Hands, Swissvale, Pa. App. filed Jan. 20, 1922.

1,477,354. METHOD OF TREATING AND RESTORING USED STORAGE BATTERIES; M. E. Hunt, Belle Plaine, Iowa. App. filed Oct. 27, 1922. By thoroughly drying plates.

1,477,359. STATIONARY INDUCTION APPARATUS; S. E. Johannesen, Pittsfield, Mass. App. filed April 11, 1921. Distributed core construction.

1,477,366. LIGHTING FIXTURE; B. F. Klein, Cleveland, Ohio. App. filed June 29, 1921. Indirect lighting unit.

1,477,367. ELECTRIC REGISTER; O. A. Knopp, Oakland, Cal. App. filed March 1, 1920. Apparatus registers simultaneously on one dial record of two meters located at distant point.

1,477,372. MEANS FOR PRODUCING A SOOTY VAPOR IN ELECTRIC FURNACES; G. M. Little, Pittsburgh, Pa. App. filed March 23, 1922. For burning out soot in resistance furnace.

1,477,375. ELECTRICALLY OPERATED WARNING HORN; R. W. Maudslay, Coventry, England. App. filed July 15, 1922. Vibrating type.

1,477,377. SYSTEM OF CONTROL; H. D. Murdock, Wilkinsburg, Pa. App. filed March 30, 1921. Protecting railway motors from overloads.

1,477,384. ELECTRIC RESISTANCE FURNACE; T. A. Reid, Wilkinsburg, Pa. App. filed Feb. 23, 1922. Small furnace.

1,477,385. ELECTRIC FURNACE; T. A. Reid, Wilkinsburg, Pa. App. filed Feb. 23, 1922. Resistance type.

1,477,387. TROLLEY FROG; W. Schaake, Pittsburgh, Pa. App. filed Jan. 7, 1922. For overhead wire.

1,477,395. AUTOMATIC RECLOSING CIRCUIT-BREAKER SYSTEM; O. C. Traver, Schenectady, N. Y. App. filed Jan. 19, 1922. For direct-current systems.